SOLICITATION/CONTRACT/ORDER FOR COMMERCIAL ITEMS
OFFEROR TO COMPLETE BLOCKS 12, 17, 23, 24 & 30

1. REQUISITION NUMBER: MR 992065 MR 002153

PAGE 1 OF 1

2. CONTRACT NO.	3. AWARD/EFFECTIVE DATE	4. ORDER NUMBER	5. SOLICITATION NUMBER	6. SOLICITATION ISSUE DATE
NAS10-00-001	June 16, 2000		RFP10-99-0021	October 18, 1999

FOR CONTRACT INFORMATION CALL:	a. NAME	b. TELEPHONE NUMBER (No collect calls)	8. OFFER DUE DATE/LOCAL TIME
	Joanne M. Seale	(321) 867-2572	April 17, 2000, 12:00 PM

7. ISSUED BY — CODE OP-OSO-ELV
NASA John F. Kennedy Space Center
Procurement Office, Mail Code: SEB-NLS
Attn: Thomas D. Tokmenko
Sharon L. White
Kennedy Space Center, Florida 32899

10. THIS ACQUISITION IS
☒ UNRESTRICTED
SET ASIDE: % FOR
SMALL BUSINESS
SMALL DISADVANTAGED BUSINESS 8(A)
SIC: 3761
SIZE STANDARD: 1000

11. DELIVERY FOR FOB DESTINATION UNLESS BLOCK IS MARKED ☐ SEE SCHEDULE

12. OFFER ACCEPTANCE PERIOD
180 Days from Date in Block 8

☒ 13A. THIS CONTRACT IS A RATED ORDER UNDER DPAS (15 CFR 700)

13B. RATING: DO-C9

14. METHOD OF SOLICITATION
☐ RFQ ☐ IFB ☒ RFP ☐ RFO

15. DELIVER TO — CODE OP-OSO-ELV
Same as Block 9.

16. ADMINISTERED BY — CODE
Same as Block 9.

17a. CONTRACTOR/OFFEROR — PPC/STATE CODE ( )( ) — FACILITY CODE
Delta Launch Services, Inc.
5301 Bolsa Avenue
Huntington Beach, CA 92647-2099
DUNS 008384588
TELEPHONE NO. (714) 896-4644

17b. CHECK IF REMITTANCE IS DIFFERENT AND PUT SUCH ADDRESS IN OFFER

18a. PAYMENT WILL BE MADE BY — CODE
JOHN F. KENNEDY SPACE CENTER
GG-B-B1
KENNEDY SPACE CENTER, FLORIDA 32899

18b. SUBMIT INVOICES TO ADDRESS SHOWN IN BLOCK 18a. UNLESS BLOCK BELOW IS CHECKED SEE ADDENDUM

19. ITEM NO.	20. SCHEDULE OF SUPPLIES/SERVICES	21. QUANTITY	22. UNIT	23. UNIT PRICE	24. AMOUNT
	NASA LAUNCH SERVICES IN ACCORDANCE WITH SECTION B, C AND D. *(Attach Additional Sheets as Necessary)*				

25. ACCOUNTING AND APPROPRIATION DATA
See Contract Section C, Clause 21.0

26. TOTAL AWARD AMOUNT *(For Govt. Use Only)*
$168,913,000.00

☒ 27a. SOLICITATION INCORPORATES IN FULL TEXT FAR 52.212-1, 52.212-4. FAR 52.212-3 & 52.212-5 ARE ATTACHED. ADDENDA ☒ ARE ☐ ARE NOT ATTACHED.

☒ 27b. CONTRACT/PURCHASE ORDER INCORPORATES IN FULL TEXT FAR 52.212-4. FAR 52.212-5 IS ATTACHED. ADDENDA ☒ ARE ☐ ARE NOT ATTACHED.

☒ 28. CONTRACTOR IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN 3 COPIES TO ISSUING OFFICE. CONTRACTOR AGREES TO FURNISH AND DELIVER ALL ITEMS SET FORTH OR OTHERWISE IDENTIFIED ABOVE AND ON ANY ADDITIONAL SHEETS SUBJECT TO THE TERMS AND CONDITIONS SPECIFIED HEREIN.

☐ 29. AWARD OF CONTRACT: REFERENCE OFFER DATED , THE OFFER ON SOLICITATION (BLOCK 5), INCLUDING ANY ADDITIONS OR CHANGES WHICH ARE SET FORTH HEREIN, IS ACCEPTED AS TO ITEMS:

30a. SIGNATURE OF OFFEROR/CONTRACTOR
M C Sterbens

31a. UNITED STATES OF AMERICA *(Signature of Contracting Officer)*
James E. Hattaway Jr.

30b. NAME AND TITLE OF SIGNER *(Type or print)*
M.C. Sterbens
Manager, Contracts & Pricing

30c. DATE SIGNED
6-15-2000

31b. NAME OF CONTRACTING OFFICER *(Type or print)*
James E. Hattaway, Jr.
Director, Procurement Office

31c. DATE SIGNED
16 JUNE 00

32a. QUANTITY IN COLUMN 21 HAS BEEN
☐ RECEIVED ☐ INSPECTED ☐ ACCEPTED, AND CONFORMS TO THE CONTRACT, EXCEPT AS NOTED

33. SHIP NUMBER
☐ PARTIAL ☐ FINAL

34. VOUCHER NUMBER

35. AMOUNT VERIFIED CORRECT FOR

32b. SIGNATURE OF AUTHORIZED GOVT. REPRESENTATIVE

32c. DATE

36. PAYMENT
☐ COMPLETE ☐ PARTIAL ☐ FINAL

37. CHECK NUMBER

38. S/R ACCOUNT NO.

39. S/R VOUCHER NO.

40. PAID BY

41a. I CERTIFY THIS ACCOUNT IS CORRECT AND PROPER FOR PAYMENT

41b. SIGNATURE AND TITLE OF CERTIFYING OFFICER

41c. DATE

42a. RECEIVED BY *(Print)*

42b. RECEIVED AT (Location)

42c. DATE REC'D (YY/MM/DD)

42d. TOT. CONTAINERS

File Copy of —

FOIA RELEASE COPY

NAS10-00-001

NASA LAUNCH SERVICES CONTRACT

TABLE OF CONTENTS

SECTION A STANDARD FORM 1449 ..... A-1

SECTION B TABLE OF CONTENTS ..... B-i

SECTION B STANDARD FORM 1449 CONTINUATION B-1

SECTION C TABLE OF CONTENTS ..... C-i

SECTION C CONTRACT TERMS AND CONDITIONS C-1

SECTION D DOCUMENTS, EXHIBITS, AND ATTACHMENTS D-1

ATTACHMENT D1 TABLE OF CONTENTS D1-i

STATEMENT OF WORK D1-1

EXHIBIT 1 CAPABILITIES, SPECIFICATIONS AND ENVIRONMENTS

SECTION 1 VEHICLE CONFIGURATION D1-E1.1-1

SECTION 2 PAYLOAD DELIVERY CAPABILITY D1-E1.2-1

SECTION 3 INSERTION ACCURACIES D1-E1.3-1

SECTION 4 PAYLOAD SEPARATION ATTITUDE ACCURACY AND RATES D1-E1.4-1

SECTION 5 PAYLOAD FAIRING D1-E1.5-1

SECTION 6 MECHANICAL INTERFACE D1-E1.6-1

SECTION 7 ELECTRICAL INTERFACE D1-E1.7-1

SECTION 8 PAYLOAD ENVIRONMENT D1-E1.8-1

SECTION 9 PAYLOAD ENVIRONMENT INSTRUMENTATION D1-E1.9-1

SECTION 10 GENERIC SECONDARY PAYLOAD CHARACTERISTICS/INTERFACE D1-E1.10-1

EXHIBIT 2 STANDARD LAUNCH SERVICES LIST D1-E2-1

EXHIBIT 3 DELTA II NON-STANDARD SERVICES LIST D1-E3-1

EXHIBIT 4 SAMPLE CERTIFICATE OF FLIGHT READINESS D1-E4-1

EXHIBIT 5 FIRMS/OPTIONS MISSION SOLUTIONS D1-E5-1

CLIN 1 -- EOS-CHEM-1 ..... D1-E5-3

CLIN 2 -- DEEP IMPACT D1-E5-7

CLIN 3 -- MESSENGER D1-E5-11

CLIN 4 -- OPTION 1 ..... D1-E5-15

CLIN 5 -- OPTION 2 ..... D1-E5-19

CLIN 8 -- OPTION 5 ..... D1-E5-23

CLIN 9 -- OPTION 6 ..... D1-E5-27

CLIN 10 -- OPTION 7 ..... D1-E5-33

FIRMS/OPTIONS MISSION SOLUTIONS RLSP-1 ..... D1-E5-39

CLIN 14 – NPP D1-E5-41

CLIN 15 – Dawn D1-E5-47

CLIN 16 – SBIRS Low 1 ..... D1-E5-51

CLIN 17 – GLAST D1-E5-55

CLIN 18 – Ocean Surface Topography Mission D1-E5-59

CLIN 19 – MIDEX 5 ..... D1-E5-63

CLIN 20 – SBIRS Low 2 ..... D1-E5-67

CLIN 21 – Kepler D1-E5-71

CLIN 22 – SDO D1-E5-75

CLIN 23 – Space Science 1 ..... D1-E5-81

CLIN 24 – Aquarius D1-E5-85

CLIN 25 – MIDEX 6 ..... D1-E5-89

CLIN 26 – SLI/AAS Demo D1-E5-93

CLIN 27 – SLI Demo D1-E5-97

CLIN 28 – Discovery 11 ..... D1-E5-101

CLIN 29 – MMS D1-E5-105

CLIN 30 – MIDEX 7 ..... D1-E5-109

CLIN 31 – Discovery 12 ..... D1-E5-113

CLIN 32 – Geospace Electrodynamics Connection (GEC) D1-E5-117

EXHIBIT 6 AWARDED LSTO MISSIONS D1-E6-1

EXHIBIT 7 LAUNCH VEHICLE DATA AND QUALIFICATION PLAN

SECTION 1 INTRODUCTION D1-E7.1-1

SECTION 2 DELTA II LAUNCH VEHICLE QUALIFICATION D1-E7.2-1

SECTION 3 DELTA III LAUNCH VEHICLE QUALIFICATION D1-E7.3-1

SECTION 4 DELTA IV LAUNCH VEHICLE QUALIFICATION D1-E7.4-1

SECTION 5 DELTA FAMILY QUALIFICATION SUMMARY D1-E7.5-1

SECTION 6 DELTA PROGRAM MANAGEMENT D1-E7.6-1

EXHIBIT 8 MISSION INTERFACE CONTROL DOCUMENTS D1-E8-1

ATTACHMENT D2 CONTRACT DATA REQUIREMENTS LIST D2-1

ATTACHMENT D3 SUPPLEMENTAL DATA LIST D3-1

ATTACHMENT D4 THE BOEING COMPANY, EXPENDABLE LAUNCH SYSTEMS SMALL BUSINESS AND SMALL DISADVANTAGED BUSINESS SUBCONTRACTING PLAN D4-1

ATTACHMENT D5 SAFETY AND HEALTH PLAN D5-1

ATTACHMENT D6 RELIABILITY PROGRAM PLAN..... D6-1

ATTACHMENT D7 QUALITY MANAGEMENT PLAN..... D7-1

(PRO-570, CORPORATE QUALITY MANUAL)

(D-51-MD, EXPENDABLE LAUNCH SYSTEMS (ELS) SITE-SPECIFIC QUALITY MANUAL)

(SOFTWARE QUALITY ASSURANCE PLAN)

ATTACHMENT D8 NLS PAYMENT SCHEDULE WORK PLAN FOR DELTA II AND III* D8-1

ATTACHMENT D9 MOST FAVORED CUSTOMER CERTIFICATION PLAN D9-1

ATTACHMENT D10 ACRONYMS AND ABBREVIATIONS..... D10-1

SECTION B

STANDARD FORM 1449 CONTINUATION

TABLE OF CONTENTS

1.0 SCHEDULE OF SUPPLIES AND/OR SERVICES TO BE PROVIDED B-1
1.1 Basic Contract Firm Launch Service Requirements B-1
1.2 Standard Launch Service and Non-Standard Services Firm and Option Mission Profile Matrix B-3
1.3 Optional Launch Service Requirements CLIN Structure B-9
1.4 Non-Standard Services Ordered Independently of a Defined Mission (CLINS 1-5, 8-10) B-12
1.5 Special Task Assignment (Studies and Analyses) B-12.1
1.6 IDIQ Launch Service Task Order (LSTO) B-13
1.7 NTE Prices - Standard Launch Services for IDIQ Missions B-14
1.8 NTE Prices - Non-Standard Services for IDIQ Missions B-16
1.9 NTE Prices – Non-Standard Services Launch Site Maintenance B-23.1

2.0 TOTAL AWARD AMOUNT B-24
2.1 Total Contract Amount B-24

3.0 LAUNCH SERVICE FLEXIBILITY B-24
3.1 General B-24
3.2 Standard Launch Service Substitutions B-24
3.3 Non-Standard Service Additions and Deletions B-25.1

4.0 MOST FAVORED CUSTOMER B-33

5.0 IDIQ LAUNCH SERVICE AND PRICE UPDATES B-33

6.0 ONE TIME LAUNCH SERVICE CREDITS B-33

7.0 Non-Standard Services Ordered Independently of a Defined Mission (CLIN 11) – Definitized B-34

8.0 Special Task Assignments (Studies and Analyses) (CLIN 12) – Definitized B-35

9.0 CCAFS Extensive Repairs (CLIN 34) - Definitized B-36

10. VAFB Extensive Repairs (CLIN 35) - Definitized B-36

LIST OF TABLES

Table B-1 Basic Contract Firm Launch Service Requirements B-1

Table B-1.1 Firm Launch Service Requirements RLSP-1 ..... B-2.4

Table B-2 LV Configuration and Associated Non-Standard Service Matrix B-3

Table B-2.1 LV Confirmation and Associated Non-Standard Service Matrix RLSP-1 ..... B-8.1

Table B-3 Optional Launch Service Requirements CLIN Structure B-9

Table B-3.1 Optional Launch Service Requirements CLIN Structure RLSP-1 ... B-11.1

Table B-4 Non-Standard Services Ordered Independently of a Defined Mission CLINS 1-5, 8-10 ..... B-12

Table B-4.1 Non-Standard Services Ordered Independently of a Defined Mission CLINS 14-32 ..... B-12

Table B-5 Special Task Assignments (Studies and Analyses) B-12.1

Table B-6 Hourly Labor Rate - FFP List B-12.1

Table B-7 Hourly Labor Rate - NTE Price List B-13

Table B-8 IDIQ Launch Service Task Order B-14

Table B-9 NTE Price List - Standard Launch Services for IDIQ Missions B-15

Table B-9A Table of IDIQ Quantity Buy Discounts B-15

Table B-9.1 NTE Price List - Standard Launch Services for IDIQ Missions (August 2004 On-Ramp) B-15 ..... B-16

Table B-10 NTE Price List - Non-Standard Services for IDIQ Missions B-17

Table B-10.1 NTE Price List – Non-Standard Services for Launch Site Maintenance B-23.1

Table B-11 FFP List for Standard Launch Services CLINS 1-5, 8-10 ..... B-25

Table B-11.1 FFP List for Standard Launch Services CLINS 14-32 ..... B-25

Table B-12 FFP List for Non-Standard Services CLINS 1-5, 8-10 ..... B-26

Table B-12.1 FFP List for Non-Standard Services CLINS 14-32 ..... B-32.1

SECTION B

STANDARD FORM 1449 CONTINUATION

1.0 SCHEDULE OF SUPPLIES AND/OR SERVICES TO BE PROVIDED

The Contractor shall provide all services, facilities, and resources (except as may be expressly stated in this contract as furnished by the Government) necessary to furnish the Contract Line Item Number (CLIN) items (Tables B-1 through B-12) in accordance with the Statement of Work (SOW), Exhibits, and Documents attached hereto.

1.1 Firm Launch Service Requirements

CLIN	Description of Supplies and Services	Qty	Unit	Unit Price ($)	Total Amount ($)
1	**Launch Service for AURA**	1	Service		$
SubCLIN					
1A	Standard Launch Services and Standard Mission Integration in accordance with the SOW and Exhibit 2	1	Lot	$	
1B	Non-Standard Services In accordance with SOW and Exhibit 3	1	Lot	$	
	NSS 9.1.1	1	Each	$	
	Non-Recurring for NSS 28.1	1	Each	$	
	NSS 28.1	1	Each	$	
	NSS 20.1	1	Each	$	
1C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 5	1	Lot	$	
N/A	Launch Delays Section C, Table C-2	N/A	N/A	$	

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price ($)	Total Amount ($)
2	**Launch Service for Deep Impact**	1	Service		$
SubCLIN					
2A	Standard Launch Services and Standard Mission Integration in accordance with the SOW and Exhibit 2	1	Lot	$	
2B	Non-Standard Services in accordance with the SOW and Exhibit 3				
	NSS 20.1	1	Ea	$	
2C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Paragraph 9.0 and Exhibit 5	1	Lot	$	
N/A	Milestone Payment Adjustment Section C, Table C-1.2	N/A	N/A	$	
N/A	Launch Delay Section C, Table C-2	N/A	N/A	$	

Table B-1: Firm Launch Service Requirements

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price ($)	Total Amount ($)
3	**Launch Service for MESSENGER**	1	Service		$
SubCLIN					
3A	Standard Launch Services and Standard Mission Integration in accordance with the SOW and Exhibit 2	1	Lot		
3B	Non-Standard Services in accordance with the SOW and Exhibit 3	1	Lot		
	NSS 20.3.2 NSS 20.1	1 1	Ea Ea		
3C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 5	1	Lot	$	
N/A	Milestone Payment Adjustments Section C, Table C-1.3	N/A	N/A	$	
N/A	Launch Delay	N/A	N/A	$	

Table B-1: Firm Launch Service Requirements

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price ($)	Total Amount ($)
4	**Launch Service for Swift**	1	Service		$
SubCLIN					
4A	Standard Launch Services and Standard Mission Integration in accordance with the SOW, and Exhibit 2	1	Lot		
4B	Non-Standard Services in accordance with the SOW and Exhibit 3				
	NSS 9.1.1	1	Ea		
	NSS 11.1	1	Ea		
	NSS 11.2	1	Ea		
	NSS 10.1	1	Ea		
	NSS 20.1	1	Ea		
4C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 5	1	Lot		
N/A	Launch Delays Section C, Table C-2	N/A	N/A		

Table B-1: Firm Launch Service Requirements

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price ($)	Total Amount ($)
8	Launch Service for STEREO	1	Service		$
SubCLIN					
8A	Standard Launch Services and Standard Mission Integration in accordance with the SOW, and Exhibit 2	1	Lot		
8B	Non-Standard Services in accordance with the SOW and Exhibit 3	1	Lot		
	NSS 9.1.1 NSS 20.1	1 1	Ea Ea		
8C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 5	1	Lot		

Table B-1: Firm Launch Service Requirements

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price ($)	Total Amount ($)
9	Launch Service for NOAA-N'	1	Service		$
SubCLIN					
9A	Standard Launch Services and Standard Mission Integration in accordance with the SOW, and Exhibit 2	1	Lot		
9B	Non-Standard Services in accordance with the SOW and Exhibit 3	1	Lot		
9C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 5	1	Lot		
N/A	Milestone Payment Adjustment Section C, Table C-1.51	N/A	N/A		
N/A	Launch Delays Section C, Table C-2	N/A	N/A		

Table B-1: Firm Launch Service Requirements

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price ($)	Total Amount ($)
10	**Launch Service for MER-B (Mars Exploration Rover II 2003)**	1	Service		$
SubCLIN					
10A	Standard Launch Services and Standard Mission Integration in accordance with the SOW and Exhibit 2	1	Lot		
10B	Non-Standard Services in accordance with the SOW and Exhibit 3	1	Lot		
	NSS 20.3.3 NSS 10.1	1 2	Ea Ea		
10C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 5	1	Lot	$	
	Section D, Attach D1, SOW Paragraph 9.0, Modification CO 37 paragraph	1	Ea	$	
	Section D, Attach D1, SOW Paragraph 9.0, Modification 54 paragraph	1	Ea	$	

Table B-1: Firm Launch Service Requirements

1.1.2 Firm Launch Service Requirements RLSP-1*

*Request for Launch Service Proposal-1 (RLSP-1) consists of Firm CLINS 14-25 and Option CLINS 26-32.

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price (FFP $)	Total Amount (FFP $)
14	**Launch Service for NPP**	1	Service		$62,401,700
SubCLIN					
14A	Standard Launch Services and Standard Mission Integration in accordance with the SOW and Exhibit 2	1	Lot		
14B	Non-Standard Services in accordance with the SOW and Exhibit 3				
	NSS 2.1.2	1	Ea		
	NSS 11.1	1	Ea		
	NSS 11.2	1	Ea		
	NSS 27.1	1	Ea		
	NSS 30.2	1	Ea		
14C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 5				
N/A	Launch Delay	N/A	N/A		

Table B-1.1: Firm Launch Service Requirements RLSP-1

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price (FFP $)	Total Amount (FFP $)
15	**Launch Service for** Dawn	1	Service		
SubCLIN					
15A	Standard Launch Services and Standard Mission Integration in accordance with the SOW and Exhibit 2	1	Lot		
15B	Non-Standard Services in accordance with the SOW and Exhibit 3				
	NSS 1.1	1	Ea		
	One-Time FPR Discount to Heavy Vehicle Upgrade	1	Ea		
	NSS 11.1	1	Ea		
	NSS 11.2	1	Ea		
	NSS 30.2	1	Ea		
15C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 5	1	Lot		

Table B-1.1: Firm Launch Service Requirements RLSP-1

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price (FFP $)	Total Amount (FFP $)
16	**Launch Service for Space Tracking and Surveillance System (STSS)**	1	Service		
SubCLIN					
16A	Standard Launch Services and Standard Mission Integration in accordance with the SOW and Exhibit 2	1	Lot		
16B	Non-Standard Services in accordance with the SOW and Exhibit 3				
	NSS 30.2 NSS 26.1	1 1	Ea Ea	(	
16C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 5	1	Lot	$	
N/A	Milestone Payments Adjustment Section C, Table C-1.8	N/A	N/A	$	

Table B-1.1: Firm Launch Service Requirements RLSP-1

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price (FFP $)	Total Amount (FFP $)
17 SubCLIN	**Launch Service for Gamma Ray Large Area Space Telescope (GLAST)**	1	Service		
17A	Standard Launch Services and Standard Mission Integration in accordance with the SOW and Exhibit 2	1	Lot		
17B	Non-Standard Services in accordance with the SOW and Exhibit 3				
	NSS 1.1	1	Ea		
	One-Time FPR Discount to Heavy Vehicle Upgrade	1	Ea		
	NSS 19.1	1	Ea		
	NSS 26.1	1	Ea		
17C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 5	1	Lot		

Table B-1.1: Firm Launch Service Requirements RLSP-1

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price (FFP $)	Total Amount (FFP $)
18	Launch Service for Ocean Surface Topography Mission (OSTM)	1	Service		
SubCLIN					
18A	Standard Launch Services and Standard Mission Integration in accordance with the SOW and Exhibit 2	1	Lot		
18B	Non-Standard Services in accordance with the SOW and Exhibit 3				
	NSS 2.1.2	1	Ea	$	
	NSS 19.2	1	Ea	$	
	NSS 26.2	1	Ea	$	
	NSS 27.1	1	Ea	$	
18C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 5	1	Lot	$	

Table B-1.1: Firm Launch Service Requirements RLSP-1

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price (FFP $)	Total Amount (FFP $)
19	**Launch Service for THEMIS**	1	Service		
SubCLIN					
19A	Standard Launch Services and Standard Mission Integration in accordance with the SOW and Exhibit 2	1	Lot		
19B	Non-Standard Services in accordance with the SOW and Exhibit 3				
	NSS 2.1.2	1	Ea		
	NSS 11.2	1	Ea		
	NSS 26.1	1	Ea		
	NSS 30.2	1	Ea		
	NSS 9.1.2	1	Ea		
	NSS 2.2.3	2	Ea		
19C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 5	1	Lot	$	

Table B-1.1: Firm Launch Service Requirements RLSP-1

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price (FFP $)	Total Amount (FFP $)
20 **SubCLIN**	**Launch Service for Space Tracking Surveillance System (STSS) Block 2010 Risk Reduction**	1	Service		
20A	Standard Launch Services and Standard Mission Integration in accordance with the SOW and Exhibit 2	1	Lot		
20B	Non-Standard Services in accordance with the SOW and Exhibit 3				
	NSS 9.1.1	1	Ea	$	
	NSS 11.1	1	Ea	$	
	NSS 11.2	1	Ea	$	
	NSS 20.1	1	Ea	$	
	NSS 27.1	1	Ea	$	
	NSS 30.2	1	Ea	$	
20C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 5	1	Lot	$	

Table B-1.1: Firm Launch Service Requirements RLSP-1

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price (FFP $)	Total Amount (FFP $)
21	**Launch Service for Kepler**	1	Service		$
SubCLIN					
21A	Standard Launch Services and Standard Mission Integration in accordance with the SOW and Exhibit 2	1	Lot		
21B	Non-Standard Services in accordance with the SOW and Exhibit 3				
	NSS 2.1.1	1	Ea		
	NSS 2.1.2	1	Ea		
	NSS 19.1	1	Ea		
21C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 5				
	(1) 10L Fairing use at Eastern Range*	1	Ea		

Table B-1.1: Firm Launch Service Requirements RLSP-1

*If CLIN 8, Stereo, launches prior to the launch of CLIN 21, Kepler, then this mission unique will not be required and shall be credited to the mission price.

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price (FFP $)	Total Amount (FFP $)
22	**Launch Service for Phoenix**	1	Service		$(
SubCLIN					
22A	Standard Launch Services and Standard Mission Integration in accordance with the SOW and Exhibit 2	1	Lot		
22B	Non-Standard Services in accordance with the SOW and Exhibit 3				
	NSS 11.1	1	Ea		
	NSS 11.2	1	Ea		
	NSS 30.2	1	Ea		
22C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 5				

Table B-1.1: Firm Launch Service Requirements RLSP-1

Note: In the event that CLIN 22 – requires Non-Standard Service 1.1 – Heavy Vehicle Upgrade, the "One-Time FPR Discount for Heavy Vehicle Upgrade" in the amount of $2,000,000 shall be applicable. The appropriate price for NSS 1.1 shall be determined from Table B-12.1, and the discount applied as a separate line item.

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price (FFP $)	Total Amount (FFP $)
23	**Launch Service for Magnetospheric Multiscale (MMS)**	1	Service		$
SubCLIN					
23A	Standard Launch Services and Standard Mission Integration in accordance with the SOW and Exhibit 2	1	Lot		
23B	Non-Standard Services in accordance with the SOW and Exhibit 3				
	NSS 1.1	1	Ea		
	One-Time FPR Discount for Heavy Vehicle Upgrade	1	Ea		
	NSS 2.1.2	1	Ea		
	NSS 19.1	1	Ea		
	NSS 26.2	1	Ea		
23C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 5	1	Lot		

Table B-1.1: Firm Launch Service Requirements RLSP-1

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price (FFP $)	Total Amount (FFP $)
24	**Launch Service for Aquarius**	1	Service		$
SubCLIN					
24A	Standard Launch Services and Standard Mission Integration in accordance with the SOW and Exhibit 2	1	Lot		
24B	Non-Standard Services in accordance with the SOW and Exhibit 3				
	NSS 19.2	1	Ea		
	NSS 27.1	1	Ea		
24C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 5	1	Lot		

Table B-1.1: Firm Launch Service Requirements RLSP-1

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price (FFP $)	Total Amount (FFP $)
25 SubCLIN	Launch Service for MIDEX 6	1	Service		$
25A	Standard Launch Services and Standard Mission Integration in accordance with the SOW and Exhibit 2	1	Lot		
25B	Non-Standard Services in accordance with the SOW and Exhibit 3				
	NSS 19.1	1	Ea		
	NSS 2.1.2	1	Ea		
25C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 5	1	Lot		

Table B-1.1: Firm Launch Service Requirements RLSP-1

1.2 Standard Launch Service and Non-Standard Services Firm and Option Mission Profile Matrix

For each proposed firm and option standard launch service CLIN, the launch vehicle configuration and associated non-standard services corresponding with the standard launch service are identified by an 'X' in the appropriate column and box. An asterisk (*) placed in the appropriate column and box designates those non-standard services that are included as part of the standard launch service. An '11' indicates a Non-Standard Service Ordered Independently of a Defined Mission (CLIN 11) (see Section B, Clause 1.4 and Section B, Clause 7.0). Finally, an 'N/A' in the appropriate column and box designates those non-standard services that are not applicable or not available for a specific launch vehicle configuration and CLIN.

LV CONFIGURATION		CLIN							
		1	2	3	4	5	8	9	10
Delta II 2320-10					X			X	
Delta II 2325-9.5									
Delta II 2420-10									
Delta II 2425-9.5						X			
Delta II 2920-10		X							
Delta II 2925-9.5			X	X			X		X
NON-STANDARD SERVICE									
1.0	**Alternate Vehicle Configuration/ Performance Enhancements**								
1.1	Heavy vehicle upgrade	N/A	N/A	X	N/A	N/A	N/A	N/A	X
2.0	**Alternative Fairing Configuration and/or Modifications**								
2.1	Alternate configurations								
2.1.1	Replace a 10-ft PLF with a 10L PLF	X	N/A	N/A	N/A	N/A	X	N/A	N/A

Table B-2: LV Configuration and Associated Non-Standard Service Matrix

LV CONFIGURATION		CLIN							
		1	2	3	4	5	8	9	10
NON-STANDARD SERVICE									
2.1.2	Replace a 9.5-ft PLF with a 10-ft PLF	N/A	N/A	N/A	N/A	X	X	N/A	N/A
2.1.3	Replace a 10-ft PLF with a 9.5-ft PLF	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2.2	Add'l access doors in excess of three in the standard service								
2.2.1	9 x 13-inch door	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2.2.2	21.48 x 24.8-inch door	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2.2.3	24-inch-dia door	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2.2.4	10.5-inch-dia door	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2.2.5	18 x 18-inch door	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2.2.6	21.86 x 24.8-inch door	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2.2.7	25 x 25-inch door	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2.3	Add'l access doors of non-standard size	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2.4	Mounting provisions, cabling and antenna system for re-radiating signals from the payload to remote sites	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2.5	S, C, X and Ku-band re-radiation equipment	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2.6	RF-transparent doors	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3.0	**Alternative Payload Adapters (PAs)**								
3.1	Different size or different payload interface PAs								
3.1.1	5624 Payload Adapter	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3.1.2	6915 Payload Adapter	N/A	N/A	N/A	X	N/A	N/A	N/A	N/A
3.2	Low tip-off rate PAs								
3.2.1	6306 Payload Adapter	X	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3.2.2	6019 Payload Adapter	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4.0	**Upper Stage Hardware**								
4.1	Star-37 third stage								
4.1.1	Star-37 third stage with a yo-yo despin	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4.1.2	Star-37 third stage with a tumble system	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4.2	Payload adapters (PA)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4.3	Spin system with enhanced capability	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table B-2: LV Configuration and Associated Non-Standard Service Matrix

LV CONFIGURATION		CLIN							
		1	2	3	4	5	8	9	10
NON-STANDARD SERVICE									
4.4	Despin system with enhanced capability	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4.5	Improved insertion accuracy options	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4.6	Exchange a Star-48 despin system with a tumble system	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5.0	**Multiple PA, Inc. Related Mission Integration Support**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6.0	**Secondary PA for Non-Sep Secondary Payload**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7.0	**Secondary PA/Sep Sys for Sep Secondary Payload**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8.0	**RF Through-the-Fairing Transmission Capability**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9.0	**Enhanced Electrical Interface**								
9.1	Increased capacity payload-to-GSE interface								
9.1.1	Two 61-Pin electrical interface from fairing to payload	X	N/A	N/A	X	N/A	X	N/A	N/A
9.1.2	Two 61-Pin electrical interface across separation plane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9.1.3	Two 37-Pin electrical interface from fairing to upper stage								
9.1.3A	Electrical interface locations at stations 398.69 and 401.94	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9.1.3B	New electrical interface locations between stations 413.5 and 397.23 of Quad I (and 3.25 in. apart)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9.2	LV command and control of payload	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9.3	LV supplied payload power capability	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9.4	Enhanced telemetry capabilities	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9.5	Additional LV environmental instrumentation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10.0	**LV Mounted Cameras**								
10.1	Launch vehicle mounted cameras	N/A	N/A	N/A	X	N/A	N/A	N/A	XX
11.0	**Special Contamination Control Options**								
11.1	Enhanced fairing environment	N/A	N/A	N/A	X	N/A	X	N/A	N/A
11.2	Enhanced fairing internal surface cleaning	X	N/A	N/A	X	N/A	X	N/A	N/A

Table B-2: LV Configuration and Associated Non-Standard Service Matrix

LV CONFIGURATION		CLIN							
		1	2	3	4	5	8	9	10
NON-STANDARD SERVICE									
11.3	Optional payload/vehicle integration environments								
11.3.1	Fairing air conditioning between 50 and 55 deg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
11.3.2	Payload hydrocarbon level to 15 PPM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
11.4	Additional instrument purge system(s) up to T-0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
11.5	Grade B Nitrogen (GN_2) or pure air cooling supply for spot cooling of payload components from payload mate or encapsulation up to T-0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
12.0	**Vehicle Data Book For Radioactive Components**								
12.1	The first environmental assessment data book	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
12.2	Updated environmental assessment data book	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
13.0	**Co-Manifested Payload Mission Service**								
13.1	Dual payload attach fitting (DPAF) mission	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
13.2	Non-recurring for first flight of DPAF mission from the ER	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
13.3	Recurring credit for DPAF missions from the ER	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
14.0	**NASA Secondary Payload Mission Service**								
14.1	Non-separating secondary payload service	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
14.2	Separating secondary payload service	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15.0	**Payload Compatibility Assessment**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16.0	**Secondary Payload Mission Feasibility Study**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
17.0	**Secondary Payload Accommodation Study**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
18.0	**Secondary Payload Mass Simulator**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table B-2: LV Configuration and Associated Non-Standard Service Matrix

LV CONFIGURATION		CLIN							
		1	2	3	4	5	8	9	10
NON-STANDARD SERVICE									
19.0	**Payload Processing Facilities**								
19.1	Ground Processing Facilities—Payloads at Eastern Range	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
19.2	Ground processing Facilities—Payloads at Western Range	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
20.0	**Additional Mission Analysis and Support**								
20.1	Pedigree review	X	X	X	X	N/A	N/A	N/A	N/A
20.2	Support for additional mission integ. working group (MIWG) meetings	N/A	N/A	11	11	N/A	N/A	N/A	N/A
20.3	Mission Analysis (e.g., PGAA, Loads, Controls, Thermal, RF Link, and Clearance) Prior to ATP	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
20.3.1	Early Dynamic Assessment of Spacecraft Attitude Rates After Separation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
20.3.2	Preliminary Performance/Trajectory Analysis	N/A	11	11	N/A	N/A	N/A	N/A	N/A
20.3.3	Quick-Turnaround Coupled Loads	11	11	N/A	11	N/A	N/A	N/A	X
20.3.4	Final Design Load Cycle (FDLC)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
21.0	**Launch Call-Up Capability**								
21.1	Launch service price adjustment for ATP at L-18 months	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
21.2	Launch service price adjustment for ATP at L-12 months	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
21.3	Launch service price adjustment for ATP at TBP months	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
22.0	**NASA Public Affairs Office Support**								
22.1	NASA Public Affairs Office Support	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
23.0	**Credits**								
23.1	Later mission integration start at L-**TBP** (Limited to L-21M or L-18M)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
23.2	Penalty for "failed mission determination" limited to withholding of final payment (10%)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
23.3	No penalty for "partial or failed mission determination"	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table B-2: LV Configuration and Associated Non-Standard Service Matrix

LV CONFIGURATION		CLIN							
		1	2	3	4	5	8	9	10
NON-STANDARD SERVICE									
23.4	Alternate quarterly launch service payment schedule without any failure penalty								
23.4A	L-42M to L-24M Payment Schedule	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
23.4B	L-36M to L-12M Payment Schedule	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
24.0	**Dual Payload Attach Fitting (DPAF) Special Options**								
24.1	T-0 GN_2 purge for lower DPAF spacecraft	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
24.2	Special instrumentation for WTR DPAF missions	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
24.3	Standard instrumentation for lower DPAF spacecraft	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
24.4	T-0 ground battery air conditioning for WTR DPAF missions	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
24.5	Additional access hole in the DPAF	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
25.0	**120 Day Mission Call-Up For Option 6**								
25.1	Facility call-up capability	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
25.2	Recurring call-up charges								
25.2.1	Monthly charge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
25.2.2	Per-vehicle charge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
26.0	**First Flight Core Vehicle Analysis**								
26.1	Category "1" core vehicle analysis (Medium)	N/A	N/A	N/A	N/A	N/A	X	N/A	N/A
26.2	Category "2" core vehicle analysis (Small)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	X
27.0	**Western Range (WR) Launch Incremental**								
27.1	Western Range (WR) Launch Incremental	X	N/A	N/A	N/A	N/A	N/A	X	N/A
28.0	Special Instrumentation for Delta II (2-Stage Vehicles)								
28.1	Special Instrumentation for Delta II (2-Stage Vehicles) - Recurring	X	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table B-2: LV Configuration and Associated Non-Standard Service Matrix

1.2.1 Standard Launch Service and Non-Standard Services Firm and Option Mission Profile Matrix RLSP-1

For each proposed firm and option standard launch service CLIN, the launch vehicle configuration and associated non-standard services corresponding with the standard launch service are identified by an 'X' in the appropriate column and box. An asterisk (*) placed in the appropriate column and box designates those non-standard services that are included as part of the standard launch service. An '11' indicates a Non-Standard Service Ordered Independently of a Defined Mission (CLIN 11) (see Section B, Clause 1.4 and Section B, Clause 7.0). Finally, an 'N/A' in the appropriate column and box designates those non-standard services that are not applicable or not available for a specific launch vehicle configuration and CLIN.

LV CONFIGURATION	CLIN								
	14	15	16	17	18	19	20	21	22
Delta II 2320-10					X				
Delta II 2325-9.5									
Delta II 2420-10									
Delta II 2425-9.5									
Delta II 2920-10	X		X	X			X		
Delta II 2925-9.5		X				X		X	X
NON-STANDARD SERVICE									
1.0 Alternate Vehicle Configuration/ Performance Enhancements									
1.1 Heavy vehicle upgrade		X		X					
2.0 Alternative Fairing Configuration and/or Modifications									
2.1 Alternate configurations									
2.1.1 Replace a 10-ft PLF with a 10L PLF								X	

Table B-2.1: LV Configuration and Associated Non-Standard Service Matrix RLSP-1

LV CONFIGURATION		CLIN								
		14	15	16	17	18	19	20	21	22
	NON-STANDARD SERVICE									
2.1.2	Replace a 9.5-ft PLF with a 10-ft PLF	X				X	X		X	
2.1.3	Replace a 10-ft PLF with a 9.5-ft PLF									
2.2	Add'l access doors in excess of three in the standard service									
2.2.1	9 x 13-inch door									
2.2.2	21.48 x 24.8-inch door									
2.2.3	24-inch-dia door						X(2)			
2.2.4	10.5-inch-dia door									
2.2.5	18 x 18-inch door									
2.2.6	21.86 x 24.8-inch door									
2.2.7	25 x 25-inch door									
2.3	Add'l access doors of non-standard size									
2.4	Mounting provisions, cabling and antenna system for re-radiating signals from the payload to remote sites									
2.5	S, C, X and Ku-band re-radiation equipment									
2.6	RF-transparent doors									
3.0	**Alternative Payload Adapters (PAs)**									
3.1	Different size or different payload interface PAs									
3.1.1	5624 Payload Adapter									
3.1.2	6915 Payload Adapter									
3.1.3	3715C Payload Adapter									
3.2	Low tip-off rate PAs									
3.2.1	6306 Payload Adapter									
3.2.2	6019 Payload Adapter									
4.0	**Upper Stage Hardware**									
4.1	Star-37 third stage									
4.1.1	Star-37 third stage with a yo-yo despin									
4.1.2	Star-37 third stage with a tumble system									
4.2	Payload adapters (PA)									
4.3	Spin system with enhanced capability									

Table B-2.1: LV Configuration and Associated Non-Standard Service Matrix RLSP-1

LV CONFIGURATION		CLIN								
		14	15	16	17	18	19	20	21	22
NON-STANDARD SERVICE										
4.4	Despin system with enhanced capability									
4.5	Improved insertion accuracy options									
4.6	Exchange a Star-48 despin system with a tumble system									
5.0	**Multiple PA, Inc. Related Mission Integration Support**									
6.0	**Secondary PA for Non-Sep Secondary Payload**									
7.0	**Secondary PA/Sep Sys for Sep Secondary Payload**									
8.0	**RF Through-the-Fairing Transmission Capability**									
9.0	**Enhanced Electrical Interface**									
9.1	Increased capacity payload-to-GSE interface									
9.1.1	Two 61-Pin electrical interface from fairing to payload	11						X		
9.1.2	Two 61-Pin electrical interface across separation plane						X			
9.1.3	Two 37-Pin electrical interface from fairing to upper stage									
9.1.3A	Electrical interface locations at stations 398.69 and 401.94									
9.1.3B	New electrical interface locations between stations 413.5 and 397.23 of Quad I (and 3.25 in. apart)									
9.2	LV command and control of payload									
9.3	LV supplied payload power capability									
9.4	Enhanced telemetry capabilities									
9.5	Additional LV environmental instrumentation									
10.0	**LV Mounted Cameras**									
10.1	Launch vehicle mounted cameras									
11.0	**Special Contamination Control Options**									
11.1	Enhanced fairing environment	X	X					X		X
11.2	Enhanced fairing internal surface cleaning	X	X				X	X		X

Table B-2.1: LV Configuration and Associated Non-Standard Service Matrix RLSP-1

LV CONFIGURATION		CLIN								
		14	15	16	17	18	19	20	21	22
NON-STANDARD SERVICE										
11.3	Optional payload/vehicle integration environments									
11.3.1	Fairing air conditioning between 50 and 55 deg									
11.3.2	Payload hydrocarbon level to 15 PPM									
11.4	Additional instrument purge system(s) up to T-0									
11.5	Grade B Nitrogen (GN_2) or pure air cooling supply for spot cooling of payload components from payload mate or encapsulation up to T-0									
12.0	**Vehicle Data Book For Radioactive Components**									
12.1	The first environmental assessment data book									
12.2	Updated environmental assessment data book									
13.0	**Co-Manifested Payload Mission Service**									
13.1	Dual payload attach fitting (DPAF) mission									
13.2	Non-recurring for first flight of DPAF mission from the ER									
13.3	Recurring credit for DPAF missions from the ER									
14.0	**NASA Secondary Payload Mission Service**									
14.1	Non-separating secondary payload service									
14.2	Separating secondary payload service									
15.0	**Payload Compatibility Assessment**									
16.0	**Secondary Payload Mission Feasibility Study**									
17.0	**Secondary Payload Accommodation Study**									
18.0	**Secondary Payload Mass Simulator**									

Table B-2.1: LV Configuration and Associated Non-Standard Service Matrix RLSP-1

LV CONFIGURATION		CLIN								
		14	15	16	17	18	19	20	21	22
	NON-STANDARD SERVICE									
19.0	**Payload Processing Facilities**									
19.1	Ground Processing Facilities—Payloads at Eastern Range				X				X	
19.1.1	Enhanced Payload Processing Environment Increment (ER)									
19.1.2	Enhanced Environmental Monitoring (ER)									
19.2	Ground processing Facilities—Payloads at Western Range					X				
20.0	**Additional Mission Analysis and Support**									
20.1	Pedigree review							X		
20.2	Support for additional mission integ. working group (MIWG) meetings				11x3					
20.3	Mission Analysis (e.g., PGAA, Loads, Controls, Thermal, RF Link, and Clearance) Prior to ATP									
20.3.1	Early Dynamic Assessment of Spacecraft Attitude Rates After Separation									
20.3.2	Preliminary Performance/Trajectory Analysis								11	11
20.3.3	Quick-Turnaround Coupled Loads	11	11			11			11	
20.3.4	Final Design Load Cycle (FDLC)				11x2				X	11
21.0	**Launch Call-Up Capability**									
21.1	Launch service price adjustment for ATP at L-18 months									
21.2	Launch service price adjustment for ATP at L-12 months									
21.3	Launch service price adjustment for ATP at TBP months									
22.0	**NASA Public Affairs Office Support**									
22.1	NASA Public Affairs Office Support									
23.0	**Credits**									
23.1	Later mission integration start at L-TBP (Limited to L-21M or L-18M)									
23.2	Penalty for "failed mission determination" limited to withholding of final payment (10%)									
23.3	No penalty for "partial or failed mission determination"									
23.4	Alternate quarterly launch service payment schedule without any failure penalty									

Table B-2.1: LV Configuration and Associated Non-Standard Service Matrix RLSP-1

LV CONFIGURATION		CLIN								
		14	15	16	17	18	19	20	21	22
NON-STANDARD SERVICE										
23.4A	L-42M to L-24M Payment Schedule									
23.4B	L-36M to L-12M Payment Schedule									
24.0	Dual Payload Attach Fitting (DPAF) Special Options									
24.1	T-0 GN_2 purge for lower DPAF spacecraft									
24.2	Special instrumentation for WTR DPAF missions									
24.3	Standard instrumentation for lower DPAF spacecraft									
24.4	T-0 ground battery air conditioning for WTR DPAF missions									
24.5	Additional access hole in the DPAF									
25.0	120 Day Mission Call-Up For Option 6									
25.1	Facility call-up capability									
25.2	Recurring call-up charges									
25.2.1	Monthly charge									
25.2.2	Per-vehicle charge									
26.0	First Flight Core Vehicle Analysis									
26.1	Category "1" core vehicle analysis (Medium)			X	X		X			
26.2	Category "2" core vehicle analysis (Small)	X				X				
27.0	Western Range (WR) Launch Incremental									
27.1	Western Range (WR) Launch Incremental	X				X		X		
28.0	Special Instrumentation for Delta II (2-Stage Vehicle)									
28.1	Special Instrumentation for Delta II (2-Stage Vehicle)--Recurring									
29.0	Reserved									
30.0	Long Lead Material Procurement									
30.1	Long-Lead Material Procurement									
30.2	Long-Lead Material Procurement Liquidation (per vehicle, CLINS 14-22 only)	X	X	X			X	X		X
31.0	CCAFS Launch Site Maintenance									
31.1	Maintenance Model – SLC-17 Style (Monthly Charge)									
31.2	Maintenance Model – SLC-2 Style (Monthly Charge)									
31.3	Maintenance Model – Commercial Style (Monthly Charge)									

LV CONFIGURATION		CLIN								
		14	15	16	17	18	19	20	21	22
NON-STANDARD SERVICE										
19.0	**Payload Processing Facilities**									
19.1	Ground Processing Facilities—Payloads at Eastern Range				X				X	
19.1.1	Enhanced Payload Processing Environment Increment (ER)									
19.1.2	Enhanced Environmental Monitoring (ER)									
19.2	Ground processing Facilities—Payloads at Western Range					X				
20.0	**Additional Mission Analysis and Support**									
20.1	Pedigree review							X		
20.2	Support for additional mission integ. working group (MIWG) meetings				11x3					
20.3	Mission Analysis (e.g., PGAA, Loads, Controls, Thermal, RF Link, and Clearance) Prior to ATP									
20.3.1	Early Dynamic Assessment of Spacecraft Attitude Rates After Separation									
20.3.2	Preliminary Performance/Trajectory Analysis								11	11
20.3.3	Quick-Turnaround Coupled Loads	11	11			11			11	
20.3.4	Final Design Load Cycle (FDLC)				11x2				X	11
21.0	**Launch Call-Up Capability**									
21.1	Launch service price adjustment for ATP at L-18 months									
21.2	Launch service price adjustment for ATP at L-12 months									
21.3	Launch service price adjustment for ATP at TBP months									
22.0	**NASA Public Affairs Office Support**									
22.1	NASA Public Affairs Office Support									
23.0	**Credits**									
23.1	Later mission integration start at L-TBP (Limited to L-21M or L-18M)									
23.2	Penalty for "failed mission determination" limited to withholding of final payment (10%)									
23.3	No penalty for "partial or failed mission determination"									
23.4	Alternate quarterly launch service payment schedule without any failure penalty									

Table B-2.1: LV Configuration and Associated Non-Standard Service Matrix RLSP-1

LV CONFIGURATION		CLIN								
		14	15	16	17	18	19	20	21	22
NON-STANDARD SERVICE										
23.4A	L-42M to L-24M Payment Schedule									
23.4B	L-36M to L-12M Payment Schedule									
24.0	Dual Payload Attach Fitting (DPAF) Special Options									
24.1	T-0 GN_2 purge for lower DPAF spacecraft									
24.2	Special instrumentation for WTR DPAF missions									
24.3	Standard instrumentation for lower DPAF spacecraft									
24.4	T-0 ground battery air conditioning for WTR DPAF missions									
24.5	Additional access hole in the DPAF									
25.0	120 Day Mission Call-Up For Option 5									
25.1	Facility call-up capability									
25.2	Recurring call-up charges									
25.2.1	Monthly charge									
25.2.2	Per-vehicle charge									
26.0	First Flight Core Vehicle Analysis									
26.1	Category "1" core vehicle analysis (Medium)			X	X		X			
26.2	Category "2" core vehicle analysis (Small)	X				X				
27.0	Western Range (WR) Launch Incremental									
27.1	Western Range (WR) Launch Incremental	X				X		X		
28.0	Special Instrumentation for Delta II (2-Stage Vehicle)									
28.1	Special Instrumentation for Delta II (2-Stage Vehicle)--Recurring									
29.0	Reserved									
30.0	Long Lead Material Procurement									
30.1	Long-Lead Material Procurement									
30.2	Long-Lead Material Procurement Liquidation (per vehicle, CLINS 14-22 only)	X	X	X			X	X		X
31.0	CCAFS Launch Site Maintenance									
31.1	Maintenance Model – SLC-17 Style (Monthly Charge)									
31.2	Maintenance Model – SLC-2 Style (Monthly Charge)									
31.3	Maintenance Model – Commercial Style (Monthly Charge)									

LV CONFIGURATION		CLIN								
		14	15	16	17	18	19	20	21	22
NON-STANDARD SERVICE										
32.0	VAFB Launch Site Maintenance									
32.1	West Coast Maintenance (Monthly Charge)									
33.0	Post Production Support									
33.1	Post Production Support									
34.0	Delta II Launch Vehicle Flexibility									
34.1	Additional 40-Inch GEM(s)									
34.2	Installation of One Additional 40-Inch GEM									

Table B-2.1: LV Configuration and Associated Non-Standard Service Matrix RLSP-1

LV CONFIGURATION	CLIN									
	23	24	25	26	27	28	29	30	31	32
Delta II 2320-10		X								
Delta II 2325-9.5										
Delta II 2420-10								X		
Delta II 2425-9.5			X							
Delta II 2920-10				X	X					X
Delta II 2925-9.5	X					X	X		X	
NON-STANDARD SERVICE										
1.0 Alternate Vehicle Configuration/ Performance Enhancements										
1.1 Heavy vehicle upgrade	X				X		X		X	
2.0 Alternative Fairing Configuration and/or Modifications										
2.1 Alternate configurations										
2.1.1 Replace a 10-ft PLF with a 10L PLF										

Table B-2.1: LV Configuration and Associated Non-Standard Service Matrix RLSP-1

LV CONFIGURATION		CLIN									
		23	24	25	26	27	28	29	30	31	32
NON-STANDARD SERVICE											
2.1.2	Replace a 9.5-ft PLF with a 10-ft PLF	X		X				X			
2.1.3	Replace a 10-ft PLF with a 9.5-ft PLF										
2.2	Add'l access doors in excess of three in the standard service										
2.2.1	9 x 13-inch door										
2.2.2	21.48 x 24.8-inch door										
2.2.3	24-inch-dia door										X
2.2.4	10.5-inch-dia door										
2.2.5	18 x 18-inch door										
2.2.6	21.86 x 24.8-inch door										
2.2.7	25 x 25-inch door										
2.3	Add'l access doors of non-standard size										
2.4	Mounting provisions, cabling and antenna system for re-radiating signals from the payload to remote sites										
2.5	S, C, X and Ku-band re-radiation equipment										
2.6	RF-transparent doors										
3.0	**Alternative Payload Adapters (PAs)**										
3.1	Different size or different payload interface PAs										
3.1.1	5624 Payload Adapter										
3.1.2	6915 Payload Adapter										
3.2	Low tip-off rate PAs										
3.2.1	6306 Payload Adapter										
3.2.2	6019 Payload Adapter										
4.0	**Upper Stage Hardware**										
4.1	Star-37 third stage										
4.1.1	Star-37 third stage with a yo-yo despin										
4.1.2	Star-37 third stage with a tumble system										
4.2	Payload adapters (PA)										
4.3	Spin system with enhanced capability										

Table B-2.1: LV Configuration and Associated Non-Standard Service Matrix RLSP-1

LV CONFIGURATION		CLIN									
		23	24	25	26	27	28	29	30	31	32
NON-STANDARD SERVICE											
4.4	Despin system with enhanced capability										
4.5	Improved insertion accuracy options										
4.6	Exchange a Star-48 despin system with a tumble system										
5.0	**Multiple PA, Inc. Related Mission Integration Support**										
6.0	**Secondary PA for Non-Sep Secondary Payload**										
7.0	**Secondary PA/Sep Sys for Sep Secondary Payload**										
8.0	**RF Through-the-Fairing Transmission Capability**										
9.0	**Enhanced Electrical Interface**										
9.1	Increased capacity payload-to-GSE interface										
9.1.1	Two 61-Pin electrical interface from fairing to payload										
9.1.2	Two 61-Pin electrical interface across separation plane										
9.1.3	Two 37-Pin electrical interface from fairing to upper stage										
9.1.3A	Electrical interface locations at stations 398.69 and 401.94										
9.1.3B	New electrical interface locations between stations 413.5 and 397.23 of Quad I (and 3.25 in. apart)										
9.2	LV command and control of payload										
9.3	LV supplied payload power capability										
9.4	Enhanced telemetry capabilities										
9.5	Additional LV environmental instrumentation										
10.0	**LV Mounted Cameras**										
10.1	Launch vehicle mounted cameras										
11.0	**Special Contamination Control Options**										
11.1	Enhanced fairing environment										
11.2	Enhanced fairing internal surface cleaning										

Table B-2.1: LV Configuration and Associated Non-Standard Service Matrix RLSP-1

LV CONFIGURATION	CLIN									
	23	24	25	26	27	28	29	30	31	32
NON-STANDARD SERVICE										
11.3 Optional payload/vehicle integration environments										
11.3.1 Fairing air conditioning between 50 and 55 deg										
11.3.2 Payload hydrocarbon level to 15 PPM										
11.4 Additional instrument purge system(s) up to T-0										
11.5 Grade B Nitrogen (GN_2) or pure air cooling supply for spot cooling of payload components from payload mate or encapsulation up to T-0										
12.0 Vehicle Data Book For Radioactive Components										
12.1 The first environmental assessment data book										
12.2 Updated environmental assessment data book										
13.0 Co-Manifested Payload Mission Service										
13.1 Dual payload attach fitting (DPAF) mission										
13.2 Non-recurring for first flight of DPAF mission from the ER										
13.3 Recurring credit for DPAF missions from the ER										
14.0 NASA Secondary Payload Mission Service										
14.1 Non-separating secondary payload service										
14.2 Separating secondary payload service										
15.0 Payload Compatibility Assessment										
16.0 Secondary Payload Mission Feasibility Study										
17.0 Secondary Payload Accommodation Study										
18.0 Secondary Payload Mass Simulator										

Table B-2.1: LV Configuration and Associated Non-Standard Service Matrix RLSP-1

LV CONFIGURATION	CLIN									
	23	24	25	26	27	28	29	30	31	32
NON-STANDARD SERVICE										
19.0 Payload Processing Facilities										
19.1 Ground Processing Facilities—Payloads at Eastern Range	X		X	X	X	X	X		X	
19.1.1 Enhanced Payload Processing Environment Increment (ER)										
19.1.2 Enhanced Environmental Monitoring (E)										
19.2 Ground processing Facilities—Payloads at Western Range		X						X		X
20.0 Additional Mission Analysis and Support										
20.1 Pedigree review										
20.2 Support for additional mission integ. working group (MIWG) meetings										
20.3 Mission Analysis (e.g., PGAA, Loads, Controls, Thermal, RF Link, and Clearance) Prior to ATP										
20.3.1 Early Dynamic Assessment of Spacecraft Attitude Rates After Separation										
20.3.2 Preliminary Performance/Trajectory Analysis										
20.3.3 Quick-Turnaround Coupled Loads										
20.3.4 Final Design Load Cycle (FDLC)										
21.0 Launch Call-Up Capability										
21.1 Launch service price adjustment for ATP at L-18 months										
21.2 Launch service price adjustment for ATP at L-12 months										
21.3 Launch service price adjustment for ATP at TBP months										
22.0 NASA Public Affairs Office Support										
22.1 NASA Public Affairs Office Support										
23.0 Credits										
23.1 Later mission integration start at L-**TBP** (Limited to L-21M or L-18M)										
23.2 Penalty for "failed mission determination" limited to withholding of final payment (10%)										
23.3 No penalty for "partial or failed mission determination"										

Table B-2.1: LV Configuration and Associated Non-Standard Service Matrix RLSP-1

LV CONFIGURATION		CLIN									
		23	24	25	26	27	28	29	30	31	32
	NON-STANDARD SERVICE										
11.3	Optional payload/vehicle integration environments										
11.3.1	Fairing air conditioning between 50 and 55 deg										
11.3.2	Payload hydrocarbon level to 15 PPM										
11.4	Additional instrument purge system(s) up to T-0										
11.5	Grade B Nitrogen (GN_2) or pure air cooling supply for spot cooling of payload components from payload mate or encapsulation up to T-0										
12.0	**Vehicle Data Book For Radioactive Components**										
12.1	The first environmental assessment data book										
12.2	Updated environmental assessment data book										
13.0	**Co-Manifested Payload Mission Service**										
13.1	Dual payload attach fitting (DPAF) mission										
13.2	Non-recurring for first flight of DPAF mission from the ER										
13.3	Recurring credit for DPAF missions from the ER										
14.0	**NASA Secondary Payload Mission Service**										
14.1	Non-separating secondary payload service										
14.2	Separating secondary payload service										
15.0	**Payload Compatibility Assessment**										
16.0	**Secondary Payload Mission Feasibility Study**										
17.0	**Secondary Payload Accommodation Study**										
18.0	**Secondary Payload Mass Simulator**										

Table B-2.1: LV Configuration and Associated Non-Standard Service Matrix RLSP-1

LV CONFIGURATION		CLIN									
		23	24	25	26	27	28	29	30	31	32
NON-STANDARD SERVICE											
19.0	**Payload Processing Facilities**										
19.1	Ground Processing Facilities—Payloads at Eastern Range	X		X	X	X	X	X		X	
19.1.1	Enhanced Payload Processing Environment Increment (ER)										
19.1.2	Enhanced Environmental Monitoring (E)										
19.2	Ground processing Facilities—Payloads at Western Range		X						X		X
20.0	**Additional Mission Analysis and Support**										
20.1	Pedigree review										
20.2	Support for additional mission integ. working group (MIWG) meetings										
20.3	Mission Analysis (e.g., PGAA, Loads, Controls, Thermal, RF Link, and Clearance) Prior to ATP										
20.3.1	Early Dynamic Assessment of Spacecraft Attitude Rates After Separation										
20.3.2	Preliminary Performance/Trajectory Analysis										
20.3.3	Quick-Turnaround Coupled Loads										
20.3.4	Final Design Load Cycle (FDLC)										
21.0	**Launch Call-Up Capability**										
21.1	Launch service price adjustment for ATP at L-18 months										
21.2	Launch service price adjustment for ATP at L-12 months										
21.3	Launch service price adjustment for ATP at TBP months										
22.0	**NASA Public Affairs Office Support**										
22.1	NASA Public Affairs Office Support										
23.0	**Credits**										
23.1	Later mission integration start at L-**TBP** (Limited to L-21M or L-18M)										
23.2	Penalty for "failed mission determination" limited to withholding of final payment (10%)										
23.3	No penalty for "partial or failed mission determination"										

Table B-2.1: LV Configuration and Associated Non-Standard Service Matrix RLSP-1

LV CONFIGURATION	CLIN									
	23	24	25	26	27	28	29	30	31	32
NON-STANDARD SERVICE										
11.3 Optional payload/vehicle integration environments										
11.3.1 Fairing air conditioning between 50 and 55 deg										
11.3.2 Payload hydrocarbon level to 15 PPM										
11.4 Additional instrument purge system(s) up to T-0										
11.5 Grade B Nitrogen (GN_2) or pure air cooling supply for spot cooling of payload components from payload mate or encapsulation up to T-0										
12.0 Vehicle Data Book For Radioactive Components										
12.1 The first environmental assessment data book										
12.2 Updated environmental assessment data book										
13.0 Co-Manifested Payload Mission Service										
13.1 Dual payload attach fitting (DPAF) mission										
13.2 Non-recurring for first flight of DPAF mission from the ER										
13.3 Recurring credit for DPAF missions from the ER										
14.0 NASA Secondary Payload Mission Service										
14.1 Non-separating secondary payload service										
14.2 Separating secondary payload service										
15.0 Payload Compatibility Assessment										
16.0 Secondary Payload Mission Feasibility Study										
17.0 Secondary Payload Accommodation Study										
18.0 Secondary Payload Mass Simulator										

Table B-2.1: LV Configuration and Associated Non-Standard Service Matrix RLSP-1

LV CONFIGURATION	CLIN									
	23	24	25	26	27	28	29	30	31	32
NON-STANDARD SERVICE										
19.0 Payload Processing Facilities										
19.1 Ground Processing Facilities—Payloads at Eastern Range	X		X	X	X	X	X		X	
19.1.1 Enhanced Payload Processing Environment Increment (ER)										
19.1.2 Enhanced Environmental Monitoring (E)										
19.2 Ground processing Facilities—Payloads at Western Range		X						X		X
20.0 Additional Mission Analysis and Support										
20.1 Pedigree review										
20.2 Support for additional mission integ. working group (MIWG) meetings										
20.3 Mission Analysis (e.g., PGAA, Loads, Controls, Thermal, RF Link, and Clearance) Prior to ATP										
20.3.1 Early Dynamic Assessment of Spacecraft Attitude Rates After Separation										
20.3.2 Preliminary Performance/Trajectory Analysis										
20.3.3 Quick-Turnaround Coupled Loads										
20.3.4 Final Design Load Cycle (FDLC)										
21.0 Launch Call-Up Capability										
21.1 Launch service price adjustment for ATP at L-18 months										
21.2 Launch service price adjustment for ATP at L-12 months										
21.3 Launch service price adjustment for ATP at TBP months										
22.0 NASA Public Affairs Office Support										
22.1 NASA Public Affairs Office Support										
23.0 Credits										
23.1 Later mission integration start at L-TBP (Limited to L-21M or L-18M)										
23.2 Penalty for "failed mission determination" limited to withholding of final payment (10%)										
23.3 No penalty for "partial or failed mission determination"										

Table B-2.1: LV Configuration and Associated Non-Standard Service Matrix RLSP-1

LV CONFIGURATION	CLIN									
	23	24	25	26	27	28	29	30	31	32
NON-STANDARD SERVICE										
11.3 Optional payload/vehicle integration environments										
11.3.1 Fairing air conditioning between 50 and 55 deg										
11.3.2 Payload hydrocarbon level to 15 PPM										
11.4 Additional instrument purge system(s) up to T-0										
11.5 Grade B Nitrogen (GN_2) or pure air cooling supply for spot cooling of payload components from payload mate or encapsulation up to T-0										
12.0 Vehicle Data Book For Radioactive Components										
12.1 The first environmental assessment data book										
12.2 Updated environmental assessment data book										
13.0 Co-Manifested Payload Mission Service										
13.1 Dual payload attach fitting (DPAF) mission										
13.2 Non-recurring for first flight of DPAF mission from the ER										
13.3 Recurring credit for DPAF missions from the ER										
14.0 NASA Secondary Payload Mission Service										
14.1 Non-separating secondary payload service										
14.2 Separating secondary payload service										
15.0 Payload Compatibility Assessment										
16.0 Secondary Payload Mission Feasibility Study										
17.0 Secondary Payload Accommodation Study										
18.0 Secondary Payload Mass Simulator										

Table B-2.1: LV Configuration and Associated Non-Standard Service Matrix RLSP-1

LV CONFIGURATION		CLIN									
		23	24	25	26	27	28	29	30	31	32
	NON-STANDARD SERVICE										
19.0	**Payload Processing Facilities**										
19.1	Ground Processing Facilities—Payloads at Eastern Range	X		X	X	X	X	X		X	
19.1.1	Enhanced Payload Processing Environment Increment (ER)										
19.1.2	Enhanced Environmental Monitoring (E)										
19.2	Ground processing Facilities—Payloads at Western Range		X						X		X
20.0	**Additional Mission Analysis and Support**										
20.1	Pedigree review										
20.2	Support for additional mission integ. working group (MIWG) meetings										
20.3	Mission Analysis (e.g., PGAA, Loads, Controls, Thermal, RF Link, and Clearance) Prior to ATP										
20.3.1	Early Dynamic Assessment of Spacecraft Attitude Rates After Separation										
20.3.2	Preliminary Performance/Trajectory Analysis										
20.3.3	Quick-Turnaround Coupled Loads										
20.3.4	Final Design Load Cycle (FDLC)										
21.0	**Launch Call-Up Capability**										
21.1	Launch service price adjustment for ATP at L-18 months										
21.2	Launch service price adjustment for ATP at L-12 months										
21.3	Launch service price adjustment for ATP at TBP months										
22.0	**NASA Public Affairs Office Support**										
22.1	NASA Public Affairs Office Support										
23.0	**Credits**										
23.1	Later mission integration start at L-**TBP** (Limited to L-21M or L-18M)										
23.2	Penalty for "failed mission determination" limited to withholding of final payment (10%)										
23.3	No penalty for "partial or failed mission determination"										

Table B-2.1: LV Configuration and Associated Non-Standard Service Matrix RLSP-1

LV CONFIGURATION		CLIN									
		23	24	25	26	27	28	29	30	31	32
NON-STANDARD SERVICE											
23.4	Alternate quarterly launch service payment schedule without any failure penalty										
23.4A	L-42M to L-24M Payment Schedule										
23.4B	L-36M to L-12M Payment Schedule										
24.0	**Dual Payload Attach Fitting (DPAF) Special Options**										
24.1	T-0 GN_2 purge for lower DPAF spacecraft										
24.2	Special instrumentation for WTR DPAF missions										
24.3	Standard instrumentation for lower DPAF spacecraft										
24.4	T-0 ground battery air conditioning for WTR DPAF missions										
24.5	Additional access hole in the DPAF										
25.0	**120 Day Mission Call-Up For Option 6**										
25.1	Facility call-up capability										
25.2	Recurring call-up charges										
25.2.1	Monthly charge										
25.2.2	Per-vehicle charge										
26.0	**First Flight Core Vehicle Analysis**										
26.1	Category "1" core vehicle analysis (Medium)				X						
26.2	Category "2" core vehicle analysis (Small)	X									
27.0	**Western Range (WR) Launch Incremental**										
27.1	Western Range (WR) Launch Incremental		X						X		X
28.0	**Special Instrumentation for Delta II (2-Stage Vehicle)**										
28.1	Special Instrumentation for Delta II (2-Stage Vehicle)-Recurring										
29.0	**Reserved**										
30.0	**Long Lead Material Procurement**										
30.1	Long-Lead Material Procurement										
30.2	Long-Lead Material Procurement Liquidation (per vehicle, CLINS 14-22 only)										
31.0	**CCAFS Launch Site Maintenance**										
31.1	Maintenance Model – SLC-17 Style (Monthly Charge)										
31.2	Maintenance Model – SLC-2 Style (Monthly Charge)										

Table B-2.1: LV Configuration and Associated Non-Standard Service Matrix RLSP-1

LV CONFIGURATION		CLIN									
		23	24	25	26	27	28	29	30	31	32
NON-STANDARD SERVICE											
31.3	Maintenance Model – Commercial Style (Monthly Charge)										
32.0	**VAFB Launch Site Maintenance**										
32.1	West Coast Maintenance (Monthly Charge)										
33.0	**Post Production Support**										
33.1	Post Production Support										
34.0	**Delta II Launch Vehicle Flexibility**										
34.1	Additional 40-Inch GEM(s)										
34.2	Installation of One Additional 40-Inch GEM										

Table B-2.1: LV Configuration and Associated Non-Standard Service Matrix RLSP-1

1.3 Optional Launch Service Requirements CLIN Structure

The Government reserves the right to exercise up to five optional launch services in accordance with Table B-3 through calendar year 2004. Optional launch services missions will be TBD (i.e., unnamed) at time of contract award and named prior to the Authority to Proceed (ATP) and exercise of option. Prior to exercise of options in Table B-3, the Government reserves the right to substitute a standard launch service for SubCLIN A in accordance with Table B-11 and add or delete non-standard services for SubCLIN B in accordance with Table B-12. The NASA Contracting Officer will exercise options in accordance with the procedures at FAR Subpart 17.2.

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price ($)	Total Amount ($)
4 SubCLIN	Optional Launch Service (Option 1)				
	Exercised in Contract Modification 16				

Table B-3: Optional Launch Service Requirements CLIN Structure

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price ($)	Total Amount ($)
5 SubCLIN	**Optional Launch Service (Option 2)**	1	Service		$
5A	Standard Launch Services and Standard Mission Integration in accordance with the SOW and Exhibit 2	1	Lot		
5B	Non-Standard Services in accordance with the SOW and Exhibit 3	1	Lot		
5C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 5	1	Lot		
8 SubCLIN	**Optional Launch Service (Option 5)**				
	Exercised in Contract Modification No. 88				

Table B-3: Optional Launch Service Requirements CLIN Structure

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price ($)	Total Amount ($)
9 SubCLIN	**Optional Launch Service (Option 6)**				
	Exercised in Contract Modification No. 72				
10 SubCLIN	**Optional Launch Service (Option 7)**				
	Exercised in Contract Modification No. 9				

Table B-3: Optional Launch Service Requirements CLIN Structure

1.3.1 Optional Launch Service Requirements CLIN Structure RLSP-1

The Government reserves the right to exercise up to seven optional launch services in accordance with Table B-3.1 and Section C, Paragraph 10.0. Optional launch services will be TBD (i.e. unnamed) at time of contract award and named prior to the Authority to Proceed (ATP) and exercise of option.

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price (FFP $)	Total Amount (FFP $)
26	**Optional Launch Service (Option 8)**	1	Service		$
SubCLIN					
26A	Standard Launch Services and Standard Mission Integration in accordance with the SOW and Exhibit 2	1	Lot		
26B	Non-Standard Services in accordance with the SOW and Exhibit 3				
	NSS 19.1	1	Ea		
	NSS 26.1	1	Ea		
26C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 5	1	Lot		

Table B-3.1: Optional Launch Service Requirements CLIN Structure RLSP-1

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price (FFP $)	Total Amount (FFP $)
27	**Optional Launch Service (Option 9)**	1	Service		$
SubCLIN					
27A	Standard Launch Services and Standard Mission Integration in accordance with the SOW and Exhibit 2	1	Lot		
27B	Non-Standard Services in accordance with the SOW and Exhibit 3				
	NSS 1.1	1	Ea		
	One-Time FPR Discount for Heavy Vehicle Upgrade	1	Ea		
	NSS 19.1	1	Ea		
27C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 5	1	Lot		

Table B-3.1: Optional Launch Service Requirements CLIN Structure RLSP-1

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price (FFP $)	Total Amount (FFP $)
28	**Optional Launch Service (Option 10)**	1	Service		$66,410,900
SubCLIN					
28A	Standard Launch Services and Standard Mission Integration in accordance with the SOW and Exhibit 2	1	Lot		
28B	Non-Standard Services in accordance with the SOW and Exhibit 3				
	NSS 19.1	1	Ea		
28C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 5	1	Lot		

Table B-3.1: Optional Launch Service Requirements CLIN Structure RLSP-1

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price (FFP $)	Total Amount (FFP $)
29	**Optional Launch Service (Option 11)**	1	Service		$
SubCLIN					
29A	Standard Launch Services and Standard Mission Integration in accordance with the SOW and Exhibit 2	1	Lot	$65,422,000	
29B	Non-Standard Services in accordance with the SOW and Exhibit 3				
	NSS 1.1	1	Ea	$10,284,400	
	One-Time FPR Discount for Heavy Vehicle Upgrade	1	Ea	($2,000,000)	
	NSS 2.1.2	1	Ea	$ -0-	
	NSS 19.1	1	Ea	$ 988,900	
29C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 5	1	Lot	$ -0-	

Table B-3.1: Optional Launch Service Requirements CLIN Structure RLSP-1

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price (FFP $)	Total Amount (FFP $)
30 **SubCLIN**	**Optional Launch Service (Option 12)**	1	Service		$
30A	Standard Launch Services and Standard Mission Integration in accordance with the SOW and Exhibit 2	1	Lot		
30B	Non-Standard Services in accordance with the SOW and Exhibit 3				
	NSS 19.2	1	Ea		
	NSS 27.1	1	Ea		
30C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 5	1	Lot		

Table B-3.1: Optional Launch Service Requirements CLIN Structure RLSP-1

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price (FFP $)	Total Amount (FFP $)
31	**Optional Launch Service (Option 13)**	1	Service		$
SubCLIN					
31A	Standard Launch Services and Standard Mission Integration in accordance with the SOW and Exhibit 2	1	Lot		
31B	Non-Standard Services in accordance with the SOW and Exhibit 3				
	NSS 1.1	1	Ea		
	One-Time FPR Discount for Heavy Vehicle Discount	1	Ea	)	
	NSS 19.1	1	Ea		
31C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 5				

Table B-3.1: Optional Launch Service Requirements CLIN Structure RLSP-1

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price (FFP $)	Total Amount (FFP $)
32	**Optional Launch Service (Opton 14)**	1	Service		$
SubCLIN					
32A	Standard Launch Services and Standard Mission Integration in accordance with the SOW and Exhibit 2	1	Lot		
32B	Non-Standard Services in accordance with the SOW and Exhibit 3				
	NSS 2.2.3	1	Ea	$	
	NSS 19.2	1	Ea	$	
	NSS 27.1	1	Ea	$	
32C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 5				
	1) Multi-Spacecraft Launch Systems Separation Commands	1	Ea	$	
	2) Pre-Launch Spacecraft Battery Cooling	1	Ea	$	

Table B-3.1: Optional Launch Service Requirements CLIN Structure RLSP-1

1.5 Special Task Assignments (Studies and Analyses)

CLIN	Description of Supplies and Service	Qty*	Unit	Unit Price ($)	Total Amount ($)
12	Special Task Assignments - Firm Fixed-Price Composite Labor Hours	A/R	Labor Hour	See Tables B-6/7	See Tables B-6/7
	See Section B, Clause 8.0 for definitized task assignments				

* Not to exceed 500,000 Cumulative Hours for Calendar Years 2000 through 2010

Table B-5: Special Task Assignments (Studies and Analyses)

HOURLY LABOR RATE (COMPOSITE SKILL MIX AND BURDENED)	FIRM FIXED-PRICE ($) IN CALENDAR YEAR ORDERED				
	2000	2001	2002	2003	2004
Labor Rate	$	$	$	$	$

HOURLY LABOR RATE (COMPOSITE SKILL MIX AND BURDENED)	FIRM FIXED-PRICE ($) IN CALENDAR YEAR ORDERED				
	2005	2006	2007	2008	2009
Labor Rate	$	$	$	$	$

HOURLY LABOR RATE (COMPOSITE SKILL MIX AND BURDENED)	FIRM FIXED-PRICE ($) IN CALENDAR YEAR ORDERED				
	2010				
Labor Rate	$				

Table B-6: Hourly Labor Rate - FFP List

1.4 Non-Standard Services Ordered Independently of a Defined Mission (CLINS 1-5, 8-10)

The Government reserves the right to order non-standard services independently of firm, optional, or Launch Service Task Order (LSTO) missions under this CLIN from the items listed in Table B-12. The Contracting Officer may order the services at any time by written notice to the Contractor from the effective date of the contract through calendar year 2004.

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price ($)	Total Amount ($)
11	Non-Standard Services Ordered Independently of a Defined Mission	A/R	Service	See Table B-12	See Table B-12
	See Section B, Clause 7.0 for definitized orders				

Table B-4: Non-Standard Services Ordered Independently of a Defined Mission CLINS 1-5, 8-10

1.4.1 Non-Standard Services Ordered Independently of a Defined Mission RLSP-1 CLINS 14-32

The Government reserves the right to order non-standard services independently of firm, optional, or Launch Service Task Order (LSTO) missions under this CLIN from the items listed in Table B-12.1. The Contracting Officer may order the services at any time by written notice to the Contractor from the effective date of the contract through calendar year 2007.

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price ($)	Total Amount ($)
11A	Non-Standard Services Ordered Independently of a Defined Mission	A/R	Service	See Table B-12.1	See Table B-12.1
	See Section B, Clause 7.0 for definitized orders				

Table B-4.1: Non-Standard Services Ordered Independently of a Defined Mission CLINS 14-32

The Contractor shall submit a price proposal update to convert NTE CY 2005 – 2010 labor rates into FFP labor rates at least 180 days prior to the end of CY 2004. The proposed labor rates shall be negotiated using the applicable procedures of FAR Part 15 and incorporated herein.

HOURLY LABOR RATE (COMPOSITE SKILL MIX AND BURDENED)	NOT TO EXCEED (NTE) PRICE ($) IN CALENDAR YEAR ORDERED					
	2005	2006	2007	2008	2009	2010
Labor Rate	N/A	N/A	N/A	N/A	N/A	N/A

Table B-7: Hourly Labor Rate - NTE Price List

1.6 IDIQ Launch Service Task Order (LSTO)

The Government reserves the unilateral right to order launch services at any time from contract award through the second quarter of CY 2010 in accordance with contract Section C, Clause 14.0, Launch Service Task Ordering Procedures. These launch services are identified in Tables B-9 and B-10 and described in Exhibits 2 and 3 to the Statement of Work.

NTE prices for launch services for IDIQ missions will not be part of the evaluation and selection for award of firm and option missions. IDIQ launch services for TBD missions represent potential requirements for launch services in addition to the firm and optional requirements for launch services.

The minimum order quantity for the IDIQ portion of this contract shall be one launch service for contracts awarded in the initial round. The Government is under no obligation to fulfill the minimum order quantity if the contractor fails to achieve the appropriate launch vehicle qualification. The Government shall deem the minimum order quantity satisfied and all its obligations fulfilled by virtue of the award of a firm mission, exercise of an option mission, or award of a launch service task order under the IDIQ portion of the contract. In no event shall the Government be obligated to pay for any launch service prior to ATP and obligation of funds for that launch service. The minimum order quantity for IDIQ contracts awarded in accordance with Section C, Clause 2.0, On-Ramp and Technology Insertion, is $100,000. The maximum order quantity for this IDIQ contract portion is sixty Launch Service Task Orders and associated non-standard services/mission unique services.

CLIN 13	Description of Supplies and Services	Qty	Unit	Unit Price ($)	Total Amount ($)
Order TBD	IDIQ Launch Service Task Order	TBD[1]	Service	TBD	TBD
SubCLIN					
TBD A	Standard Launch Services and Standard Mission Integration in accordance with the SOW and Exhibit 2	TBD[2]	Lot	See Table B-9	
TBD B	Non-Standard Services in accordance with the SOW and Exhibit 3	TBD	Lot	See Table B-10	
TBD C	Known Mission Unique Hardware and Software Non-recurring Items in accordance with SOW Exhibit 6	TBD	Lot	TBD	

1. The actual number of LSTOs to be awarded is TBD.
2. The actual number of missions to be included in each LSTO is TBD.

Table B-8: IDIQ Launch Service Task Order

1.7 NTE Prices - Standard Launch Services for IDIQ Missions

The Government shall have the right to order the standard launch services at the prices and for the launch vehicle configurations identified in Tables B-9 and B-9.1. Nothing in this clause precludes the Contractor from proposing more favorable prices or discount terms in response to specific requests for launch service proposals in accordance with contract Section C, Clause 14.0.

The Government shall have the right to order the standard launch services at the discounts identified in Table B-9A. Each discounted amount shall apply to each launch service in the Quantity Buy. The Quantity discount does not cross vehicle classifications. The Quantity discount is applicable to Table B-9 only; Quantity discount is not applicable to Table B-9.1.

LAUNCH VEHICLE CONFIGURATION	NOT-TO-EXCEED PRICE ($) IN CALENDAR YEAR ORDERED				
	2000	2001	2002	2003	2004
Delta II, 2320					
Delta II, 2325					
Delta II, 2420					
Delta II, 2425					
Delta II, 2920					
Delta II, 2925					
Delta III, 3940					
Delta IV, 4040					
Delta IV, 4240					
Delta IV, 4450					
Delta IV, 4050H					

	2005	2006	2007	2008	2009	2010
Delta II, 2320						
Delta II, 2325						
Delta II, 2420						
Delta II, 2425						
Delta II, 2920						
Delta II, 2925						
Delta III, 3940						
Delta IV, 4040						
Delta IV, 4240						
Delta IV, 4450						
Delta IV, 4050H						

Table B-9: NTE Price List - Standard Launch Services for IDIQ Missions

Quantity of Missions	Vehicle Performance Class			
	Delta II	Delta III	Delta IV	
			4040, 4240, 4450	4050H
1				
2				
3				
4				
5				

Table B-9A: Table of IDIQ Quantity Buy Discounts

LAUNCH VEHICLE CONFIGURATION	NOT-TO-EXCEED PRICE ($) IN CALENDAR YEAR ORDERED				
	2005	2006	2007	2008	2009
Delta II, 2320					
Delta II, 2325					
Delta II, 2420					
Delta II, 2425					
Delta II, 2920					
Delta II, 2925					
Delta IV, 4040					
Delta IV, 4240					
Delta IV, 4450					
Delta IV, 4050H					

Table B-9.1: NTE Price List - Standard Launch Services for IDIQ Missions (August 2004 On-Ramp)

1.8 NTE Prices – Non-Standard Services for IDIQ Missions

	NON-STANDARD SERVICE ITEM	Launch Vehicle Configuration - Delta II
1.0	Alternate Vehicle Config/Perf Enhancements	
1.1	Heavy vehicle upgrade	
2.0	Alternative Fairing Config and/or Modifications	
2.1	Alternate configurations	
2.1.1	Replace a 10-ft PLF with a 10L PLF	
2.1.2	Replace a 9.5-ft PLF with a 10-ft PLF	
2.1.3	Replace a 10-ft PLF with a 9.5-ft PLF	
2.2	Add'l access doors in excess of three in the standard service	
2.2.1	9 x 13-inch door	
2.2.2	21.48 x 24.8-inch door	
2.2.3	24-inch diameter door	
2.2.4	10.5-inch diameter door	
2.2.5	18 x 18-inch door	
2.2.6	21.86 x 24.8-inch door	
2.2.7	25 x 25-inch door	
2.3	Add'l access doors of non-standard size	
2.4	Mounting provisions, cabling and antenna system for re-radiating signals from the payload to remote sites	
2.5	S, C, X and Ku-band re-radiation equipment	
2.6	RF-transparent doors	
3.0	Alternative Payload Adapters (PAs)	
3.1	Different size or differen payload interface PAs	
3.1.1	5624 Payload Adapter	
3.1.2	6915 Payload Adapter	
3.2	Low tip-off rate PAs	
3.2.1	6306 Payload Adapter	
3.2.2	6019 Payload Adapter	

Table B-10: NTE Price List - Non-Standard Services for IDIQ Missions

X = Specific Non-Standard Se vice available for listed vehicle configuration, N/A = Not available for any configuration, NSF = Not Separately Priced and included in the standard service

	NON-STANDARD SERVICE ITEM	Launch Vehicle Configuration - Delta II
4.0	Upper Stage Hardware	
4.1	Star-37 third stage	
4.1.1	Star-37 third stage with a yo-yo despin	
4.1.2	Star-37 third stage with a tumble system	
4.2	Payload adapters (PAs)	
4.3	Spin system with enhanced capability	
4.4	Despin system with enhanced capability	
4.5	Improved insertion accuracy options	
4.6	Exchange a Star-48 despin system with a tumble system	
5.0	Multiple PA, inc. related mission integration support	
6.0	Secondary PA for Non Sep Secondary Payload	
7.0	Secondary PA/Sep. Sys for Sep. Secondary Payload	
8.0	RF Through-the-Fairing Transmission Capability	
9.0	Enhanced Electrical Interface	
9.1	Increased capacity payload-to-GSE interface	
9.1.1	Two 61-Pin electrical interface from fairing to payload	
9.1.2	Two 61-Pin electrical interface across separation plane	

Table B-10: NTE Price List - Non-Standard Services for IDIQ Missions

X = Specific Non-Standard Service available for listed vehicle configuration, N/A = Not available for any configuration, NSP = Not Separately Priced and included with the standard service

	NON-STANDARD SERVICE ITEM
9.1.3	Two 37-Pin electrical interface from fairing to upper stage
9.1.3A	Electrical interface locations at station 398.69 and 401.94
9.1.3B	New electrical interface locations between stations 413.5 and 397.23 of Quad I (and 3.25 inches apart)
9.2	LV command and control of payload
9.3	LV supplied payload power capability
9.4	Enhanced telemetry capabilities
9.5	Additional LV environmental instrumentation
10.0	**LV Mounted Cameras**
10.1	Launch vehicle mounted cameras
11.0	**Special Contamination Control Options**
11.1	Enhanced fairing environment
11.2	Enhanced fairing internal surface cleaning
11.3	Optional payload/vehicle integration environments
11.3.1	Fairing air conditioning between 50 and 55 degrees
11.3.2	Payload hydrocarbon level to 15 PPM

Table B-10: NTE Price List - Non-Standard Services for IDIQ Missions

X = Specific Non-Standard Service available for listed vehicle configuration, N/A = Not available for any configuration, NSP = Not Separately Priced and included with the standard service

	NON-STANDARD SERVICE ITEM
11.4	Additional instrument purge system(s) up to T-0
11.5	Grade B Nitrogen (GN2) or pure air cooling supply for spot cooling of payload components from payload mate or encapsulation up to T-0
12.0	Vehicle Data Book For Radioactive Components
12.1	The First environmental assessment data book
12.2	Updated environmental assessment data book
13.0	Co-Manifested Payload Mission Service
13.1	Dual payload attach fitting (DPAF) mission
13.2	Non-recurring for first flight of DPAF missions from the ER
13.3	Recurring credit for DPAF missions from the ER
14.0	NASA Secondary Payload Mission Service
14.1	Non-separating secondary payload service
14.2	Separating secondary payload service
15.0	Payload Compatibility Assessment
16.0	Secondary Payload Mission Feasibility Study

Table B-10: NTE Price List - Non-Standard Services for IDIQ Missions

X = Specific Non-Standard Service available for listed vehicle configuration, N/A = Not available for any configuration, NSP = Not Separately Priced and included with the standard service

Redacted the following pages in their entirety, per FOIA Exemption B (4):

Table B-10 NTE Price List – Non-Standard Services for IDIQ Missiions

B-21
B-22
B-23
B-23-1
B-23-2
B-23-3
B-23-4
B-23-5
B-23-6
B-23-7
B-23-8

1.9 NTE Prices – Non-Standard Services Launch Site Maintenance

The Government shall have the right to order the following non-standard services per Table B-10.1, in accordance with Section C, Clause 40.1 and Section D, Attachment D1, Exhibit 3, for Delta II Launch Site Maintenance at the Eastern Range (CCAFS). The Contractor will provide Firm Fixed Prices for these services for incorporation into Table B-12.1 at a later date to be determined by mutual agreement of the parties.

NON-STANDARD SERVICE ITEM	
31.0	CCAFS Launch Site Maintenance
31.1*	Maintenance Model SLC-17 Style (Monthly Charge)
31.2*	Maintenance Model SLC-2 Style (Monthly Charge)
31.3*	Maintenance Model Commercial Style (Monthly Charge)

Table B-10.1: NTE Price List – Non-Standard Services for Launch Site Maintenance
TBP - To Be Proposed if required due to early USAF transfer of facilities responsibility. See Section C, Clause 40.1
* For 31.1, 31.2, and 31.3 Calendar Year Ordered = Calendar Year Performed

2.0 TOTAL AWARD AMOUNT

The total firm fixed-price of the contract for all work under CLINs 1 through 3 is $168,913,000. The value of the three firm missions is $168,913,000 and the value of the five optional missions is $248,717,000 for a total potential contract value of $417,630,000 awarded to the contractor under NLS. In addition, the maximum estimated number of missions that may be procured under the combined NLS IDIQ contracts is sixty missions, of which the contractor is eligible to be awarded between zero and fifty nine such missions. Should the Government order, and the contractor be awarded, all sixty missions through the competitive launch service task order procedure set forth in the NLS contract, the estimated maximum value of the IDIQ portion of this NLS contract, excluding mission uniques and special task assignments, is $4,500,000,000. Therefore, the total maximum value of this contract, including firm/option missions and the sixty IDIQ missions is $5,000,000,000.

2.1 Total Contract Amount

The total firm fixed-price of the contract for all definitized work under the contract is $1,211,465,397. This amount includes CLINS 1, 2, 3, 4, 8, 9, 10, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24 and 25, Total Amounts (including SubCLINs), and CLINS 11 and 12 Total Amounts (in Section B Clauses 7.0 and 8.0 respectively).

3.0 LAUNCH SERVICE FLEXIBILITY

3.1 General

For any mission awarded under the firm, or option, portion of this contract, the Government reserves the right to unilaterally substitute standard launch services and add/delete non-standard services in accordance with the following paragraphs. The launch service CLIN price and contract value will be adjusted accordingly. All other changes to the standard launch services, non-standard services, or mission unique services shall be accomplished pursuant to the changes clause of the contract. Once payment begins on a qualified standard launch service and NASA insight commences, the Government reserves the right to approve any Contractor initiated substitution of the launch vehicle or reallocation of launch vehicle hardware designated for a NASA mission under this contract. The Government reserves the right to make payload substitutions after ATP. Such payload substitutions will constitute a change within the scope of this contract under the Changes Clause.

3.2 Standard Launch Service Substitutions

The Government reserves the unilateral right to substitute standard launch services for firm missions under Table B-1, and optional missions (CLINS 4-5 & 8-10) under

Table B-3 prior to ATP in accordance with Table B-11. These standard launch services are identified and described in Table B-11 and in Exhibit 2 to the Statement of Work.

LAUNCH VEHICLE CONFIGURATION	FIRM-FIXED PRICE ($) IN CALENDAR YEAR ORDERED				
	2000	2001	2002	2003	2004
Delta II, 2320					
Delta II, 2325					
Delta II, 2420					
Delta II, 2425					
Delta II, 2920					
Delta II, 2925					
Delta III, 3940					

Note: The price of the launch service shall be established from Table B-11 based on the "Calendar Year Ordered" price commensurate with the planned ATP date and associated payment schedule. ATP shall typically be the mission launch date minus 27 months (L-27), and can be No Earlier Than L-30 months and No Later Than L-24 months.

Table B-11: FFP List for Standard Launch Services CLINS 1-5, 8-10

3.2.1 Standard Launch Vehicle Substitutions CLINS 14-32

The Government may substitute standard launch services for missions under Table B-1.1, and optional missions under Table B-3.1 by executing a bilateral agreement with the Contractor per Section C, paragraph 40.6 Special Considerations Regarding Table B-11.1. These standard launch services are identified and described in Table B-11.1 and in Exhibit 2 to the Statement of Work.

LAUNCH VEHICLE CONFIGURATION	FIRM-FIXED PRICE ($) IN CALENDAR YEAR ORDERED				
	2003	2004	2005	2006	2007
Delta II, 2320					
Delta II, 2325					
Delta II, 2420					
Delta II, 2425					
Delta II, 2920					
Delta II, 2925					

Note: The price of the launch service shall be established from Table B-11.1 based on the "Calendar Year Ordered" price commensurate with the planned ATP date and associated payment schedule. ATP shall typically be the mission launch date minus 27 months (L-27), and can be No Earlier Than L-30 months and No Later Than L-24 months.

Table B-11.1: FFP List for Standard Launch Services CLINS 14-32

3.3 Non-Standard Service Additions and Deletions

The Government reserves the unilateral right to add or delete non-standard services for firm missions (CLINS 1-3) under Table B-1 and optional missions (CLINS 4-5,8-10) under Table B-3 prior to the 'no-later-than ordering date' limitations in accordance with Exhibit 3 to the Statement of Work. These non-standard services are identified and described in Table B-12 and Exhibit 3 to the Statement of Work.

3.3.1 Non-Standard Service Additions and Deletions RLSP-1

The Government reserves the right to add or delete non-standard services for firm missions (CLINS 14-25) under table B-1.1, and optional missions (CLINS 26-32) under Table B-3.1 prior to the 'no-later-than ordering date' limitation in accordance with Exhibit 3 to the Statement of Work. These non-standard services are identified and described in Table B-12.1 and Exhibit 3 to the Statement of Work.

	Launch Vehicle Configuration - Delta II	
	NON-STANDARD SERVICE ITEM	FIRM FIXED-PRICE PRICE ($) IN CALENDAR YEAR ORDERED
1.0	**Alternate Vehicle Config/Perf Enhancements**	
1.1	Heavy vehicle upgrade	
2.0	**Alternative Fairing Config and/or Modifications**	
2.1	Alternate configurations	
2.1.1	Replace a 10-ft PLF with a 10L PLF	
2.1.2	Replace a 9.5-ft PLF with a 10-ft PLF	
2.1.3	Replace a 10-ft PLF with a 9.5-ft PLF	
2.2	Add'l access doors in excess of three in the standard service	
2.2.1	9 x 13-inch door	
2.2.2	21.48 x 24.8-inch door	
2.2.3	24-inch diameter door	
2.2.4	10.5-inch diameter door	
2.2.5	18 x 18-inch door	
2.2.6	21.86 x 24.8-inch door	
2.2.7	25 x 25-inch door	
2.3	Add'l access doors of non-standard size	
2.4	Mounting provisions, cabling and antenna system for re-radiating signals from the payload to remote sites	
2.5	S, C, X and Ku-band re-radiation equipment	
2.6	RF-transparent doors	
3.0	**Alternative Payload Adapters (PAs)**	
3.1	Different size or different payload interface PAs	
3.1.1	5624 Payload Adapter	
3.1.2	6915 Payload Adapter	
3.2	Low tip-off rate PAs	
3.2.1	6306 Payload Adapter	
3.2.2	6019 Payload Adapter	

Table B-12. FFP List for Non-Standard Services CLINS 1-5, 8-10

X = Specific Non-Standard Service available for listed vehicle configuration, N/A = Not available for any configuration,
NSP = Not Separately Priced and included with the standard service

Launch Vehicle Configuration - Delta II	
NON-STANDARD SERVICE ITEM	FIRM FIXED-PRICE PRICE ($) IN CALENDAR YEAR ORDERED
4.0 **Upper Stage Hardware**	
4.1 Star-37 third stage	
4.1.1 Star-37 third stage with a yo-yo despin	
4.1.2 Star-37 third stage with a tumble system	
4.2 Payload adapters (PAs)	
4.3 Spin system with enhanced capability	
4.4 Despin system with enhanced capability	
4.5 Improved insertion accuracy options	
4.6 Exchange a Star-48 despin system with a tumble system	
5.0 **Multiple PA, inc. related mission integration support**	
6.0 **Secondary PA for Non-Sep Secondary Payload**	
7.0 **Secondary PA/Sep. Sys for Sep. Secondary Payload**	
8.0 **RF Through-the-Fairing Transmission Capability**	
9.0 **Enhanced Electrical Interface**	
9.1 Increased capacity payload-to-GSE interface	
9.1.1 Two 61-Pin electrical interface from fairing to payload	
9.1.2 Two 61-Pin electrical interface across separation plane	
9.1.3 Two 37-Pin electrical interface from fairing to upper stage	

Table B-12. FFP List for Non-Standard Services CLINS 1-5, 8-10
X = Specific Non-Standard Service available for listed vehicle configuration, N/A = Not available for any configuration,
NSP = Not Separately Priced and included with the standard service

	Launch Vehicle Configuration - Delta II
NON-STANDARD SERVICE ITEM	FIRM FIXED-PRICE PRICE ($) IN CALENDAR YEAR ORDERED
9.1.3A Electrical interface locations at station 398.69 and 401.94	
9.1.3B New electrical interface locations between stations 413.5 and 397.23 of Quad I (and 3.25 inches apart)	
9.2 LV command and control of payload	
9.3 LV supplied payload power capability	
9.4 Enhanced telemetry capabilities	
9.5 Additional LV environmental instrumentation	
10.0 LV Mounted Cameras	
10.1 Launch vehicle mounted cameras	
11.0 Special Contamination Control Options	
11.1 Enhanced fairing environment	
11.2 Enhanced fairing internal surface cleaning	
11.3 Optional payload/vehicle integration environments	
11.3.1 Fairing air conditioning between 50 and 55 degrees	
11.3.2 Payload hyrocarbon level to 15 PPM	
11.4 Additional instrument purge system(s) up to T-0	

Table B-12. FFP List for Non-Standard Services CLINS 1-5, 8-10
X = Specific Non-Standard Service available for listed vehicle configuration, N/A = Not available for any configuration,
NSP = Not Separately Priced and included with the standard service

	Launch Vehicle Configuration - Delta II	
	NON-STANDARD SERVICE ITEM	FIRM FIXED-PRICE PRICE ($) IN CALENDAR YEAR ORDERED
11.5	Grade B Nitrogen (GN2) or pure air cooling supply for spot cooling of payload components from payload mate or encapsulation up to T-0	
12.0	**Vehicle Data Book For Radioactive Components**	
12.1	The First environmental assessment data book	
12.2	Updated environmental assessment data book	
13.0	**Co-Manifested Payload Mission Service**	
13.1	Dual payload attach fitting (DPAF) mission	
13.2	Non-recurring for first flight of DPAF missions from the ER	
13.3	Recurring credit for DPAF missions from the ER	
14.0	**NASA Secondary Payload Mission Service**	
14.1	Non-separating secondary payload service	
14.2	Separating secondary payload service	
15.0	**Payload Compatibility Assessment**	
16.0	**Secondary Payload Mission Feasibility Study**	
17.0	**Secondary Payload Accommodation Study**	
18.0	**Secondary Payload Mass Simulator**	

Table B-12. FFP List for Non-Standard Services CLINS 1-5, 8-10

X = Specific Non-Standard Service available for listed vehicle configuration, N/A = Not available for any configuration, NSP = Not Separately Priced and included with the standard service

	Launch Vehicle Configuration - Delta II	
	NON-STANDARD SERVICE ITEM	FIRM FIXED-PRICE PRICE ($) IN CALENDAR YEAR ORDERED
19.0	**Payload Processing Facilities**	
19.1	Ground processing facilities - payloads at Eastern Range	
19.2	Ground processing facilities - payloads at Western Range	
20.0	**Additional Mission Analysis and Support**	
20.1	Pedigree review	
20.2	Support for additional mission integration working group (MIWG) meetings	
20.3	Mission Analysis (e.g., PGAA, Loads, Controls, Thermal, RF Link, and Clearance) prior to ATP	
20.3.1	Early dynamic assess. of spacecraft altitude rate after separation	
20.3.2	Preliminary performance/Trajectory analysis	
20.3.3	Quick-turnaround coupled loads	
20.3.4	Final design load cycle (FDLC)	
21.0	**Launch Call-Up Capability**	
21.1	Launch service price adjustment for ATP at L-18 months	
21.2	Launch service price adjustment for ATP at L-12 months.	
21.3	Launch service price adjustment for ATP at TBP months	

Table B-12. FFP List for Non-Standard Services CLINS 1-5, 8-10

X = Specific Non-Standard Service available for listed vehicle configuration, N/A = Not available for any configuration,

NSP = Not Separately Priced and included with the standard service

	NON-STANDARD SERVICE ITEM	FIRM FIXED-PRICE PRICE ($) IN CALENDAR YEAR ORDERED
22.0	NASA Public Affairs Office Support	
22.1	NASA Public Affairs Office support	
23.0	Credits	
23.1	Later mission integration start at L-TBP (limited to L-21M or L-18M)	
23.2	Penalty for "failed mission determination" limited to witholding of final payment (10%)	
23.3	No penalty for "partial or failed mission determination"	
23.4	Alternate quarterly launch service payment schedule without any failure penalty	
23.4A	L-42M to L-24M Payment Schedule*	
23.4B	L-36M to L-12M Payment Schedule*	
24.0	Dual Payload Attach Fiting (DPAF) Special Options	
24.1	T-0 GN2 purge for lower DPAF spacecraft	
24.2	Reserved	
24.3	Standard instrumentation for lower DPAF spacacraft	
24.4	T-0 ground battery air conditioning for WR DPAF missions	
24.5	Additional access hole in the DPAF	

Table B-12. FFP List for Non-Standard Services CLINS 1-5, 8-10

X = Specific Non-Standard Service available for listed vehicle configuration, N/A = Not available for any configuration,

NSP = Not Separately Priced and included with the standard service

*The percentages in 23.4A and 23.4B represent discounts from the total launch service price.

Launch Vehicle Configuration - Delta II	
NON-STANDARD SERVICE ITEM	FIRM FIXED-PRICE PRICE ($) IN CALENDAR YEAR ORDERED ____
25.0 **120 Day Mission Call-Up For Option 6**	
25.1 Facility call-up capability	
25.2 Recurring call-up charges	
25.2.1 Monthly charge	
25.2.2 Per-vehicle charge	
26.0 **First Flight Core Vehicle Analysis**	
26.1 Category "1" core vehicle analysis (Medium)	
26.2 Category "2" core vehicle analysis (Small)	
27.0 **Western Range (WR) Launch Incremental**	
27.1 Western Range (WR) Launch Incremental	
28.0 Special Instrumentation for Delta II (2-Stage Vehicles)	
28.1 Special Instrumentation for Delta II (2-Stage Vehicles) - Recurring	

Table B-12. FFP List for Non-Standard Services CLINS 1-5, 8-10

X = Specific Non-Standard Service available for listed vehicle configuration, N/A = Not available for any configuration,
NSP = Not Separately Priced and included with the standard service
*TBP = Price not available at present, contractor to update table at a later date

	Launch Vehicle Configuration - Delta II	
	NON-STANDARD SERVICE ITEM	FIRM FIXED-PRICE PRICE ($) IN CALENDAR YEAR ORDERED
25.0	120 Day Mission Call-Up For Option 6	
25.1	Facility call-up capability	
25.2	Recurring call-up charges	
25.2.1	Monthly charge	
25.2.2	Per-vehicle charge	
26.0	First Flight Core Vehicle Analysis	
26.1	Category "1" core vehicle analysis (Medium)	
26.2	Category "2" core vehicle analysis (Small)	
27.0	Western Range (WR) Launch Incremental	
27.1	Western Range (WR) Launch Incremental	
28.0	Special Instrumentation for the Delta II (2-Stage Vehicle)	
28.1	Special Instrumentation for the Delta II (2-Stage Vehicle)--Recurring	

Table B-12. FFP List for Non-Standard Services CLINS 1-5, 8-10

X = Specific Non-Standard Service available for listed vehicle configuration, N/A = Not available for any configuration,
NSP = Not Separately Priced and included with the standard service
*TBP = Price not available at present, contractor to update table at a later date

Launch Vehicle Configuration - Delta II		
	NON-STANDARD SERVICE ITEM	FIRM FIXED-PRICE PRICE ($) IN CALENDAR YEAR ORDERED
1.0	Alternate Vehicle Config/Perf Enhancements	
1.1	Heavy vehicle upgrade	
2.0	Alternative Fairing Config and/or Modifications	
2.1	Alternate configurations	
2.1.1	Replace a 10-ft PLF with a 10L PLF	
2.1.2	Replace a 9.5-ft PLF with a 10-ft PLF	
2.1.3	Replace a 10-ft PLF with a 9.5-ft PLF	
2.2	Add'l access doors in excess of three in the standard service	
2.2.1	9 x 13-inch door	
2.2.2	21.48 x 24.8-inch door	
2.2.3	24-inch diameter door	
2.2.4	10.5-inch diameter door	
2.2.5	18 x 18-inch door	
2.2.6	21.86 x 24.8-inch door	
2.2.7	25 x 25-inch door	
2.3	Add'l access doors of non-standard size	
2.4	Mounting provisions, cabling and antenna system for re-radiating signals from the payload to remote sites	
2.5	S, C, X and Ku-band re-radiation equipment	
2.6	RF-transparent doors	
3.0	Alternative Payload Adapters (PAs)	
3.1	Different size or different payload interface PAs	
3.1.1	5624 Payload Adapter	
3.1.2	6915 Payload Adapter	
3.1.3	3715C Payload Adapter	
3.2	Low tip-off rate PAs	
3.2.1	6306 Payload Adapter	
3.2.2	6019 Payload Adapter	

Table B-12.1. FFP List for Non-Standard Services CLINS 14-32

X = Specific Non-Standard Service available for listed vehicle configuration, N/A = Not available as a Non-Standard Service for any configuration, NSP = Not Separately Priced and included with the standard service, TBP = Price not available at present, contractor to update at a later date

	Launch Vehicle Configuration - Delta II											
	NON-STANDARD SERVICE ITEM	FIRM FIXED-PRICE PRICE ($) IN CALENDAR YEAR ORDERED										
4.0	Upper Stage Hardware											
4.1	Star-37 third stage											
4.1.1	Star-37 third stage with a yo-yo despin											
4.1.2	Star-37 third stage with a tumble system											
4.2	Payload adapters (PAs)											
4.3	Spin system with enhanced capability											
4.4	Despin system with enhanced capability											
4.5	Improved insertion accuracy options											
4.6	Exchange a Star-48 despin system with a tumble system											
5.0	Multiple PA, inc. related mission integration support											
6.0	Secondary PA for Non-Sep Secondary Payload											
7.0	Secondary PA/Sep. Sys for Sep. Secondary Payload											
8.0	RF Through-the-Fairing Transmission Capability											
9.0	Enhanced Electrical Interface											
9.1	Increased capacity payload-to-GSE interface											
9.1.1	Two 61-Pin electrical interface from fairing to payload											
9.1.2	Two 61-Pin electrical interface across separation plane											
9.1.3	Two 37-Pin electrical interface from fairing to upper stage											

Table B-12.1 FFP List for Non-Standard Services CLINS 14-32

X = Specific Non-Standard Service available for listed vehicle configuration, N/A = Not available as a Non-Standard Service for any configuration, NSP = Not Separately Priced and included with the standard service, TBP = Price not available at present, contractor to update at a later date

	Launch Vehicle Configuration - Delta II	
	NON-STANDARD SERVICE ITEM	FIRM FIXED-PRICE PRICE ($) IN CALENDAR YEAR
9.1.3A	Electrical interface locations at station 398.69 and 401.94	
9.1.3B	New electrical interface locations between stations 413.5 and 397.23 of Quad I (and 3.25 inches apart)	
9.2	LV command and control of payload	
9.3	LV supplied payload power capability	
9.4	Enhanced telemetry capabilities	
9.5	Additional LV environmental instrumentation	
10.0	**LV Mounted Cameras**	
10.1	Launch vehicle mounted cameras	
11.0	**Special Contamination Control Options**	
11.1	Enhanced fairing environment	
11.2	Enhanced fairing internal surface cleaning	X
11.3	Optional payload/vehicle integration environments	
11.3.1	Fairing air conditioning between 50 and 55 degrees	
11.3.2	Payload hyrocarbon level to 15 PPM	
11.4	Additional instrument purge system(s) up to T-0	

Table B-12.1 FFP List for Non-Standard Services CLINS 14-32

X = Specific Non-Standard Service available for listed vehicle configuration, N/A = Not available as a Non-Standard Service for any configuration, NSP = Not Separately Priced and included with the standard service, TBP = Price not available at present, contractor to update at a later date

	Launch Vehicle Configuration - Delta II						
	NON-STANDARD SERVICE ITEM	FIRM FIXED-PRICE PRICE ($) IN CALENDAR YEAR ORDERED					
		2003	2004	2005	2006	2007	2008-2010
11.5	Grade B Nitrogen (GN2) or pure air cooling supply for spot cooling of payload components from payload mate or encapsulation up to T-0						
12.0	**Vehicle Data Book For Radioactive Components**						
12.1	The First environmental assessment data book						
12.2	Updated environmental assessment data book						
13.0	**Co-Manifested Payload Mission Service**						
13.1	Dual payload attach fitting (DPAF) mission						
13.2	Non-recurring for first flight of DPAF missions from the ER						
13.3	Recurring credit for DPAF missions from the ER						
14.0	**NASA Secondary Payload Mission Service**						
14.1	Non-separating secondary payload service						
14.2	Separating secondary payload service						
15.0	**Payload Compatibility Assessment**						
16.0	**Secondary Payload Mission Feasibility Study**						
17.0	**Secondary Payload Accommodation Study**						
18.0	**Secondary Payload Mass Simulator**						

Table B-12.1 FFP List for Non-Standard Services CLINS 14-32

X = Specific Non-Standard Service available for listed vehicle configuration, N/A = Not available as a Non-Standard Service for any configuration, NSP = Not Separately Priced and included with the standard service, TBP = Price not available at present, contractor to update at a later date

	NON-STANDARD SERVICE ITEM	h Vehicle Configuration - Delta II FIRM FIXED-PRICE PRICE ($) IN CALENDAR YEAR ORDERED					
		2003	2004	2005	2006	2007	2008-2010
19.0	Payload Processing Facilities						
19.1	Ground processing facilities - payloads at Eastern Range						
19.1.1	Enhanced Payload Processing Environment Increment (ER)						
19.1.2	Enhanced Environmental Monitoring (E)						
19.2	Ground processing facilities - payloads at Western Range						
20.0	**Additional Mission Analysis and Support**						
20.1	Pedigree review						
20.2	Support for additional mission integration working group (MIWG) meetings						
20.3	Mission Analysis (e.g., PGAA, Loads, Controls, Thermal, RF Link, and Clearance) prior to ATP						
20.3.1	Early dynamic assess. of spacecraft altitude rate after separation						
20.3.2	Preliminary performance/Trajectory analysis						
20.3.3	Quick-turnaround coupled loads						
20.3.4	Final design load cycle (FDLC)						
21.0	**Launch Call-Up Capability**						
21.1	Launch service price adjustment for ATP at L-18 months						
21.2	Launch service price adjustment for ATP at L-12 months						
21.3	Launch service price adjustment for ATP at TBP months						

Table B-12.1 FFP List for Non-Standard Services CLINS 14-32

X = Specific Non-Standard Service available for listed vehicle configuration, N/A = Not available as a Non-Standard Service for any configuration, NSP = Not Separately Priced and included with the standard service, TBP = Price not available at present, contractor to update at a later date

	Launch Vehicle Configuration - Delta II						
	NON-STANDARD SERVICE ITEM	FIRM FIXED-PRICE PRICE ($) IN CALENDAR YEAR ORDERED					
		2003	2004	2005	2006	2007	2008-2010
22.0	**NASA Public Affairs Office Support**						
22.1	NASA Public Affairs Office support						
23.0	**Credits**						
23.1	Later mission integration start at L-TBP (limited to L-21M or L-18M)						
23.2	Penalty for "failed mission determination" limited to witholding of final payment (10%)						
23.3	No penalty for "partial or failed mission determination"						
23.4	Alternate quarterly launch service payment schedule without any failure penalty						
23.4A	L-42M to L-24M Payment Schedule*						
23.4B	L-36M to L-12M Payment Schedule*						
24.0	**Dual Payload Attach Fiting (DPAF) Special Options**						
24.1	T-0 GN2 purge for lower DPAF spacecraft						
24.2	Reserved						
24.3	Standard instrumentation for lowe DPAF spacacraft						
24.4	T-0 ground battery air conditioning for WR DPAF missions						
24.5	Additional access hole i the DPAF						

Table B-12.1 FFP List for Non-Standard Services CLINS 14-32

X = Specific Non-Standard Service available for listed vehicle configuration, N/A = Not available as a Non-Standard Service for any configuration, NSP = Not Separately Priced and included with the standard service

*The percentages in 23.4A and 23.4B represent discounts from the total launch service price. TBP = Price not available at present, contractor to update at a later date

	Launch Vehicle Configuration - Delta II	
	NON-STANDARD SERVICE ITEM	FIRM FIXED-PRICE PRICE ($) IN CALENDAR YEAR ORDERED*
25.0	120 Day Mission Call-Up For Option 6	
25.1	Facility call-up capability	
25.2	Recurring call-up charges	
25.2.1	Monthly charge	
25.2.2	Per-vehicle charge	
26.0	**First Flight Core Vehicle Analysis**	
26.1	Category "1" core vehicle analysis (Medium)	
26.2	Category "2" core vehicle analysis (Small)	
27.0	**Western Range (WR) Launch Incremental**	
27.1	Western Range (WR) Launch Incremental	
28.0	**Special Instrumentation for Delta II (2 Stage Vehicle) - Recurring**	
28.1	Special Instrumentation for Delta II (2 Stage Vehicle)–Recurring	
29.0	**Reserved**	
30.0	**Long Lead Material Procurment**	
30.1	Long Lead Material Procurment	
30.2	Long Lead Material Liquidation (per vehicle, CLINS 14-25 only)	
31.0	**CCAFS Launch Site Maintenance**	
31.1*	Maintenance Model - SLC-17 Style (Monthly Charge)	

Table B-12.1. FFP List for Non-Standard Services CLINS 14-32

X = Specific Non-Standard Service available for listed vehicle configuration, N/A = Not available as a Non-Standard Service for any configuration, NSP = Not Separately Priced and included with the standard service

TBP = Price not available at present, contractor to update at a later date

* For NSS 31.1 Calendar Year Ordered = Calendar Year Performed

	Launch Vehicle Configuration - Delta II	
	NON-STANDARD SERVICE ITEM	FIRM FIXED-PRICE PRICE ($) IN CALENDAR YEAR ORDERED*
31.2*	Maintenance Model - SLC-2 Style (Monthly Charge)	
31.3*	Maintenance Model - Commercial Style (Monthly Charge)	
32.0	**VAFB Launch Site Maintenance**	
32.1*	West Coast Maintenance (Monthly Charge)	
32.2	VAFB Launch Site Standby Mode	
32.2.1*	VAFB Launch Site Standby Mode – First 12 Months (Monthly Credit)	
32.2.2*	VAFB Launch Site Standby Mode – Each Additional Month Past 12 Months (Monthly Credit)	
33.0	**Post Production Support**	
33.1*	Post Production Support - Labor	
33.2	Mission Critical Material	
33.3	GEM Shelf Life Extension	
34.0	**Delta II Launch Vehicle Flexibility**	
34.1	Additional 40-Inch GEM(S)	

Table B-12.1. FFP List for Non-Standard Services CLINS 14-32

X = Specific Non-Standard Service available for listed vehicle configuration, N/A = Not available as a non-Standard Service for any configuration, NSP = Not Separately Priced and included with the standard service

TBP = Price not available at present, contractor to update at a later date

* For 31.2, 31.3, 32.1 32.2.1, 32.2.2 & 33.1 Calendar Year Ordered = Calendar Year Performed

4.0 MOST FAVORED CUSTOMER

The Contractor hereby certifies the CLIN prices for standard launch services (including standard mission integration) under this contract are no higher than the lowest price charged to any other commercial or U.S. Government customer for an equivalent launch service during the twelve (12) months both preceding and following contract award, option exercise, or placement of a launch service task order. The Government shall be entitled to a one-time reduction in contract price for each standard launch service failing to meet this certification. The price credit will be equal to the difference between the standard launch service price under this contract and the lower price awarded for an equivalent launch service.

5.0 IDIQ LAUNCH SERVICE AND PRICE UPDATES

Successful Offerors who receive contract awards may propose additional IDIQ NTE launch services and prices via the on-ramp and technology insertion clause, Section C, Clause 2.0. IDIQ contract holders will not be entitled to unilaterally adjust NTE prices or delete launch services already in the contract. Contractor initiated changes to the launch vehicle configuration, vendor, or design shall be subject to the launch vehicle qualification requirements of Section C, Clause 3.0. Contractor initiated changes to the launch vehicle configuration, vendor, or design, after mission ATP, shall be at no increase to the contract price and subject to the written approval of the Contracting Officer. New launch vehicle qualification plans and revisions to existing qualification plans may be proposed for inclusion into the contract when submitting Launch Service Proposals (LSPs) pursuant to Section C, Clause 14.0, and shall be subject to the written approval of the Contracting Officer.

6.0 ONE TIME LAUNCH SERVICE CREDITS

The parties agree that upon notice provided by the Contractor, the contracting officer, on a one-time basis only, may unilaterally change the prices for the launch services associated only with the CLINs and conditions identified below:

a. In the event that the launch vehicles identified under CLINs 2 and 3 are not the first flight of a Delta II 2925H-9.5 configuration, the Government will be entitled to a one-time credit (i.e., downward price adjustment) of for each CLIN for the change to perform a NSS 26.2 Category 2 core vehicle analysis – "small" under a CLIN other than CLINs 2 and 3.

b. In the event the launch vehicles identified under CLINs 8 and 10 are not the first flight of a group "G" vehicle (i.e., Requires NSS 26.1 Category 1 core vehicle analysis – "medium"), the government will be entitled to a one-time credit (i.e., downward price adjustment) of for the change to perform a NSS 26.2 Category 2 core vehicle analysis – "small" for each CLIN.

c. In the event that CLIN 2, Launch Service for Deep Impact requires Non-Standard Service (NSS) CLIN 1.1, the price shall be discounted by

d. In the event that the CLIN 3 Launch Service requires Mission Unique Service – Five inch Payload Adapter Spacer – the price shall be $. In the event that the CLIN 3 Launch Service does not require the standard Yo-Yo Despin System, the NSS 4.6 may be placed on the contract at a credit of not less than $

c. In the event that CLIN 2, Launch Service for Deep Impact requires Non-Standard Service (NSS) CLIN 1.1, the price shall be discounted by $932,700.

7.0 Non-Standard Services Ordered Independently of a Defined Mission (CLIN 11) - Definitized

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price ($)	Total Amount ($)
11.1	NSS 20.2 – Support for Additional mission integration working group meeting for MESSENGER mission	1			
11.2	NSS 20.3.3 – Quick-Turnaround Coupled Loads for the AURA mission	1			
11.3	NSS 20.3.2 – Preliminary Performance/Trajectory Analysis for the Deep Impact mission	1			
11.4	NSS 20.2 – Support for Additional mission integration working group meeting for Swift mission	1			
11.5	NSS 20.3.3 – Quick-Turnaround Coupled Loads for the Stereo I/II mission	1			
11.6	NSS 20.3.3 – Quick-Turnaround Coupled Loads for the Deep Impact mission	1			
11.7	NSS 20.3.3 – Quick-Turnaround Coupled Loads for the Swift mission	1			
11.8	NSS 20.2 – Support for Additional mission integration working group meetings for Stereo I/II mission	1			
11.9	NSS 30.1 – Long Lead Material Procurement for GFY 2003	1			
11.10	NSS 33.3 – GEM Shelf Life Extension	1			
	SubTotal				

7.0 Non-Standard Services Ordered Independently of a Defined Mission (CLIN 11) – Definitized--continued

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price ($)	Total Amount ($)
11.11	NSS 20.3.4 Final Design Load Cycle (FDLS) for the GLAST Mission	1			
11.12	NSS 20.3.3 Quick-turnaround Coupled Loads for the NPP Mission	1			
11.13	NSS 20.2 Support for Additional mission integration working group meetings for GLAST mission	1			
11.14	NSS 20.3.3 Quick-turnaround Coupled Loads for the STSS Mission	1			
11.15	NSS 9.1.1 Two 61-Pin Electrical Interface from fairing to payload for NPP Mission	1			
11.16	NSS 30.1 Long Lead Material Procurement	1			
11.17	NSS 20.2 Support for Additional mission integration working group meeting for STEREO Mission	1			
11.18	NSS 20.3.2 Preliminary Performance/Trajectory Analysis for STSS	1			
11.19	NSS 20.3.3 Quick-Turnaround Coupled Loads for Dawn	1			
11.20	NSS 20.3.3 Quick-Turnaround Coupled Loads for Kepler	1			
	Sub Total				

7.0 Non-Standard Services Ordered Independently of a Defined Mission (CLIN 11) – Definitized--continued

CLIN	Description of Supplies and Service	Qty	Unit	Unit Price ($)	Total Amount ($)
11.21	NSS 20.3.2 Preliminary Performance/Trajectory Analysis for PHOENIX	1			)
11.22	NSS 20.3.4 Second Final Design Load Cycle (FDLC) for the GLAST Mission	1			)
11.23	NSS 20.2 Support for Additional Mission Integration Working Group Meeting for GLAST Mission	1			
11.24	NSS 33.1 Post Production Support for CY 2005	1			
11.25	NSS 33.2 Mission Critical Material	1		$	
11.26	NSS 32.1 West Coast Maintenance for CY05	12	Per month		
11.27	NSS 20.3.4 Final Design Load Cycle (FDLC) for the PHOENIX Mission	1			
11.28	NSS 20.3.2 Preliminary Performance/Trajectory Analysis for the KEPLER Mission	1			
11.29	NSS 20.3.3 Quick-Turnaround Coupled Loads for the OSTM Mission	1			
11.30	NSS 20.3.4 Final Design Load Cycle (FDLC) for the Kepler Mission	1			
11.31	NSS 20.2 Support for Additional Mission Integration Working Group (MIGW) meetings for the GLAST Mission	1			
	TOTAL				

8.0 Special Task Assignments (Studies and Analyses) (CLIN 12) - Definitized

Task Assignment No.	Description	Hours	Firm Fixed-Price
NLSB-001R1	Alternate Access to Station Study		
NLSB-002R1	"CHIPS" Secondary Payload		
NLSB-003R1	ST-5 Secondary Payload Feasibility Study		
NLSB-004	Deep Impact Range Introduction and GOWG Support		
NLSB-005	Transfer CLA Time Histories to EOS-CHEM (AURA) Project		
NLSB-006R1	EOS-CHEM (AURA) Special Instrumentation for Delta II, 2-stage vehicle – Feasibility Study		
NLSB-007R1	Europa Orbiter Performance Assessment for Delta 4050H		
NLSB-008	MER-B 2925H Acoustic Environment Update		
NLSB-009R2	Delta Fleet Review		
NLSB-010	Deep Impact Updated Trajectory Study		
NLSB-011	Preliminary Performance/Trajectory Analysis for Deep Impact		
NLSB-012	Deep Impact Injection Accuracy Study		
NLSB-013	Reserved		
NLSB-014	Swift Mission Specific Acoustic Study		
NLSB-015R1	Deep Impact 3rd Stage Motor Dome Blanket Thermal Property Study		
NLSB-016R1	Delta IV Communication Capability to Hanger AE		
NLSB-017R1	Deep Impact Parking Orbit Thermal Attitude Study		
NLSB-018	New Horizons PKB Mission Performance Assessment for Delta 4050H		
NLSB-019	MESSENGER Backup Launch Period Launch Asymptote Inputs for TFA (May 2002)		
NLSB-020R1	Deep Impact Contamination Assessment		

Task Assignment No.	Description	Hours	Firm Fixed-Price
NLSB-021	Deep Impact Mission Static Load Test Support		
NLSB-022	Clearance for Low Gain Antenna Envelope Violation – Acoustic Analysis		
NLSB-023	Preliminary Performance/ Trajectory Analysis for the STEREO Mission		
NLSB-024R1	LV Provision for Discretes with a Grounding Scheme for the AURA Mission		
NLSB-025	MER-B Additional DTO Work for 2 Additional Masses		
NLSB-026	Electrical and GN2 Purge Umbilicals for the STEREO Mission		
NLSB-027	FTS ADS Modification Study for Delta 4050H		
NLSB-028	Support to Orientation Meeting for the SBIRS-Low Mission at VAFB		
NLSB-029	Injection Accuracy NTC Parametric Study for Deep Impact		
NLSB-030R1	Delta IV LV Integration Options for GSFC S/C		
NLSB-031	MER B Re-Run of FCLA due to S/C Model Update		
NLSB-032	Support for LV Nuclear Safety Databook TIM		
NLSB-033R1	STEREO CDR and Support		
NLSB-034	Partial Acoustic Barrier Removal for the Messenger Mission		
NLSB-035R1	MER B Flight Harnesses		
NLSB-036	MER B GEM-46 Hardware Acceptance Review		
NLSB-037R1	NPP CLA Time Histories		
NLSB-038R1	Thermal Analysis of STEREO PAF Flange, Spacecraft Flange, and Clampband Strap		
NLSB-039R1	Pluto New Horizons ICD Development		
NLSB-040	Pluto New Horizons Trajectory Analysis		

Task Assignment No.	Description	Hours	Firm Fixed-Price
NLSB-041	PLUTO New Horizons Delta IVH EIS LV Databook Support		
NLSB-042R1	PLUTO New Horizons Electrical Umbilical Mission Unique Design and Qualification		
NLSB-043R1	OSP Sixty-Day Data Exchange		
NLSB-044	OSP EELV Reliability Enhancement Study		
NLSB-045	MESSENGER PLF Acoustic Barrier—Clearance for S/C Sunshade—Strength Analysis		
NLSB-046	SWIFT Larger Separation Pads		
NLSB-047	OSP EELV Initial Feasibility Study		
NLSB-048R2	MESSENGER Backup Opportunity Preliminary Mission Analysis (PMA)		
NLSB-049	SWIFT Assessment of PAF Assembly Modifications		
NLSB-050	MESSENGER PLF Acoustic Barrier Mod – Clearance for Spacecraft Sunshade		
NLSB-051R2	PLUTO New Horizons Coupled Loads Analysis – Delta IV Heavy		
NLSB-052R1	MESSENGER Training Propellant Loading		
NLSB-053R1	DEEP IMPACT -- PGAA		
NLSB-054	MER-B Additional PLF Cleaning		
NLSB-055R1	DEEP IMPACT -- Metal Velcro		
NLSB-056	SWIFT Engineering PAF Modification		
NLSB-057	GLAST -- Rerun Coupled Loads Analysis		
NLSB-058R1	OSP Program PHASE II Data Exchange and Analysis		
NLSB-059	MER B Video from Hawaii		
NLSB-060	Delta II Third Stage Flight Date		

Task Assignment No.	Description	Hours	Firm Fixed-Price
NLSB-061R1	AURA SLC-2 Mission Unique Modification		
NLSB-062R1	MER-B RTS Data Relay		
NLSB-063	MER B Expanded Flight Support		
NLSB-064	SBIRS Low 1/STSS CDR & Support		
NLSB-065	SWIFT Machining of PAF		
NLSB-066	Boeing Participation in Cryogenic Ullage Low-g Testing		
NLSB-067R1	OSP RAC-2.9.a ELV Integration and Launch Infrastructure Needs Assessment		
NLSB-068R1	MER B De-Ballast & Launch Period Analysis		
NLSB-069	STSS Preliminary Performance and Trajectory Analysis Phase I		
NLSB-070	STSS CDR & Pre-ATP Support		
NLSB-071	DEEP IMPACT Motor Dome Blanket Assembly		
NLSB-072	STEREO Static Loads Testing Support		
NLSB-073R1	STSS CDR Preparations Support		
NLSB-074	GLAST 2nd Rerun Coupled Loads Analysis		
NLSB-075	DAWN Trajectory Sequence Analysis		
NLSB-076	STEREO Structural Testing Support		
NLSB-077R1	OSP EELV Familiarization Training Class		
NLSB-078	MESSENGER Trajectory Analysis for Backup Opportunity		
NLSB-079	STEREO Integration Support		
NLSB-080R1	OSP Program Phase III Data Exchange and Analysis		

Task Assignment No.	Description	Hours	Firm Fixed-Price
NLSB-081	SWIFT PAF Cleaning to VC-5		
NLSB-082	DEEP IMPACT -- PGAA (PMA-2)		
NLSB-083R1	MESSENGER Spacecraft Fuel Loading		
NLSB-084	MESSENGER PAF and Motor Dome Cleaning and Inspection		
NLSB-085	Static Test Firing of GEM 40		
NLSB-086	MESSENGER Performance Enhancement Analysis/Recapture Performance Loss		
NLSB-087	MESSENGER Remove PLF Acoustic Barrier		
NLSB-088	MESSENGER Detailed Test Objectives for July/Aug Backup Opportunity		
NLSB-089	MESSENGER S/C Observe Cold Flow During Fuel Loading		
NLSB-090R1	STSS Integration and Telecon		
NLSB-091	GLAST cg Lateral Load Limit versus Mass Analysis		
NLSB-092	AURA Composite Payload Fairing Manufacturing Process Verification		
NLSB-093R1	MESSENGER HBK Telemetry Support		
NLSB-094	STEREO -- Revisit the Electrical and GN2 Umbilical Design		
NLSB-095	DAWN Pre-ATP Mission Integration Support		
NLSB-096	GLAST 61 Pin Electrical Connector & Use of 6915 Drill Template		
NLSB-097R2	STSS Integration and Telecon Support		
NLSB-98	THEMIS Probe Carrier Separation		
NLSB-99R1	THEMIS Integration & Telecon Support		
NLSB-100	STEREO Structure Vibration Testing		

Task Assignment No.	Description	Hours	Firm Fixed-Price
NLSB-101	MESSENGER Performance Enhancement- Thermal Analysis		
NLSB-102	Delta Launch Processing System (DLSP) Plan		
NLSB-103R2	MESSENGER Telemetry Tracking Services from Namibia		
NLSB-104	MESSENGER GEM-46 Hardware Acceptance Review		
NLSB-105R1	MESSENGER Spacecraft Fuel Loading		
NLSB-106	AURA Malindi Earth Station Satcom Uplink		
NLSB-107R2	STSS SLC 17 Air Conditioning Purge Study		
NLSB-108	AURA SLC 2 Relative Humidity Control		
NLSB-109	AURA Diving Board Modifications		
NLSB-110	DEEP IMPACT Launch Period Extension		
NLSB-111	PHOENIX Additional Trajectory Analysis		
NLSB-112R1	SWIFT Detailed Test Objectives (DTO) Update		
NLSB-113	EXPLORATION Heavy Lift Launch Study		
NLSB-114	AURA Analyses Update & COLA Support		
NLSB-115R1	AURA Malindi Telemetry Tracking Service		
NLSB-116	MESSENGER Analyses Updates for July/Aug Launch Period		
NLSB-117	SWIFT Shower Curtain Extension		
NLSB-118	MESSENGER Star 48 Coupon Testing		
NLSB-119	MESSENGER USAF Range Safety Analysis and Coordination		
NLSB-120	STEREO Gaseous Nitrogen Purge Study		

Task Assignment No.	Description	Hours	Firm Fixed-Price
NLSB-121	NPP TPAF Modifications		
NLSB-122	STEREO Coupled Loads w/Solid Spacer Ring		
NLSB-123	SWIFT Delta II LV COLA Support		
NLSB-124	MESSENGER Dongara Telemetry Tracking Service		
NLSB-125	THEMIS Launch Trajectory Analysis Support		
NLSB-126	GLAST Dist Aerodynamics Coefficients CLA		
NLSB-127	THEMIS Acoustic Analysis		
NLSB-128R1	MESSENGER Extension of July/Aug Launch Window		
NLSB-129	DEEP IMPACT Extended Launch Period Software & Analysis		
NLSB-130	DEEP IMPACT Spacecraft On-Pad RF Radiation Procedures		
NLSB-131	PHOENIX Additional Trajectory Analysis		
NLSB-132R2	THEMIS Boeing 3712 Bolted PAF Interface Model and Stress Analysis		
NLSB-133	TDRSS Compatible Telemetry System		
NLSB-134	SWIFT Additional Flight Design Analysis		
NLSB-135	SWIFT Console Notebooks		
NLSB-136	DEEP IMPACT Pad 17 B Assignment Change Tasks		
NLSB-137	GLAST TPAF Shipment & Inspection		
NLSB-138	THEMIS Separation Sequencing System		
NLSB-139	SWIFT Video Tracking Service		
NLSB-140	DEEP IMPACT Console Notebooks		

Task Assignment No.	Description	Hours	Firm Fixed-Price
NLSB-141	DEEP IMPACT Telemetry Tracking Service Hartebeestoek		
NLSB-142R2	DEEP IMPACT Telemetry Tracking Service Namibia		
NLSB-143	JIMO Project Study		
NLSB-144	DEEP IMPACT Star 48 Coupon Testing		
NLSB-145	STEREO Blankets		
NLSB-146	DELTA II Sine & Random		
NLSB-147	DAWN Trajectory Analysis		
NLSB-148R1	THEMIS TLX Flight Ordnance System correction		
NLSB-149	GLAST TPAF Inspection at GD/SASS		
NLSB-150	STEREO 61-Pin Umbilical Re-Routing		
NLSB-151	JIMO Advanced Cryogenic Evolved Stage (ACES) Technical Investigation		
TOTAL		93,150.5	

9.0 CCAFS Extensive Repairs (CLIN 34) - Definitized

CLIN	Description	Firm Fixed Price ($)

10.0 VAFB Extensive Repairs (CLIN 35) - Definitized

CLIN	Description	Firm Fixed Price ($)

SECTION C

CONTRACT TERMS AND CONDITIONS

TABLE OF CONTENTS

1.0 FAR 52.212-4 CONTRACT TERMS AND CONDITIONS—COMMERCIAL ITEMS (APR 1998) (TAILORED) C-1

2.0 ON-RAMP AND TECHNOLOGY INSERTION C-5

3.0 LAUNCH VEHICLE QUALIFICATION C-6

4.0 OFF-RAMP CLAUSE C-8

5.0 LAUNCH SERVICE PAYMENTS, MILESTONE EVENTS AND COMPLETION CRITERIA C-9

6.0 NFS 1852.232-77 LIMITATION OF FUNDS (FIXED-PRICE CONTRACT) (MAR 1989) C-15

7.0 SECURITY FOR LAUNCH SERVICE PAYMENT FINANCING C-17

8.0 SCOPE OF WORK – SPECIAL TASK ASSIGNMENTS (STUDIES AND ANALYSES) (CLIN 12) C-19

9.0 ORDERING PROCEDURE AND PAYMENT FOR SPECIAL TASK ASSIGNMENTS (STUDIES AND ANALYSES) (CLIN 12) C-19

10.0 FAR 52.217-7 OPTION FOR INCREASED QUANTITY – SEPARATELY PRICED LINE ITEM (MAR 1989) C-21

11.0 FAR 52.216-18 ORDERING (OCT 1995) C-22

12.0 FAR 52.216-19 ORDER LIMITATIONS (OCT 1995) C-22

13.0 FAR 52.216-22 INDEFINITE QUANTITY (OCT 1995) C-23

14.0 LAUNCH SERVICE TASK ORDERING PROCEDURES C-24

15.0 PRESERVATION, PACKING, PACKAGING, AND MARKING FOR DOCUMENTATION C-27

16.0 FAR 52.246-11 HIGHER LEVEL CONTRACT QUALITY REQUIREMENT (FEB 1999) C-28

17.0 INSPECTION SYSTEM RECORDS C-28

18.0 REQUIRED TIME OF DELIVERY FOR LAUNCH SERVICES C-28

19.0 ADJUSTMENTS TO LAUNCH SCHEDULE C-29

20.0 PLACE OF PERFORMANCE C-33

21.0 ACCOUNTING AND APPROPRIATION DATA C-34

22.0 NFS 1852.227-72 DESIGNATION OF NEW TECHNOLOGY REPRESENTATIVE AND PATENT REPRESENTATIVE (JUL 1997) C-35

23.0 USE OF GOVERNMENT PROPERTY, FACILITIES, AND ASSETS C-36

24.0 MISSION SUCCESS DETERMINATION, INVESTIGATION, AND CORRECTIVE ACTIONS C-36

25.0 GOVERNMENT INSIGHT AND APPROVAL C-41

26.0 GOVERNMENT LAUNCH READINESS ASSESSMENT C-44

27.0 LICENSES AND PERMITS FOR A LAUNCH SERVICE OPERATOR C-44

28.0 ADVANCE UNDERSTANDING REGARDING TERMINATION SETTLEMENT UNDER FAR 52.212-4(l) C-44

29.0 CO-MANIFESTED PAYLOADS C-46

30.0 EXPORT CONTROL AND FOREIGN NATIONALS C-50

31.0 DOMESTIC SOURCE CRITERIA C-50

32.0 LIABILITY FOR THIRD PARTY CLAIMS C-51

33.0 FAR 52.212-3 OFFEROR REPRESENTATIONS AND CERTIFICATIONS – COMMERCIAL ITEMS (OCT 1999) ALT I (JUN 1999) C-54

34.0 FAR 52.212-5 CONTRACT TERMS AND CONDITIONS REQUIRED TO IMPLEMENT STATUTES OR EXECUTIVE ORDERS – COMMERCIAL ITEMS (FEB 2000) C-54

35.0 LISTING OF CLAUSES INCORPORATED BY REFERENCE C-58

36.0 FAR 52.252-2 CLAUSES INCORPORATED BY REFERENCE (FEB 1998) C-59

37.0 FAR 52.252-6 AUTHORIZED DEVIATIONS IN CLAUSES (APR 1984) C-60

38.0 SPECIAL UNDERSTANDING REGARDING DAMAGE TO GOVERNMENT PAYLOADS C-60

39.0 CORPORATE GUARANTEE AND ASSURANCE OF PERFORMANCE C-60

40.0 SPECIAL UNDERSTANDING REGARDING LAUNCH SITES, LONG-LEAD MATERIAL PROCUREMENT, POST PRODUCTION SUPPORT, TERMINATION LIABILITY, MISSION CONSIDERATIONS AND ATP FOR FIRM MISSIONS C-61

41.0 DEPARTMENT OF ENERGY (DOE) 952.250-70 NUCLEAR HAZARDS INDEMNITY AGREEMENT (JUN 1996) C-73

LIST OF TABLES

Table C-1 Launch Service Payment Schedule C-11

Table C-1.1 CLIN 1 (AURA) Launch Service Payment Schedule C-12

Table C-1.2 CLIN 2 (Deep Impact) Launch Service Payment Schedule C-13

Table C-1.3 CLIN 3 (MESSENGER) Launch Service Payment Schedule C-14

Table C-1.4 CLIN 10 (MER-B) Launch Service Payment Schedule C-14.1

Table C-1.5 CLIN 4 (SWIFT) Launch Service Payment Schedule C-14.2

Table C-1.6 CLIN 14 (NPP) Launch Service Payment Schedule C-14.3

Table C-1.7 CLIN 15 (Dawn) Launch Service Payment Schedule C-14.4

Table C-1.8 CLIN 16 (SBIRS Low 1) Launch Service Payment Schedule C-14.5

Table C-1.9 CLIN 17 (GLAST) Launch Service Payment Schedule C-14.6

Table C-1.10 CLIN 18 (OSTM) Launch Service Payment Schedule C-14.7

Table C-1.11 CLIN 19 (MIDEX 5) Launch Service Payment Schedule C-14.8

Table C-1.12 CLIN 20 (SBIRS Low 2) Launch Service Payment Schedule C-14.9

Table C-1.13 CLIN 21 (Kepler) Launch Service Payment Schedule C-14.10

Table C-1.14 CLIN 22 (SDO) Launch Service Payment Schedule C-14.11

Table C-1.15 CLIN 23 (Space Science 1) Launch Service Payment Schedule C-14.12

Table C-1.16 CLIN 24 (Aquarius) Launch Service Payment Schedule C-14.13

Table C-1.17 CLIN 25 (MIDEX 6) Launch Service Payment Schedule C-14.14

Table C-1.18 CLIN 26 (SLI/AAS Demo) Launch Service Payment Schedule C-14.15

Table C-1.19 CLIN 27 (SLI Demo) Launch Service Payment Schedule C-14.16

Table C-1.20 CLIN 28 (Discovery 11) Launch Service Payment Schedule C-14.17

Table C-1.21 CLIN 29 (MMS) Launch Service Payment Schedule C-14.18

Table C-1.22 CLIN 30 (MIDEX 7) Launch Service Payment Schedule C-14.19

Table C-1.23 CLIN 31 (Discovery 12) Launch Service Payment Schedule C-14.20

Table C-1.24 CLIN 32 (GEC) Launch Service Payment Schedule C-14.21

Table C-2 Firm Launch Service Delivery Schedule C-28

Table C-3 Optional Launch Service Delivery Schedule C-29

Table C-4 IDIQ LSTO Delivery Schedule C-29

Table C-5 Contractor Liquidated Damages and Grace Periods C-31

Table C-6 Government Postponement Fees and Grace Periods C-32

Table C-7 Accounting and Appropriation Data C-34

Table C-8 Mission Success Payment Schedule C-39

Table C-9 Launch Payment and Termination Repayment Schedule C-45

Table C-10 NSS 34.1 Milestone Payment Schedule C-70

Table C-11 Vehicle Substitution Table CLINS 29-32 ..... C-72

CONTRACT TERMS AND CONDITIONS

1.0 FAR 52.212-4 CONTRACT TERMS AND CONDITIONS--COMMERCIAL ITEMS (APR 1998) (TAILORED)

(a) *Inspection/Acceptance.* Pursuant to FAR Subpart 12.402(b), FAR clause 52.246-11 Higher-Level Contract Quality Requirement (Feb 1999) shall govern and apply to this contract and is provided in full text in Section C, Clause 16.0. For launch service Contract Line Item Numbers (CLINs) prior to launch, the provisions of FAR clause 52.246-4 Inspection of Services—Fixed-Price (Aug 1996) shall govern and apply to this contract and is incorporated by reference under contract Section C, Clause 35.0. The Government reserves the right to perform in-process inspection or testing of any supplies or launch services tendered for acceptance prior to launch.

The Government will accept only those launch services that successfully deliver a separated and undamaged payload to the proper orbit conditions and insertion accuracies and do not exceed the environmental parameters stated in the Interface Control Document (ICD) except as otherwise provided in this contract. Acceptance of launch service CLINs shall be in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. The Contractor shall only tender for acceptance those items conforming to the contract requirements. For launch services not conforming to the contract requirements, the sole remedy for partial mission success is the forfeiture of the final payment. The sole remedy for a failed mission is the forfeiture of the final payment and the return of 15% of the launch service price as determined by the provisions of contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. For supplies or services other than launch services, the Government will require repair or replacement of nonconforming supplies or re-performance of nonconforming services at no increase in contract price. For launch services, the Government must exercise its post-acceptance rights within the time specified in contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. For supplies or services other than launch services, the Government must exercise its post-acceptance rights --

(1) Within a reasonable time after the defect was discovered or should have been discovered; and

(2) Before any substantial change occurs in the condition of the item, unless the change is due to the defect in the item.

(b) *Assignment.* The Contractor or its assignee's rights to be paid amounts due as a result of performance of this contract, may be assigned to a bank, trust

company, or other financing institution, including any Federal lending agency in accordance with the Assignment of Claims Act (31 U.S.C. 3727).

(c) *Changes.* FAR clause 52.243-1 Changes - Fixed-Price (Aug 1987) Alt I (Apr 1984) is hereby incorporated by reference under contract Section C, Clause 35.0. The time requirement for proposal submission is increased from thirty (30) days to (60) sixty days.

(d) *Disputes.* This contract is subject to the Contract Disputes Act of 1978, as amended (41 U.S.C. 601-613). Failure of the parties to this contract to reach agreement on any request for equitable adjustment, claim, appeal or action arising under or relating to this contract shall be a dispute to be resolved in accordance with the clause at FAR 52.233-1, Disputes (Dec 1998), incorporated herein by reference. The Contractor shall proceed diligently with performance of this contract, pending final resolution of any dispute arising under the contract.

(e) *Definitions.* The clause at FAR 52.202-1, Definitions (Oct 1995), is incorporated herein by reference under contract Section C, Clause 35.0.

(f) *Excusable delays.* The Contractor shall be liable for default unless nonperformance is caused by an occurrence beyond the reasonable control of the Contractor and without its fault or negligence such as, acts of God or the public enemy, acts of the Government in either its sovereign or contractual capacity, fires, floods, epidemics, quarantine restrictions, strikes, unusually severe weather, and delays of common carriers. The Contractor shall notify the Contracting Officer in writing as soon as it is reasonably possible after the commencement of any excusable delay, setting forth the full particulars in connection therewith, shall remedy such occurrence with all reasonable dispatch, and shall promptly give written notice to the Contracting Officer of the cessation of such occurrence. Excusable delays for launch delays by either party are identified and shall be resolved in accordance with contract Section C, Clause 19.0, Adjustments to Launch Schedule.

(g) *Invoice.* The Contractor shall submit an original invoice and three copies (or electronic invoice, if authorized,) to the address designated in the contract to receive invoices. An invoice must include:

(1) Name and address of the Contractor

(2) Invoice date

(3) Contract number, contract line item number, and, if applicable, the order number

(4) Description, quantity, unit of measure, unit price and extended price of the items delivered

(5) Shipping number and date of shipment including the bill of lading number and weight of shipment if shipped on Government bill of lading

(6) Terms of any prompt payment discount offered

(7) Name and address of official to whom payment is to be sent

(8) Name, title, and phone number of person to be notified in event of defective invoice. Invoices will be handled in accordance with the Prompt Payment Act (31 U.S.C. 3903) and Office of Management and Budget (OMB) Circular A-125, Prompt Payment. Contractors are encouraged to assign an identification number to each invoice.

(h) *Patent indemnity*. The Contractor shall indemnify the Government and its officers, employees and agents against liability, including costs, for actual or alleged direct or contributory infringement of, or inducement to infringe, any United States or foreign patent, trademark or copyright, arising out of the performance of this contract, provided the Contractor is reasonably notified of such claims and proceedings.

(i) *Payment*. Payment shall be made for items accepted by the Government that have been delivered to the delivery destinations set forth in this contract. The Government will make payment in accordance with the Prompt Payment Act (31 U.S.C. 3903) and Office of Management and Budget (OMB) Circular A-125, Prompt Payment. If the Government makes payment by Electronic Funds Transfer (EFT), see 52.212-5(b) for the appropriate EFT clause. In connection with any discount offered for early payment, time shall be computed from the date of the invoice. For the purpose of computing the discount earned, payment shall be considered to have been made on the date which appears on the payment check or the specified payment date if an electronic funds transfer payment is made.

(j) *Risk of loss*. Risk of loss of or damage to Government property under this contract will be governed by FAR clause 52.246-25 Limitation of Liability--Services (Feb 1997) and is hereby incorporated by reference under contract Section C, Clause 35.0.

(k) *Taxes*. The contract price includes all applicable federal, state, and local taxes and duties.

(l) *Termination for the Government's convenience*. The Government reserves the right to terminate this contract, or any part hereof, for its sole convenience subject to the terms of this contract specified in contract

Section C, Clause 28.0, Advance Understanding Regarding Termination Settlement Under FAR Clause 52.212-4(l).

(m) *Termination for cause.* The Government may terminate this contract, or any part hereof, for cause in the event of any default by the Contractor, including failure to meet launch dates or maintain qualified launch vehicles, or if the Contractor fails to comply with any contract terms and conditions, or fails to provide the Government, upon request, with adequate assurances of future performance. In the event of termination for cause, the Government shall not be liable to the Contractor for any amount for supplies or services not accepted, including all launch service payments previously paid and all launch service payments remaining to be paid, the Contractor shall be liable to the Government for any and all rights and remedies provided by law. If it is determined that the Government improperly terminated this contract for default, such termination shall be deemed a termination for convenience.

(n) *Title.* Unless otherwise specified in a Task Assignment, title to items furnished in conjunction with services under this contract shall remain with the Contractor. In accordance with 42 U.S.C. 2465d, NASA shall not take title to launch vehicles under contracts for launch services.

(o) *Warranty.* Unless otherwise specified in a Task Assignment, the Contractor makes no warranty, express or implied, with respect to the services delivered or performed hereunder.

(p) *Limitation of liability.* Except as provided for in paragraphs (a) and (j) above, the Contractor will not be liable to the Government for consequential damages resulting from any defect or deficiencies in accepted items.

(q) *Other compliances.* The Contractor shall comply with all applicable Federal, State and local laws, executive orders, rules and regulations applicable to its performance under this contract.

(r) *Compliance with laws unique to Government contracts.* The Contractor agrees to comply with 31 U.S.C. 1352 relating to limitations on the use of appropriated funds to influence certain Federal contracts; 18 U.S.C. 431 relating to officials not to benefit; 40 U.S.C. 327, *et seq.*, Contract Work Hours and Safety Standards Act; 41 U.S.C. 51-58, Anti-Kickback Act of 1986; 41 U.S.C. 265 and 10 U.S.C. 2409 relating to whistleblower protections; 49 U.S.C. 40118, Fly American; and 41 U.S.C. 423 relating to procurement integrity.

(s) *Order of precedence.* Any inconsistencies in this solicitation or contract shall be resolved by giving precedence in the following order:

(1) The schedule and description of supplies/services (Section B, C, and Statement of Work, excluding contract clauses incorporated by reference).

(2) The Assignments, Disputes, Payments, Invoice, Other Compliances, and Compliance with Laws Unique to Government Contracts paragraphs of this clause.

(3) The clause at FAR 52.212-5 (Section C, Clause 34.0).

(4) Addenda to this solicitation or contract, including any license agreements for computer software.

(5) Solicitation provisions if this is a solicitation.

(6) Other paragraphs of this clause.

(7) The Standard Form 1449.

(8) Contract clauses incorporated by reference.

(9) Other documents, exhibits, and attachments.

(10) The specification.

2.0 ON-RAMP AND TECHNOLOGY INSERTION

2.1 The purpose of the IDIQ on-ramp is to create an opportunity for new, emerging launch service providers and for incumbent launch service providers to introduce qualified launch vehicles not available at the time of the award of the initial contract and to compete for additional requirements not identified as firm or option requirements under the basic contract. The intent of the on-ramp is to foster competition for future requirements for launch services, not to recompete existing firm and optional requirements awarded under the basic contract.

2.2 The parties mutually agree the original solicitation shall remain open during the life of this contract for the IDIQ portion of this contract only. For the initial round of contract award(s), which will include the firm and option missions, this solicitation shall close and initial proposals are due on January 7, 2000. At any time subsequent to the award of the present contract, the Government may award additional contracts for the IDIQ requirements identified in the present contract. Each February and August, after the award of the initial contract(s),

and during the life of this contract, the Government will accept proposals from new launch service providers for IDIQ contracts and proposals from existing IDIQ contractors for additional launch services. If the Government issues a solicitation notice, new launch service providers and current IDIQ contractors will be allowed to submit proposals, within the notice's stated response time. The minimum contract requirements, the technical acceptability standards, evaluation factors, solicitation terms and conditions, price reasonableness, and basis for award shall remain in full force and effect for each new proposal. Upon award of each additional contract, the Government shall notify all present Contractors of the award, and the new Contractor shall thenceforth be eligible to compete with all present Contractors for the award of IDIQ task orders.

2.3 Expansion of Performance Capabilities

NASA reserves the right to consider, in the future, expansion of the performance capabilities covered by the IDIQ portion of the NLS contract (either above or below those mission sets competed herein), by properly soliciting offers from all interested sources capable of meeting the requirements in the expanded performance capabilities.

2.4 Technology Insertion – Additional Launch Services Not Previously Proposed

Existing Contractors may submit proposals each February and August subsequent to award to update launch service prices and/or introduce new launch service capabilities, improvements, and technology upgrades. The Contractor may propose new or modified launch services consistent with the terms and conditions of this contract. New or modified vehicles will be qualified based on the requirements established by NPD 8610.7, ELV Risk Mitigation Policy for NASA-Owned and NASA-Sponsored Payloads and contract Section C, Clause 3.0, Launch Vehicle Qualification. Launch services must comply with all the conditions and requirements of the SOW.

2.5 The minimum order quantity for IDIQ contracts awarded in accordance with this On-Ramp Clause is $100,000.

3.0 LAUNCH VEHICLE QUALIFICATION

3.1 Any launch vehicle configuration utilized by the Contractor to provide launch services under this contract must be qualified by NASA in accordance with NPD 8610.7, ELV Risk Mitigation Policy for NASA-Owned or NASA-Sponsored Payloads. Launch vehicle configuration qualification will be performed in accordance with Program Management Instruction (PMI) K-ELV-10.2, Launch Vehicle Qualification.

3.2 Qualification Criteria:

(A) The Launch Service Provider (LSP) shall be a domestic LSP pursuant to Section 201 of Public Law 105-303, Commercial Space Act of 1998.

(B) The LSP must obtain an ISO 9001 third party certification, from a registrar accredited by either the International Registrar of Certified Auditors (IRCA) or the Registrar Accreditation Board (RAB), for any corporation, corporate divisions, subsidiaries, joint ventures, partner(s) and/or any other business entity actually performing launch vehicle manufacturing, management, payload/launch vehicle integration, testing and launch.

(C) For contract award of firm, option, and IDIQ launch services, the launch vehicle configuration must be qualified to the required payload risk category or the Contractor must provide a viable plan, subject to Government assessment and acceptance, to achieve all qualification requirements prior to launch. If a qualification plan (Attachment D1, Exhibit 7) is submitted, it shall be exempt from disclosure as provided under the FOIA.

(D) Services under this contract will only include launch vehicles qualified to risk mitigation Category 2 and 3 in accordance with NPD 8610.7. The Contractor shall submit required documentation for NASA evaluation and determination of qualification category. NASA shall not bear any cost associated with the development of any LSP documentation required for the qualification of a launch vehicle configuration.

(E) For Category 2 and 3 missions, the proposed launch vehicle configuration shall achieve one successful launch prior to formal notification of mission Authority to Proceed (ATP).

(F) Prior to launch of the NASA payload, the proposed launch vehicle configuration shall be qualified to the required payload risk category.

(G) NASA reserves the right to require that selected Category 3 payloads be launched only on launch vehicle configurations that have fourteen consecutive, successful launches of the launch vehicle configuration.

(H) A launch vehicle qualified to a higher category is inherently qualified to launch payloads designated as a lower category (i.e., launch vehicles qualified to launch category 3 payloads are also qualified to launch category 1 and 2 payloads).

(I) (I) If no qualified launch vehicle configurations exist to meet specific mission requirements solicited under a NASA request for contract proposal, the ELV Program Office (ELVPO) may elect to award or issue ATP of a mission

contingent on the launch vehicle configuration achieving qualification requirements tailored by NASA.

3.3 For new vehicles and upgraded or modified vehicle configurations, NASA may require additional technical insight into the design, manufacturing, testing, integration, and first launch of the effected systems and launch vehicle.

3.4 In the event of a launch failure of a qualified common vehicle configuration, the ELVPO may participate in or perform a failure investigation/return-to-flight board to re-qualify the launch vehicle configuration to a particular risk mitigation qualification category.

4.0 OFF-RAMP CLAUSE

4.1 The Government intends to award firm and option missions contingent upon one successful launch of the proposed vehicle prior to ATP and launch vehicle qualification prior to launch of the NASA mission.

4.2 ATP is formal written direction from the Contracting Officer that will typically occur at L-27 months before launch. Prior to ATP, the Government will perform an assessment of the Contractor's current plan to achieve launch vehicle qualification prior to launch of the NASA mission. In the event qualification does not occur prior to L-12 months, the Government will perform an additional assessment of the current qualification plan. If the Government determines the launch vehicle will not obtain qualification prior to launch of the NASA mission, the Government retains the right to invoke the remedies described in paragraphs 4.3 and 4.4 of this clause.

4.3 In the event the Government determines the launch vehicle will not be qualified by launch based on its L-12 month assessment, or the launch vehicle configuration loses qualification status after ATP, the Government may withhold payment, and/or delay the launch date and payment schedule until launch vehicle re-qualification at no increase in price, or terminate the launch service for cause pursuant to contract Section C, Clause 1.0(m) Termination for cause. In the event the Government delays the launch date and payment schedule, the Contractor shall be liable for liquidated damages for the length of delay as established by contract Section C, Clause 19.0, Adjustments to Launch Schedule. This clause shall also apply to any launch service awarded via LSTOs in fulfillment of IDIQ contract requirements.

4.4 The Contracting Officer shall send a cure notice prior to terminating a contract for cause. The Government's rights after a termination for cause shall include all the remedies available to the Government under the Termination for Cause of FAR 52.212-4(m). The Government's preferred remedy will be to acquire similar items from another Contractor and to charge the defaulted Contractor with any excess re-procurement costs together with any incidental or consequential damages

incurred because of the termination. The contractor's liability for excess reprocurement costs shall be limited to the costs associated with re-procuring a commercial launch service. When a termination for cause is appropriate, the Contracting Officer shall send the Contractor a written notification regarding the termination. At a minimum, this notification shall:

(A) Indicate the contract is terminated for cause

(B) Specify the reasons for the termination

(C) Indicate which remedies the Government intends to seek or provide a date by which the Government will inform the Contractor of the remedy

(D) State that the notice constitutes a final decision of the Contracting Officer and that the Contractor has the right to appeal under the Disputes clause.

5.0 LAUNCH SERVICE PAYMENTS, MILESTONE EVENTS AND COMPLETION CRITERIA

5.1 The Contracting Officer will inform the Contractor of ATP with the launch service via written direction. ATP is independent of contract award, option exercise, or launch service task order award. The Government is not obligated to pay the Contractor for any launch service activity prior to the Contracting Officer's written notification of ATP.

5.2 Upon successful completion of a milestone event and submission of a properly certified invoice, the Contractor may request commercial interim payments. The commercial interim payments will be paid in accordance with the payment schedule shown in Table C-1 and based on the milestone events identified in the contract Work Plan (Attachment D8).

5.3 Commercial interim payments are contract financing payments that are not payment for accepted items. Commercial interim payments are fully recoverable, in the same manner as progress payments, in the event of default. Commercial interim payments are contract financing payments and, therefore, are not subject to the interest-penalty provisions of prompt payment. However, these payments shall be made in accordance with the Agency's policy for prompt payment of contract financing payments. In accordance with 42 U.S.C. 2465d, NASA shall not take title to launch vehicles under contract for launch services.

5.4 In the event an option is exercised or an LSTO is issued less than twenty-four months prior to launch, the initial payment for such launch service will be the cumulative total of all payments that would have been paid if the option had been exercised or the LSTO had been issued at L-27 months. If a non-standard "call-up" service is ordered when an option is exercised or an LSTO is issued, the

initial payment shall include the catalog price adjustment. If no "call-up" service exists, the initial payment shall be subject to equitable adjustment.

5.5 Scheduled dates in Table C-1 are tentative and represent invoice submission dates. Payment schedules may be deferred or canceled by the Government if the Contractor fails to make substantial progress in accomplishing the major launch service milestone events in the attached contract Work Plan. Payments falling due in the first quarter of each fiscal year (October - December) shall be paid promptly to the maximum extent practicable, but shall not be considered late until January 31 of the following calendar year.

5.6 In the event launch service SubCLINs are terminated independently of standard launch service CLINs, the parties mutually agree the same termination refund schedule percentage(s) shall be used and applied against the price for the terminated SubCLIN. Table C-1 milestone events shall apply to each firm and optional launch service and IDIQ LSTO issued under this contract.

5.7 This paragraph will apply to any postponement declared by the Government or the Contractor for any reason, including launch schedule adjustments and Contractor failure to make substantial progress in accordance with launch service milestone events (as determined by the Government under this clause). In the event of a launch schedule adjustment by the Government or Contractor in accordance with contract Section C, Clause 19.0, Adjustments to Launch Schedule, the payment schedule for the applicable launch service CLINs and SubCLINs shall be postponed for the length of the delay, if necessary, by the Government to correspond with the new launch date and the milestone events in the attached Work Plan. The requirement to make substantial progress in general conformance with the attached Work Plan, however, is not waived for any postponed launch service. In the event of a launch schedule adjustment by the Government or Contractor, the Government or Contractor shall be entitled to an equitable adjustment as determined by the contract Section C, Clause 19.0, Adjustments to Launch Schedule.

5.8 The Contractor agrees in the event of a termination of this contract pursuant to contract Section C, Clause 28.0, Advance Understanding Regarding Termination Settlement Under FAR Clause 52.212-4(l), the Government shall not be obligated in any event to pay or reimburse the Contractor any amount in excess of the amount already obligated to the contract. The Contractor shall not be obligated to continue performance of the work beyond such point. The Government shall not be obligated in any event to pay or reimburse the Contractor in excess of the amount obligated to the contract on a quarterly basis, notwithstanding anything to the contrary in contract Section C, Clause 28.0, Advance Understanding Regarding Termination Settlement Under FAR 52.212-4(l) and NFS 1852.232-77 Limitation of Funds (Fixed-Price Contract) (Mar 1989).

CLIN TBD—Launch Service Payment Schedule						
Milestone/ Commercial Interim Payment No.	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Payment Amount ($)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Repayment Schedule— Percentage (%) of Cumulative Payments Made to Date To Be Returned to Government
1	TBD	L-27	10	TBD	TBD	50
2	TBD	L-24	10	TBD	TBD	50
3	TBD	L-21	10	TBD	TBD	50
4	TBD	L-18	10	TBD	TBD	55
5	TBD	L-15	10	TBD	TBD	55
6	TBD	L-12	10	TBD	TBD	55
7	TBD	L-09	10	TBD	TBD	60
8	TBD	L-06	10	TBD	TBD	60
9	TBD	L-03	10	TBD	TBD	60
10	TBD	Launch[2]	10	TBD	TBD	—

Table C-1: Launch Service Payment Schedule

[1] The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-30 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

[2] The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Launch Service Payment Schedule						
Milestone/ Commercial Interim Payment No.	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Individual Dollar Amounts ($)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Repayment Schedule— Payment (%) of Cumulative Payments Made to Date to be Returned to Government
1	04/10/01	L-27	10			50
2	07/10/01	L-24	6			37.5
3	10/10/01	L-21	6			31.8
4	03/10/02	L-18	10			43.8
5	10/15/02	L-15	18			55
6	01/15/03	L-12	10			55
7	04/15/03	L-09	10			60
8	07/15/03	L-06	10			60
9	03/17/04	L-03	10			60
10	07/15/04	Launch[2,3]	10			—

1 The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-30 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

2 The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. No final payment shall be made in event of partial mission success or failed mission determination by the Government in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. In the event of a partial mission success or failed mission, the final payment shall be forfeited by the Contractor and is not recoupable. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Table C-1.1: CLIN1 (AURA) Launch Service Payment Schedule

Launch Service Payment Schedule						
Milestone/ Commercial Interim Payment No.	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Individual Dollar Amounts ($)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Repayment Schedule— Payment (%) of Cumulative Payments Made to Date to be Returned to Government
1	10/02/01	L-27	10			50
2	01/02/02	L-24	10			50
3	04/02/02	L-21	10			50
4	07/02/02	L-18	6			50
5	10/02/02	L-15	10			51.1
6	01/02/03	L-12	10			51.8
7	04/02/03	L-09	14			60
8	06/30/04	L-06	10			60
9	09/30/04	L-03	10			60
10	01/12/05	Launch[2]	10			—

[1] The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-30 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

[2] The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. No final payment shall be made in event of partial mission success or failed mission determination by the Government in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. In the event of a partial mission success or failed mission, the final payment shall be forfeited by the Contractor and is not recoupable. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Table C-1.2: CLIN 2 (Deep Impact) Launch Service Payment Schedule

Launch Service Payment Schedule						
Milestone/ Commercial Interim Payment No	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Individual Dollar Amounts ($)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Repayment Schedule—Payment (%) of Cumulative Payments Made to Date to be Returned to Government
1A	ATP	ATP	9			50
1B	12/10/01	L-27	5			36.4%
2	03/10/02	L-24	5			29.7
3	06/10/02	L-21	9			36.4
4	09/10/02	L-18	9			45.8
5	12/10/02	L-15	9			47.7
6	03/10/03	L-12	9			49
7	06/10/03	L-09	9			55.5
8	09/10/03	L-06	6			54.2
9	02/11/04	L-03	13			57.1
10	08/03/04	Launch[2]	17			—

1 The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-30 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

2 The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. No final payment shall be made in event of partial mission success or failed mission determination by the Government in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. In the event of a partial mission success or failed mission, the final payment shall be forfeited by the Contractor and is not recoupable. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Table C-1.3: CLIN 3 (MESSENGER) Launch Service Payment Schedule

Launch Service Payment Schedule						
Milestone/ Commercial Interim Payment No	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Individual Dollar Amounts ($)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Repayment Schedule— Payment (%) of Cumulative Payments Made to Date to be Returned to Government
1A	12/27/00	L-30	9			50
1B	03/27/01	L-27	9			50
2	06/27/01	L-24	9			50
3	09/27/01	L-21	9			50
4	12/25/01	L-18	9			55
5	03/25/02	L-15	9			55
6	06/25/02	L-12	9			55
7	09/25/02	L-09	9			60
8	12/25/02	L-06	9			60
9	03/25/03	L-03	9			60
10	07/07/03	Launch[2]	10			—

1 The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-30 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

2 The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. No final payment shall be made in event of partial mission success or failed mission determination by the Government in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. In the event of a partial mission success or failed mission, the final payment shall be forfeited by the Contractor and is not recoupable. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Table C-1.4: CLIN 10 (MER-B) Launch Service Payment Schedule

Launch Service Payment Schedule						
Milestone/ Commercial Interim Payment No	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Individual Dollar Amounts ($)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Repayment Schedule— Payment (%) of Cumulative Payments Made to Date to be Returned to Government
1A	ATP	L-30	9			50
1B	06/30/01	L-27	9			50
2	09/30/01	L-24	9			50
3	12/30/01	L-21	9			50
4	03/30/02	L-18	9			55
5	06/30/02	L-15	9			55
6	09/30/02	L-12	9			55
7	12/30/02	L-09	9			60
8	06/05/03	L-06	9			60
9	06/01/04	L-03	9			60
10	11/20/04	Launch[2,3]	10			—

1 The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-30 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

2 The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. No final payment shall be made in event of partial mission success or failed mission determination by the Government in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. In the event of a partial mission success or failed mission, the final payment shall be forfeited by the Contractor and is not recoupable. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Table C-1.5: CLIN 4 (Swift) Launch Service Payment Schedule

Launch Service Payment Schedule						
Milestone/ Commercial Interim Payment No.	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Individual Dollar Amounts ($)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Repayment Schedule— Payment (%) of Cumulative Payments Made to Date to be Returned to Government
1	11/15/03	L-24	20			50
2	02/15/04	L-21	10			50
3	08/11/04	L-18	10			55
4	11/11/04	L-15	10			55
5	02/11/05	L-12	10			55
6	05/11/05	L-09	10			60
7	08/11/05	L-06	10			60
8	11/11/05	L-03	10			60
9	02/11/06	Launch[2]	10			--

1 The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-30 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

2 The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. No final payment shall be made in event of partial mission success or failed mission determination by the Government in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. In the event of a partial mission success or failed mission, the final payment shall be forfeited by the Contractor and is not recoupable. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Table C-1.5.1: CLIN 8 (STEREO) Launch Service Payment Schedule

Launch Service Payment Schedule						
Milestone/ Commercial Interim Payment No.	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Individual Dollar Amounts ($)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Repayment Schedule— Payment (%) of Cumulative Payments Made to Date to be Returned to Government
1	06/30/03	L-24	20			50
2	04/30/04	L-21	2			32.1
3	05/01/05	MCRD-18	6			36.1
4	08/01/05	MCRD-15	2			25.6
5	11/01/05	MCRD-12	2			16.5
6	03/01/06	MCRD-08	2			18.6
7	07/01/06	MCRD-04	22			43.3
8	11/01/06	MCRD	34			60.2
9	12/01/07	Launch[2]	10			—

[1] The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-30 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

[2] The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. No final payment shall be made in event of partial mission success or failed mission determination by the Government in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. In the event of a partial mission success or failed mission, the final payment shall be forfeited by the Contractor and is not recoupable. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Table C-1.5.2: CLIN 9 (NOAA-N') Launch Service Payment Schedule

Launch Service Payment Schedule						
Milestone/ Commercial Interim Payment No.	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Individual Dollar Amounts ($)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Repayment Schedule—Payment (%) of Cumulative Payments Made to Date to be Returned to Government
1[3]	07/31/04	L-27	10			50
2	10/31/04	L-24	10			50
3	01/31/05	L-21	10			50
4	04/30/05	L-18	10			55
5	12/01/05	L-15	10			55
6	03/01/06	L-12	10			55
7	06/01/06	L-09	10			60
8	09/01/06	L-06	10			60
9	12/01/06	L-03	10			60
10	03/01/07	Launch[2]	10			—

1 The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-30 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

2 The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. No final payment shall be made in event of partial mission success or failed mission determination by the Government in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. In the event of a partial mission success or failed mission, the final payment shall be forfeited by the Contractor and is not recoupable. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Table C-1.6: CLIN 14 (NPP) Launch Service Payment Schedule

Launch Service Payment Schedule						
Milestone/ Commercial Interim Payment No.	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Individual Dollar Amounts ($)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Repayment Schedule—Payment (%) of Cumulative Payments Made to Date to be Returned to Government
1[3]	03/17/04	L-27	10	-	-	50
2	06/17/04	L-24	10	-	-	50
3	09/17/04	L-21	10	-	-	50
4	12/17/04	L-18	10	-	-	55
5	03/17/05	L-15	10	-	-	55
6	06/17/05	L-12	10	-	-	55
7	09/17/05	L-09	10	-	-	60
8	12/17/05	L-06	10	-	-	60
9	03/17/06	L-03	10	-	-	60
10	06/17/06	Launch[2]	10	-	-	—

1 The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-30 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

2 The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. No final payment shall be made in event of partial mission success or failed mission determination by the Government in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. In the event of a partial mission success or failed mission, the final payment shall be forfeited by the Contractor and is not recoupable. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Table C-1.7: CLIN 15 (Dawn) Launch Service Payment Schedule

Launch Service Payment Schedule						
Milestone/ Commercial Interim Payment No.	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Individual Dollar Amounts ($)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Repayment Schedule— Payment (%) of Cumulative Payments Made to Date to be Returned to Government
1[3]	ATP	L-27	10			50
2	02/01/05	L-24	10			50
3	05/01/05	L-21	10			50
4	08/01/05	L-18	3			55
5	11/01/05	L-15	17			55
6	02/01/06	L-12	10			55
7	05/01/06	L-09	10			60
8	08/01/06	L-06	2			60
9	11/01/06	L-03	18			60
10	02/01/07	Launch[2]	10			—

1 The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-30 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

2 The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. No final payment shall be made in event of partial mission success or failed mission determination by the Government in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. In the event of a partial mission success or failed mission, the final payment shall be forfeited by the Contractor and is not recoupable. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Table C-1.8: **CLIN 16 (STSS) Launch Service Payment Schedule**

Launch Service Payment Schedule

Milestone/ Commercial Interim Payment No.	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Individual Dollar Amounts ($)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Repayment Schedule—Payment (%) of Cumulative Payments Made to Date to be Returned to Government
1[3]	06/07/05	L-27	10			50
2	09/07/05	L-24	10			50
3	12/07/05	L-21	10			50
4	03/07/06	L-18	10			55
5	06/07/06	L-15	10			55
6	09/07/06	L-12	10			55
7	12/07/06	L-09	10			60
8	03/07/07	L-06	10			60
9	06/07/07	L-03	10			60
10	09/07/07	Launch[2]	10			—

1 The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-30 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

2 The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. No final payment shall be made in event of partial mission success or failed mission determination by the Government in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. In the event of a partial mission success or failed mission, the final payment shall be forfeited by the Contractor and is not recoupable. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Table C-1.9: CLIN 17 (GLAST) Launch Service Payment Schedule

Launch Service Payment Schedule						
Milestone/ Commercial Interim Payment No.	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Individual Dollar Amounts ($)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Repayment Schedule—Payment (%) of Cumulative Payments Made to Date to be Returned to Government
1A[3]	ATP	L-30	9		–	50
1	01/31/06	L-27	9		–	50
2	04/30/06	L-24	9		–	50
3	07/31/06	L-21	9		–	50
4	10/31/06	L-18	9		–	55
5	01/31/07	L-15	9		–	55
6	04/30/07	L-12	9		–	55
7	07/31/07	L-09	9		–	60
8	10/31/07	L-06	9		–	60
9	01/31/08	L-03	9		–	60
10	04/30/08	Launch[2]	10		–	—

1 The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-30 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

2 The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. No final payment shall be made in event of partial mission success or failed mission determination by the Government in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. In the event of a partial mission success or failed mission, the final payment shall be forfeited by the Contractor and is not recoupable. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Table C-1.10: CLIN 18 (OSTM) Launch Service Payment Schedule

Launch Service Payment Schedule						
Milestone/ Commercial Interim Payment No.	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Individual Dollar Amounts ($)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Repayment Schedule— Payment (%) of Cumulative Payments Made to Date to be Returned to Government
1[3]	07/19/04	L-27	10			50
2	10/19/04	L-24	10			50
3	01/19/05	L-21	10			50
4	04/19/05	L-18	10			55
5	07/19/05	L-15	10			55
6	10/19/05	L-12	10			55
7	01/19/06	L-09	10			60
8	04/19/06	L-06	10			60
9	07/19/06	L-03	10			60
10	10/19/06	Launch[2]	10			—

1 The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-30 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

2 The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. No final payment shall be made in event of partial mission success or failed mission determination by the Government in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. In the event of a partial mission success or failed mission, the final payment shall be forfeited by the Contractor and is not recoupable. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Table C-1.11: CLIN 19 (THEMIS) Launch Service Payment Schedule

Launch Service Payment Schedule						
Milestone/ Commercial Interim Payment No.	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Individual Dollar Amounts ($)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Repayment Schedule— Payment (%) of Cumulative Payments Made to Date to be Returned to Government
1[3]	ATP	L-24	20			50
2	03/31/05	L-21	10			50
3	05/26/05	L-18	10			55
4	07/31/05	L-15	10			55
5	10/31/05	L-12	10			55
6	01/31/06	L-09	10			60
7	04/30/06	L-06	10			60
8	07/31/06	L-03	10			60
9	10/31/06	Launch[2]	10			—

1 The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-30 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

2 The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. No final payment shall be made in event of partial mission success or failed mission determination by the Government in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. In the event of a partial mission success or failed mission, the final payment shall be forfeited by the Contractor and is not recoupable. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Table C-1.12: CLIN 20 (STSS Block 2010 Risk Reduction) Launch Service Payment Schedule

Launch Service Payment Schedule						
Milestone/ Commercial Interim Payment No.	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Individual Dollar Amounts ($)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Repayment Schedule—Payment (%) of Cumulative Payments Made to Date to be Returned to Government
1[3]	07/31/05	L-27	10			50
2	10/31/05	L-24	10			50
3	01/31/06	L-21	10			50
4	04/30/06	L-18	10			55
5	07/31/06	L-15	10			55
6	10/31/06	L-12	10			55
7	01/31/07	L-09	10			60
8	04/30/07	L-06	10			60
9	07/31/07	L-03	10			60
10	10/31/07	Launch[2]	10			—

1 The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-30 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

2 The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. No final payment shall be made in event of partial mission success or failed mission determination by the Government in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. In the event of a partial mission success or failed mission, the final payment shall be forfeited by the Contractor and is not recoupable. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Table C-1.13: CLIN 21 (Kepler) Launch Service Payment Schedule

Milestone/ Commercial Interim Payment No.	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Individual Dollar Amounts ($)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Repayment Schedule— Payment (%) of Cumulative Payments Made to Date to be Returned to Government
1[3]	ATP	L-27	10			50
2	08/03/05	L-24	10			50
3	11/03/05	L-21	10			50
4	02/03/06	L-18	10			55
5	05/03/06	L-15	10			55
6	08/03/06	L-12	10			55
7	11/03/06	L-09	10			60
8	02/03/07	L-06	10			60
9	05/03/07	L-03	10			60
10	08/03/07	Launch[2]	10			—

[1] The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-30 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

[2] The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. No final payment shall be made in event of partial mission success or failed mission determination by the Government in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. In the event of a partial mission success or failed mission, the final payment shall be forfeited by the Contractor and is not recoupable. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Table C-1.14: CLIN 22 (Phoenix) Launch Service Payment Schedule

Launch Service Payment Schedule						
Milestone/ Commercial Interim Payment No.	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Individual Dollar Amounts ($)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Maximum Liability Schedule—Percentage of Launch Service Price[3]
1[3]	10/31/06	L-27	10			50
2	01/31/07	L-24	10			50
3	04/30/07	L-21	10			50
4	07/31/07	L-18	10			55
5	10/31/07	L-15	10			55
6	01/31/08	L-12	10			55
7	04/30/08	L-09	10			60
8	07/31/08	L-06	10			60
9	10/31/08	L-03	10			60
10	01/31/09	Launch[2]	10			—

1 The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-30 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

2 The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. No final payment shall be made in event of partial mission success or failed mission determination by the Government in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. In the event of a partial mission success or failed mission, the final payment shall be forfeited by the Contractor and is not recoupable. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Table C-1.15: CLIN 23 (MMS) Launch Service Payment Schedule

Launch Service Payment Schedule						
Milestone/ Commercial Interim Payment No.	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Individual Dollar Amounts ($)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Repayment Schedule— Payment (%) of Cumulative Payments Made to Date to be Returned to Government
1[3]	06/30/06	L-27	10			50
2	09/30/06	L-24	10			50
3	12/30/06	L-21	10			50
4	03/30/07	L-18	10			55
5	06/30/07	L-15	10			55
6	09/30/07	L-12	10			55
7	12/30/07	L-09	10			60
8	03/30/08	L-06	10			60
9	06/30/08	L-03	10			60
10	09/30/08	Launch[2]	10			—

1 The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-30 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

2 The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. No final payment shall be made in event of partial mission success or failed mission determination by the Government in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. In the event of a partial mission success or failed mission, the final payment shall be forfeited by the Contractor and is not recoupable. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Table C-1.16: CLIN 24 (Aquarius) Launch Service Payment Schedule

Launch Service Payment Schedule						
Milestone/ Commercial Interim Payment No.	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Individual Dollar Amounts ($)	Cumulative Amount of Launch Service Payments (%)	Termination for Convenience of the Government Maximum Liability Schedule—Percentage of Launch Service Price[4]
1[3]	12/31/05	L-27	10	-	-	20.0
2	03/31/06	L-24	10	-	-	31.4
3	06/30/06	L-21	10	-	-	42.8
4	09/30/06	L-18	10	-	-	54.2
5	12/31/06	L-15	10	-	-	65.6
6	03/31/07	L-12	10	-	-	77.0
7	06/30/07	L-09	10	-	-	88.4
8	09/30/07	L-06	10	-	-	100
9	12/31/07	L-03	10	-	-	100
10	03/31/08	Launch[2]	10	-	-	—

1 The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-30 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

2 The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. No final payment shall be made in event of partial mission success or failed mission determination by the Government in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. In the event of a partial mission success or failed mission, the final payment shall be forfeited by the Contractor and is not recoupable. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Table C-1.17: CLIN 25 (MIDEX 6) Launch Service Payment Schedule

Launch Service Payment Schedule						
Milestone/ Commercial Interim Payment No.	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Individual Dollar Amounts ($)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Repayment Schedule— Payment (%) of Cumulative Payments Made to Date to be Returned to Government
1	04/30/04	L-27	10	-	-	50
2	07/31/04	L-24	10	-	-	50
3	10/31/04	L-21	10	-	-	50
4	01//31/05	L-18	10	-	-	55
5	04/30/05	L-15	10	-	-	55
6	07/31/05	L-12	10	-	-	55
7	10/31/05	L-09	10	-	-	60
8	01/31/06	L-06	10	-	-	60
9	04/30/06	L-03	10	-	-	60
10	07/31/06	Launch[2]	10	-	-	—

1 The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-30 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

2 The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. No final payment shall be made in event of partial mission success or failed mission determination by the Government in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. In the event of a partial mission success or failed mission, the final payment shall be forfeited by the Contractor and is not recoupable. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Table C-1.19: CLIN 27 (Option 9) Launch Service Payment Schedule

Launch Service Payment Schedule						
Milestone/ Commercial Interim Payment No.	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Individual Dollar Amounts ($)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Repayment Schedule—Payment (%) of Cumulative Payments Made to Date to be Returned to Government
1	01/31/04	L-27	10			50
2	04/30/04	L-24	10			50
3	07/31/04	L-21	10			50
4	10/31/04	L-18	10			55
5	01/31/05	L-15	10			55
6	04/30/05	L-12	10			55
7	07/31/05	L-09	10			60
8	10/31/05	L-06	10			60
9	01/31/06	L-03	10			60
10	04/30/06	Launch[2]	10			—

[1] The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-30 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

[2] The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. No final payment shall be made in event of partial mission success or failed mission determination by the Government in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. In the event of a partial mission success or failed mission, the final payment shall be forfeited by the Contractor and is not recoupable. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Table C-1.18: CLIN 26 (Option 8) Launch Service Payment Schedule

Launch Service Payment Schedule						
Milestone/ Commercial Interim Payment No.	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Individual Dollar Amounts ($)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Maximum Liability Schedule—Percentage of Launch Service Price[3]
1	02/14/06	L-27	10			20.0
2	05/18/06	L-24	10			31.4
3	08/19/06	L-21	10			42.8
4	11/20/06	L-18	10			54.2
5	02/21/07	L-15	10			65.6
6	05/25/07	L-12	10			77.0
7	08/26/07	L-09	10			88.4
8	11/27/07	L-06	10			100
9	02/28/08	L-03	10			100
10	05/31/08	Launch[2]	10			—

1 The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-30 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

2 The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. No final payment shall be made in event of partial mission success or failed mission determination by the Government in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. In the event of a partial mission success or failed mission, the final payment shall be forfeited by the Contractor and is not recoupable. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Table C-1.20: CLIN 28 (Option 10) Launch Service Payment Schedule

Launch Service Payment Schedule						
Milestone/ Commercial Interim Payment No.	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Individual Dollar Amounts ($)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Maximum Liability Schedule—Percentage of Launch Service Price[3]
1	10/31/06	L-27	10			50.0
2	01/31/07	L-24	10			62.5
3	04/30/07	L-21	10			75.0
4	07/31/07	L-18	10			87.5
5	10/31/07	L-15	10			100
6	01/31/08	L-12	10			100
7	04/30/08	L-09	10			100
8	07/31/08	L-06	10			100
9	10/31/08	L-03	10			100
10	01/31/09	Launch[2]	10			—

1 The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-30 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

2 The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. No final payment shall be made in event of partial mission success or failed mission determination by the Government in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. In the event of a partial mission success or failed mission, the final payment shall be forfeited by the Contractor and is not recoupable. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Table C-1.21: CLIN 29 (Option 11) Launch Service Payment Schedule

Launch Service Payment Schedule						
Milestone/ Commercial Interim Payment No.	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Individual Dollar Amounts ($)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Maximum Liability Schedule—Percentage of Launch Service Price[3]
1	12/31/06	L-27	10			50.0
2	03/31/07	L-24	10			62.5
3	06/30/07	L-21	10			75.0
4	09/30/07	L-18	10			87.5
5	12/31/07	L-15	10			100
6	03/31/08	L-12	10			100
7	06/30/08	L-09	10			100
8	09/30/08	L-06	10			100
9	12/31/08	L-03	10			100
10	03/31/09	Launch[2]	10			—

1 The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-3 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

2 The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. No final payment shall be made in event of partial mission success or failed mission determination by the Government in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. In the event of a partial mission success or failed mission, the final payment shall be forfeited by the Contractor and is not recoupable. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Table C-1.22: CLIN 30 (Option 12) Launch Service Payment Schedule

Launch Service Payment Schedule						
Milestone/ Commercial Interim Payment No.	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Individual Dollar Amounts ($)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Maximum Liability Schedule—Percentage of Launch Service Price[3]
1	02/28/07	L-27	10			50.0
2	05/31/07	L-24	10			62.5
3	08/31/07	L-21	10			75.0
4	11/30/07	L-18	10			87.5
5	02/28/08	L-15	10			100
6	05/31/08	L-12	10			100
7	08/31/08	L-09	10			100
8	11/30/08	L-06	10			100
9	02/28/09	L-03	10			100
10	05/31/09	Launch[2]	10			—

1 The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-30 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

2 The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. No final payment shall be made in event of partial mission success or failed mission determination by the Government in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. In the event of a partial mission success or failed mission, the final payment shall be forfeited by the Contractor and is not recoupable. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Table C-1.23: CLIN 31 (Option 13) Launch Service Payment Schedule

Launch Service Payment Schedule						
Milestone/ Commercial Interim Payment No.	Invoice Submission Dates	Payment(s) Months Before Launch[1]	Amount (% of Launch Service CLIN Price)	Individual Dollar Amounts ($)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Maximum Liability Schedule—Percentage of Launch Service Price[3]
1	06/30/07	L-27	10			60.0
2	09/30/07	L-24	10			73.5
3	12/31/07	L-21	10			86.8
4	03/31/08	L-18	10			100
5	06/30/08	L-15	10			100
6	09/30/08	L-12	10			100
7	12/31/08	L-09	10			100
8	03/31/09	L-06	10			100
9	06/30/09	L-03	10			100
10	09/30/09	Launch[2]	10			—

1 The Government reserves the right to extend or shorten the above payment schedule by plus or minus three months (i.e., L-30 or L-24) at no increase in contract value to accommodate mission specific requirements. The additional L-30 payment, if required, will be 9% of the launch service price and the next nine payments will be reduced by 1% from 10% to 9%. The Launch payment shall remain unchanged at 10%. In the event the first payment is made at L-24, the first payment shall be 20% of the launch service price.

2 The Contracting Officer will either approve the final payment within fifteen days after receipt of the final flight report, CDRL C4-13 or withhold the final payment in accordance with the provisions of contract Section C, Clause 24.0. No final payment shall be made in event of partial mission success or failed mission determination by the Government in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions. In the event of a partial mission success or failed mission, the final payment shall be forfeited by the Contractor and is not recoupable. In the event of a failed mission determination, 15% of the launch service price shall be applied as a credit to another launch service or be returned to the Government if it cannot be applied to a subsequent launch service. If funds are not credited or returned within thirty days of a failed mission determination, the funds shall be subject to interest penalties at the prevailing U.S. Treasury interest rate established for Prompt Payment.

Table C-1.24: CLIN 32 (Option 14) Launch Service Payment Schedule

5.9 The Contracting Officer will unilaterally determine the Contractor's accomplishment and successful completion of each milestone event. The Contracting Officer's determination of milestone event completion will include, but is not limited to, the accomplishment criteria listed for the major milestone events set forth in Attachment D8, Work Plan. In addition, the Contracting Officer will determine if the following are complete for each payment requested: all Contract Data Requirements List (CDRL) data item deliverables for which delivery is required prior to the requested payment have been delivered and the Contracting Officer has approved those data items requiring Government approval; there are no proposals due from the Contractor which have exceeded the time period in the contract Changes clause; and all previous events have been met and payment has been approved by the Contracting Officer. Approval of the final payment will be made in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions.

6.0 NFS 1852.232-77 LIMITATION OF FUNDS (FIXED-PRICE CONTRACT) (MAR 1989)

(a) The sum of , is presently available for payment and allotted to this contract. It is anticipated that from time to time additional funds will be allocated to the contract as required by the payment schedule in contract Section C, Clause 5.0, Launch Service Payments, Milestone Events and Completion Criteria, until the total price of said CLINs is allotted.

(b) The Contractor agrees to perform or have performed work on the items specified in paragraph (a) of this clause up to the point at which, if this contract is terminated pursuant to contract Section C, Clause 1.0(l) "Termination for the Government's convenience" of this contract, the total amount payable by the Government pursuant to contract Section C, Clause 1.0(l) would equal the amount retained by the Contractor pursuant to Section C, Clause 5.0 and Table C-1. The Contractor is not obligated to continue performance of the work beyond that point. The Government is not obligated in any event to pay or reimburse the Contractor more than the amount from time to time allotted to the contract, anything to the contrary in contract Section C, Clause 1.0(l) "Termination for the Government's convenience" notwithstanding.

(c) (1) It is contemplated that funds presently allotted to this contract will cover the work to be performed until December 31, 2005.

(2) If funds allotted are considered by the Contractor to be inadequate to cover the work to be performed until that date, or an agreed date substituted for it, the Contractor shall notify the Contracting Officer in writing when within the next sixty (60) days the work will reach a point at which, if the contract is terminated pursuant to contract Section C, Clause 1.0(l) "Termination for the Government's convenience" of this contract, the total amount payable by the Government pursuant to contract Section C, Clause 1.0(l) would equal the amount retained by the Contractor pursuant to contract Section C, Clause 5.0 and Table C-1.

contract, the total amount payable by the Government pursuant to contract Section C, Clause 1.0(l) would equal the amount retained by the Contractor pursuant to contract Section C, Clause 5.0 and Table C-1.

(3) (i) The notice shall state the estimate when the point referred to in paragraph (c)(2) of this clause will be reached and the estimated amount of additional funds required to continue performance to the date specified in paragraph (c)(1) of this clause, or an agreed date substituted for it.

(ii) The Contractor shall, sixty (60) days in advance of the date specified in paragraph (c)(1) of this clause, or an agreed date substituted for it, advise the Contracting Officer in writing as to the estimated amount of additional funds required for the timely performance of the contract for a further period as may be specified in the contract or otherwise agreed to by the parties.

(4) If, after the notification referred to in paragraph (c)(3)(ii) of this clause, additional funds are not allotted by the date specified in paragraph (c)(1) of this clause, or an agreed date substituted for it, the Contracting Officer shall, upon the Contractor's written request, terminate this contract on that date or on the date set forth in the request, whichever is later, pursuant to contract Section C, Clause 1.0(l) "Termination for the Government's convenience".

(d) When additional funds are allotted from time to time for continued performance of the work under this contract, the parties shall agree on the applicable period of contract performance to be covered by these funds. The provisions of paragraphs (b) and (c) of this clause shall apply to these additional allotted funds and the substituted date pertaining to them, and the contract shall be modified accordingly.

(e) If, solely by reason of the Government's failure to allot additional funds in amounts sufficient for the timely performance of this contract, the Contractor incurs additional costs or is delayed in the performance of the work under this contract, and if additional funds are allotted, an equitable adjustment shall be made in the price(s) (including appropriate target, billing, and ceiling prices where applicable) of the items to be delivered, or in the time of delivery, or both.

(f) The Government may at any time before termination, and, with the consent of the Contractor, after notice of termination, allot additional funds for this contract.

(g) The provisions of this clause with respect to termination shall in no way be deemed to limit the rights of the Government under the Termination for

Cause clause of this contract. The provisions of this Limitation of Funds clause are limited to the work on and allotment of funds for the items set forth in paragraph (a) of this clause. This clause shall become inoperative upon the allotment of funds for the total price of said work except for rights and obligations then existing under this clause.

(h) Nothing in this clause shall affect the right of the Government to terminate this contract pursuant to contract Section C, Clause 1.0(l) "Termination for the Government's convenience" of this contract.

7.0 SECURITY FOR LAUNCH SERVICE PAYMENT FINANCING

7.1 *Requirements for payment.* Payments will be made under this contract upon submission of properly certified invoices or vouchers by the Contractor, and approval by the administering office, NASA John F. Kennedy Space Center. The amount of all invoices or vouchers submitted shall not exceed the total contract price for launch service CLINs, authorized LSTOs issued under the IDIQ contract, and special task assignments (studies and analyses).

7.2 *Security.* Pursuant to FAR Subpart 32.202-4 Security for Government Financing and 10 U.S.C. 2307(f) and 41 U.S.C. 255(f), the Government is required to obtain adequate security for Government financing. Adequate security for payments made under this contract shall be required in the form of a preferred creditor's lien. The Contractor shall grant the Government a preferred creditor's lien i.e., a first lien paramount to all other liens against all work in process sufficient to recompense the Government for all monies advanced under this contract should the Contractor's performance prove to be materially unsatisfactory.

7.3 *Insurance.* The Contractor represents and warrants that it maintains with responsible insurance carriers (1) insurance on plant and equipment against fire and other hazards to the extent similar properties are usually insured by others operating plants and properties of similar character in the same general locality; (2) adequate insurance against liability on account of damage to persons or property; and (3) adequate insurance under all applicable workers' compensation laws. The Contractor agrees that, until work under this contract has been completed and all payments made under this contract have been liquidated, it will maintain this insurance and furnish any certificates with respect to its insurance that the administering office may require.

7.4 *Representations and Warranties.* The Contractor represents and warrants the following:

(A) The balance sheet, the profit and loss statement, and any other supporting financial statements furnished to the administering office fairly reflect the financial condition of the Contractor at the date shown or the period covered, and there has been no subsequent materially adverse change in the financial condition of the Contractor.

(B) No litigation or criminal or civil proceedings are presently pending or threatened against the Contractor, which would jeopardize performance under this contract, except as shown in the financial statements.

(C) The Contractor has disclosed all contingent liabilities in the financial statements furnished to the administering office, which would jeopardize performance under this contract.

(D) None of the terms in this clause conflict with the authority under which the Contractor is doing business or with the provision of any existing indenture or agreement of the Contractor.

(E) The Contractor has the power to enter into this contract and accept payments, and has taken all necessary actions to authorize the acceptance under the terms of this contract.

(F) The assets of the Contractor are not subject to any lien or encumbrance of any character, which would jeopardize performance under this contract, except for current taxes not delinquent and except as shown in the financial statements. There is no current assignment of claims under any contract affected by these payment provisions.

(G) All information furnished by the Contractor to the administering office in connection with each request for payment is true and correct.

(H) These representations and warranties shall be continuing and shall be considered to have been repeated by the submission of each invoice for payments.

7.5 *Work Plan Submission.* The Contractor shall comply with the Work Plan that identifies the major milestone events and a corresponding narrative of the work activity necessary to accomplish the major milestone events.

8.0 SCOPE OF WORK – SPECIAL TASK ASSIGNMENTS (STUDIES AND ANALYSES) (CLIN 12)

8.1 It is contemplated the total hours in CLIN 12 will be allocated to launch services on an as-required basis. To accomplish this work, the Contractor shall perform specific task assignments that will be defined through the issuance of task orders in accordance with contract Section C, Clause 9.0, Ordering Procedure and Payment for Special Task Assignments (Studies and Analyses) (CLIN 12) and paragraphs 8.2, 8.3, 8.4, and 8.5 herein.

8.2 In the performance of all Firm-Fixed-Price (FFP), completion-basis, non-LSTOs assigned under this contract, the Contractor may be required to expend a cumulative total of not more than 500,000 hours under CLIN 12 in support of east and west coast missions of fully burdened direct labor (which includes all direct and indirect cost and profit) at the FFP composite hourly labor rate stated in contract Section B, paragraph 1.5. Requirements for materials, subcontracted efforts, and hardware fabrication may be authorized and negotiated separately on a case-by-case basis by the Contracting Officer under individual task orders in addition to the FFP labor hours.

8.3 Only hours expended against specific written task orders authorized by the Contracting Officer shall be paid under this contract. Task orders shall be performed on an FFP, completion-effort basis. The Government is under no obligation to reimburse the Contractor for any costs, which exceed the maximum hours under CLIN 12 or the number of hours authorized on each task order.

8.4 The Government may require Special Task Assignments (Studies and Analyses) in any calendar year from 2000 through 2004 at the FFP composite labor rates identified in Section B, paragraph 1.5, and in any calendar year from 2005 through 2010 at the NTE prices identified Section B, paragraph 1.5, up to 500,000 hours of fully burdened labor (including all direct and indirect cost and profit).

8.5 The Contractor shall submit a price proposal update to convert NTE CY 2005 – 2010 labor rates into FFP labor rates at least 180 days prior to the end of CY 2004. The proposed labor rates shall be negotiated using the applicable procedures of FAR Part 15 and incorporated herein.

9.0 ORDERING PROCEDURE AND PAYMENT FOR SPECIAL TASK ASSIGNMENTS (STUDIES AND ANALYSES) (CLIN 12)

9.1 Performance under this contract effort shall be subject to the following ordering procedure:

(A) The Contractor shall incur hours under CLIN 12 of this contract only in the performance of task orders and revisions to task orders issued in

accordance with this ordering procedure. No other costs or hours under CLIN 12 are authorized. Task orders shall be performed under an FFP completion-basis unless specifically authorized otherwise by the Contracting Officer.

(B) During the term of this contract, task orders will be issued in writing by the Contracting Officer to the Contractor providing direction which fills in detail for specific work or otherwise completes the general description of the work within the scope of CLIN 12. Each task order will indicate the objective(s) and/or desired results of each special task assignment.

(C) Task orders will contain, as a minimum, the following information:

(i) Signature of the Contracting Officer

(ii) Contract number, task order number, and date

(iii) Title and description of work requested

(iv) Total price, including the number of labor hours, travel and material estimates, and other resources authorized

(v) Delivery schedule and documentation requirements

(vi) Quality assurance standards, as appropriate

(vii) Any other necessary information

(viii) Accounting and appropriation data

(D) The Contractor shall construe each task order as formal direction and authorization to proceed with the implementation of each special task assignment. The Contracting Officer may modify a task order in the same manner as it is issued via formal amendments.

(E) Within thirty (30) calendar days after receipt of each task order, the Contractor shall either accept the task order, as written, by signing and returning it to the Contracting Officer or shall submit a Contractor task plan (in a format deemed suitable by the Contractor) for Government approval. The task plan shall include:

(i) Discussion of the technical approach for performing the work and rationale for any proposed changes to the task order.

(ii) Estimated date of commencement of work and any changes proposed to the schedule of performance.

(b) The travel and material estimates, if applicable.

(c) An estimate for subcontractors and consultants, if applicable.

(F) The Contracting Officer shall approve, in writing, all task plans within ten working days of receipt or enter into negotiations with the Contractor. Accepted task orders or approved task plans shall be definitized and incorporated by reference into the contract via contract modification. The contract modification will reflect the mutual agreement of the parties with respect to changes in contract value, funding, and any other terms deemed pertinent to the task order.

(G) After the Contractor accepts the task order or the Contracting Officer approves the task plan, any revisions that become necessary in the scope of work shall require Government approval prior to implementation. The Contractor shall promptly submit a revision of the task order/plan to the Contracting Officer. Revised task orders/plans submitted by the Contractor are subject to the review and approval of the Contracting Officer. Hours or costs incurred in excess of those authorized by the Contracting Officer shall be at the Contractor's own expense.

9.2 In the event the Contractor and Contracting Officer cannot reach agreement on the task plan, the task order shall prevail. Failure to agree to any adjustment shall be a dispute under the Disputes clause. However, nothing in this clause shall excuse the Contractor from proceeding with the task order as written.

9.3 The price for effort under CLIN 12 will be paid upon satisfactory completion of each individual special task assignment.

10.0 FAR 52.217-7 OPTION FOR INCREASED QUANTITY – SEPARATELY PRICED LINE ITEM (MAR 1989)

10.1 The Government may require the delivery of the option CLINs 4-5, 8-10, identified in the Schedule as fixed-price options for standard launch services or non-standard services, in the quantity and at the price stated in Section B of the Schedule. The Contracting Officer may exercise the option(s) at any time by written notice to the Contractor from the effective date of the contract through calendar year 2004. Delivery of added items shall continue at the same rate that like items are called for under the contract, unless the parties otherwise agree.

10.2 The Government may require the delivery of the option CLINS 26-27 identified in the Schedule as fixed price options for standard launch services or non-standard services, in the quantity and price stated in Section B of the Schedule. These options expire on September 30, 2003, unless mutually agreed otherwise by both parties. The Contracting Officer may exercise the option(s) at any time by written notice to the Contractor from the effective date of the contract through September 30, 2003.

10.3 The Government may require the delivery of the option CLINS 28-32 identified in the Schedule as fixed price options for standard launch services or non-standard services, in the quantity and price stated in Section B of the Schedule. The Contracting Officer may exercise the option(s) at any time by written notice to the Contractor from the effective date of the contract through December 31, 2006 for CLINS 28-30, and through December 31, 2007 for CLINS 31-32.

10.4 Should the Government wish to exercise these options beyond these dates, the prices for these options shall be re-established pursuant to the prices stated in Section B, Table B-11.1. If no applicable price is available from Table B-11.1, then the Contractor shall propose additional new prices, and negotiate such prices in good faith with the Government.

11.0 FAR 52.216-18 ORDERING (OCT 1995) [Note: Applicable to IDIQ contract portion only]

(a) Any supplies and services to be furnished under this contract shall be ordered by issuance of delivery orders or task orders by the individuals or activities designated in the Schedule. Such orders may be issued from the effective date of the contract through the second quarter of calendar year 2010.

(b) All delivery orders or task orders are subject to the terms and conditions of this contract. In the event of conflict between a delivery order or task order and this contract, the contract shall control.

(c) If mailed, a delivery order or task order is considered "issued" when the Government deposits the order in the mail. Orders may be issued orally, by facsimile, or by electronic commerce methods only if authorized in the Schedule.

12.0 FAR 52.216-19 ORDER LIMITATIONS (OCT 1995) [Note: Applicable to IDIQ contract portion only]

(a) *Minimum order.* When the Government requires supplies or services covered by this contract in an amount of less than:

(1) One Launch Service, or

(2) One Special Task Assignment, or

(3) One Non-Standard Service

the Government is not obligated to purchase, nor is the Contractor obligated to furnish, those supplies or services under the contract.

(b) *Maximum order.* The Contractor is not obligated to honor—

(1) During any calendar year, any order for a single item in excess of

0 Delta II Launch Services*, 0 Delta III Launch Services*, and 7 Delta IV Launch Services or
25 Special Task Assignments or
25 Non-Standard Services for Delta II only

* The Contractor is not obligated to provide either Delta II or Delta III launch services beyond those firm and option missions currently on this contract. However, as indicated in the single asterisk (*) note under Table B-9.1, the Contractor may be able to provide Delta II Launch Services should it have

Delta II launch vehicles available from the current production lot at the time the Government wishes to place an IDIQ order. Therefore, an order in excess of the maximum order quantity for a Delta II Launch Service may be achieved through a bilateral agreement between the Government and the Contractor.

(2) Any order for a combination of items in excess of 57; or

(3) A series of orders from the same ordering office within thirty (30) days that together call for quantities exceeding the limitation in paragraph (b)(1) or (2) of this clause.

(c) If this is a requirements contract (i.e., includes the Requirements clause at subsection 52.216-21 of the Federal Acquisition Regulation (FAR)), the Government is not required to order a part of any one requirement from the Contractor if that requirement exceeds the maximum-order limitations in paragraph (b) of this clause.

(d) Notwithstanding paragraphs (b) and (c) of this clause, the Contractor shall honor any order exceeding the maximum order limitations in paragraph (b), unless that order(s) is returned to the ordering office within thirty (30) days after issuance, with written notice stating the Contractor's intent not to ship the item(s) called for and the reasons. Upon receiving this notice, the Government may acquire the supplies or services from another source.

13.0 52.216-22 INDEFINITE QUANTITY (OCT 1995) [Note: Applicable to IDIQ contract portion only]

(a) This is an indefinite-quantity contract for the supplies or services specified, and effective for the period stated, in Section B and C of the Schedule. The quantities of supplies and services specified in the Schedule are estimates only and are not purchased by this contract.

(b) Delivery or performance shall be made only as authorized by orders issued in accordance with contract Section C, Clause 11.0, FAR 52.216-18, Ordering (Oct 1995). The Contractor shall furnish to the Government, when and if ordered, the supplies or services specified in the Schedule up to and including the quantity designated in the Schedule as the "maximum." The Government shall order at least the quantity of supplies or services designated in the Schedule as the "minimum."

(c) Except for any limitations on quantities in contract Section C, Clause 12.0, FAR 52.216-19 Order Limitations (Oct 1995) or in the Schedule, there is no limit on the number of orders that may be issued. The Government may issue orders requiring delivery to multiple destinations or performance at multiple locations.

(d) Any order issued during the effective period of this contract and not completed within that period shall be completed by the Contractor within the time specified in the order. The contract shall govern the Contractor's and Government's rights and obligations with respect to that order to the same extent as if the order were completed during the contract's effective period; provided, the Contractor shall not be required to make any deliveries under this contract after December 31, 2012.

14.0 LAUNCH SERVICE TASK ORDERING PROCEDURES [Note: Applicable to IDIQ contract portion only]

14.1 *Requirements for Competition.* The intent of IDIQ is to support missions in addition to the awarded firm and optional missions. The Government will provide all multiple award Contractors a fair opportunity to be considered for task orders issued under this contract based upon the specific task order requirements, unless the Contracting Officer determines that one of the following apply:

(A) The Agency need is of such urgency that competing the requirements among Contractors would result in unacceptable delays;

(B) Only one Contractor is capable of providing the service requested at the level of quality required because the service ordered is unique or highly specialized;

(C) The order should be issued on a sole-source basis in the interest of economy and efficiency as a logical follow-on to an order issued under the contract, provided that all Contractors were given a fair opportunity to be considered for the original order; or

(D) It is necessary to place an order to satisfy the minimum guarantee.

14.2 Types of Task Orders

There are two types of task orders that may be issued under this contract. The first type is an LSTO. Any required services related to a specific launch service will be included in the LSTO. All items other than launch services and items not related to a specific launch service will be obtained by task orders referred to herein as Special Task Assignments (Studies and Analyses).

14.3 Launch Service Task Orders

(A) *Requests for Launch Service Proposals (LSPs).* Prior to the issuance of a request for LSP, exchanges and fact-finding may take place with multiple award Contractors. The request for LSP will include specific information unique to the mission such as payload mass and volume; orbital requirements (such as altitude and/or inclination); target launch date and science window, if appropriate; and any unique payload design considerations.

The request for LSP will provide any special instructions regarding the level of detail required in the proposal. The request for LSP will include a date and time for submission of the proposal. Proposals will be due within thirty (30) calendar days from the date of the request for LSP unless stated

otherwise. The Contractor shall submit one original and five copies of the LSP to the Contracting Officer.

(B) *Launch Service Proposal.* The Contractor, when submitting an LSP, shall indicate the LSP is compliant with the contract terms, statement of work, and the specific requirements contained in the request for LSP.

Pricing for all LSPs shall not exceed the prices contained in the Schedule. The prices contained in the Schedule are prices, which can be adjusted downward by the Contractor for the specific launch service being proposed. Any Contractor proposed reduction will be applicable to the current LSP only and will not be deemed as a permanent reduction of the prices contained in the Schedule. Any mission unique modifications not priced in the non-standard services must be separately identified and individually priced, and are not limited by the unit price in the Schedule.

The proposed launch service price, including applicable priced non-standard services, and mission uniques shall be totaled for a single firm fixed-price for all efforts required under the order for that launch service. The total firm fixed-price shall be applied to the percentages in contract Section C, Clause 5.0, Launch Service Payments, Milestone Events and Completion Criteria, for conversion to dollar amounts for each payment event. In addition, the Work Plan milestones shall be appropriately modified to add any non-standard and/or mission unique services.

(C) *Mandatory Proposal Submission.* Unless otherwise agreed to by the Contracting Officer, it is mandatory for contract holders under multiple award NLS contracts to respond to each order for launch service requirements provided these requirements are identified in the schedule and do not conflict with the contract ordering limitations. In the event there arises legitimate reasons for an awardee not to submit a proposal for a particular launch service task order (e.g., limited capacity to perform, excessive performance capability) the Contracting Officer may waive the requirement for proposal submission.

(D) *LSP Evaluation/LSTO Selection Criteria.* All LSPs shall be submitted by the date and time specified in the request for LSP, or it will be treated as a late proposal in accordance with FAR 52.215-1, Instructions to Offerors – Competitive Acquisition.

If this requirement is met, the Contracting Officer will consider the following three factors prior to award of an LSTO:

(i) Technical capability/risk, including the following:

(a) Contractor's ability to meet SOW and specific payload requirements, including launch period and launch date

(b) Launch vehicle qualification or reasonableness of the Offeror's plan to obtain qualification prior to mission launch

(c) Information gained through Government insight and approval activities

(d) Status of significant baseline vehicle changes and resolution of anomalies

(e) Unique terms and conditions contained in a contract, which may impact price, performance or risk

(f) Proposed launch vehicle's demonstrated flight experience

(ii) Reasonableness of proposed price, including any proposed quantity discounts, probable cost impacts to the Government as a result of technical risks introduced by the LSP, and any increased price to the Government associated with any proposed launch locations or other launch service provider unique processing requirements.

(iii) Past performance, with emphasis given to the most recent and more relevant experience, including small business achievements.

The Requests for Launch Service Proposals shall state, whether all evaluation factors other than cost or price, when combined, are—

(i) Significantly more important than cost or price;

(ii) Approximately equal to cost or price; or

(iii) Significantly less important than cost or price.

The Government reserves the right to modify the evaluation criteria for individual LSTOs. The final evaluation criteria will be defined in the request for LSTO proposal. In any event, the Government intends to award an LSTO to the Contractor who provides the best value in launch services that meet the Government's requirements.

(E) *Award of an LSTO.* Each of the IDIQ Contractors will be notified of the Government's award of an LSTO. Pursuant to FAR 16.505(a)(7), a task order award, or proposed award, is not subject to protest except on the

grounds that the order increases the scope, period, or maximum value of the contract. The debriefing requirements of FAR 15.5 are not applicable to orders issued under this contract. However, the Government intends to provide feedback to the other Contractors regarding any significant issues resulting in their non-selection.

(F) *Modifications to LSTOs.* After an LSTO is issued, it may be necessary to add priced non-standard services to the LSTO. These additions will be accomplished via modifications to the original LSTO. In addition, mission uniques that are not included in the priced non-standard services may be added to, or deleted from, LSTOs via modification to the original LSTO. In this instance, the terms of the existing LSTO, such as price, milestone events, and Work Plan completion criteria, may be modified to reflect the change. The remainder of the price of the modification will be applied to the remaining payment milestone event amounts, as performance dictates.

(G) *Task Order Authorization and Content.* The only persons authorized to issue task orders under this contract are the KSC Contracting Officers. Task orders will be issued in writing. However, any facsimile, or electronic, task orders issued by the Contracting Officer will be confirmed in writing within five (5) business days. The Contractor will acknowledge receipt and acceptance of the task order by signing the task order and returning it to the Contracting Officer. Each task order will include the following information:

(i) Date of the task order

(ii) Contract number and task order number

(iii) Statement of Work and any other documentation on which the price is based

(iv) Product or service to be delivered

(v) Task order price

(vi) Completion/Delivery date

(vii) Accounting and appropriation data

(viii) Any other necessary information

15.0 PRESERVATION, PACKING, PACKAGING, AND MARKING FOR DOCUMENTATION

Preservation, packing, packaging and marking for shipment of all items ordered hereunder shall be in accordance with commercial practice and adequate to

ensure safe transportation, acceptable by common carrier, and transportation at the most economical rate(s). The Contractor shall place identical requirements on all subcontracts for items delivered to NASA.

16.0 FAR 52.246-11 HIGHER LEVEL CONTRACT QUALITY REQUIREMENT (FEB 1999)

The Contractor shall comply with the higher-level quality standard selected below.

	Title	Number	Date	Tailoring
[X]	ISO	9001	1994	
[X]	ANSI/ASQC	Q9001	1994	

17.0 INSPECTION SYSTEM RECORDS

The Contractor shall maintain records evidencing inspections in accordance with the Inspection clauses of this contract for one year after delivery of all items and/or completion of all services called for by the contract.

18.0 REQUIRED TIME OF DELIVERY FOR LAUNCH SERVICES

18.1.1 The Government requires launch service delivery to be made according to the schedules provided in Tables C-2, C-3, and C-4.

FIRM LAUNCH SERVICES			
CLIN	Mission	Quantity	Launch Date (CY)
1	AURA	1	07/15/04
2	Deep Impact	1	01/12/05
3	Messenger	1	08/03/04
4	Swift	1	11/20/04
8	STEREO		02/11/06
9	NOAA-N'	1	NET 12/07
10	MER-B	1	07/07/03
14	NPP	1	NET 3/1/07
15	Dawn	1	06/17/06
16	STSS	1	02/01/07
17	GLAST	1	09/07/07
18	OSTM	1	04/08
19	THEMIS	1	10/19/06
20	STSS Block 2010 Risk Reduction	1	10/31/06
21	Kepler	1	10/31/07
22	Phoenix	1	08/03/07
23	MMS	1	01/31/09
24	Aquarius	1	09/08
25	MIDEX 6	1	03/31/08

Table C-2: Firm Launch Service Delivery Schedule

OPTIONAL LAUNCH SERVICES			
CLIN	Mission	Quantity	Launch Date[1] (CY)
4	Option 1 Exercised by Mod 16		
5	Option 2	1	07/04
6	Option 3 Reserved		
7	Option 4 Reserved		
8	Option 5 Exercised by Mod 88		
9	Option 6 Exercised by Mod 72		
10	Option 7 Exercised by Mod 9		
26	Option 8	1	04/30/06
27	Option 9	1	07/31/06
28	Option 10	1	05/31/08
29	Option 11	1	01/31/09
30	Option 12	1	03/31/09
31	Option 13	1	05/31/09
32	Option 14	1	09/30/09

[1] Launch dates are tentative at contract award. Launch dates and mission names will be definitized at option exercise.

Table C-3: Optional Launch Service Delivery Schedule

IDIQ LSTOs			
CLIN 13	Mission	Quantity	Launch Date
Order TBD	TBD	TBD	TBD

Table C-4: IDIQ LSTO Delivery Schedule

18.2 The Government shall select a particular launch day and time within the established launch month as soon as practicable, but not later than three months prior to the established launch month. In the event the parties cannot agree on a specific launch day and time, the last day of the established launch month shall be construed as the required launch date.

19.0 ADJUSTMENTS TO LAUNCH SCHEDULE

19.1 The Government/Contractor will give written notice of any desired change in the launch schedule as soon as possible. In the case of a request for postponement of the launch date by the Government/Contractor, the Government/Contractor will propose a new launch date. Within two weeks of receipt of the written request of a launch schedule adjustment, the Government/Contractor will inform the Contractor/Government whether a launch opportunity exists as requested or will propose an alternatively available launch date. The Government/Contractor has thirty (30) days following receipt of the Contractor's/Government's proposition to give its written agreement. If mutual agreement on the revised launch date cannot be reached due to a Range conflict, resolution between the parties shall be handled by the Current Launch Schedule Review Board (CLSRB) in accordance with Air Force Space Command Instruction (AFSPCI) 10-1213. If mutual agreement on the revised launch date cannot be reached due to launch vehicle or payload readiness, resolution between the parties shall be handled per the Disputes Clause, FAR 52.233-1.

19.2 Once payment(s) of the standard launch service price has been made, postponement requests by the Government/Contractor shall not exceed a total of twelve (12) months, exclusive of any applicable grace period, for each party under this contract clause. In the event of a single postponement, or cumulative postponements for each launch service by the Government/Contractor exceeds twelve (12) months, the contract shall be subject to equitable adjustment for that portion of delay exceeding twelve (12) months in addition to the maximum postponement fees for the twelve month delay, and/or other available remedies provided for under contract Section C, Clause 28.0, Advance Understanding Regarding Termination Settlement Under FAR 52.212-4(l), and contract Section C, Clause 1.0(m), Termination for cause. Alternatively, requests for adjustments to the launch schedule occurring greater than twenty-seven (27) months prior to the launch date shall be subject to equitable adjustment. Any delay declared by the Government, which results in a launch date later than the contract period of performance shall be subject to an equitable adjustment.

19.3 If the Contractor requests a postponement of the launch date and the Government agrees to the postponement, the Parties agree that, in lieu of Termination for cause and in place of actual damages, and as fixed, agreed, and liquidated damages, the price of each applicable launch service shall be reduced, dependent upon when receipt of the notification is received, for each calendar day of delay in excess of the grace period by the amount as shown in Table C-5. In this event, the Government shall have the right of approval of the revised launch date prior to its implementation. The Government shall also have the right of approval of the reallocation of launch vehicles if milestone payments have already been made towards a designated launch vehicle. Finally, the Government shall have the right of approval prior to any revision in its position (i.e., the order in the Contractor's launch manifest queue sequence, if it results in the postponement of the Government launch date).

19.4 If the Contractor fails to request a postponement and the major program milestone event designated as the launch is delayed (i.e., the launch service is not completed by the contractual required time of delivery launch date), for reasons other than those excusable delays described in paragraph 19.9, then the Contractor shall pay the Government for each day of delay the maximum liquidated damages, cumulatively not to exceed for each launch service under this contract. Alternatively, if delivery or performance is so delayed by the Contractor, the Government may terminate this contract in whole or in part under contract Section C, Clause 1.0(m), Termination for cause, of this contract and in that event, the Contractor shall be liable for fixed, agreed, and liquidated damages accruing until the time the Government may reasonably obtain delivery or performance of similar supplies or services, up to the maximum specified in Table C-5. The liquidated damages shall be in addition to any other costs under contract Section C, Clause 1.0(m), Termination for cause.

19.5 Each postponement request by the Contractor that is not the result of paragraph 19.9 herein is subject to the liquidated damages shown in Table C-5. The delay damages are calculated on a per mission basis.

Contractor Liquidated Damages and Grace Periods			
During Months Prior to Launch Date - First Day to Last Day (Months)	Liquidated Damages Paid to Government for Each Day of Launch Delay ($)	Maximum Liquidated Damages Paid By the Contractor ($)	Grace Period (Days)
L-27 through L-25			150
L-24 through L-13			120
L-12 through L-7			90
L-6 through L-4			60
L-3 through L-11 Days			30
L-10 Days through Launch			7

Table C-5: Contractor Liquidated Damages and Grace Periods

Contractor Liquidated Damages and Grace Periods			
During Months Prior to Launch Date - First Day to Last Day (Months)	Liquidated Damages Paid to Government for Each Day of Launch Delay ($)	Maximum Liquidated Damages Paid By the Contractor ($)	Grace Period (Days)
L-27 through L-25			150
L-24 through L-13			180
L-12 through L-7			150
L-6 through L-4			110
L-3 through L-11 Days			50
L-10 Days through Launch			14

Table C-5.1: Contractor Liquidated Damages and Grace Periods for CLIN 20

The maximum amount paid for delays (in excess of the grace period) by the Contractor shall not exceed a total of A grace period is defined as the number of days the Contractor may delay the launch date, without incurring

liquidated damages. The amount of Grace available for any period is the smaller of the number of days in the Grace period column in Table C-5 compared to the remaining available Grace days from the previous period.

Schedule Incentive in the amount of $ shall be added to the CLIN 20 mission price, and milestone payment 9 when the launch occurs. In the event launch occurs after October 31, 2006 due to Contractor caused delays, available Schedule Incentive will be reduced by the amount of liquidated damages that would be due, according to the contract, after available Grace days are exceeded. Contractor will only be liable for liquidated damages when the Schedule Incentive has been exhausted.

19.6 If the Government requests a postponement of the launch date, the Parties agree that, in place of actual damages, and as fixed, agreed, and liquidated damages, the price of each applicable launch service shall be increased, dependent upon when receipt of the notification is received, for each calendar day of delay in excess of the grace period by the amount as shown in Table C-6. Each postponement request by the Government that is not the result of paragraph 19.9 is subject to the postponement fees shown in Table C-6. The amount of Grace available for any period is the smaller of the number of days in the Grace period column in Table C-6 compared to the remaining available Grace days from the previous period.

Government Postponement Fees and Grace Periods			
During Months Prior to Launch Date - First Day to Last Day (Months)	Postponement Fees Paid to Contractor for Each Day of Launch Delay ($)	Maximum Postponement Fees Paid By the Government ($)	Grace Period (Days)
L-27 through L-25			150
L-24 through L-13			120
L-12 through L-7			90
L-6 through L-4			60
L-3 through L-11 Days			30
L-10 Days through Launch			7

Table C-6: Government Postponement Fees and Grace Periods

19.7 The maximum amount paid for delays (in excess of the grace period) by the Government shall not exceed a total of (A grace period is defined as the number of days the Government may delay the launch date without incurring postponement fees.

19.8 In the event that the Government/Contractor postpones the launch date, the payment schedule shall be suspended for the length of the delay and then resumed with all remaining payments shifted by the amount (length) of the delay. For Government delays only, the Contractor may elect to receive payments as major program milestone events are completed in lieu of the payment of postponement fees, provided funding is available and obligated to the contract.

19.9 The Government/Contractor will not be charged with postponement fees/liquidated damages when the delay in delivery or performance arises solely out of causes beyond the control of the Government/Contractor and not due to the fault or negligence of the Government/Contractor. Such causes include, but are not limited to the following:

Delays resulting from mission rule requirements, Range launch constraints, Range mandatory hold requirements, acts of God, acts (including delay or failure to act) of any Governmental authority (De Jure or De Facto), wars (declared or undeclared), riots, revolution, hijacking, fires, freight embargoes, sabotage, epidemics and

interruptions of essential services such as electricity, natural gases, fuels and water, or any condition which jeopardizes the safety of the employees of the Contractor, the Government, or its subcontractors; or a launch vehicle failure investigation, provided

queue sequence and that all data related to the failure investigation is made available to the Government without restriction.

19.10 Once a specific launch date and time have been established, they may be changed by the cumulative amount of the grace period established above by the Government or the Contractor without consideration to the other party if the mission requirements can be met. The cumulative total of grace periods exercised by either the Government or the Contractor shall not exceed 150 days.

19.11 The amount of postponement fees shall be added to/subtracted from (as applicable) the next milestone payment made pursuant to the contract Section C, Clause 5.0, Launch Service Payments, Milestone Events and Completion Criteria. In addition, the delivery schedule shall be adjusted to reflect the revised launch date.

19.12 In the event of an anomaly on a previous mission of the same launch vehicle (including a non-NASA mission), the Government reserves the right to delay the launch service, until the next available launch opportunity, without accruing damages or providing an equitable adjustment to the Contractor until resolution of the anomaly.

19.13 This clause, including grace periods, shall not apply to missions with scientific and planetary launch windows and/or planetary and lunar exclusion periods when the launch schedule postponement is greater than twelve months. Clause 19.5 (and Table C-5) and Clause 19.6 (and Table C-6) shall apply to planetary launch windows and/or planetary and lunar exclusion periods when the launch postponement is twelve months or less. Requests for launch adjustments for missions with scientific and planetary launch windows and/or planetary and lunar exclusion periods shall be in accordance with the "Changes" clause of this contract. Contractor requests for launch adjustments for missions with scientific and planetary launch windows and/or planetary and lunar exclusion periods are subject to equitable adjustment and require approval of the Government prior to implementation. If Government approval is granted, the Contractor shall be obligated to launch at the next available scientific opportunity and planetary launch window, irrespective of other launch commitments or customer's priorities.

20.0 PLACE OF PERFORMANCE

The place of performance and launch site will be identified in each launch service or task order. The delivery schedule and/or period of performance of this contract are based upon the launch dates specified in the schedule or each individual task order.

21.0 RESERVED

22.0 NFS 1852.227-72 DESIGNATION OF NEW TECHNOLOGY REPRESENTATIVE AND PATENT REPRESENTATIVE (JUL 1997)

(a) For purposes of administration of the clause of this contract entitled "New Technology" or "Patent Rights—Retention by the Contractor (Short form)," whichever is included, the following named representatives are hereby designated by the Contracting Officer to administer such clause:

Name	Title	Mailcode	Address
Dave Makufka	New Technology Representative	YA-C	John F. Kennedy Space Center, NASA Kennedy Space Center, FL 32899
Diana Cox	Patent Representative	CC	John F. Kennedy Space Center, NASA Kennedy Space Center, FL 32899

(b) Reports of reportable items, and disclosure of subject inventions, interim reports, final reports, utilization reports, and other reports required by the clause, as well as any correspondence with respect to such matters, should be directed to the New Technology Representative unless transmitted in response to correspondence or request from the Patent Representative. Inquiries or requests regarding disposition of rights, election of rights, or related matters should be directed to the Patent Representative. This clause shall be included in any subcontract hereunder requiring a "New Technology" clause or "Patent Rights—Retention by the Contractor (Short Form)" clause, unless otherwise authorized or directed by the Contracting Officer. The respective responsibilities and authorities of the above-named representatives are set forth in 1827.305-370 of the NASA FAR Supplement.

23.0 USE OF GOVERNMENT PROPERTY, FACILITIES, AND ASSETS

23.1 The Contractor shall obtain and maintain any necessary agreements between the Contractor and any Government Agency authorizing the use of Government property, facilities, assets or services required in performance of this contract.

23.2 The Government makes no warranty whatsoever as to the suitability for use of Government property, facilities and other assets made available under the terms and conditions of any Government use agreements or contracts. Any costs necessary to maintain, restore, refurbish, and/or replace any assets, for use under this contract, shall result in no increase in the price of this contract.

23.3 The Contractor is responsible for determining the suitability for use of all materials, property, and facilities acquired or made available to the Contractor by the Government under any contract agreement. Any use of Government-Furnished Property (GFP), materials, or facilities and services shall not relieve the Contractor of full launch service performance responsibility.

24.0 MISSION SUCCESS DETERMINATION, INVESTIGATION, AND CORRECTIVE ACTIONS

24.1 Mission Success Criteria

(A) A mission will be determined a *Mission Success*, whether or not the payload performs its intended mission, if:

(i) The payload is placed into the required orbit by the LV, and

(ii) The LV causes no damage to the payload during deployment or thereafter from collision or contamination products.

(iii) Received telemetry data shows the Interface Control Document (ICD) environments and parameters were not exceeded, or if ICD environments and parameters are exceeded, evaluation of the payload's capabilities and longevity meets 95 percent or more of the Payload Evaluation Criteria four (4) months after launch.

(B) A mission will be determined a *Partial Mission Success* if:

(i) The payload is not placed into the required orbit, but evaluation of the payload's capabilities and longevity at the actual orbit meets 70% or more of the Payload Evaluation Criteria four (4) months after launch, or

(ii) Received telemetry data shows the ICD environments and parameters were exceeded (or no confirming telemetry data were received), but evaluation of the payload's capabilities and longevity meets 70% or more of the Payload Evaluation Criteria four (4) months after launch, or

(iii) The payload is damaged during deployment or thereafter from collision or contamination products, but evaluation of the payload's capabilities and longevity at the actual orbit meets 70% or more of the Payload Evaluation Criteria four (4) months after launch.

(C) A mission will be determined a *Failed Mission* if the payload:

(i) Is destroyed during launch, or

(ii) Cannot be separated from the LV, or

(iii) Is not placed into the required orbit and evaluation of the payload's capabilities and longevity at the actual orbit meets less than 70% of the Payload Evaluation Criteria four (4) months after launch, or

(iv) Is subjected to environments or parameters which exceed the ICD and evaluation of the payload's capabilities and longevity meets less than 70% of the Payload Evaluation Criteria four (4) months after launch, or

(v) Is damaged during deployment or thereafter from collision or contamination products and evaluation of the payload's capabilities and longevity meets less than 70% of the Payload Evaluation Criteria four (4) months after launch.

24.2 Mission Success Determination

(A) The ELVPO, along with the payload customer, will establish the Payload Evaluation Criteria. The Payload Evaluation Criteria will consist of:

(i) The payload orbit/attitude ranges determined necessary to obtain data sufficient to meet 70 percent or more of the mission's objectives, and

(ii) A list of payload systems which, individually and/or in combination, are required to operate successfully in order to achieve 70 percent or more of the mission's objectives, and

(iii) A list of payload instruments which, individually and/or in combination, are required to operate successfully in order to achieve 70 percent or more of the mission's objectives.

(B) The Contractor shall be responsible for providing telemetry data confirming the required orbit conditions and payload environments were met as stated in the ICD. The Contractor shall measure and provide telemetry data to the extent required by the SOW. The Government will be responsible for providing data supporting payload capability status and longevity analysis.

(C) In order to determine mission success under paragraphs 24.1(B) or 24.1(C)(iii), (iv) or (v), the Government will evaluate the payload condition four (4) months after launch. If the payload meets 70% or more of its capabilities and longevity as listed in the Payload Evaluation Criteria, the mission will be considered a partial mission success. If the payload operation is less than 70% of the capabilities and longevity as listed in the Payload Evaluation Criteria, the mission will be considered a failed mission.

(D) The Contracting Officer has authority to determine whether a launch mission is a Mission Success, Partial Mission Success, or a Failed Mission, based on the application of the Payload Evaluation Criteria.

24.3 Procedures

(A) Not less than two (2) months prior to launch of a payload, the Contracting Officer will provide, in writing, the Payload Evaluation Criteria to the Contractor.

(B) Within fifteen (15) days from submittal of the Final Flight Report (CDRL C4-13), the Contracting Officer will either determine the launch a Mission Success or inform the Contractor of the Government's intent to withhold final payment and mission determination until the completion of the payload operability and longevity evaluation.

(C) If the Government informs the Contractor it will withhold the final payment, the payload's operability and longevity will be assessed four (4) months from the launch date using the Payload Evaluation Criteria for mission success determination. The Government will also utilize the Final Flight Report (CDRL C4-13), findings from the Contractor's investigation board, and findings from the NASA-chaired Failure Review Board (FRB) if activated. The Contracting Officer shall submit a final determination of either Partial Mission Success or Failed Mission within one (1) week of the payload evaluation. If a Partial Mission Success determination is made, an operability ranking of the payload between 70% and 100% will be included.

24.4 Performance-Based Payment for Final Mission Success Determination

(A) In the event the Contracting Officer determines the launch service a Mission Success, the Contractor shall receive full payment of the final payment event for the launch service.

(B) In the event the Contracting Officer determines the launch service a Partial Mission Success, the Government will pay no portion of the final payment in accordance with Table C-8.

Mission Success Determination	Payload Operability Ranking (%)	% Awarded of Final Payment	% of Total Launch Service Price Reallocated/Refunded to the Government
Full Success	95-100	100	0
Partial Mission Success	70-94	0	0
Failed Mission	0-69	0	15

Table C-8: Mission Success Payment Schedule

(C) In the event the Contracting Officer determines the launch service a *Failed Mission*, the Government will pay no portion of the final payment (reference Table C-8) and the Contractor shall reallocate 15% of the total launch service (CLIN) price to another NASA mission or refund the 15% if a subsequent launch service is unavailable. Withholding of the final payment and a 15% reallocation/refund to the Government are the sole remedies of the Government for a *Failed Mission* determination.

24.5 Investigation and Corrective Action

(A) In the event of an anomaly or failed mission, a NASA-chaired FRB will determine the cause of anomaly or failure, if activated. The FRB will evaluate all available data from the launch vehicle, payload, Range, and other sources in order to determine if the mission failure was attributable to the launch vehicle or conditions for which the Contractor would normally be expected to control or avoid. Based on the findings and recommendations of the FRB, the Government shall make the final determination as to partial mission success or failed mission. If the Contractor disagrees with the determination, the decision shall be subject to the Disputes clause of this contract.

(B) If one or more of the ICD environmental requirements are exceeded or orbit requirements are not achieved on a particular mission, the Contractor shall investigate the anomaly or failure at its own expense. The Contractor shall determine the scope of the investigation and shall conduct and control the investigation. The Government may designate representatives to observe and participate in the Contractor's failure investigation board. If the Contractor changes the launch vehicle design, the Contractor shall provide NASA insight into the change. The Government may establish an independent assessment team to assess the Contractor's investigative and corrective actions.

(C) The Contractor shall present to the Government its findings resulting from the investigation and the proposed corrective actions (return to flight activities), if any. The Contractor shall be responsible for proving the corrective action is sufficient to return to flight. The Contracting Officer may

either accept or reject any finding or corrective action. If the Contracting Officer accepts a finding and the related corrective action, the Contractor shall be responsible for the cost of the corrective action including re-acceptance for NASA missions. In the event the Government requires additional analyses or tests beyond those planned by the Contractor, the Contractor shall implement the Contracting Officer's written direction to perform the additional tests or analyses. The costs of implementing these additional tests or analyses may be the basis for an adjustment to this contract. The Government may, at its option and its expense, conduct its own investigation of the anomaly or failure. The Contractor shall cooperate with and fully support the Government investigation.

(D) The Contractor shall report to NASA any flight anomalies from non-NASA missions. For non-NASA missions, the requirements of paragraphs 24.5(B) and (C) apply to these anomalies as the Contracting Officer finds them to be related to NASA missions. Rights under the Default clause and the right to require corrective action before return to flight shall also apply in the event the requirements of NPD 8610.7 are not met.

24.6 Finality of Contracting Officer's Determination

(A) Except for the determinations described in paragraph 24.6(B), each of the Contracting Officer's Determinations, under paragraph 24.2, are subject to FAR 52.233-1, Disputes.

(B) The following Contracting Officer's Determinations under this clause are final and not subject to FAR 52.233-1, Disputes:

(i) A determination the payload is not operational

(ii) A determination that a payload defect is not the cause of the payload being inoperable

(iii) A determination of the Payload Evaluation Criteria

(C) In the event the Contractor appeals the Government decision under the Disputes clause in accordance with FAR subpart 33.2 and submits a claim under the Contract Disputes Act, the parties hereby agree the burden of proof shall rest on the Contractor to prove the failure was not due to the LV. The Contractor assumes the responsibility for providing confirming data. The Government will be responsible for providing proof of payload degradation or reduction in operational capacity or longevity.

24.7 Acceptance

Final acceptance of the launch service will be accomplished following the Contracting Officer's mission success determination.

25.0 GOVERNMENT INSIGHT AND APPROVAL

25.1 The Contractor shall provide NASA an adequate level of insight into and/or approval of certain Contractor tasks and milestones in order to ensure all reasonable steps have been taken that result in the highest probability of mission success. This includes insight into any corporation, corporate divisions, subsidiaries, joint ventures, partner(s) and/or any other business entity actually performing launch vehicle manufacturing, management, payload/launch vehicle integration, testing and launch. This also includes insight into certain major sub-contractor tasks and milestones (i.e., those sub-contractors that perform major portions of manufacturing or integration of the launch vehicle system).

25.2 The Government's monitoring of launch services provided by the private sector has two elements: approval and insight. Government approval is defined as providing authority to proceed and/or formal acceptance of requirements, plans, tests, or success criteria in specified areas. Where Government approval is required, the Contractor shall submit the necessary documentation to the Contracting Officer and copies to the Contracting Officer's Technical Representative (COTR).

25.3 Government insight is defined as gaining an understanding necessary to knowledgeably concur/non-concur with the Contractor's actions through watchful observation, documentation, meeting attendance, reviews, tests and compliance evaluations. Where Government insight is required, the Contractor shall notify the Contracting Officer, the Government Resident Office or the appropriate Government operations organization at the launch site of meetings, reviews, or tests in sufficient time to permit meaningful Government participation.

25.4 Should approval or insight identify non-compliance with the terms and conditions of the contract, a difference in interpretation of test results, or disagreement with the Contractor technical directions, the Government will take appropriate action within the terms of the contract to ensure compliance via written direction to the Contractor.

25.5 NASA shall have insight into any Contractor initiated fleet changes or any changes that may affect NASA missions. This insight shall be accommodated with no increase in contract price.

25.6 Specific areas where the Government requires approval and/or insight are listed in paragraphs 25.7 and 25.8 respectively. The paragraphs document

requirements specified in NPD 8610.23, Technical Management of Expendable Launch Vehicle (ELV) Launch Services.

25.7 Specific areas requiring Government approval are:

(A) Payload-to-LV interface control documents/drawings.

(B) Decisions/resolutions of action items as determined by joint NASA/Contractor mission integration working groups.

(C) Mission unique hardware design, analysis, manufacture, and test.

(D) Mission unique software design, analysis, and test.

(E) The Contractor's Safety and Health, Reliability, and Quality Management Plans

(F) Top-level test plans, requirements, and success criteria for integrated vehicle systems tests and launch site vehicle assembly and test.

(G) Launch commit criteria.

(H) Closeout of actions from NASA-Chaired Launch and Flight Readiness Reviews.

(I) Payload handling procedures and deviations.

(J) Integrated payload/vehicle mate, test, and closeout procedures and deviations.

(K) Integrated payload/vehicle mate, test, and closeout as-run procedures and deviations.

(L) Launch countdown procedures and deviations that affect payload/vehicle integrated assembly.

(M) Anomaly resolutions that affect the integrated assembly.

(N) Launch Go/No-Go.

25.8 Specific areas to be open to Government insight are:

(A) Baseline vehicle design, analyses, and configuration management.

(B) Production program reviews, plans, and schedules.

(C) Production and systems test Material Review Boards.

(D) Critical flight hardware pedigree.

(E) Safety and Mission Assurance compliance evaluations (prime and subcontractors).

(F) Pre-ship reviews.

(G) Design and qualification reviews.

(H) Major/critical problems.

(I) Major system and integrated systems tests.

(J) Post-test data.

(K) Anomaly resolutions.

(L) Failure analysis.

(M) Vehicle/ground support equipment procedures.

(N) Launch site support work schedules and plans.

(O) Launch site vehicle preparations and closeout data.

(P) Vehicle walkdown inspections.

(Q) Operations and procedure discipline.

(R) Work practices and documentation.

(S) Conduct of Contractor chaired Mission, Launch, and Flight Readiness Reviews.

(T) Post-flight vehicle, tracking, and range data.

(U) Post-flight anomaly investigations/close-outs.

25.9 Notwithstanding the insight and approvals set forth in Clause 25.0 herein, the Contractor assumes full performance responsibility as set forth in this contract.

26.0 GOVERNMENT LAUNCH READINESS ASSESSMENT

26.1 The Contractor shall participate in a Government-chaired Flight Readiness Review (FRR) (reference 2.2.1.3(D) of the SOW) to be held subsequent to the Government-chaired Launch Readiness Review (LRR) and any Contractor LRR. At the FRR, the Contractor shall summarize the status of its launch vehicle and all supporting elements and attest to readiness to launch the mission. If, after due consideration of the status of the launch vehicle, payload and other launch support systems, the Government does not agree that the total mission is ready for launch, the Government has the right to delay the launch.

26.2 The Contractor shall poll the Government in the final launch countdown and any re-cycle procedure during status checks for their approval of the final launch readiness assessment. The Government may declare a "HOLD" and delay the launch at any time during the final launch countdown.

26.3 In the event the Government delays the launch, as a result of exercising its rights under this clause, and the causes of the delay were within the control of or due to the fault or negligence of the Contractor or its Subcontractors at any tier, then the provisions of Section C, Clause 19.0, Adjustments to Launch Schedule shall govern and the Contractor shall be deemed to have caused the delay. For the purpose of this clause, the burden of proof for showing that the causes of delay were within the control or fault and/or negligence on the part of the Contractor or its Subcontractors at any tier rests with the Government. If the Government delays the launch beyond the grace period established in Section C, Clause 19.0 and the causes of the delay were not within the control or due to the fault or negligence of the Contractor or its Subcontractors at any tier, then the provisions of Section C, Clause 19.0, Adjustments to Launch Schedule shall apply.

27.0 LICENSES AND PERMITS FOR A LAUNCH SERVICE OPERATOR

The Contractor shall obtain and maintain the necessary licenses, permits and clearances that may be required by the Department of Transportation, Department of Commerce, Department of Defense, NASA, or other Governmental agencies in order to provide launch services under this contract. No Federal Aviation Administration commercial launch license is required under this contract. All costs and fees associated with obtaining licenses, permits and clearances are included in the standard launch service price. Approvals required by the payload are the responsibility of NASA.

28.0 ADVANCE UNDERSTANDING REGARDING TERMINATION SETTLEMENT UNDER FAR 52.212-4(I)

28.1 In the event the Government decides to exercise its right to terminate all or part of this contract under Section C, Clause 1.0(I), Termination for the Government's convenience, it is agreed in advance that the Contractor, after receipt of a written

notice of termination, will have satisfied all obligations and discharged all duties required by Section C, Clause 1.0(l), Termination for the Government's convenience, when the Contractor has refunded that portion of the milestone-based payment(s) for each launch service affected by the termination, in accordance with Table C-9.

28.2 The parties agree that by virtue of the refund specified in Table C-9, any and all claims for equitable adjustment as a result of the termination are fully satisfied and discharged. The parties agree that this settlement represents fair compensation for Contractor effort accomplished for the terminated portions of the contract and that the terms as stated herein represent full and final settlement between the parties. The parties agree that the Contractor shall retain title to all hardware associated with the terminated launch service. The parties agree that the above settlement shall represent the total amount to be paid to the Contractor without agreeing on or segregating the particular elements of costs or profits comprising this amount.

28.3 The refund amount shall be payable in full no later than thirty (30) days after receipt of the written notice of termination. Delinquent payment(s) shall be subject to interest at the applicable rate as determined by the Secretary of the Treasury.

Performance Based Milestone/ Payment No.	Payment(s) Months Before Launch	Amount (% of Launch Service CLIN Price)	Cumulative Amount of Launch Service Payments ($)	Termination for Convenience of the Government Repayment Schedule – Percentage (%) of Cumulative Payments Made to Date to be Returned to Government
1	L-27	10	TBD	50
2	L-24	10	TBD	50
3	L-21	10	TBD	50
4	L-18	10	TBD	55
5	L-15	10	TBD	55
6	L-12	10	TBD	55
7	L-09	10	TBD	60
8	L-06	10	TBD	60
9	L-03	10	TBD	60
10	Launch	10	TBD	--

Table C-9: Launch Payment and Termination Repayment Schedule

28.4 The provisions of this Contract clause shall only apply until the point of intentional ignition of the launch vehicle. The provision of this Contract clause shall in no way be deemed to limit the rights of the Government under Section C, Clause

1.0(m), Termination for Cause. In the event the Government exercises its rights under Section C, Clause 1.0(m), Termination for Cause, the provisions of this contract clause will not apply.

29.0 CO-MANIFESTED PAYLOADS

29.1 Definitions

(A) Primary Payload: the payload which serves to determine the launch day and time, and without which the vehicle would not launch.

(B) Secondary Payload: any payload carried by the launch vehicle in space not required by the primary, which requires the approval of the primary payload customer prior to manifesting; or, any payload, if not ready to support scheduled launch day, which would be demanifested and replaced with a mass simulator.

29.2 NASA Secondary Payload with NASA Primary Payload

(A) Procedures

NASA may request to manifest a NASA secondary payload on a NASA primary mission. The preferred method of ordering this secondary payload service will be via non-standard service task order. If the non-standard service is not provided in the catalog for the particular launch service, the Government will submit a task order requesting a proposal for a non-standard service to accommodate a secondary payload. The Contracting Officer will provide a description of the proposed secondary payload including, as a minimum: volume, mass, attachment requirements, and data requested by the Contractor. The task order will identify any additional non-standard services or mission unique requirements.

Upon receipt of the task order, the Contractor shall develop a proposal to accommodate the secondary payload or provide a response that the Contractor cannot accommodate the secondary payload on any existing planned missions. The Contractor's proposal shall include a firm fixed-price for the secondary payload (if not ordered under a non-standard service), any additional non-standard services required, any mission unique services, and a proposed payment schedule with accomplishment criteria.

If the Government is unable to provide the secondary payload for launch vehicle integration or there is insufficient time to complete a new mission analysis before the launch date, the Government will bear the cost and the Contractor shall be responsible for designing, fabricating, and installing a secondary payload mass simulator.

In the event of termination for convenience of the NASA secondary payload services, all costs associated with terminating such service shall be determined in accordance with contract Section C, Clause 1.0(I), "Termination for the Government's convenience."

(B) Delays

Any delays shall be subject to contract Section C, Clause 19.0, Adjustments to Launch Schedule.

(C) Mission Success

Mission success determination for the NASA primary and secondary payload shall be made in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions with the following exception:

In the event the secondary payload causes primary mission failure, NFS 1852.228-78, Cross-Waiver of Liability for NASA Expendable Launch Vehicle Launches, shall apply and the primary mission shall be determined a full success for purposes of contract Section C, paragraph 24.2.

29.3 Non-NASA Payload with NASA Primary Payload

(A) Procedures

The Contractor may propose to manifest a non-NASA payload on a NASA primary mission. The Contractor shall propose the mission requirements and consideration to be received by NASA. The Contractor shall submit, at no cost to NASA, a detailed payload description, a dual payload compatibility assessment, and any additional documentation or analyses requested by NASA. NASA maintains the right to approve or disapprove the non-NASA payload proposed for manifesting on a NASA primary mission. The Government will respond to the Contractor's request within sixty (60) calendar days after receipt of all NASA requested documentation and analyses.

If the Contractor is unable to provide the non-NASA payload for launch vehicle integration or there is insufficient time to complete a new mission analysis before the launch date, the Contractor shall bear the cost and be responsible for designing, fabricating, and installing a secondary payload mass simulator.

(B) Delays

NASA shall incur no costs or damages associated with delaying the non-NASA mission under any circumstance. The non-NASA payload shall not cause the NASA primary mission launch date to be delayed without NASA approval. If NASA approves a launch delay caused by the non-NASA payload, the NASA Contracting Officer will unilaterally determine whether the Government will be entitled to equitable adjustment under contract Section C, Clause 19.0, Adjustments to Launch Schedule.

(C) Mission Success

Mission success determination for the NASA primary payload shall be made in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions with the following exception:

> In the event the non-NASA payload causes primary mission failure, NFS 1852.228-78, Cross-Waiver of Liability for NASA Expendable Launch Vehicle Launches, shall apply and the primary mission shall be determined a full success for purposes of contract Section C, paragraph 24.2.

29.4 NASA Secondary Payload on a Non-NASA Primary Payload

(A) Procedures

NASA may request to manifest a NASA secondary payload on a non-NASA primary mission via a task order requesting a proposal for a non-standard service to accommodate a secondary payload. The Contracting Officer will provide a description of the proposed secondary payload including, as a minimum: volume, mass, attachment requirements, and data requested by the Contractor. The task order will also identify any additional non-standard services or mission unique requirements. If the Government is unable to provide the secondary payload for LV integration or there is insufficient time to complete a new mission analysis before the launch date, the Government will bear the cost and the Contractor shall be responsible for designing, fabricating, and installing a secondary payload mass simulator.

Upon receipt of the task order, the Contractor shall develop a proposal to accommodate the secondary payload or provide a response that the Contractor cannot accommodate the secondary payload on any existing planned missions. The Contractor's proposal shall include a firm-fixed price for the secondary payload, any additional non-standard services required, any mission unique services, and a proposed payment schedule with accomplishment criteria. The Contractor shall identify the primary mission

and the target launch date for the mission. The Contractor shall make all arrangements for and coordinate the concurrence of manifesting the secondary payload with the primary mission customer.

The terms and conditions of this contract shall apply to NASA secondary payload efforts, however the level of NASA insight and approval will be limited to those activities directly affecting the secondary payload. The Contracting Officer shall identify any additional reductions to the terms and conditions of the contract in each task order for NASA secondary payload services.

In the event of termination for convenience of the NASA secondary payload services, all costs associated with terminating such service shall be determined in accordance with contract Section C, Clause 1.0(l), "Termination for the Government's convenience."

(B) Delays

The Contractor shall incur no costs or damages associated with delaying the secondary mission. The secondary mission shall not cause the primary mission launch date to be delayed without Contractor approval. If the Contractor approves a launch delay caused by the secondary payload, delay damages shall not apply.

(C) Mission Success

Mission success determination for the NASA secondary payload shall be made in accordance with contract Section C, Clause 24.0, Mission Success Determination, Investigation, and Corrective Actions with the following exception:

> In the event the primary payload causes secondary mission failure, NFS 1852.228-78, Cross-Waiver of Liability for NASA Expendable Launch Vehicle Launches, shall apply and the secondary mission shall be determined a full success for purposes of contract Section C, paragraph 24.2.

29.5 Contractor Risk Determination for NASA Secondary Missions

Upon receipt of task order, the Contractor shall, as part of NASA secondary payload integration activities, perform a payload compatibility assessment for all manifested NASA secondary payloads. The Contractor shall notify the Contracting Officer, in writing if, in the Contractor's opinion, the NASA secondary payload would pose unacceptable risk to the success of the primary mission. The notification shall provide detailed substantiation of said risks.

In the event the Contractor, or the primary mission Customer, determines the risk is unacceptable, the Contractor and the Contracting Officer will mutually agree to terminate the task order or re-manifest the NASA secondary payload on another mission. In the event the task order is terminated, NASA will only be liable for the cost of the compatibility analysis and any other payments made to the Contractor shall be repaid to the Government or reallocated to another mission.

30.0 EXPORT CONTROL AND FOREIGN NATIONALS

30.1 The Contractor shall comply with all U.S. export control laws and regulations, including the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120-130, and the Export Administration Regulations (EAR), 15 CFR Parts 730-744, in the performance of this contract. The Contractor shall be responsible for obtaining export licenses, where required.

30.2 The Contractor shall be responsible for obtaining the required export licenses before utilizing foreign nationals in the performance of this contract, including instances where the work is to be performed at launch sites. NASA will be responsible for all ITAR requirements for their foreign national customers, as applicable.

30.3 The Contracting Officer, or designated representative, may authorize the Contractor to export ITAR-controlled technical data pursuant to the exemption set forth in 22 CFR 125.4(b)(3) where an international agreement provides for the export of such data and the data does not disclose the details of the design, development, production or manufacture of any defense article.

31.0 DOMESTIC SOURCE CRITERIA

31.1 In addition to the certification regarding United States commercial provider of space transportation services (Public Law 105-303, Title II, Section 201), the Contractor shall continue to comply with domestic source criteria. Failure to comply with the criteria may be grounds for "Termination for Cause" in accordance with contract Section C, Clause 1.0(m).

31.2 Participation in this procurement is restricted to prime Contractors from the United States LV/services industry. "United States industry" means any corporation, partnership, joint venture, association, or other entity which is organized or existing under the laws of the United States or any State, and whose controlling interest is held by United States citizens. "Launch services" means all services required in the performance of this contract, excluding those necessary to produce or manufacture launch vehicles, its components and other equipment and facilities required in the performance of the contract. "Controlling interest" means ownership of an amount of equity in such entity sufficient to direct management or to void transactions entered into by management.

Ownership of at least fifty-one (51) percent of the equity creates a rebuttable presumption that such interest is controlling.

31.3 The Contractor shall provide in the performance of this contract launch vehicles that are domestic end products. The LV shall be a domestic end product only if the cost of its components, mined, produced or manufactured in the United States exceeds 50 percent of the cost of all its components. The cost of each component includes transportation costs to the place of incorporation into the LV and any applicable duty (whether or not a duty-free entry certificate is issued). "Components," as used in this contract clause, means those materials and supplies directly incorporated into the end product.

31.4 The Contractor shall provide, in the performance of this contract, domestic launch services. Launch services shall be considered to be domestic if the cost for launch services performed by United States industry sources exceeds 50 percent of the cost of the total required launch services.

32.0 LIABILITY FOR THIRD PARTY CLAIMS

32.1 This contract clause applies to Third Party claims that arise out of the conduct of hazardous launch activities during the provision of launch services under this contract. More specifically, this contract clause allocates between the Government and the Contractor the risk of Third Party claims for damage to or loss of property or personal injury or death arising from the burning, explosion, detonation, combustion or impact of an LV, its payload, or a component thereof, whether or not the payload is separated from the LV, from the time of launch until thirty (30) days after launch.

32.2 Definitions

Covered Launch Activities: Any and all activities involved in the preparation of a launch vehicle and payload for launch, and conduct of the launch, when those activities take place at a launch site in the United States.

Launch: The intentional ignition of the first-stage motor(s) of the LV that has been integrated with the payload.

Launch Vehicle: The baseline LVS consisting of a common core booster section and any strap on motors attached, one (1) interstage, an orbital adjust module, the payload fairing and the payload adapter.

Party or Parties: The Contractor or NASA, or both.

Payload: All NASA or NASA-sponsored equipment that has been integrated with the LV for transportation into earth orbit or escape trajectories.

Related Party: (i) Any of the Parties' directors, officers, agents, employees or customers

(ii) Any of the Parties' contractors, subcontractors, or suppliers at any tier involved directly or indirectly in the performance of this Contract

(iii) Any entity having any right, title or interest, whether through sale, lease or service arrangement or otherwise, directly or indirectly, in the payload, the LV, or the launch service.

Third Party: Any person or entity other than NASA, the Contractor and Related Parties.

32.3 Required Insurance for Liability to Third Parties

(A) The Contractor shall continue in effect or acquire insurance to protect the Parties and the Related Parties from liability for claims from Third Parties for damage to or loss of property or personal injury or death arising in connection with the covered launch activities under this contract. The amount of the required insurance shall be the maximum amount available in the commercial marketplace at reasonable cost, but shall not exceed $500 million for each launch. The policy or policies shall name NASA and the related parties as additional insurers. Required insurance coverage shall attach no later than the arrival of the LV at the launch site and shall remain in force for at least thirty (30) days following launch.

(B) The Contractor shall provide acceptable evidence to the Contracting Officer of required insurance no later than thirty (30) days prior to the beginning of the covered launch activities. The amount of required insurance and the terms and conditions for the policy or policies shall be subject to review by the Contracting Officer. Once reviewed, the policy or policies may not be modified or canceled without the prior, written approval of the Contracting Officer.

(C) The foregoing insurance requirement does not preclude the Contractor from acquiring or continuing in effect any additional insurance to protect the interests of the Contractor or its Related Parties.

32.4 Third Party Claims in Excess of Required Insurance

(A) NASA has determined that launches, under this contract, are conducted by NASA in performance of its functions, as specified in 42 U.S.C. § 2473(a). As a result, once the Contractor or its insurers have paid out for Third Party claims the amount of required insurance under paragraph 32.3(B), NASA will consider any additional Third Party claims for damage to or loss of property

or personal injury or death arising from the launches as claims against the United States under the authority of 42 U.S.C. § 2473 (c)(13).

(B) The Contractor (once it or its insurers have paid to Third Party claimants, from their own funds, an amount equal to the amount of required insurance for a Launch) shall adjust, settle and pay meritorious and reasonable additional Third Party claims in excess of the amount of required insurance. To the extent NASA determines that such costs exceed $25,000, it will forward such claim to the Secretary of Treasury for certification and payment pursuant to 31 U.S.C. § 1304(a). Such costs are subject to the usual tests for allowability and the total of such costs shall be paid up to a limit of $1.5 billion above the insurance obtained by the Contractor for each launch.

(C) In evaluating Third Party claims against the United States paid by the Contractor, NASA will consider such a claim to be meritorious unless the claim represents:

(i) Liabilities for which the Contractor is otherwise responsible under the express terms or conditions of the contract or a task order issued under this contract

(ii) Liabilities for which the Contractor has failed to insure or to maintain insurance as required by the Contracting Officer

(iii) Liabilities for which the Contractor has not reasonably adjusted, settled, or paid on a meritorious and reasonable basis.

(iv) Liabilities that result from willful misconduct or lack of good faith on the part of any of the Contractor's directors, officers, managers, superintendents, or other representatives who have supervision or direction of:

(a) All or substantially all of the Contractor's business

(b) All or substantially all of the Contractor's operations at any one plant or separate location in which this contract is being performed

(c) A separate and complete major industrial operation in connection with the performance of this contract

(v) Liabilities that arise from the willful misconduct or gross negligence of the Claimant or, in the case of a claim based on death, the claimant's descendant.

32.5 Third Party Liability for NASA Secondary Payloads on Non-NASA Primaries

The requirements of this clause 32.0 shall apply to all launch services provided under this contract except for those services involving NASA secondary payloads which are manifested on a launch service for non-NASA (commercial) primary payloads. In the event that a NASA secondary payload is manifested on a launch service for a non-NASA (commercial) primary payload, the contractor shall obtain third party liability insurance and indemnification for third party claims in excess of insurance pursuant to the Commercial Space Launch Act, 49 U.S.C. 70101 et seq.

33.0 FAR 52.212-3 OFFEROR REPRESENTATIONS AND CERTIFICATIONS--COMMERCIAL ITEMS (OCT 1999) ALT I (JUN 1999)

The Offeror Representations and Certifications (Attachment E1) as completed by the Contractor are hereby incorporated in their entirety by reference with the same force and effect as if they were given in full text.

34.0 FAR 52.212-5 CONTRACT TERMS AND CONDITIONS REQUIRED TO IMPLEMENT STATUTES OR EXECUTIVE ORDERS--COMMERCIAL ITEMS (FEB 2000)

(a) The Contractor agrees to comply with the following FAR clauses, which are incorporated in this contract by reference, to implement provisions of law or executive orders applicable to acquisitions of commercial items:

(1) 52.222-3, Convict Labor (E.O. 11755); and

(2) 52.225-13, Restrictions on Certain Foreign Purchases (E.O.'s 12722, 12724, 13059, and 13067).

(3) 52.233-3, Protest after Award (31 U.S.C 3553).

(b) The Contractor agrees to comply with the FAR clauses in this paragraph, which the Contracting Officer has indicated as being incorporated in this contract by reference to implement provisions of law or executive orders applicable to acquisitions of commercial items or components:

_X_(1) 52.203-6, Restrictions on Subcontractor Sales to the Government, with Alternate I (41 U.S.C. 253g and 10 U.S.C. 2402).

___(2) 52.219-3, Notice of Total HUBZone Small Business Set-Aside (Jan 1999).

___ (3) 52.219-4, Notice of Price Evaluation Preference for HUBZone Small Business Concerns (Jan 1999) (if the Offeror elects to waive the preference, it shall so indicate in its offer).

___ (4) (i) 52.219-5, Very Small Business Set-Aside (Pub. L. 103-403, section 304, Small Business Reauthorization and Amendments Act of 1994).

___ (ii) Alternate I to 52.219-5.

___ (iii) Alternate II to 52.219-5.

_X_ (5) 52.219-8, Utilization of Small Business Concerns (15 U.S.C. 637 (d)(2) and (3)).

_X_ (6) 52.219-9, Small Business Subcontracting Plan (Jan 2002) with Alt II (Oct 2001).

___ (7) 52.219-14, Limitations on Subcontracting (15 U.S.C. 637(a)(14)).

___ (8) (i) 52.219-23, Notice of Price Evaluation Adjustment for Small Disadvantaged Business Concerns (Pub. L. 103-355, section 7102, and 10 U.S.C. 2323) (if the Offeror elects to waive the adjustment, it shall so indicate in its offer).

___ (ii) Alternate I of 52.219-23.

___ (9) 52.219-25, Small Disadvantaged Business Participation Program--Disadvantaged Status and Reporting (Pub. L. 103-355, section 7102, and 10 U.S.C. 2323).

___ (10) 52.219-26, Small Disadvantaged Business Participation Program--Incentive Subcontracting (Pub. L. 103-355, section 7102, and 10 U.S.C. 2323).

___ (11) 52.222-21, Prohibition of Segregated Facilities (Feb 1999)

_X_ (12) 52.222-26, Equal Opportunity (E.O. 11246).

_X_ (13) 52.222-35, Affirmative Action for Disabled Veterans and Veterans of the Vietnam Era (38 U.S.C. 4212).

_X_ (14) 52.222-36, Affirmative Action for Workers with Disabilities (29 U.S.C. 793).

_X_ (15) 52.222-37, Employment Reports on Disabled Veterans and Veterans of the Vietnam Era (38 U.S.C. 4212).

_X_ (16) 52.225-1, Buy American Act—Balance of Payments Program - Supplies (41 U.S.C. 10a – 10d).

___ (17) 52.225-3, Buy American Act--North American Free Trade Agreement-Israeli Trade Act--Balance of Payments Program (41 U.S.C. 10a – 10d, 19 U.S.C.301 note, 19 U.S.C. 2112 note).

___ Alternate I of 52.225-3

___ Alternate II of 52.225-3

_X_ (18) 52.225-5, Trade Agreements (19 U.S.C. 2501, *et seq.*, 19 U.S.C. 3301 note).

___ (19) 52.225-15, Sanctioned European Union Country End Products (E.O. 12849).

___ (20) 52.225-16, Sanctioned European Union Country Services (E.O. 12849).

___ (21) [Reserved]

___ (22) 52.232-33, Payment by Electronic Funds Transfer - Central Contractor Registration (31 U.S.C. 3332).

_X_ (23) 52.232-34, Payment by Electronic Funds Transfer - Other than Central Contractor Registration (31 U.S.C. 3332).

___ (24) 52.232-36, Payment by Third Party (31 U.S.C. 3332).

___ (25) 52.239-1, Privacy or Security Safeguards (5 U.S.C. 552a).

___ (26) 52.247-64, Preference for Privately Owned U.S.-Flag Commercial Vessels (46 U.S.C. 1241).

(c) The Contractor agrees to comply with the FAR clauses in this paragraph, applicable to commercial services, which the Contracting Officer has indicated as being incorporated in this contract by reference to implement provisions of law or executive orders applicable to acquisitions of commercial items or components:

___ (1) 52.222-41, Service Contract Act of 1965, As Amended (41 U.S.C. 351, et seq.).

___ (2) 52.222-42, Statement of Equivalent Rates for Federal Hires (29 U.S.C. 206 and 41 U.S.C. 351, et seq.).

___ (3) 52.222-43, Fair Labor Standards Act and Service Contract Act--Price Adjustment (Multiple Year and Option Contracts) (29 U.S.C. 206 and 41 U.S.C. 351, et seq.).

___ (4) 52.222-44, Fair Labor Standards Act and Service Contract Act--Price Adjustment (29 U.S.C. 206 and 41 U.S.C. 351, et seq.).

___ (5) 52.222-47, SCA Minimum Wages and Fringe Benefits Applicable to Successor Contract Pursuant to Predecessor Contractor Collective Bargaining Agreement (CBA) (41 U.S.C. 351, Bargaining Agreement (CBA) (41U.S.C. 351 et seq.).

___ (6) 52.222-50, Nondisplacement of Qualified Workers (Executive Order 12933).

(d) *Comptroller General Examination of Record.* The Contractor agrees to comply with the provisions of this paragraph if this contract was awarded using other than sealed bid, is in excess of the simplified acquisition threshold, and does not contain the clause at 52.215-2, Audit and Records--Negotiation.

(1) The Comptroller General of the United States, or an authorized representative of the Comptroller General, shall have access to and right to examine any of the Contractor's directly pertinent records involving transactions related to this contract.

(2) The Contractor shall make available at its offices at all reasonable times the records, materials, and other evidence for examination, audit, or reproduction, until 3 years after final payment under this contract or for any shorter period specified in FAR Subpart 4.7, Contractor Records Retention, of the other clauses of this contract. If this contract is completely or partially terminated, the records relating to the work terminated shall be made available for 3 years after any resulting final termination settlement. Records relating to appeals under the disputes clause or to litigation or the settlement of claims arising under or relating to this contract shall be made available until such appeals, litigation, or claims are finally resolved.

(3) As used in this clause, records include books, documents, accounting procedures and practices, and other data, regardless of type and regardless of form. This does not require the Contractor to create or

maintain any record that the Contractor does not maintain in the ordinary course of business or pursuant to a provision of law.

(e) Notwithstanding the requirements of the clauses in paragraphs (a), (b), (c) or (d) of this clause, the Contractor is not required to include any FAR clause, other than those listed below (and as may be required by an addenda to this paragraph to establish the reasonableness of prices under Part 15), in a subcontract for commercial items or commercial components--

(1) 52.222-26, Equal Opportunity (E.O. 11246);

(2) 52.222-35, Affirmative Action for Disabled Veterans and Veterans of the Vietnam Era (38 U.S.C. 4212);

(3) 52.222-36, Affirmative Action for Workers with Disabilities (29 U.S.C. 793); and

(4) 52.247-64, Preference for Privately-Owned U.S. Flag Commercial Vessels (46 U.S.C. 1241) (flow down not required for subcontracts awarded beginning May 1, 1996).

35.0 LISTING OF CLAUSES INCORPORATED BY REFERENCE

NOTICE: The following contract clauses pertinent to this section are hereby incorporated by reference:

35.1 FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1) CLAUSES

FAR 52.202-1	Definitions (Oct 1995)
FAR 52.211-14	Notice of Priority Rating for National Defense Use (Sep 1990) (DOC9)
FAR 52.215-1(c)(3)	Instructions to Offerors-Competitive Acquisition (Oct 1997)
FAR 52.222-1	Notice to the Government of Labor Disputes (Feb 1997)
FAR 52.222-21	Prohibition of Segregated Facilities (Feb 1999)
FAR 52.222-37	Employment Reports On Disabled Veterans And Veterans of the Vietnam Era (Jan 1999)
FAR 52.227-14	Rights in Data—General (Jun 1987) Alternate II (Jun 1987) and Alternate III (Jun 1987)
FAR 52.232-18	Availability of Funds (Apr 1984)
FAR 52.232-25	Prompt Payment (Jun 1997)
FAR 52.232-29	Terms for Financing of Purchases of Commercial Items (Oct 1995)
FAR 52.232-34	Payment by Electronic Funds Transfer – Other than Central Contractor Registration (May 1999) Paragraph *(b) blank is completed with "no later than 15 days prior to submission of the first request for payment."*
FAR 52.233-1	Disputes (Dec 1998)

FAR 52.242-15	Stop-Work Order (Aug 1989)
FAR 52.243-1	Changes—Fixed-Price (Aug 1987) Alternate I (Apr 1984)
FAR 52.246-4	Inspection of Services—Fixed-Price (Aug 1996)
FAR 52.246-25	Limitation of Liability--Services (Feb 1997)

35.2 NASA FAR SUPPLEMENT (48 CFR CHAPTER 18) CLAUSES:

NFS 1852.215-84	Ombudsman (Oct 1996) James L. Jennings at (407) 867-2355
NFS 1852.219-74	Use of Rural Area Small Businesses (Sep 1990)
NFS 1852.219-75	Small, Small Disadvantaged, and Women-Owned Small Business Subcontracting Reporting (Jul 1997)
NFS 1852.219-76	NASA 8 Percent Goal (Jul 1997)
NFS 1852.223-70	Safety and Health (Mar 1997)
NFS 1852.225-70	Export Licenses (Feb 2000) Alternate I
NFS 1852.227-14	Rights in Data – General
NFS 1852.227-70	New Technology (Nov 1998)
NFS 1852.227-71	Requests for Waiver of Rights to Inventions (Apr 1984)
NFS 1852.228-78	Cross-Waiver of Liability for NASA Expendable Launch Vehicle Launches (Sep 1993)
NFS 1852.228-75	Minimum Insurance Coverage (Oct 1988)
NFS 1852.243-71	Shared Savings (Mar 1997)

35.3 KENNEDY SPACE CENTER STANDARD CLAUSES

KSC 52.204-90	Security Controls at KSC (Sep 1998)
KSC 52.204-94	Commercial and Government Entity (CAGE) Code Reporting (Apr 1999)
KSC 52.214-90	Hand Carried Offers and Use if Commercial Couriers (Aug 1998)
KSC52.243-90	Authorized Changes (Feb 1990)

36.0 FAR 52.252-2 CLAUSES INCORPORATED BY REFERENCE (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at these addresses:

http://www.arnet.gov/far/	GSA FAR Homepage
http://www.hq.nasa.gov/office/procurement/regs/nfstoc.htm	NASA FAR Supplement Homepage
http://www.ksc.nasa.gov/procurement/clause/	KSC Index of Procurement Clauses

37.0 FAR 52.252-6 AUTHORIZED DEVIATIONS IN CLAUSES (APR 1984)

The use in this solicitation or contract of any Federal Acquisition Regulation (48 CFR Chapter 1) clause with an authorized deviation is indicated by the addition of "(DEVIATION)" after the date of the clause.

The use in this solicitation or contract of any NASA FAR Supplement clause with an authorized deviation is indicated by the addition of "(DEVIATION)" after the name of the regulation.

38.0 SPECIAL UNDERSTANDING REGARDING DAMAGE TO GOVERNMENT PAYLOADS

Prior to intentional ignition of the launch vehicle on the launch pad, the Contractor shall not be responsible for damage to the spacecraft while the spacecraft is under the control of the Contractor, except when such damage is caused by the gross negligence, willful misconduct, or lack of good faith by the Contractor. In the event the Contractor is determined to be responsible for such damage, the Contractor shall reimburse the Government for the cost of spacecraft repairs as well as any costs associated with launch delays as set forth in the Section C, Clause 19.0, entitled "Adjustments to Launch Schedule." After intentional ignition, the provisions of Contract Section C, clause 24.0 shall apply.

39.0 CORPORATE GUARANTEE AND ASSURANCE OF PERFORMANCE

The Parties understand that Delta Launch Services, Inc. (DLS) is a wholly-owned subsidiary of the McDonnell Douglas Corporation (MDC), which is a wholly-owned subsidiary of The Boeing Company (TBC). TBC assumes full responsibility for and guarantees performance of DLS under the terms of this contract for NASA launch services awarded in support of NASA missions. In the event that DLS is unable, for any reason, to fulfill any of its obligations under the NLS contract, TBC will accept and perform those obligations and assume the liabilities, roles and responsibilities of DLS that may exist under said contract.

40.0 SPECIAL UNDERSTANDING REGARDING LAUNCH SITES, LONG-LEAD MATERIAL PROCUREMENT, POST PRODUCTION SUPPORT, TERMINATION LIABILITY, MISSION CONSIDERATIONS AND ATP FOR FIRM MISSIONS

Clause 40.0 redacted in its entirety (pgs. C-61 - C 74).

41.0 DEPARTMENT OF ENERGY (DOE) 952.250-70 NUCLEAR HAZARDS INDEMNITY AGREEMENT (JUN 1996)

(a) Authority. This clause is incorporated into this contract pursuant to the authority contained in subsection 170d. of the Atomic Energy Act of 1954, as amended (hereinafter called the Act.)

(b) Definitions. The definitions set out in the Act shall apply to this clause.

(c) Financial protection. Except as hereafter permitted or required in writing by DOE, the contractor will not be required to provide or maintain, and will not provide or maintain at Government expense, any form of financial protection to cover public liability, as described in paragraph (d)(2) below. DOE may, however, at any time require in writing that the contractor provide and maintain financial protection of such a type and in such amount as DOE shall determine to be appropriate to cover such public liability, provided that the costs of such financial protection are reimbursed to the contractor by DOE.

(d)(1) Indemnification. To the extent that the contractor and other persons indemnified are not compensated by any financial protection permitted or required by DOE, DOE will indemnify the contractor and other persons indemnified against (i) claims for public liability as described in subparagraph (d)(2) of this clause; and (ii) such legal costs of the contractor and other persons indemnified as are approved by DOE, provided that DOE's liability, including such legal costs, shall not exceed the amount set forth in section 170e.(1)(B) of the Act in the aggregate for each nuclear incident or precautionary evacuation occurring within the United States or $100 million in the aggregate for each nuclear incident occurring outside the United States, irrespective of the number of persons indemnified in connection with this contract.

(2) The public liability referred to in subparagraph (d)(1) of this clause is public liability as defined in the Act which (i) arises out of or in connection with the activities under this contract, including transportation; and (ii) arises out of or results from a nuclear incident or precautionary evacuation, as those terms are defined in the Act.

(e)(1) Waiver of Defenses. In the event of a nuclear incident, as defined in the Act, arising out of nuclear waste activities, as defined in the Act, the contractor, on behalf of itself and other

persons indemnified, agrees to waive any issue or defense as to charitable or governmental immunity.

(2) In the event of an extraordinary nuclear occurrence which:

(i) Arises out of, results from, or occurs in the course of the construction, possession, or operation of a production or utilization facility; or

(ii) Arises out of, results from, or occurs in the course of transportation of source material, by-product material, or special nuclear material to or from a production or utilization facility; or

(iii) Arises out of or results from the possession, operation, or use by the contractor or a subcontractor of a device utilizing special nuclear material or by-product material, during the course of the contract activity; or

(iv) Arises out of, results from, or occurs in the course of nuclear waste activities, the contractor, on behalf of itself and other persons indemnified, agrees to waive:

(A) Any issue or defense as to the conduct of the claimant (including the conduct of persons through whom the claimant derives its cause of action) or fault of persons indemnified, including, but not limited to:

1. Negligence;
2. Contributory negligence;
3. Assumption of risk; or
4. Unforeseeable intervening causes, whether involving the conduct of a third person or an act of God;

(B) Any issue or defense as to charitable or governmental immunity; and

(C) Any issue or defense based on any statute of limitations, if suit is instituted within 3 years from the date on which the claimant first knew, or reasonably could have known, of his injury or change and the cause thereof. The waiver of any such issue or defense shall be effective regardless of whether such issue or defense may otherwise be deemed jurisdictional or relating to an element in the cause of action. The waiver shall be judicially enforceable in accordance with its terms by the claimant against the person indemnified.

(v) The term extraordinary nuclear occurrence means an event, which DOE has determined to be an extraordinary nuclear occurrence as defined in the Act. A determination of whether or not there has been an extraordinary nuclear occurrence will be made in accordance with the procedures in 10 CFR part 840.

(vi) For the purposes of that determination, "offsite" as that term is used in 10 CFR Part 840 means away from "the contract location" which phrase means any DOE facility, installation, or site at which contractual activity under this contract is being carried on, and any contractor-owned or controlled facility, installation, or site at which the contractor is engaged in the performance of contractual activity under this contract.

(3) The waivers set forth above:

(i) Shall be effective regardless of whether such issue or defense may otherwise be deemed jurisdictional or relating to an element in the cause of action;

(ii) Shall be judicially enforceable in accordance with its terms by the claimant against the person indemnified;

(iii) Shall not preclude a defense based upon a failure to take reasonable steps to mitigate damages;

(iv) Shall not apply to injury or damage to a claimant or to a claimant's property which is intentionally sustained by the claimant or which results from a nuclear incident intentionally and wrongfully caused by the claimant;

(v) Shall not apply to injury to a claimant who is employed at the site of and in connection with the activity where the extraordinary nuclear occurrence takes place, if benefits therefore are either payable or required to be provided under any workmen's compensation or occupational disease law;

(vi) Shall not apply to any claim resulting from a nuclear incident occurring outside the United States;

(vii) Shall be effective only with respect to those obligations set forth in this clause and in insurance policies, contracts or other proof of financial protection; and

(viii) Shall not apply to, or prejudice the prosecution or defense of, any claim or portion of claim which is not within the protection afforded under (A) the limit of liability provisions under subsection 170e. of the Act, and (B) the terms of this agreement and the terms of insurance policies, contracts, or other proof of financial protection.

(f) Notification and litigation of claims. The contractor shall give immediate written notice to DOE of any known action or claim filed or made against the contractor or other person indemnified for public liability as defined in paragraph (d)(2). Except as otherwise directed by DOE, the contractor shall furnish promptly to DOE, copies of all pertinent papers received by the contractor or filed with respect to such actions or claims. DOE shall have the right to, and may collaborate with, the contractor and any other person indemnified in the settlement or defense of any action or claim and shall have the right to (1) require the prior approval of DOE for the payment of any claim that DOE may be required to indemnify hereunder; and (2) appear through the Attorney General on behalf of the contractor or other person indemnified in any action brought upon any claim that DOE may be required to indemnify hereunder, take charge of such action, and settle or defend any such action. If the settlement or defense of any such action or claim is undertaken by DOE, the contractor or other person indemnified shall furnish all reasonable assistance in effecting a settlement or asserting a defense.

(g) Continuity of DOE obligations. The obligations of DOE under this clause shall not be affected by any failure on the part of the contractor to fulfill its obligation under this contract and shall be unaffected by the death, disability, or termination of existence of the contractor, or by the completion, termination or expiration of this contract.

(h) Effect of other clauses. The provisions of this clause shall not be limited in any way by, and shall be interpreted without reference to, any other clause of this contract, including the clause entitled Contract Disputes, provided, however, that this clause shall be subject to the clauses entitled Covenant Against Contingent Fees, and Accounts, records, and inspection, and any provisions that are later added to this contract as required by applicable Federal law, including statutes, executive orders and regulations, to be included in Nuclear Hazards Indemnity Agreements.

(i) Civil penalties. The contractor and its subcontractors and suppliers who are indemnified under the provisions of this clause are subject to civil penalties, pursuant to 234A of the Act, for violations of applicable DOE nuclear-safety related rules, regulations, or orders.

(j) Criminal penalties. Any individual director, officer, or employee of the contractor or of its subcontractors and suppliers who are indemnified under the provisions of this clause are subject to criminal penalties, pursuant to 223(c) of the Act, for knowing and willful violation of the Atomic Energy Act of 1954, as amended, and applicable DOE nuclear safety-related rules, regulations or orders which violation results in, or, if undetected, would have resulted in a nuclear incident.

(k) Inclusion in subcontracts. The contractor shall insert this clause in any subcontract which may involve the risk of public liability, as that term is defined in the Act and further described in paragraph (d)(2) above. However, this clause shall not be included in subcontracts in which the subcontractor is subject to Nuclear Regulatory Commission (NRC) financial protection requirements under section 170b. of the Act or NRC agreements of indemnification under section 170c. or k. of the Act for the activities under the subcontract.

(End of clause)

SECTION D

DOCUMENTS, EXHIBITS, AND ATTACHMENTS

The following eight attachments are hereby incorporated into this contract in their entirety, made a part hereof, and shall apply in the performance of this contract.

Attachment D1	Statement of Work
Attachment D2	Contract Data Requirements List (CDRL)
Attachment D3	Supplemental Data List (SDL)
Attachment D4	Small Business and Small Disadvantaged Business Subcontracting Plan
Attachment D5	Safety and Health Plan
Attachment D6	Reliability Plan
Attachment D7	Quality Management Plan
Attachment D8	Work Plan
Attachment D9	Most Favored Customer Certification Plan
Attachment D10	Acronyms and Abbreviations

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ATTACHMENT D1

STATEMENT OF WORK

TABLE OF CONTENTS

1.0	**INTRODUCTION**	D1-1
1.1	Scope	D1-1
1.2	Objectives	D1-1
1.3	Compliance Documents	D1-2
1.4	Definitions	D1-3
2.0	**STANDARD LAUNCH SERVICE**	D1-3
2.1	Launch Vehicle (LV)	D1-4
2.2	Program Management	D1-6
2.2.1	Formal Reviews	D1-7
2.2.1.1	Program Reviews	D1-7
2.2.1.2	Design Reviews – Mission Unique	D1-7
2.2.1.3	Readiness Reviews	D1-10
2.2.2	Risk Management	D1-12
2.2.3	Configuration Management	D1-12
2.2.4	Manifest Policy	D1-12
2.2.5	New Launch Vehicle Orientation	D1-12
2.3	Mission Integration Services	D1-13
2.3.1	Mission Integration Management	D1-13
2.3.2	Mission Analyses	D1-14
2.3.3	Mission Success Determination	D1-14
2.4	Launch Site Support	D1-15
2.4.1	Pre-Launch Checkout and Launch Support	D1-15
2.4.1.1	Launch Vehicle Preparation and Launch	D1-15
2.4.1.2	Telemetry Data and Launch Countdown Support	D1-15
2.4.1.2.1	Baseline Vehicle Support	D1-15
2.4.1.2.2	Integrated Support	D1-16
2.4.1.2.3	Launch Countdown and Flight Support	D1-16
2.4.1.3	Launch Dress Rehearsal	D1-17
2.4.2	Launch Site Payload Support	D1-17
2.4.2.1	Payload Processing Facility	D1-17
2.4.2.2	Launch Site Payload Integration Support	D1-17
2.4.2.3	Contamination and Environmental Control	D1-19
2.4.2.4	Operational Support Services	D1-20
2.4.3	Range Support and Services	D1-20

2.5 Safety, Reliability, and Quality Assurance D1-21
2.5.1 Safety and Health Program D1-21
2.5.2 Reliability Program D1-22
2.5.3 Quality Assurance Program D1-22
2.6 NASA Insight and Approval D1-23

3.0 NON-STANDARD SERVICES D1-24

4.0 MISSION UNIQUE REQUIREMENTS D1-24
4.1 Mission Unique Hardware D1-24
4.2 Mission Unique Software D1-24
4.3 Unanticipated Mission Unique Services D1-25

5.0 SPECIAL TASK ASSIGNMENTS D1-25

6.0 RESERVED D1-25

7.0 GUIDELINE DOCUMENTS D1-26

8.0 REFERENCE DOCUMENTS D1-27

EXHIBIT 1 CAPABILITIES, SPECIFICATIONS AND ENVIRONMENTS D1-E1.1-1

1.0 VEHICLE CONFIGURATION D1-E1.1-1
2.0 PAYLOAD DELIVERY CAPABILITY D1-E1.2-1
3.0 INSERTION ACCURACIES D1-E1.3-1
4.0 PAYLOAD SEPARATION ATTITUDE ACCURACY AND RATES D1-E1.4-1
5.0 PAYLOAD FAIRING D1-E1.5-1
6.0 MECHANICAL INTERFACE D1-E1.6-1
7.0 ELECTRICAL INTERFACE D1-E1.7-1
8.0 PAYLOAD ENVIRONMENT D1-E1.8-1
9.0 PAYLOAD ENVIRONMENT INSTRUMENTATION D1-E1.9-1
10.0 GENERIC SECONDARY PAYLOAD CHARACTERISTICS/ INTERFACE D1-E1.10-1

EXHIBIT 2 STANDARD LAUNCH SERVICES LIST D1-E2-1

EXHIBIT 3 NON-STANDARD SERVICES LIST D1-E3-1

EXHIBIT 4 SAMPLE CERTIFICATE OF FLIGHT READINESS D1-E4-1

EXHIBIT 5 FIRM AND OPTIONAL MISSION DEFINITIONS (CLINS 1-10) D1-E5-1

EXHIBIT 6 AWARDED LSTO MISSIONS D1-E6-1

EXHIBIT 7 LAUNCH VEHICLE DATA D1-E7.1-1

1.0 INTRODUCTION D1-E7.1-1
2.0 DELTA II LAUNCH VEHICLE QUALIFICATION D1-E7.2-1
3.0 DELTA III LAUNCH VEHICLE QUALIFICATION D1-E7.3-1
4.0 DELTA IV LAUNCH VEHICLE QUALIFICATION D1-E7.4-1
5.0 DELTA FAMILY QUALIFICATION SUMMARY D1-E7.5-1
6.0 DELTA PROGRAM MANAGEMENT D1-E7.6-1

EXHIBIT 8 MISSION INTERFACE CONTROL DRAWINGS D1-E8-1

LIST OF TABLES

Table D1-A Mission Analyses to Support Payload Integration D1-14
Table D1-B Mission Unique Hardware Factors of Safety D1-24
Table E1-1 Vehicle Configuration D1-E1.1-1
Table E1-2 Maximum Low-Earth-Orbit (LEO) Payload Capability for Delta II 2320 Configurations D1-E1.2-5
Table E1-3 Maximum LEO Payload Capability for Delta II 2420 Configurations D1-E1.2-5
Table E1-4 Maximum LEO Payload Capability for Delta II 2920 Configurations D1-E1.2-6
Table E1-5 Maximum LEO Payload Capability for Delta II 2920H Configurations D1-E1.2-6
Table E1-6 Maximum LEO Payload Capability for Delta III and Delta IV D1-E1.2-7
Table E1-7 Maximum LEO Payload Capability for Delta IV D1-E1.2-7
Table E1-8 Maximum LEO Sun-Synchronous Payload Capability for Delta II and Delta IV D1-E1.2-10
Table E1-9 Maximum High-Energy Mission Payload Capability—Delta II with Star-37FM Upper Stage D1-E1.2-13
Table E1-9A Maximum High-Energy Mission Payload Capability—Delta II Two-Stage Vehicles D1-E1.2-13
Table E1-10 Maximum High-Energy Mission Payload Capability—Delta II with Star-48B Upper Stage D1-E1.2-14
Table E1-11 Maximum High-Energy Mission Payload Capability—Delta III and Delta IV D1-E1.2-15
Table E1-12 Maximum Geosynchronous Transfer Orbit (GTO) Payload Capability for Delta II 2326 ..... D1-E1.2-17
Table E1-12A Maximum Geosynchronous Transfer Orbit (GTO) Payload Capability for Delta II 2325 ..... D1-E1.2-18
Table E1-13 Maximum GTO Payload Capability for Delta II 2426 ..... D1-E1.2-18
Table E1-13A Maximum Geosynchronous Transfer Orbit (GTO) Payload Capability for Delta II 2425 ..... D1-E1.2-18
Table E1-14 Maximum GTO Payload Capability for Delta II 2926 ..... D1-E1.2-19
Table E1-15 Maximum GTO Payload Capability for Delta II 2925 ..... D1-E1.2-19
Table E1-16 Maximum GTO Payload Capability for Delta II 2926 and 2925 with 10L Fairing D1-E1.2-19
Table E1-17 Maximum GTO Payload Capability for Delta II 2926H D1-E1.2-20
Table E1-18 Maximum GTO Payload Capability for Delta II 2925H D1-E1.2-20
Table E1-19 Maximum GTO Payload Capability for Delta II 2926H and 2925H with 10L Fairing D1-E1.2-20
Table E1-20 Maximum GTO Payload Capability for Delta III 3940-11 ..... D1-E1.2-21
Table E1-21 Maximum GTO Payload Capability for Delta IV 4040 and 4240 ..... D1-E1.2-21

Table E1-22 Maximum GTO Payload Capability for Delta IV 4450 and 4050H D1-E1.2-21
Table E1-23 Delta 3-Sigma Orbit Dispersions for LEO and Sun-Synchronous Missions D1-E1.3-1
Table E1-24 Delta 3-Sigma Orbit Dispersions for High-Energy Missions D1-E1.3-1
Table E1-25 Delta 3-Sigma Orbit Dispersions for GTO Missions—Apogee = 100,000 km D1-E1.3-1
Table E1-26 Delta 3-Sigma Orbit Dispersions for GTO Missions—Apogee = 35,788 km D1-E1.3-2
Table E1-27 Delta 3-Sigma Orbit Dispersions for GTO Missions—Apogee = 5,000 km D1-E1.3-2
Table E1-28 Standard Payload Deployment Attitudes/Rates D1-E1.4-1
Table E1-29 Payload Electrical Interfaces (Blockhouse to Fixed Utility Tower) D1-E1.7-1
Table E1-30 Maximum Electromagnetic Radiation Levels Encountered on Delta Payloads D1-E1.8-1
Table E1-31 Delta II/III Payload Design CG Limit Load Factors, Maximum Acceleration D1-E1.8-11
Table E1-32 Delta IV Payload Design CG Limit Load Factors, Maximum Acceleration D1-E1.8-11
Table E1-33 Maximum Expected Sinusoidal Vibrations at the Base of the PA for Delta II, Delta III, and Delta IV D1-E1.8-11
Table E1-33A Recommended MECO Levels Sinusoidal Vibrations Levels (Q=10) for all Delta II Vehicles at MECO D1-E1.8-11.1
Table E1-34 Contractor-Provided Payload Environment Instrumentation for Delta II D1-E1.9-1
Table E1-34A Contractor-Provided Payload Environment Instrumentation for Delta III D1-E1.9-1
Table E1-35 Contractor-Provided Payload Environment Instrumentation for Delta IV D1-E1.9-1
Table E1-36 Generic Secondary Payload Characteristics D1-E1.10-1
Table E3-1 Eastern Range Core Vehicle Analysis D1-E3-23
Table E3-2 Western Range Core Vehicle Analysis D1-E3-23
Table E3-3 L-42 Mission TBD D1-E3-32
Table E3-4 L-36 Mission TBD D1-E3-32
Table E5-1 Our Delta family offers NASA the flexibility required to meet NLS mission requirements and to mitigate growth risk D1-E5-1
Table E6-1 Awarded LSTO Missions D1-E6-1
Table E7-1 Delta's qualification plans provide timely data transmittal to NASA and encompass all RFP and K-ELV-10.2 requirements D1-E7.1-7
Table E7-1a Current Delta III manifest provides a qualified launch vehicle to support NASA's launch needs in 2003 ..... D1-E7.1-5

Table E7-1b The current Delta IV manifest includes 24 firm USAF and commercial launches through 2004 with ample flexibility to accommodate NASA's launch requirements D1-E7.1-6
Table E7-1c Boeing and all Delta flight-critical MSKs are third-party ISO 9001 registered D1-E7.1-6
Table E7-2 The rigorous approach used for Delta II acceptance testing, integrated final checkout, and on-pad testing provides the basis for Delta III and IV testing D1-E7-.1-8
Table E7-2a Our hardware heritage across the entire Delta family minimizes risk and supports satisfying NASA Category-3 requirements D1-E1.1-11
Table E7-2b Examples of the 700 producibility items implemented reflect our quality focus D1-E7.1-14
Table E7-3 Rigorous qualification testing is used across the Delta launch family to verify the integrity of components, subsystems, and systems D1-E7.1-14
Table E7-4 Delta's existing documentation system provides NASA with visibility into all phases of launch vehicle activity D1-E7.1-18
Table E7-4a Our mission integrators assure requirements verification through compliance matrices D1-E7.1-19
Table E7-4b Our established processes, validated to ISO 9001, assure no item with an expired life flies D1-E7.1-20
Table E7-5 Delta II's current string of 14 consecutive successful launches satisfies the NLS Category 3 qualification requirement D1-E7.2-1
Table E7-6 Our Delta III qualification plan provides for timely Category 3 certification to support NLS needs D1-E7.3-1
Table E7-6a The rigorous approach used for Delta III acceptance testing, integrated final checkout, and on-pad testing assures successful mission operation D1-E7.3-3
Table E7-7 Delta III Flight-Qualified Systems D1-E7.3-4
Table E7-8 Delta 269 failure investigation recommendations and corrective actions are being implemented for Delta III return to flight D1-E7.3-7
Table E7-8a Delta III ordnance shares design heritage with Delta II components and systems D1-E7.3-12
Table E7-8b Delta III return-to-flight key risk elements have been identified and mitigation plans are active D1-E7.3-14
Table E7-9 Our Delta IV qualification plan provides for timely Category 2 followed by Category 3 certification to support NLS needs D1-E7.4-2

Table E7-10 GEM-60 Qualification Test Summary D1-E7.4-5
Table E7-10a The rigorous approach used for Delta IV acceptance testing, integrated final checkout, and on-pad testing provides assurance of successful mission operation D1-E7.4-8
Table E7-10b 4-m and 5-m Fairing Production Acceptance Test D1-E7.4-10
Table E7-10c Delta IV vehicle heritage assures NASA of a low-risk development and qualification program D1-E7.4-12
Table E7-10d Delta IV utilizes heritage and modified Delta II and Delta III avionics hardware D1-E7.4-14
Table E7-10e Delta IV ordnance system uses proven technologies to assure reliability D1-E7.4-15
Table E7-11 Delta IV leverages Delta II and Delta III heritage designs and additional qualification testing as needed to minimize development risk to NASA D1-E7.4-17
Table E7-11a Delta IV key risk elements have been identified and mitigation plans are active D1-E7.4-20

LIST OF FIGURES

Figure E1-1 Delta II/III/IV Vehicle Designator System D1-E1.1-2
Figure E1-2 Maximum Payload Envelope for –9.5 Fairing, Two-Stage Configuration (Various PAs) D1-E1.5-2
Figure E1-3 Maximum Payload Envelope for –9.5 Fairing, Two-Stage Configuration (6306 PAs) D1-E1.5-3
Figure E1-4 Maximum Payload Envelope for –10 Fairing, Two-Stage Configuration (Various PAs) D1-E1.5-4
Figure E1-5 Maximum Payload Envelope for –10 Fairing, Two-Stage Configuration (6306 PA) D1-E1.5-5
Figure E1-6 Maximum Payload Envelope for –10L Fairing, Two-Stage Configuration (Various PAs) D1-E1.5-6
Figure E1-7 Maximum Payload Envelope for –10L Fairing, Two-Stage Configuration (6306 PA) D1-E1.5-7
Figure E1-8 Maximum Payload Envelope for –10 Fairing, Dual-Payload Attach Fitting D1-E1.5-8
Figure E1-9 Maximum Payload Envelope for –9.5 Fairing, Three-Stage Star-37FM Configuration (3724 PA) D1-E1.5-9
Figure E1-10 Maximum Payload Envelope for –9.5 Fairing, Three-Stage Star-48B Configuration (3712PA) D1-E1.5-10
Figure E1-11 Maximum Payload Envelope for –10 Fairing, Three-Stage Star-37FM Configuration (3724 PA) D1-E1.5-11
Figure E1-12 Maximum Payload Envelope for –10 Fairing, Three-Stage Star-48B Configuration (3712 PA) D1-E1.5-12
Figure E1-13 Maximum Payload Envelope for –10L Fairing, Three-Stage Star-37B Configuration D1-E1.5-13
Figure E1-14 Maximum Payload Envelope for –10L Fairing, Three-Stage Star-48B Configuration (3712 PA) D1-E1.5-14
Figure E1-15 Maximum Payload Envelope for –11 Fairing, Delta III (1666-4 PA) D1-E1.5-15
Figure E1-16 Maximum Payload Envelope for –12 Fairing, Delta IV (Various PAs) D1-E1.5-15
Figure E1-17 Maximum Payload Envelope for –14 Fairing, Delta IV (1194-5 PA) D1-E1.5-16
Figure E1-18 Maximum Payload Envelope for –19 Fairing, Delta IV (1194-5 PA) D1-E1.5-16
Figure E1-19 Delta II Payload Adapters and Interfaces D1-E1.6-2
Figure E1-19A 3712 and 3724 PA Interface D1-E1.6-3
Figure E1-19B 3712 and 3724 Clamp Assembly and Spring Actuator D1-E1-6-4
Figure E1-19C 3712A Launch Vehicle PA Detailed Dimensions D1-E1.6-5
Figure E1-19D 3712A PA Spacecraft Interface Dimensional Constraints D1-E1.6-5
Figure E1-19E 3712A PA Spacecraft Dimensional Constraints D1-E1.6-6

Figure E1-19F 3712B Launch Vehicle PA Detailed Dimensions D1-E1.6-7
Figure E1-19G 3712B PA Spacecraft Interface Dimensional Constraints D1-E1.6-8
Figure E1-19H 3712B PA Spacecraft Interface Dimensional Constraints D1-E1.6-9
Figure E1-19I 3712C and 3724C Launch Vehicle PA Detailed Dimensions D1-E1.6-10
Figure E1-19J 3712C and 3724C PA Spacecraft Interface Dimensional Constraints D1-E1.6-11
Figure E1-19K 3712C and 3724C PA Spacecraft Interface Dimensional Constraints D1-E1.6-12
Figure E1-19L 5624 Launch Vehicle PA Detailed Assembly D1-E1.6-13
Figure E1-19M 5624 Launch Vehicle PA Detailed Dimensions D1-E1.6-14
Figure E1-19N 5624 PA Clamp Assembly and Spring Actuator D1-E1.6-15
Figure E1-19O 5624 PA Spacecraft Interface Dimensional Constraints D1-E1.6-16
Figure E1-19P 5624 PA Spacecraft Interface Dimensional Constraints D1-E1.6-17
Figure E1-19Q 6306 PA Interface D1-E1.6-18
Figure E1-19R 6306 Launch Vehicle PA Detailed Assembly D1-E1.6-19
Figure E1-19S 6306 PA Spacecraft Interface Dimensional Constraints D1-E1.6-20
Figure E1-19T 6306 PA Spacecraft Interface Dimensional Constraints D1-E1.6-21
Figure E1-19U 6019 Launch Vehicle PA Detailed Assembly D1-E1.6-22
Figure E1-19V 6019 PA Spacecraft Interface Dimensional Constraints D1-E1.6-23
Figure E1-19W 6019 PA Spacecraft Assembly D1-E1.6-24
Figure E1-19X 6915 Launch Vehicle PA Detailed Assembly D1-E1.6-25
Figure E1-19Y 6915 PA Spacecraft Interface Dimensional Constraints D1-E1.6-26
Figure E1-19Z 6915 PA Spacecraft Assembly D1-E1.6-27
Figure E1-19AA Dual-Payload Attach Fitting 37C PA Interface D1-E1.6-28
Figure E1-19AB Dual-Payload Attach Fitting 37C PA Separation System Interface D1-E1.6-29
Figure E1-19AC Dual-Payload Attach Fitting 37C PA Spacecraft Separation Interface—Electrical Connector Bracket D1-E1.6-30
Figure E1-19AD Dual-Payload Attach Fitting 37C Launch Vehicle PA Detailed Dimensions D1-E1.6-31
Figure E1-19AE Dual-Payload Attach Fitting 37C PA Spacecraft Interface Dimensional Constraints D1-E1.6-32
Figure E1-19AF Dual-Payload Attach Fitting 37C PA Spacecraft Interface Dimensional Constraints (Views B-B, C, D, and E) D1-E1.6-33
Figure E1-20 Delta III and Delta IV Payload Adapters and Interfaces (4-m-dia Fairing) D1-E1.6-34
Figure E1-20A 1666-4 Launch Vehicle PA Detailed Assembly D1-E1.6-35
Figure E1-20B 1666-4 PA Spacecraft Interface Dimensional Constraints D1-E1.6-36
Figure E1-20C 1666-4 PA SS66D Clampband Separation System D1-E1.6-37
Figure E1-20D 1666-4 Launch Vehicle PA Upper Ring Detail D1-E1.6-38

Figure E1-20E 1666-4 PA Separation Spring Interface D1-E1.6-39
Figure E1-20F 1666-4 PA Spacecraft Electrical Connector Interface D1-E1.6-40
Figure E1-20G 1666-4 PA Optional GN_2 Purge Interface D1-E1.6-40
Figure E1-20H 4-m 1194-4 Launch Vehicle PA D1-E1.6-41
Figure E1-20I 4-m 1194-4 Launch Vehicle PA Mechanical Interface D1-E1.6-42
Figure E1-20J 4-m 1575-4 Launch Vehicle PA Mechanical Interface D1-E1.6-43
Figure E1-20K 4-m 1575-4 Launch Vehicle PA Mechanical Interface—Detail D1-E1.6-44
Figure E1-21 Delta IV Payload Adapter and Interfaces (5-m-dia Fairings) D1-E1.6-45
Figure E1-21A 1194-5 Launch Vehicle PA D1-E1.6-46
Figure E1-22 Pressure Profiles and Depressurization Rates for Delta II, 9.5-ft- and 10-ft-dia Fairings (10 and 10L) D1-E1.8-2
Figure E1-23 Pressure Profiles and Depressurization Rates for Delta III 3940, -11 Fairing D1-E1.8-2
Figure E1-24 Pressure Profiles and Depressurization Rates for Delta IV 4040, -12 Fairing D1-E1.8-3
Figure E1-25 Pressure Profiles and Depressurization Rates for Delta IV 4240, -12 Fairing D1-E1.8-3
Figure E1-26 Pressure Profiles and Depressurization Rates for Delta IV 4450, -14 Fairing D1-E1.8-4
Figure E1-27 Pressure Profiles and Depressurization Rates 4050H, -19 Fairing D1-E1.8-4
Figure E1-28 Maximum Flight-Level Payload Acoustic Environment for Delta II 242X, -9.5 Fairings D1-E1.8-5
Figure E1-29 Maximum Flight-Level Payload Acoustic Environment for Delta II 242X, -10 Fairings (10 and 10L) D1-E1.8-6
Figure E1-30 Maximum Flight-Level Payload Acoustic Environment for Delta II 292X, -9.5 Fairings D1-E1.8-6
Figure E1-31 Maximum Flight-Level Payload Acoustic Environment for Delta II 292X, -10 Fairings (10 and 10L) D1-E1-.8-7
Figure E1-32 Maximum Flight-Level Payload Acoustic Environment for Delta III and Delta IV 4-m-dia Fairings D1-E1-.8-7
Figure E1-33 Maximum Flight-Level Payload Acoustic Environment for Delta IV 4450, -14 Fairings D1-E1-.8-8
Figure E1-34 Maximum Flight-Level Payload Acoustic Environment for Delta IV 4050H, -19 Fairing D1-E1.8-8
Figure E1-35 Maximum Flight-Level Payload Interface Shock Response Spectrum for Various PAs D1-E1.8-9
Figure E1-36 Maximum Flight-Level Payload Interface Shock Response Spectrum for Various PAs and the PA Interface D1-E1.8-10
Figure E1-37 Maximum Quasi-Steady Acceleration as a Function of Payload Separated Mass for Delta II D1-E1.8-12

Figure E1-38 Maximum Quasi-Steady Acceleration as a Function of Payload Separated Mass for Delta III D1-E1.8-12
Figure E1-39 Maximum Quasi-Steady Acceleration as a Function of Payload Separated Mass for Delta 4040 ..... D1-E1.8-13
Figure E1-40 Maximum Quasi-Steady Acceleration as a Function of Payload Separated Mass for Delta IV 4240 ..... D1-E1.8-13
Figure E1-41 Maximum Quasi-Steady Acceleration as a Function of Payload Separated Mass for Delta IV 4450 ..... D1-E1.8-14
Figure E1-42 Maximum Quasi-Steady Acceleration as a Function of Payload Separated Mass for Delta IV 4050H D1-E1.8-14
Figure E1-43 Maximum Quasi-Steady Acceleration as a Function of Payload Separated Mass at Third-Stage Burnout for Delta II D1-E1.8-15
Figure E1-43A Thermal Environments of Delta II and Delta III Payload Fairings D1-E1.8-16
Figure E1-43B Thermal Environments of Delta IV Payload Fairings D1-E1.8-17
Figure E1-43C Third-Stage Motor Case Soakback Temperature History is Well Characterized D1-E1.8-18
Figure E1-44 Separating Secondary Payload Standard Interface D1-E1.10-2
Figure E1-45 Non-Separating Secondary Payloads Standard Mounting Interface D1-E1.10-2
Figure E3-1 Third-Stage Motor Case Soakback Temperature History is Well Characterized D1-E3-26
Figure E3-2 Dual Payload Attach Fitting (DPAF) Allowable Access Hole Locations D1-E3-28
Figure E5-1 Delta II/III/IV Vehicle Designator System D1-E5-1
Figure E7-1 Delta's heritage allows prompt Category 3 qualification for the entire launch vehicle family and timely support of all NLS missions D1-E7.1-1
Figure E7-1A Ongoing Delta launch vehicle family development, qualification and launch activities provide reliable and robust launch services well in advance of NASA requirements D1-E7.1-3
Figure E7-2 Delta IV continues heritage processes for vigorous testing at all phases of development through launch D1-E7.1-9
Figure E7-3 Reliability of all Delta launch vehicles is assured by adhering to our disciplined family of design procedures D1-E7.1-12
Figure E7-3a The established, proven Delta II manufacturing flow is fully capable of supporting NLS needs D1-E7.1-13
Figure E7-3b Our iterative risk management process results in a low-risk program D1-E7.1-15

Figure E7-3c Our risk exposure matrix is weighted in favor of the severity of the event, assuring action on worst-case events D1-E7.1-15
Figure E7-3d Reliability is an integral element in all phases of the launch system life cycle, which improves and maximizes mission success D1-E7.1-16
Figure E7-3e Our change management approach uses automated tools to control baseline and mission-unique changes D1-E7.1-19
Figure E7-4 A comprehensive qualification program verifies Delta III vehicle design integrity D1-E7.3-2
Figure E7-5 A typical acceptance test flow shows the rigorous test philosophy applied to all Delta flight-critical components D1-E7.3-3
Figure E7-5a Orion-3 fairing flight data show close agreement with model predictions D1-E7.3-4
Figure E7-5b Orion-3 RP-1 fuel tank flight data show excellent agreement with model prediction D1-E7.3-4
Figure E7-5c Orion-3 second-stage equipment deck-EMA controller flight data are within model prediction D1-E7.3-5
Figure E7-5d Orion-3 second-stage equipment deck-hydrazine lines flight data correlate with model prediction D1-E7.3-5
Figure E7-5e Orion-3 second-stage equipment deck-isogrid structure flight data correlate with model data D1-E7.3-5
Figure E7-6 Improved manufacturing and inspection process restored confidence in the structural integrity of the RL10B-2 thrust chamber D1-E7.3-6
Figure E7-7 Delta III has evolved from Delta II and shares its long and successful heritage D1-E7.3-9
Figure E7-7a Delta III redundant avionics architecture maximizes use of Delta II heritage components to assure robust and reliable vehicle performance D1-E7.3-10
Figure E7-7b Delta III unique avionics system components feature Delta II design heritage and redundancy architecture to maximize flexibility D1-E7.3-11
Figure E7-7c Delta III shares Huntington Beach, Pueblo, and Cape Canaveral processing facilities with Delta II D1-E7.3-13
Figure E7-9 Delta IV rigorous qualification plan is completed well in advance of NASA's needs D1-E7.4-1
Figure E7-10 Our Delta IV launch plan provides a fully mature, flight-proven system to support NASA's needs D1-E7.4-2
Figure E7-11 Boeing has a well-orchestrated qualification test plan to assure NASA a fully proven Delta IV launch system D1-E7.4-3

Figure E7-12 Rigorous common booster core qualification test program supports first Delta IV launch D1-E7.4-3
Figure E7-13 RS-68 engine development and certification programs assure timely compliance with all goals D1-E7.4-4
Figure E7-14 Flight development and certification of the RS-68 engine is continuing and assures NASA a fully qualified engine D1-E7.4-5
Figure E7-15 Early qualification and testing of both the Delta IV Medium and Heavy second stages assures flexibility to meet NASA's mission requirements D1-E7.4-6
Figure E7-15a Delta IV Verification Flow D1-E7.4-9
Figure E7-15b Second-Stage Acceptance Test Flow D1-E7.4-10
Figure E7-16 Delta IV leverages the design, materials, and process heritage of the Delta launch vehicle family and assures NASA a Category 3-qualified system D1-E7.4-11
Figure E7-16a Delta IV second stages feature both Delta III heritage components and impressive 0.997 (over 40 years) RL10 reliability D1-E7.4-13
Figure E7-16b Delta IV leverages Delta II and Delta III avionics and flight-termination design and assures robust vehicle performance D1-E7.4-13
Figure E7-16c Delta IV manufacturing locations have a focused processing, assembly, and checkout flow that reduces cycle time, assuring that major components are available and promoting on-time launches D1-E7.4-18
Figure E7-16d Delta IV Decatur Focused Factory uses heritage processes to produce a common booster core hardware D1-E7.4-19
Figure E7-17 The NLS program is given high visibility in the Boeing organization D1-E7.6-1
Figure E7-18 The Boeing NLS program management team provides a dedicated focal point for integrating NLS requirements into Delta programs and assuring mission success D1-E7.6-2
Figure E7-19 The Boeing mission assurance approach is designed to provide 100% on-time mission success D1-E7.6-4

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STATEMENT OF WORK

1.0 INTRODUCTION

1.1 Scope

This Statement of Work (SOW) and all Exhibits and documents attached or referenced herein define the Government's requirements for the Contractor to provide launch services in support of NASA's Expendable Launch Vehicle (ELV) Program. The scope of this contract effort includes risk category 2 and 3 launch services capable of delivering, at a minimum, a 1500 kg payload to orbit at an altitude of 200 km and a launch inclination of 28.5°.

This SOW defines the overall launch service requirements for 'NASA or NASA-sponsored payloads' (hereinafter referred to as 'payloads'). The Contractor shall perform all tasks necessary to safely and reliably launch payloads in accordance with NASA-defined mission objectives. The Contractor shall support advance planning and perform analysis tasks as directed by the Contracting Officer.

It is the general contemplation of the parties to this contract that the Contractor shall have a broad mission in performing launch service related functions for the Government and designees. Therefore, the general scope of the contract covers any launch service and launch service related activities arising from the SOW in support of earth and space science exploration, and space station re-supply.

1.2 Objectives

The goal of the NASA Launch Services (NLS) contract is to provide the Agency with domestic launch services that are safe, successful, reliable, and affordable. The launch services will be provided at a fixed price. The contract will, to the maximum extent practical, incorporate best commercial practices.

The objectives of this contract are to:

- Ensure the safety of the public and all personnel, hardware, and property associated with the launch services.
- Provide affordable, accurate, and on-time delivery of ELV manifested payloads to space.
- Provide a mechanism to incorporate new launch services, technology upgrades, improved systems engineering processes, and advances in manufacturing techniques.

- Provide risk mitigation while utilizing commercial practices.
- Provide flexible manifesting policy that recognizes the national priorities of NASA missions.
- Provide a capability to optimize cost, schedule, and performance to satisfy mission objectives.
- Provide for clear Government visibility into program schedule, technical performance, and risk.
- Foster competition and create opportunities for new, emerging launch service providers.
- Promote partnering among customers, launch service provider, and the ELV program to maximize flexibility and responsiveness to customers needs.

1.3 Compliance Documents

The Contractor shall comply with the requirements contained in the following documents.

Document No.	Revision	Document Title
ANSI/ASQC, Q9001-1994		Quality Systems-Model for Quality Assurance in Design, Development, Production, Installation, and Servicing
EWR 127-1	Oct 1997	Eastern/Western Range, Range Safety Requirements[1] (Required for VAFB or CCAFS launches only)
ISO 9001-1994		International Organization of Standardization
KHB 1710.2	D	KSC Safety Practices Handbook[2,3]
NPD 8710.3	May 1997	NASA Policy For Limiting Orbital Debris
NSS/GO 1740.9	B, Nov 1991	NASA Safety Standard for Lifting Devices and Equipment[2]

[1] Any agreements between the Contractor and the Range for a tailored EWR 127-1 are acceptable to NASA.

[2] The Contractor shall comply with the latest revisions of KHB 1710.2D and NSS/GO 1740.9 for processes performed in NASA facilities.

[3] Any agreement between the Contractor and NASA for a tailored KHB 1710.2 are acceptable.

1.4 Definitions

Mission Specific: all standard, non-standard, and mission unique services provided to meet the requirements of the payload and mission.

Mission Unique: services provided that are newly performed or developed to meet mission requirements and that are not included in the standard and non-standard services. Typically these pertain to first flight items.

2.0 STANDARD LAUNCH SERVICE

The Contractor shall perform all launch service tasks necessary to deliver payloads to defined orbital parameters in compliance with mission requirements. The launch service shall support missions to all orbital parameters, consistent with vehicle configuration capabilities and launch Range restrictions. The Contractor shall provide launch services, which are in compliance with all Range requirements. The Contractor shall make all arrangements with the responsible authorities for the required launch Range authorization and support for vehicle processing; integrated payload/vehicle processing, launch; and launch site maintenance and modifications. NASA reserves the right to approve the choice of launch site [e.g. Cape Canaveral Air Force Station (CCAFS), Vandenberg Air Force Base (VAFB)].

The Contractor shall furnish all services, maintain all equipment and infrastructure including, but not limited to: program management, mission integration, launch site support, ground and flight system safety, and performance assurance, necessary to accomplish the safe and successful launch of payloads to the required orbit conditions within required launch periods. The Contractor shall provide facilities and services at Contractor facilities for NASA personnel performing insight and approval functions during the performance of the contract. The Contractor shall provide access to launch vehicle documentation in support of NASA insight and approval functions.

The Contractor shall provide all necessary services, test hardware and software, and mission specific elements required to integrate the payload(s) to the launch vehicle systems. The Contractor shall meet all launch service performance requirements described in Exhibit 1, Capabilities, Specifications and

Environments. All capabilities and conditions stated in Exhibit 1 must be consistent and compatible with all other capabilities and conditions stated in Exhibit 1 and in response to the requirements of the SOW. Any exceptions to the stated capabilities or conditions must be specifically noted.

The Contractor shall coordinate with NASA Public Affairs Office all press releases concerning launches under this contract. During vehicle build-up, payload integration, and launch countdown, the Contractor shall allow NASA Public Affairs access to facilities to photograph and videotape activities, including hazardous operations. The Contractor shall assist NASA Public Affairs in developing the launch commentary for NASA Television by furnishing launch countdown and operations background material. The Contractor may also be asked to provide information to support the development of the press kit document and the NASA pre-launch and post-launch news conferences. The Contractor shall coordinate with NASA Public Affairs Protocol and Guest Services a minimum of sixty (60) days in advance of each launch to determine any special requirements.

The Contractor shall provide standard launch services as delineated in Exhibit 2, Standard Services List. All hardware, software, analyses, and support required to provide each item listed in Exhibit 2, shall be included in the standard launch service.

All Contract Data Requirements List (CDRL) and Supplemental Data List (SDL) items, identified in Attachment D2 and D3 respectively, shall be included in the standard launch service.

2.1 Launch Vehicle (LV)

The standard launch service shall include, as a minimum, the following:

(A) Launch timing capabilities with

(i) Launch periods as small as 7 day in duration

(ii) Multiple approximately 24 hour re-launch attempts in the event of a launch scrub

(iii) Instantaneous launch window

(iv) Simultaneous planetary launch campaigns, with launches separated by the number of days provided in Exhibit 2.

(v) Trajectory targeting at multiple flight azimuths on any one day of the launch period

(B) A launch vehicle and Payload Adapter (PA) with appropriate electrical and mechanical interfaces (as described in Exhibit 1) required for payload integration and testing.

(C) A payload separation system with the following characteristics:

(i) The payload shall be protected from debris generated by the separation system.

(ii) The separation system shall function in a manner that prevents any re-contact with the payload, including Contractor-provided attach hardware on the payload, by the upper stage or any element of the separation system once separation has been initiated.

(iii) Redundant payload separation indications.

(D) A Payload Fairing (PLF) with the following items, as a minimum:

(i) Three payload access doors of sizes provided in Exhibit 2, whose locations shall be mission unique within the stated structural limitations of the fairing. Additional or different size doors shall be provided as a non-standard service. The Contractor shall provide payload personnel access through all standard and non-standard access doors from fairing mate through final vehicle closeout.

(ii) Thermal and/or acoustic blankets sealed or filtered such that venting of blanket material debris does not contaminate the payload.

(E) Flight instrumentation, as specified in Exhibit 1, paragraph 9.0, Payload Environment Instrumentation, to provide data adequate to support Section C, paragraph 24.2, Mission Success Determination.

(F) Capability to spin and despin payloads, when applicable, prior to deployment over the minimum ranges provided in Exhibit 2 for the standard service and Exhibit 3 for non-standard services.

(G) A Collision/Contamination Avoidance Maneuver (CCAM), when applicable, following payload separation to minimize payload contamination and any chance of re-contact with the separated payload.

(H) Provisions for the prevention of static charging on umbilical connectors that may be subjected to static charging from plasma heating or atmospheric particulate matter, either by bleed resistors, dead facing or connector covers.

(I) A logo in accordance with NASA provided artwork. The size of the logo shall be the maximum dimensions specified in Exhibit 2. The logo installation shall be appropriately documented in the mission Interface Control Document (ICD) (CDRL C2-1).

(J) Availability of a Test Payload Adapter (TPA), with appropriate mechanical interfaces and payload separation system, to support payload integration and testing at NASA/NASA Customer (NNC) facilities or such other locations as defined by the ICD. At this facility, the Contractor shall support, with necessary personnel and equipment, the following: a fit check of the payload with the flight PA, environmental testing with a TPA, payload shock testing with a TPA, and sufficient pyrotechnics for two shock test firings.

(K) Command, control, and power signal capability from the launch control facility to the payload umbilical Ground Support Equipment (GSE) per the mission specific ICD.

(L) All mechanical GSE required to interface with the payload mechanical adapters and accomplish the payload to launch vehicle mating operation per the mission ICD.

(M) Both halves of the electrical connector at each spacecraft-to-launch vehicle interface. The Contractor shall provide 3 sets for each electrical connector interface: a flight set, a flight spare set, and a set for spacecraft testing.

(N) All other hardware equipment, software, infrastructure, and logistics necessary to perform the contracted launch services.

2.2 Program Management

The Contractor shall provide all program management functions required to provide the launch services and to satisfy the mission requirements for each NASA mission. The program management function of this contract shall provide insight to NASA for all technical and programmatic activities performed under this contract.

The Contractor shall coordinate all program management functions and issues directly with the KSC ELV Program Office designated representative(s). The NASA Contracting Officer is the only NASA representative authorized to provide formal contract direction.

2.2.1 Formal Reviews

The Contractor shall conduct program reviews, design reviews, and readiness reviews, and shall provide for the participation of NNC. The Contractor shall provide minutes and action items resulting from each review to NASA within one week after the review. A copy of the presentation material shall be available at the review for all NNC attendees (CDRL C1-1).

2.2.1.1 Program Reviews

During the contract performance period, the Contractor shall conduct Program Reviews with NASA at least once per year to: report development and production status, ensure schedules support program objectives, review action items, review program schedules, and discuss any issues. The intent of the program review is to provide a forum for open dialog between NASA and the Contractor with respect to launch services. NASA will provide status of Agency direction at the reviews. The review location shall alternate between NASA and Contractor facilities unless mutually agreed upon to do otherwise.

2.2.1.2 Design Reviews – Mission Unique

The Contractor shall conduct and chair/co-chair design reviews, as described below, that apply to the system, subsystem, component, and software level for all first flight mission unique items. Where there is not a direct match between a SOW specified mission unique design review(s) and the Contractor's standard review(s), the Contractor's review process will be acceptable provided it addresses equivalent content. For items previously flown, the following design reviews will not be required, provided the Contractor allows insight into design and prior performance of each item.

(A) Mission Unique Requirements Review (MURR)

The Contractor shall conduct a MURR prior to the Mission Unique Preliminary Design Review (MUPDR) with NNC to review the mission unique design requirements for the following items:

(i) System requirements' identification and definition to a level adequate to verify launch vehicle performance capabilities.

(ii) Design restrictions, limitations, and known violations.

(iii) Physical and mechanical interfaces (e.g., payload to launch vehicle, payload envelope, and access provisions).

(iv) Electrical interfaces (e.g., launch vehicle to payload, payload to umbilical, interfaces with electrical ground support equipment, pad electrical systems, ground batteries, telemetry, grounding, and power).

(v) Functional interfaces (e.g., structures, structural loads, and vibration).

(vi) Avionics systems and interfaces (e.g., payload avionics interfaces with launch vehicle, separation systems, telemetry interfaces, payload command and telemetry, and RF).

(vii) Mass properties.

(viii) Environmental requirements (e.g., thermal, contamination, vibration, pressure, Electromagnetic Interference/Electromagnetic Compatibility (EMI/EMC), shock, launch complex RF, and lightning).

(ix) Orbital requirements, launch vehicle performance, launch window injection, and deployment attitudes and rates.

(x) Payload/Launch Vehicle (LV) separation requirements (e.g., separation conditions, launch vehicle post-separation maneuver requirements, and telemetry).

(B) Mission Unique Preliminary Design Review (MUPDR)

The Contractor shall conduct a preliminary detailed design review prior to major commitment to drawings and design. Mission unique trade studies shall be completed prior to the MUPDR. The Contractor shall discuss analyses performed and their results along with comparisons to any similar proven designs. The Contractor shall evaluate the safety of the design and its ability to meet safety requirements. The preliminary design shall be subject to NASA's approval. NASA reserves the right to withhold approval until all action items have been closed. As a minimum, the Contractor shall provide verification of the following items at the MUPDR:

(i) All system requirements have been allocated to the subsystem and component level and the flow down is adequate to verify system performance.

(ii) The design solutions being proposed are expected to meet the performance and functional requirements.

(iii) The design does not pose major problems that may cause schedule delays.

(iv) Overall system architecture has been established and all launch vehicle to payload interfaces have been identified and are verifiable.

(v) The design solution can be produced based on existing processes and techniques; if not, risk areas, which require unique and unproved processes, are identified and risk mitigation plans are established.

(vi) An acceptable operations concept has been developed.

(vii) Preliminary LV interfaces have been defined.

(viii) Preliminary plans are established for end-to-end testing methodologies.

(ix) 30% drawings released.

(C) Mission Unique Critical Design Review (MUCDR)

The Contractor shall conduct a MUCDR prior to design freeze and before significant fabrication activity begins. The Contractor shall present a final detailed design using drawings, analyses, and evaluation testing that shows the design meets final performance and interface specifications, safety requirements, and mission objectives. The Contractor shall provide selection criteria for the evaluation tests performed to prove validity. The critical design shall be subject to NASA's approval. NASA reserves the right to withhold approval until all action items have been closed. As a minimum, the Contractor shall provide verification of the following items at the MUCDR:

(i) All technical problems and design anomalies have been resolved without compromising system performance, reliability and safety.

(ii) The detailed design will meet performance, functional requirements, and schedule.

(iii) Software simulations and prototyping results do not present any potential mission risks.

(iv) All key subsystem and/or component engineering analyses are complete.

(v) Integrated safety analysis identifying any remaining hazards and proposed resolution.

(vi) Launch vehicle/payload compatibility test plans have been defined.

(vii) 90% drawings released.

2.2.1.3 Readiness Reviews

The Pre-Mate Readiness Review, Launch Management Coordination Meeting (LMCM), Launch Readiness Review (LRR), and Flight Readiness Review (FRR) described herein will be conducted for each NASA mission.

(A) Pre-Mate Readiness Review

The Contractor shall conduct a Pre-Mate Readiness Review to demonstrate the launch site and launch vehicle are ready for payload mechanical and electrical integration. The Contractor shall conduct an LV/site walk-down [reference SOW Section 2.4.1.1(D)] with NNC participation prior to or in conjunction with the Pre-Mate Readiness Review. The Contractor shall present as a minimum:

(i) Action item status, safety status, payload mating plan, closure plan, payload integration/launch site documentation, interface verifications, checkout and launch software status, nonconformance reports, launch site status, and review of flight profile.

(ii) A detailed schedule showing all activities remaining to achieve an on-time launch.

(B) Launch Management Coordination Meeting (LMCM)

The Contractor shall participate in an LMCM conducted by NASA before each launch dress rehearsal or launch. The LMCM is used to ensure the readiness of the launch team to execute the procedures necessary to conduct the launch dress rehearsal (reference SOW Section 2.4.1.3) or launch. At this meeting, participant roles and responsibilities during countdown shall be identified. The Contractor shall develop and present a decision matrix for its launch team which defines who has authority to issue a GO, NO GO, and HOLD during launch countdown. The Contractor shall describe its launch day management activities, identify key team members, and define responsibilities and communications between the launch vehicle, NASA, and payload teams.

(C) Launch Readiness Review (LRR)

NASA will conduct/chair, and the Contractor shall participate in an LRR for each mission to ensure the specific launch vehicle is acceptable for flight

and all Range and other mission requirements have been met, or will be satisfied prior to launch. The LRR is held approximately three days before launch. As a minimum, the Contractor shall provide verification that:

(i) All critical items required to proceed into final launch countdown are ready.

(ii) Vehicle configuration is defined and all vehicle systems have been verified per launch site test plans.

(iii) All previously recorded action items have been closed or are reflected on the schedule.

(iv) All previously held Contractor's readiness review actions have been closed or resolved.

(v) Launch site/Range support organizations have committed to launch.

(vi) Tracking and data support resources are committed to launch.

(vii) Any open work is identified and closeout plans and schedules are in place and supportable.

(viii) Any constraints to launch are identified and resolution plans developed.

(ix) Mission risks are known and documented.

(x) Launch commit criteria for payload and launch vehicle is approved and released.

The Contractor shall also discuss:

(i) Anomalies from previous missions, including non-NASA missions

(ii) Hardware/software failures in the field either on our vehicle or in the fleet

(iii) Open corrective actions/problems reports

(iv) First flight items

(D) Flight Readiness Review (FRR)

NASA will conduct/chair, and the Contractor shall participate in an FRR one day prior to launch to verify all actions from the LRR are complete and final processing has been successfully completed. NASA will appoint the chairperson for this review. At the conclusion of this review, an "approval to proceed with launch countdown" is given. Representatives from the Contractor, Range, and NNC agencies sign the Certificate of Flight Readiness. The Contractor shall prepare the Certificate of Flight Readiness. A sample Certificate of Flight Readiness is provided in Exhibit 4.

2.2.2 Risk Management

The Contractor shall implement risk management techniques that address the identification, analysis, mitigation, and tracking of potential impacts to mission success. The Contractor shall develop the criteria, methods, and procedures used for identifying critical items.

2.2.3 Configuration Management

The Contractor shall perform configuration management of the launch vehicle design and production for all launch vehicle components/subsystems, hardware, and software.

2.2.4 Manifest Policy

The Contractor shall develop a manifest policy that addresses the Contractor's overall approach to ensuring timely launch of payloads. The Contractor shall provide a five-year planning manifest to the Government (CDRL C1-4) to support Government mission scheduling.

2.2.5 New Launch Vehicle Orientation

At the initiation of a new launch service the Contractor shall support an orientation briefing at KSC. This briefing shall introduce Contractor personnel and establish project interfaces with NASA personnel and describe the Contractor's organization and infrastructure. The briefing shall contain information summarizing the design, performance, fabrication, integration, testing, qualification and operational features of the launch vehicle systems and supporting facilities required to provide the launch service in the form of diagrams, schematics, pictures, drawings, videos, etc.

2.3 Mission Integration Services

2.3.1 Mission Integration Management

The Contractor shall be responsible for managing the mission integration of the payload flight and ground systems with the launch vehicle and its associated GSE. In accordance with this responsibility, the Contractor shall perform, as a minimum, the following services:

(A) Provide a single point of contact with overall mission responsibility for each mission. This single point of contact shall be responsible for coordinating support from all technical disciplines and management during the integration process.

(B) Conduct mission integration meetings (kick-off, working group, technical interchange) approximately quarterly from L-27 months to launch

(C) Provide a co-chairperson along with NASA for all working groups and technical interchange meetings. The Contractor co-chairperson shall be responsible for preparing and distributing agendas, minutes and action item logs for each meeting. The Contractor shall maintain the action item database and ensure closure of all actions.

(D) Provide appropriate technical/engineering representation at payload preliminary and critical design reviews.

(E) Plan, schedule, and manage mission analyses required to define and verify compatibility of the payload with the interface requirements and environments (reference Table D1-A, SOW paragraph 2.3.2).

(F) Track development status of and resolve issues associated with mission specific hardware and software.

(G) Coordinate interface and support requirements for the mission.

(H) Plan/coordinate mission specific flight operations.

(I) Manage integration activities at the launch site.

(J) Manage and coordinate the launch vehicle safety approval process.

(K) Prepare, maintain and implement a payload to launch vehicle ICD for each mission. Implement the ICD verification matrix. The ICD shall include all mission requirements including LV and launch site interface definition and

environments. The ICD shall include the payload to LV/launch site electrical and mechanical interface drawings (CDRL C2-1).

(L) Manage the design, development, qualification, testing and integration of mission unique requirements.

(M) Evaluate the capability of the launch vehicle and define any performance and payload volume the Contractor may make available to NASA for secondary payloads.

(N) Provide mission status to NNC throughout the launch campaign from Authority to Proceed (ATP) through mission success determination.

2.3.2 Mission Analyses

All vehicles provided under this contract shall include the following analysis for each mission as part of the standard launch service. The Contractor shall prepare and submit the standard mission analyses as listed in Table D1-A.

CDRL	ANALYSIS
C4-1	Performance and Guidance Accuracy Analysis (3 submittals)
C4-2	Final Mission Analysis (FMA)
C4-3	Payload/Expended Stage Separation Analysis (2 submittals)
C4-4	Payload Fairing Venting Analysis
C4-5	Payload Fairing Clearance Analysis (3 submittals)
C4-6	Pre-Flight Controls and Stability Analysis
C4-7	Coupled Dynamic Loads Analysis (3 submittals)
C4-8	Integrated Thermal Analysis
C4-9	RF Link Analysis
C4-10	Payload/Launch Vehicle EMI/EMC and RF Compatibility Analysis

Table D1-A: Mission Analyses to Support Payload Integration

The standard launch service shall include all analyses required to demonstrate compliance with NPD 8710.3, NASA Policy for Limiting Orbital Debris.

2.3.3 Mission Success Determination

Mission success will be based on the criteria set forth in Section C, paragraph 24.1, Mission Success Criteria. Mission success determination requirements are detailed in Section C, paragraph 24.2, Mission Success Determination.

The Contractor shall prepare and submit a Quick Look Flight Report (CDRL

C4-12) and a Final Flight Report (CDRL C4-13). Within fifteen (15) days of receipt of the Final Flight Report, the Contracting Officer will either determine the launch a Mission Success or inform the Contractor of the Government's intent to withhold determination for payload evaluation.

2.4 Launch Site Support

2.4.1 Pre-Launch Checkout and Launch Support

2.4.1.1 Launch Vehicle Preparation and Launch

For launch services provided under this contract, the Contractor shall, as a minimum;

(A) Perform all LV preparations and launch site operations necessary to safely and successfully deliver the payload to the desired orbit.
(B) Generate the required documents and obtain all required safety approvals for the LV System and integrated payload/launch vehicle system operations including payload/LV system integration and launch operations.

(C) Provide NASA access to all meetings including, but not limited to, scheduling meetings, test briefings, and technical meetings. Upon request, the Contractor shall provide copies of schedules, test briefings, and other material presented at technical meetings.

(D) Conduct LV/launch site walk-downs with NNC participation.

2.4.1.2 Telemetry Data and Launch Countdown Support

2.4.1.2.1 Baseline Vehicle Support

The Contractor shall provide, in electronic and hard copy form, all raw LV telemetry (RF and hardwire) formats used in sufficient detail to allow NASA to process and verify the data (CDRL C6-1). This shall include a detailed listing and description of all measurements and calibration coefficients for all LV telemetry (TM) links including the guidance system.

Upon NASA request, the Contractor shall provide NASA with a test tape representative of the telemetry (RF and hardwire) signals of the launch vehicle and GSE sufficiently prior to the initial power-up test on each mission to allow NASA to verify its ability to process the Contractor's telemetry (SDL S6-1). Upon NASA request, the Contractor shall submit an end-to-end link test plan (SDL S6-2). The Contractor shall ensure proper operation of all LV telemetry links (RF and hardwire), voice communication channels, and video to the NASA ground telemetry station prior to baseline launch vehicle processing. Upon NASA

request, the Contractor shall provide an electronic copy and/or a magnetic tape of all significant vehicle test data (SDL S6-3). Upon NASA request, the Contractor shall provide real-time LV telemetry (RF and hardwire) data to NASA's ground telemetry station(s). Examples include, but are not limited to telemetry test data during initial vehicle power application, flight simulation prior to payload mate, and flight simulation following payload mate.

2.4.1.2.2 Integrated Support

Upon NASA request, the Contractor shall provide an electronic copy and/or a magnetic tape of all integrated test data (SDL S6-3). Upon NASA request, the Contractor shall provide real time integrated test telemetry (RF and hardwire) data to NASA's ground telemetry station(s).

2.4.1.2.3 Launch Countdown and Flight Support

The Contractor shall provide launch countdown procedures, Mission Constraints Documents (CDRL C1-2) and a Mission Console Notebook (CDRL C1-3).

The Contractor shall provide NASA personnel access to consoles, with vehicle monitoring capabilities, co-located within the Contractor's launch control center as described in Exhibit 2. The Contractor shall provide access to real-time telemetry (RF and hardwire), voice communication channels with talk/listen capabilities, video and telephones for the co-located NASA personnel.

The Contractor shall deliver real-time LV telemetry (RF and hardwire), voice communication channels and video to the NASA ground telemetry station and the Payload Operation Control Center (POCC) from the start of launch countdown through Range Loss of Signal (LOS) when in range of an existing ground receiving station, or as supplemented as described in SOW paragraph 2.4.3, Range Support and Services. NASA will be responsible for any distribution off base. If the LV telemetry, voice communication channels or video is uniquely encoded, the Contractor shall provide the decoded LV telemetry, voice communication channels, and video.

The Contractor shall receive and record the raw LV telemetry data for all phases of powered flight, from two (2) minutes prior to stage ignition through 60 seconds after stage shutdown. T he Contractor shall receive and record LV telemetry from 120 seconds prior to and 60 seconds after payload separation. For all mandatory receive and record vehicle TM coverage times, real time transmission back to the NASA TM station shall be provided whenever possible. Post launch and upon request, the Contractor shall provide the raw telemetry data recorded (SDL S6-3).

During the Launch Countdown, the Contractor shall poll NASA at key milestone events for GO/NO-GO status. The final poll shall include the NASA Launch Manager's GO/NO-GO status for launch. The Contractor shall provide NASA access to anomalies and concurrence with anomaly resolution prior to proceeding with Launch Countdown. The Contractor shall poll NASA for any recycle of the Launch Countdown.

2.4.1.3 *Launch Dress Rehearsal*

The Contractor shall conduct a minimum of one Dress Rehearsal prior to launch. The rehearsal shall exercise the launch countdown procedure, and will have the participation of the NNC and LV Contractor launch teams. The rehearsal may use an abbreviated countdown script with simulated payload/vehicle conditions, including anomalies.

2.4.2 Launch Site Payload Support

2.4.2.1 Payload Processing Facility

For launches conducted from CCAFS and VAFB, NASA will provide the Payload Processing Facility (PPF) unless processing services are purchased as a non-standard service. In the event the Contractor proposes and NASA approves an alternate launch site, the Contractor shall be responsible for providing a PPF, subject to NASA approval, meeting the payload requirements.

2.4.2.2 Launch Site Payload Integration Support

The Contractor shall provide all services, equipment, and support required for the integration and launch of each payload. Services shall include, as a minimum, the following:

(A) Encapsulation of the payload complement at the PPF, for either flight or transport to the launch complex, mate with the LV and performance of integrated checkout activities.

(B) Verification of the end-to-end functionality of the umbilical lines provided for payload use.

(C) Support for the installation and checkout of the payload GSE (provided by the payload customer) at the launch site, and payload communication accommodations from the pad to the PPF. The Contractor shall also provide for a payload safety console at the Contractor's launch control center.

(D) Provision of the mountings for, and the installation of, the payload GSE (provided by the payload customer) at the launch complex and/or remote sites.

(E) Provision for contingency off-loading of payload propellants in accordance with the appropriate Range Safety requirements and appropriate payload procedures.

(F) Provision of launch site services to meet payload requirements such as: power, air conditioning, GN_2/GHe purges, and contamination control.

(G) Support of all activities required to de-mate and to return the payload to the processing facility if necessary.

(H) Preparation of the procedures for integrated LV/payload operations for NASA approval and incorporation of the payload procedures as appropriate (CDRL C5-5).

(I) Coordination of payload and LV operations into an integrated operational flow, preparation of the schedules, and provision of the schedules with updates as needed to NNC.

(J) Provision of contamination control for payloads while they are in the possession of the Contractor, or in a Contractor-provided PPF per the SOW, paragraph 2.4.2.3.

(K) Provision of a payload protective cover for use after payload mate to the LV, if the fairing is installed at the launch pad. The cover shall be purged with conditioned air meeting the minimum requirements stated in the SOW, paragraph 2.4.2.3(C). Provisions shall be made for payload personnel ingress and egress.

(L) Certification of payload contamination control requirements for: fairing surface cleanliness, cleanroom environments, and purge system cleanliness.

(M) Support for the installation of customer provided RF re-radiating equipment.

(N) Provision for the planning and execution of activities associated with the integrated testing of the customer's payload with the LV on the launch pad.

2.4.2.3 Contamination and Environmental Control

The Contractor shall provide and implement a generic payload contamination control plan and, if required, provide and implement a contamination control implementation plan for each payload. Using MIL-STD-1246C, MIL-PRF-27401D, FED-STD-209E, and NASA RP-1124 (Rev-4) as guidelines, the launch service shall meet the following minimum requirements:

(A) Payload/Vehicle Integration Environment. For all Contractor provided facilities where the payload resides and is exposed (including payload processing facilities, integration facilities, or facilities at the launch pad), a Class 100,000 clean room environment per FED-STD-209E shall be provided. In addition, the environment shall be maintained within a temperature and humidity range described in Exhibit 2. This environment shall be maintained at all times unless the payload is encapsulated within a transportation container or payload fairing and purge air has been established per 2.4.2.3(B) or (C), herein. If the Contractor provides a payload protective cover as identified in paragraph 2.4.2.2(K) of the SOW, and purge air has been established, the facility environment may be exceeded. Prior to removal of the payload protective cover, the facility shall be returned to a Class 100,000 clean room environment. The Contractor shall provide contamination and environmental monitoring when the payload is exposed.

(B) Transportation Environment. The following shall apply to all payload transportation containers (including the payload fairing, if used for transportation) provided by the Contractor. Following payload encapsulation, the transportation container shall be purged with conditioned filtered air or GN_2 and the payload environment shall be maintained within a temperature and humidity range described in Exhibit 2. The Contractor shall identify periods or configurations where the temperature and humidity requirements cannot be met. Conditioned air filtration shall be capable of removing 99.97% of all particles greater than 0.3 microns and removing 95% of all hydrocarbons with a molecular weight greater than 70. GN_2 shall be Grade A, Type 1, (or better) per MIL-PRF-27401D. Transportation GN_2 purging or conditioned air shall not impinge directly on the payload at any point.

(C) Fairing Environment. Following fairing installation and payload mate to the LV, the PLF environment shall be purged with conditioned filtered air and shall maintain a temperature set point range, selectable by the payload within the values of Exhibit 2, and controllable to the values of Exhibit 2, through T-0. Relative humidity shall be maintained within 30% to 60%. The Contractor shall identify periods or configurations where the temperature and

humidity requirements cannot be met. Conditioned air filtration shall be capable of removing 99.97% of all particles greater than 0.3 microns and removing 95% of all hydrocarbons with a molecular weight greater than 70. After the fairing has been closed out for flight, Grade A, Type 1, GN_2 (or better) per MIL-PRF-27401D, may be used for purging the fairing environment. Fairing GN_2 purging or conditioning air shall not impinge directly on the payload at any point.

(D) Fairing Internal Surface Cleaning. The internal surfaces of the payload fairing shall be cleaned, certified, and maintained to MIL-STD-1246C Level 750A, or better.

(E) Clean Room Garments. Personnel garments used, at a contractor facility, in the integration of the payload shall be provided and cleaned by the Contractor. Personnel garments used in the integration of the payload shall comply with accepted clean room and personnel safety operating standards as specified in the mission specific contamination control plan.

(F) Materials. All materials used in areas in close proximity to the payload shall be selected based on NASA RP-1124 (Rev-4). Materials shall have a Total Mass Loss (TML) of less than 1.0% and Collected Volatile Condensable Materials (CVCM) of less than 0.10%, or be expressly identified and submitted to NASA for approval.

2.4.2.4 Operational Support Services

The Contractor shall provide safety training, instruction, and certification for all Contractor-operated or provided integration facilities and launch sites to ensure users are aware of facility, launch site, launch vehicle and payload hazards and have adequate knowledge to carry out their tasks unescorted in a safe manner. The Contractor shall provide access for payload personnel to the payload/LV or storage facilities to accommodate payload customer requirements. The Contractor shall provide security to meet the requirements for payload or personnel protection.

2.4.3 Range Support and Services

Launch vehicles provided under this contract shall include all hardware, software, analysis and support necessary to meet the requirements of EWR 127-1, Eastern/Western Range Safety Requirements.

As part of the launch service, the Contractor shall make all launch Range support arrangements for: scheduling Range for launch and integrated testing, Range Safety functions, communications and timing, metric C-band beacon (radar) coverage, telemetry coverage, camera coverage of launch, and tracking

and telemetry station acquisition predictions. If required, NASA will provide down range telemetry aircraft, Tracking and Data Relay Satellite System (TDRSS) and/or NASA owned ground station support for tracking and data recovery. The Contractor shall be responsible for coordinating and ensuring all tracking and data recovery support meets mission requirements (CDRLs C2-3 and C2-4).

The Contractor shall make arrangements for Range provided services necessary to support the launch service. As a minimum, the following services are to be provided: fluids, gases, propellants, ordnance storage, facility usage, equipment support, shop and laboratory services, meteorology, base security, fire protection and environmental health.

The mission specific Program Requirements Document/Operational Requirements (PRD/OR)(CDRL C2-2), or equivalent mission specific Range support documentation, shall be submitted to obtain Range support. The Contractor, with support from NASA, shall complete all forms pertinent to the mission and submit them to the appropriate Range for formal acceptance.

2.5 Safety, Reliability, and Quality Assurance

During the period of performance the Contractor shall establish, implement, and maintain comprehensive safety and health, reliability and quality assurance programs covering program management, mission integration management, and the design, development, production, test, integration and launch of the LVS.

2.5.1 Safety and Health Program

The Contractor shall provide a Safety and Health Plan that will implement safety requirements consistent with federal, state, and local government regulations and applicable NASA and Range Safety and Health requirements. This Plan shall describe the Safety organization including structure of management interfaces. Methods employed to ensure compliance with applicable safety requirements shall be identified in accordance with EWR 127-1. When the contractor is performing work in any NASA owned or operated facility (e.g., buildings 836 and 1610 at VAFB, SAEF-2 and PHSF at KSC), all NASA requirements and documentation as contained in the SOW, paragraph 1.3, Compliance Documents, shall be adhered. Each Contractor employee on NASA property, or custodian of NASA assets elsewhere, is responsible for reporting mishaps (CDRL C3-2). The Contractor shall make provisions for NASA safety representative insight into integrated Payload/LV processing.

The Contractor shall implement a system safety program, which identifies and controls system/subsystem hazards that affect personnel, flight hardware and facilities.

2.5.2 Reliability Program

The Contractor shall implement and maintain a Reliability Program with an overall vehicle design reliability of no less than 95% at an 80% confidence factor. The Contractor's program shall facilitate evaluation of the Contractor and subcontractor's programs to determine if the product meets the overall design reliability requirements. Overall vehicle reliability predictions shall be incrementally revised to reflect design modifications.

2.5.3 Quality Assurance Program

The Contractor shall maintain a quality management system that is ISO 9001 third party certified. The Registrar shall be accredited by either the International Registrar of Certified Auditors (IRCA) or the Registrar Accreditation Board (RAB). In the event the Contractor certification is revoked, NASA shall be notified within 5 business days (CDRL C3-3).

The Contractor shall maintain a Software Assurance Program using ISO 9000-3 as a guideline.

The Contractor shall accommodate NASA participation in Contractor and subcontractor ISO audits. NASA insight will consist of monitoring audits with the Contractor's auditors and inspectors in order to provide understanding of the Contractor's quality system and insight of their processes.

The Contractor shall support NASA performance of ISO 2nd party audits, as required. The audits will be performed in accordance with ISO 10011 requirements. The Contractor shall provide a current Audit Plan and schedule for in-house and sub-Contractor audits upon request from NASA (SDL S3-1). The Contractor shall provide a copy of both the Contractor performed internal Quality Audit Report and the subcontractor/vendor Quality Audit Reports (SDL S3-2), when requested by NASA.

The Contractor shall provide for NASA attendance at any flight hardware reviews the Contractor performs at Contractor or subcontractor facilities. The Contractor shall make available to NASA any build paper, test results, nonconformance reports, discrepancy history, statistical process control, and failure analyses that are relevant to the reviews.

The Contractor shall provide read-only quality information to NASA (via remote terminal) from such Quality Assurance on-line database systems as exist and to which the Contractor has regular and timely input. An example is an on-line Problem/Failure Reporting (P/FR) system.

The contractor shall provide NASA all anomaly resolutions that affect the integrated payload/launch vehicle assembly, including both hardware and software. NASA will approve all integrated payload/launch vehicle anomaly resolutions. The contractor shall provide insight to Material Review Board (MRB) and failure reporting for all criticality 1 anomalies.

The Contractor shall participate in the Government/Industry Data Exchange Program (GIDEP) and provide Alert System Documentation (CDRL C3-1).

2.6 NASA Insight and Approval

The Contractor shall comply with the Government's implementation of NPD 8610.23 and NPD 8610.24 as defined under Section C, Clause 25.0 and the SOW paragraph 2.2.1, Formal Reviews. As part of the standard launch service, the Contractor shall provide the data, documentation, drawings, analytical models, and support services as necessary to accommodate the requirements specified under contract Section C, Clause 25.0, Government Insight and Approval.

The Contractor shall notify NASA of qualification or test anomalies involving similar launch vehicles, systems, subassemblies and components. The Contractor shall make available to NASA all problem reports or discrepancy reports on LV systems' failures and anomalies. This shall include insight into fleet-wide problems, anomalies, MRB actions, deviations or waivers to systems, subsystems, materials, processes, and test equipment including those used on non-NASA missions.

In the event of an anomaly or launch failure, the Contractor shall support NASA's Failure Review Board, if activated, or shall allow NASA to fully participate in the Contractor's Failure Investigation Board including those for non-NASA missions.

NASA may elect to have representation as a resident office at the Contractor's major manufacturing and engineering facilities for the life of the contract. The Contractor shall provide accommodations and services, such as badging, furniture, telephones, and use of easily accessible fax, viewgraph, and copy machines from one to three residents and up to four visitors. A minimum of two voice and two data phone lines shall be provided. Electronic data transfer compatibility between the resident office and off-site NASA institutions is required. A 'Resident Office' will not be required at CCAFS or VAFB, but NASA will require operational support accommodations (i.e. office space, power, phone, communication boxes for monitoring vehicle testing, etc.) at the launch complex during NASA launch operations.

3.0 NON-STANDARD SERVICES

The Contractor shall provide the non-standard services identified in Exhibit 3 as directed by the Contracting Officer. Implementation of all non-standard services shall be fully compliant with this SOW.

4.0 MISSION UNIQUE REQUIREMENTS

The Contractor shall provide the mission unique services identified in Exhibit 5 as directed by the Contracting Officer. Implementation of all mission unique services shall be fully compliant with this SOW.

4.1 Mission Unique Hardware

The Contractor shall design, manufacture, test, and qualify for flight the mission unique hardware that is required to support the payload and mission. The Contractor shall prepare and submit drawings (CDRL C5-4), test plans (CDRL C5-2), and test reports (CDRL C5-3) to support NASA insight and approval of mission unique hardware.

For vehicle changes initiated by the Contractor that are not fleet-wide changes, the Contractor shall prepare and submit a vehicle data package (CDRL C5-1).

The Contractor shall use MIL-STD-1540 B or C as a guideline when developing environmental qualification and acceptance criteria and related test and analysis. Factors of safety for mission unique hardware shall meet the requirements of Table D1-B.

Application	Test		Analysis (No Test)	
	Yield	Ultimate	Yield	Ultimate
Non-Man Rated	1.10	1.25	1.65	1.90

Table D1-B: Mission Unique Hardware Factors of Safety

4.2 Mission Unique Software

The Contractor shall provide source code and mission constants' listings (CDRL C4-11) with appropriate requirement specifications to support NASA approval of mission unique software. The Contractor shall prepare and submit a pre-flight control system and stability analysis report (CDRL C4-6) for the vehicle and mission unique software used for each mission.

4.3 Unanticipated Mission Unique Services

At the time of contract award, the Government may not have identified all mission unique services required for each mission. As unanticipated mission unique services are identified, the Contracting Officer will authorize the Contractor, in accordance with FAR 52.243-1, Changes – Fixed Price Alt I, to perform these services. In performing unanticipated mission unique services, the Contractor shall design the necessary ground and flight hardware/software; conduct appropriate design reviews; and manufacture, test and qualify for flight LV mission unique hardware/software, i.e., other than that provided as a standard service (Exhibit 2) or described in the non-standard services list (Exhibit 3). The Statement of Work for authorized unanticipated mission unique services is in the SOW paragraph 9.0.

5.0 SPECIAL TASK ASSIGNMENTS

The Contractor shall be required to perform special studies and analyses, provide materials, or fabricate hardware in support of this contract. Each task will be initiated by written direction from the NASA Contracting Officer. At the Contracting Officer's discretion, these tasks generally include: advance planning and feasibility studies in support of future contemplated missions; analyses in support of change requirements to authorized missions; development, fabrication, and test of hardware/software to support planning studies or special tests; mission unique studies; material provision; and hardware fabrication in support of missions.

6.0 RESERVED

7.0 GUIDELINE DOCUMENTS

The following documents are to be used as guidelines to the extent specified in this SOW.

Document No	Rev.	Document Title
AFSPCI 10-1213	7/1/98	Spacelift Launch Strategy and Scheduling Procedures
FED-STD-209	E	Airborne Particulate Cleanliness Classes in Cleanrooms and Clean Zones
IRIG-106-99		Telemetry Standards
ISO 9000-3		Application of ISO 9001 to Software Development
ISO 10011		Guidelines for Auditing Quality System
JSC SN-C-0005	D	Contamination Control Requirements
MIL-STD-1553[1]	B	Digital Time Division Command/Response Multiplex Data Bus
MIL-STD-1540	B or C	Test Requirements for Launch, Upper-Stage, and Space Vehicles
MIL-STD-176	A, Notice 1	Weight and Balance Data Reporting Forms for Guided Missiles and Space Launch Vehicles
MIL-STD-1773	Notice 1	Fiber Optics Mechanization of an Aircraft Internal Time Division Command/Response Multiplex Data Bus
MIL-STD-1246	C, Notice 3	Product Cleanliness Levels and Contamination Control Program
MIL-PRF-27401	D	Performance Specification, Propellant Pressurizing Agent, Nitrogen
NASA RP-1124	4	Outgassing Data for Selecting Spacecraft Materials

[1] MIL-STD-1773 may be substituted

8.0 REFERENCE DOCUMENTS

The following documents are hereby incorporated by reference. The Contractor shall comply with the Government's implementation of these policies and instructions.

Document No.	Document Title
NPD 8610.23	NASA Insight and Approval
NPD 8610.24	Expendable Launch Vehicle (ELV) Launch Services Pre-launch Reviews
NPD 8610.7	Launch Services Risk Mitigation Policy for NASA-Owned or NASA-Sponsored Payloads
PMI K-ELV-10.2	ELV Program Management Instruction for Launch Vehicle Qualification

9.0 Unanticipated Mission Unique Services Statement Of Work

CLIN 2 – Launch Service for Deep Impact – Mission Unique Services Statement of Work:

A. TEST PAYLOAD ATTACH FITTING (PAF) AND SEPARATION SYSTEM SUPPORT

1. The contractor shall provide a basic 3712C PAF structure without ordnance, electrical, nutation control and propulsion systems. The PAF structure shall have attach provisions for separation system extractors, retainers and umbilical brackets such that the test PAF could support spacecraft shock and environmental testing. The extractors, retainers and umbilical brackets are not required as part of this test PAF.

2. The contractor shall provide two test separation bands with Ground Support Equipment (GSE) band end bolts. These test bands shall be capable of being configured with flight bolts and bolt cutters for support of shock tests. The flight bolts and bolt cutters are not required as part of this test separation system.

3. This test PAF and separation system shall be delivered to Ball Aerospace and Technology Corporation in Boulder, Colorado before June 1, 2002. It will remain in use for the Deep Impact Mission until launch. The test PAF and separation shall be designated as Government Property accountable to Contract NAS10-00-001.

9.0 Unanticipated Mission Unique Services Statement of Work (continued)

CLIN 10 – MER-B (Mars Exploration Rover II 2003)

MODIFICATION CO 37

The contractor shall provide the recurring effort to fabricate, assemble and install a payload fairing access door similar to, and in the same location as, the MER-A door (Sta 373.225 and centerline at 157.382 degrees).

MODIFICATION CO 43

The contractor is directed to proceed with the procurement of long lead ordnance hardware listed below for the implementation of the Star 48 Break-up System and Flight Termination System Modification. The labor and material associated with these long lead items is authorized.

EBA&D
FCDC ETA's (4)
T's (2)

UPCO
TLX (6)
CTLX (2)
Relay Boxes (4)

ALLIANT
Conical Shape Charges (2)

MODIFICATION 54

The contractor shall provide all effort and materials necessary to implement the Star 48 Motor Breakup system for the MER B mission as defined by the recurring portion negotiated and agreed to for the MER A mission under Contract NAS5-32933.

9.0 Unanticipated Mission Unique Services Statement of Work (continued)

CLIN 16 - STSS

The Contractor shall provide 61-pin connectors in lieu of the standard service 37-pin connector at no increase in contract value. The STSS Spacecraft shall provide the Payload Attach Fitting (PAF) in lieu of the standard service 6915 PAF provided by the Contractor.

Exhibit 1
CAPABILITIES, SPECIFICATIONS, AND ENVIRONMENTS

The following performance capabilities, specifications, and environments are part of our proposed launch services. When mutually agreed upon by The Boeing Company and NASA, Boeing will incorporate available improvements in performance, accuracy, environments, and interfaces whether or not they are contained in the User Guide(s).

1.0 VEHICLE CONFIGURATION

Table E1-1 defines the vehicle, solid rocket motors, upper stage, payload adapter, and payload fairing configuration options comprising the family of vehicles available through the NASA Launch Services contract. These configurations include all standard electrical systems, mechanical systems, propulsion systems, ordnance devices, and flight instrumentation.

Table E1-1. Vehicle Configurations

Vehicle configuration ID No.	Delta II 2320	Delta II 2420	Delta II 2920	Delta II 2920H	Delta III 3940	Delta IV 4040	Delta IV 4240	Delta IV 4450	Delta IV 4050H
Solid Rocket Motors (SRM)									
Standard Delta II 40-in.-dia. Graphite-epoxy motor (GEM)	3	4	9						
Delta III 46-in.-dia GEM				9	9				
Delta IV 60-in.-dia GEM							2	4	
Upper Stage									
Star-37FM solid motor	X	X	X	X					
Star-48B solid motor	X	X	X	X					
Payload Adapter (PA)									
5624 43 kg	X	X	X	X					
6306 47 kg	X	X	X	X					
6019 67 kg	X	X	X	X					
6915 94 kg Delta II baseline*	X	X	X	X					
37C DPAF 363 kg	X	X	X	X					
3724 64 kg, Star-37FM, third stage	X	X	X	X					
3712 59 kg, Star-48B, third stage	X	X	X	X					
1666-4 191 kg Delta III baseline*					X	X	X		
1194-4 238 kg Delta IV baseline (4 m)*						X	X		
1575-4 269 kg						X	X		
1194-5 393 kg Delta IV baseline (5 m)*								X	X
Payload Fairing (PLF)									
9.5 9.5-ft-(2.9-m)-dia metal	X	X	X	X					
10 10-ft-(3-m)-dia composite	X	X	X	X					
10L 10-ft-(3-m)-dia stretched composite			X	X					
11 4-m-dia composite, 10.8 m (35.5 ft) long					X				
12 4-m-dia composite, 11.7 m (38.5 ft) long						X	X		
14 5-m-dia composite, 14.3 m (47 ft) long								X	
19 5-m-dia composite, 19 m (62.7 ft) long									X

*Note: Baseline PAs and the masses shown are used for the corresponding performance tables in Section 2

Figure E1-1 shows the Delta II/III/IV vehicle designator system.

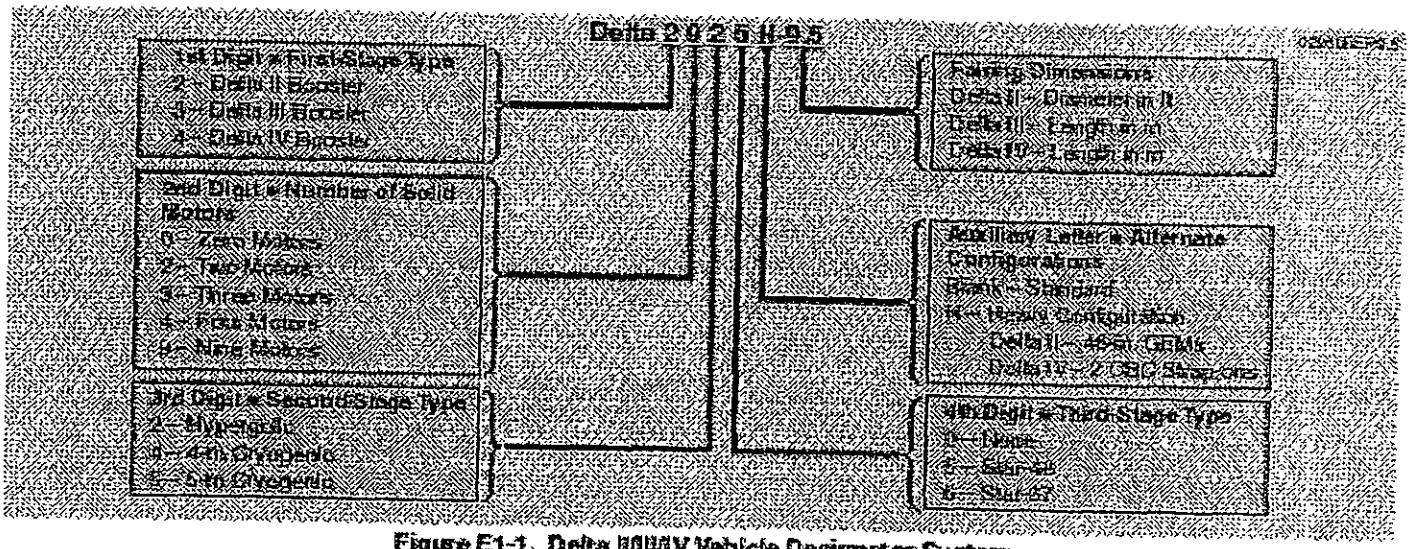


Figure E1-1. Delta II/III/IV Vehicle Designator System

2.0 PAYLOAD DELIVERY CAPABILITY

The launch program, services, and vehicle model(s) proposed are capable of supporting launches with any of the orbits and maximum separated payload masses defined in Tables E1-1 through E1-22. Note that inclinations of 70 deg or greater require a Vandenberg Air Force Base (VAFB) Western Range launch. Delta II 2920H and Delta III launches are not available at VAFB. Three-stage missions from VAFB are shown for reference purposes only and can be made available through a mission-unique proposal for the recurring and nonrecurring effort. Only one payload fairing, as shown in Table E1-1, is available for Delta III and each Delta IV configuration.

Alternate payload adapters (PA) are available as indicated in Table E1-1 (the performance shown assumes a baseline PA). The separated payload masses in Tables E1-2 through E1-22 may be modified for differing PAs by adjusting mass values for the difference between the masses of the selected PA and the baseline PA as indicated in Table E1-1.

The Delta IV 1194-4 PA cannot accommodate a payload greater than 6000 kg for a center of gravity (CG) more than 2 m above the payload separation plane. The Delta IV 1194-5 PA cannot accommodate a payload greater than 7000 kg for a CG more than 2 m above the payload separation plane.

The maximum payload capabilities presented herein are based on Delta standard practice second-stage propellant reserve that allows for a high probability (99.7%) of command shutdown (PCS) on the vehicle's guided second stage.

The payload capabilities presented represent the maximum values that can be offered at this time. The margins and reserves identified below are for the exclusive use of Boeing and are not to be construed as additional capability that is available to the spacecraft. Once specific mission requirements, such as launch date, PA, and complete orbit definition, are available, performance capability can be updated to be consistent with these requirements. Please note that no additional propellant reserve has been maintained to allow for spent orbiting upper-stage hardware orbit/re-entry for debris mitigation.

Delta II Generic Assumptions

Delta III Generic Assumptions

Delta IV Generic Assumptions

Maximum LEO Performance Assumptions (Delta II, III)

Maximum LEO Performance Assumptions (Delta IV)

D1-E1.2-4

Table E1-2. Maximum Low-Earth-Orbit (LEO) Payload Capability for Delta II 2320 Configurations

Orbit altitude (km)	Separated payload mass (kg)									
	Delta II 2320-9.5					Delta II 2320-10				
	Inclination (deg)					Inclination (deg)				
	28.5	38	60	70	90	28.5	38	60	70	90
200	2650	2576	1821	1913	1945	2549	2477	1746	1836	1867
300	2575	2503	1763	1854	1885	2476	2406	1690	1778	1808
400	2504	2433	1708	1797	1827	2406	2337	1636	1723	1752
500	2435	2365	1655	1742	1772	2339	2271	1584	1669	1698
600	2369	2300	1604	1690	1719	2275	2207	1534	1618	1647
700	2305	2237	1555	1639	1668	2212	2146	1486	1569	1597
800	2244	2177	1507	1590	1619	2152	2087	1440	1521	1549
900	2185	2119	1462	1544	1571	2095	2031	1396	1476	1503
1000	2128	2063	1418	1498	1526	2039	1976	1353	1432	1458
1100	2073	2009	1376	1455	1482	1986	1924	1312	1389	1415
1200	2020	1957	1335	1413	1439	1934	1873	1273	1348	1374
1300	1968	1907	1296	1373	1399	1884	1824	1234	1309	1334
1400	1919	1858	1258	1334	1359	1836	1777	1197	1271	1296
1500	1871	1811	1222	1296	1321	1790	1731	1162	1234	1259
1600	1825	1766	1187	1260	1285	1745	1687	1128	1199	1223
1700	1781	1723	1152	1225	1249	1701	1645	1094	1165	1189
1800	1738	1680	1120	1191	1215	1659	1604	1062	1132	1155
1900	1696	1640	1088	1158	1182	1619	1564	1031	1100	1123
2000	1656	1600	1057	1126	1150	1580	1525	1001	1069	1092

Table E1-3. Maximum LEO Payload Capability for Delta II 2420 Configurations

Orbit altitude (km)	Separated payload mass (kg)									
	Delta II 2420-9.5					Delta II 2420-10				
	Inclination (deg)					Inclination (deg)				
	28.5	38	60	70	90	28.5	38	60	70	90
200	3046	2963	2187	2293	2329	2963	2882	2109	2212	2247
300	2963	2881	2120	2225	2260	2881	2802	2044	2146	2180
400	2882	2802	2056	2159	2194	2802	2724	1982	2082	2116
500	2805	2726	1995	2096	2130	2727	2649	1923	2021	2054
600	2730	2652	1936	2035	2069	2653	2577	1865	1962	1994
700	2658	2581	1880	1977	2010	2583	2508	1810	1905	1937
800	2588	2513	1825	1921	1953	2515	2441	1757	1850	1882
900	2521	2447	1773	1867	1899	2449	2376	1706	1798	1829
1000	2457	2383	1722	1815	1846	2386	2314	1657	1747	1778
1100	2394	2322	1673	1765	1796	2325	2254	1610	1698	1728
1200	2334	2263	1627	1716	1747	2266	2196	1564	1651	1681
1300	2276	2205	1581	1670	1700	2209	2140	1520	1606	1635
1400	2220	2150	1538	1625	1654	2154	2086	1477	1562	1591
1500	2165	2097	1496	1581	1610	2101	2034	1437	1520	1548
1600	2113	2046	1455	1539	1568	2049	1984	1397	1479	1507
1700	2062	1996	1416	1499	1527	2000	1935	1359	1440	1467
1800	2013	1948	1378	1460	1488	1952	1888	1322	1402	1429
1900	1966	1901	1341	1422	1449	1905	1842	1286	1365	1392
2000	1920	1856	1306	1386	1413	1861	1798	1252	1329	1356

Table E1-4. Maximum LEO Payload Capability for Delta II 2920 Configurations

Orbit altitude (km)	Separated payload mass (kg)														
	Delta II 2920-9.5					Delta II 2920-10					Delta II 2920-10L				
	Inclination (deg)					Inclination (deg)					Inclination(deg)				
	28.5	38	60	70	90	28.5	38	60	70	90	28.5	38	60	70	90
200	4914	4766	2907	3285	3684	4738	4591	2815	3185	3576	4638	4493	2750	3115	3499
300	4785	4639	2822	3193	3585	4610	4466	2732	3095	3478	4511	4369	2668	3025	3403
400	4661	4518	2740	3104	3489	4487	4345	2652	3008	3385	4390	4250	2590	2940	3311
500	4541	4401	2662	3019	3397	4368	4229	2576	2925	3294	4273	4136	2514	2858	3222
600	4427	4289	2586	2937	3308	4255	4118	2502	2845	3208	4161	4027	2442	2779	3137
700	4316	4181	2514	2859	3223	4146	4011	2432	2768	3125	4054	3922	2373	2704	3055
800	4210	4077	2445	2783	3141	4041	3909	2364	2694	3045	3950	3821	2306	2631	2976
900	4108	3977	2378	2710	3063	3939	3810	2299	2623	2968	3851	3723	2242	2561	2900
1000	4010	3881	2314	2641	2987	3842	3715	2236	2555	2894	3755	3630	2180	2494	2827
1100	3915	3788	2253	2573	2914	3749	3624	2176	2489	2822	3663	3540	2121	2429	2757
1200	3823	3698	2193	2509	2843	3659	3536	2118	2426	2753	3574	3453	2064	2367	2689
1300	3735	3612	2136	2446	2776	3572	3451	2063	2365	2687	3489	3370	2010	2307	2624
1400	3650	3529	2081	2386	2710	3488	3369	2009	2307	2623	3407	3290	1957	2249	2561
1500	3568	3449	2028	2328	2647	3407	3290	1957	2250	2562	3327	3212	1906	2194	2500
1600	3489	3372	1977	2272	2586	3330	3214	1907	2195	2502	3251	3138	1857	2140	2442
1700	3413	3297	1928	2218	2527	3255	3141	1859	2143	2445	3177	3066	1810	2088	2385
1800	3339	3225	1881	2166	2471	3182	3071	1813	2092	2389	3106	2996	1764	2038	2331
1900	3267	3155	1835	2116	2416	3112	3002	1768	2043	2336	3037	2929	1720	1990	2278
2000	3198	3088	1790	2067	2363	3045	2936	1725	1995	2284	2971	2864	1678	1943	2227

Table E1-5. Maximum LEO Payload Capability for Delta II 2920H Configurations

Orbit altitude (km)	Separated payload mass (kg)														
	Delta II 2920H-9.5					Delta II 2920H-10					Delta II 2920H-10L				
	Inclination (deg)					Inclination (deg)					Inclination (deg)				
	28.5	38	60	70	90	28.5	38	60	70	90	28.5	38	60	70	90
200	5763	5556	3683	N/A	N/A	5628	5425	3587	N/A	N/A	5530	5330	3519	N/A	N/A
300	5610	5407	3572	N/A	N/A	5478	5278	3478	N/A	N/A	5382	5185	3411	N/A	N/A
400	5463	5263	3465	N/A	N/A	5333	5137	3374	N/A	N/A	5239	5046	3309	N/A	N/A
500	5321	5126	3364	N/A	N/A	5194	5002	3274	N/A	N/A	5103	4913	3210	N/A	N/A
600	5186	4993	3266	N/A	N/A	5061	4873	3178	N/A	N/A	4972	4786	3116	N/A	N/A
700	5055	4867	3173	N/A	N/A	4933	4748	3087	N/A	N/A	4845	4663	3026	N/A	N/A
800	4930	4745	3083	N/A	N/A	4810	4629	2999	N/A	N/A	4724	4545	2940	N/A	N/A
900	4809	4627	2998	N/A	N/A	4692	4514	2915	N/A	N/A	4608	4432	2857	N/A	N/A
1000	4694	4515	2916	N/A	N/A	4578	4403	2834	N/A	N/A	4496	4323	2777	N/A	N/A
1100	4582	4406	2837	N/A	N/A	4469	4296	2757	N/A	N/A	4388	4218	2701	N/A	N/A
1200	4475	4302	2761	N/A	N/A	4364	4194	2683	N/A	N/A	4284	4117	2628	N/A	N/A
1300	4371	4201	2688	N/A	N/A	4262	4095	2611	N/A	N/A	4184	4020	2557	N/A	N/A
1400	4271	4104	2618	N/A	N/A	4164	4000	2543	N/A	N/A	4088	3926	2490	N/A	N/A
1500	4175	4011	2551	N/A	N/A	4070	3909	2477	N/A	N/A	3995	3836	2425	N/A	N/A
1600	4083	3921	2486	N/A	N/A	3979	3820	2414	N/A	N/A	3905	3749	2362	N/A	N/A
1700	3993	3834	2424	N/A	N/A	3891	3735	2353	N/A	N/A	3819	3665	2302	N/A	N/A
1800	3907	3750	2364	N/A	N/A	3806	3653	2294	N/A	N/A	3735	3584	2244	N/A	N/A
1900	3823	3669	2306	N/A	N/A	3725	3573	2237	N/A	N/A	3655	3506	2189	N/A	N/A
2000	3743	3591	2251	N/A	N/A	3646	3497	2183	N/A	N/A	3577	3430	2135	N/A	N/A

Note: Delta 2920-H is not available for Western Range (WR) launches, 70- and 90-deg inclinations.

Table E1-6. Maximum LEO Payload Capability for Delta III and Delta IV

Orbit altitude (km)	Separated payload mass (kg)														
	Delta III 3940-11					Delta IV 4040-12					Delta IV 4240-12				
	Inclination (deg)					Inclination (deg)					Inclination (deg)				
	28.5	38	60	70	90	28.5	38	60	70	90	28.5	38	60	70	90
200	8005	7836	6160	N/A	N/A	8763	8661	7977	7871	7286	11698	11560	10163	10495	9847
300	7880	7713	6050	N/A	N/A	8752	8631	7945	7826	7256	11651	11528	10136	10469	9812
400	7759	7593	5943	N/A	N/A	8714	8589	7904	7786	7213	11623	11498	10093	10426	9753
500	7642	7477	5839	N/A	N/A	8694	8534	7856	7747	7174	11579	11433	10038	10372	9700
600	7528	7364	5738	N/A	N/A	8673	8463	7800	7706	7134	11495	11355	9968	10306	9631
700	7417	7255	5640	N/A	N/A	8652	8373	7738	7660	7070	11310	11175	9844	10186	9511
800	7310	7148	5545	N/A	N/A	8586	8246	7626	7554	6969	11122	10983	9718	10042	9381
900	7205	7044	5453	N/A	N/A	8523	8119	7513	7442	6862	10934	10800	9592	9900	9252
1000	7103	6943	5363	N/A	N/A	8377	7985	7400	7330	6757	10747	10618	9467	9766	9126
1100	7004	6845	5276	N/A	N/A	8228	7855	7290	7219	6654	10562	10432	9344	9638	9002
1200	6907	6749	5191	N/A	N/A	8086	7727	7182	7111	6553	10380	10248	9223	9513	8880
1300	6813	6656	5109	N/A	N/A	7937	7602	7077	7006	6455	10201	10071	9104	9388	8761
1400	6721	6566	5029	N/A	N/A	7785	7479	6974	6904	6359	10026	9897	8989	9263	8645
1500	6632	6478	4951	N/A	N/A	7642	7358	6875	6805	6266	9855	9725	8876	9139	8531
1600	6545	6392	4875	N/A	N/A	7506	7243	6778	6710	6174	9686	9556	8765	9020	8420
1700	6461	6308	4801	N/A	N/A	7370	7126	6683	6617	6085	9521	9390	8657	8906	8311
1800	6378	6226	4729	N/A	N/A	7234	7011	6591	6526	5998	9358	9227	8550	8800	8204
1900	6298	6147	4659	N/A	N/A	7108	6897	6501	6436	5913	9197	9069	8447	8696	8098
2000	6219	6069	4591	N/A	N/A	6984	6789	6411	6346	5830	9038	8916	8346	8584	7994

Notes:
1. Delta III is not available for WR launches, 70- and 90-deg inclinations.
2. Delta IV performance for inclinations of 38, 60, and 70 deg incorporated in Modification 20.
3. Delta IV maximum payload capability for altitudes below approximately 370 km is less than that at 370 km. To meet the Eastern Range (ER) Range Safety Flight Termination System requirements through second-stage engine cutoff (SECO-1) (ER launches only), the Delta IV upper stage must loft significantly. For the lower altitude LEO orbits, the second-stage propellant needs to be significantly off-loaded to help shorten the burn time and reduce the necessary lofting. At SECO-1, this lofting produces an orbit injection altitude that is higher than the final orbit altitude for the lower LEO missions

Table E1-7. Maximum LEO Payload Capability for Delta IV

Orbit altitude (km)	Separated payload mass (kg)									
	Delta IV 4450-14					Delta IV 4050H-19				
	Inclination (deg)					Inclination (deg)				
	28.5	38	60	70	90	28.5	38	60	70	90
200	13202	12843	11313	11683	11185	23060	23228	22155	22689	22072
300	13101	12753	11297	11670	11161	22772	23092	22000	22497	21989
400	13069	12746	11279	11653	11144	22854	22953	21981	22353	21833
500	13100	12770	11244	11625	11111	23166	23154	21689	22128	21633
600	12942	12586	11142	11513	11013	23181	22905	21430	21853	21408
700	12733	12397	11005	11365	10874	22860	22539	21166	21575	21170
800	12510	12163	10864	11215	10733	22451	22084	20896	21294	20926
900	12280	11937	10722	11063	10591	22051	21621	20624	21011	20682
1000	12051	11721	10581	10913	10449	21619	21235	20353	20730	20439
1100	11829	11506	10440	10763	10308	21226	20881	20083	20452	20199
1200	11616	11294	10301	10616	10169	20861	20545	19817	20178	19962
1300	11414	11094	10165	10472	10032	20515	20222	19555	19907	19729
1400	11221	10898	10030	10330	9899	20186	19911	19297	19643	19500
1500	11038	10715	9898	10191	9768	19869	19610	19044	19383	19276
1600	10863	10540	9769	10055	9640	19564	19319	18796	19128	19056
1700	10694	10373	9642	9922	9515	19271	19037	18553	18879	18842
1800	10529	10211	9519	9792	9392	18989	18764	18312	18634	18632
1900	10370	10054	9397	9665	9272	18717	18499	18073	18394	18428
2000	10216	9902	9279	9541	9155	18452	18243	17835	18156	18227

Notes:
1. Delta IV performance for inclinations of 38, 60, and 70 deg incorporated in Modification 20.
2. Delta IV maximum payload capability for altitudes below approximately 370 km is less than that at 370 km. To meet the Eastern Range (ER) range safety flight termination system requirements through second-stage engine cutoff (SECO-2) (ER launches only), the Delta IV upper stage must loft significantly. For the lower-altitude LEO orbits, the second-stage propellant needs to be significantly off-loaded to help shorten the burn time and reduce the necessary lofting. At SECO-1, this lofting produces an orbit injection altitude that is higher than the final orbit altitude for the lower LEO missions.

Maximum LEO Sun-Synchronous (SS) Performance Assumptions (Delta II)

Maximum LEO Sun-Synchronous Performance Assumptions (Delta IV)

Table E1-8. Maximum LEO Sun-Synchronous Payload Capability for Delta II and Delta IV

Orbit altitude (km)	Separated payload mass (kg)										
	Vehicle										
	2320 9.5	2320 10	2420 9.5	2420 10	2920 9.5	2920 10	2920 10L	4040 12	4240 12	4450 14	4050H 19
200	1907	1829	2290	2211	3661	3549	3473	7407	9864	11,354	21,585
300	1845	1769	2221	2143	3561	3451	3376	7104	9636	11,086	21,301
400	1786	1711	2153	2077	3465	3357	3283	6,970	9,484	10,981	21,273
500	1729	1655	2088	2013	3371	3265	3193	6,918	9,414	10,931	21,043
600	1674	1602	2025	1951	3281	3176	3105	6,862	9,332	10,828	20,792
700	1621	1550	1964	1891	3192	3090	3020	6,793	9,212	10,675	20,529
800	1570	1500	1905	1833	3107	3006	2938	6,694	9,071	10,519	20,262
900	1520	1452	1847	1777	3024	2925	2858	6,579	8,931	10,362	19,993
1000	1473	1405	1792	1723	2944	2846	2781	6,465	8,791	10,205	19,725
1100	1426	1360	1738	1671	2866	2770	2706	6,352	8,654	10,050	19,459
1200	1381	1317	1686	1621	2791	2697	2633	6,242	8,520	9,896	19,195
1300	1338	1274	1636	1572	2718	2625	2563	6,134	8,387	9,744	18,935
1400	1296	1233	1587	1525	2647	2556	2495	6,028	8,258	9,594	18,678
1500	1255	1194	1540	1479	2579	2489	2429	5,924	8,131	9,447	18,426
1600	1216	1155	1494	1434	2513	2424	2365	5,822	8,006	9,302	18,178
1700	1177	1117	1450	1391	2448	2362	2304	5,723	7,883	9,159	17,934
1800	1140	1081	1407	1350	2386	2301	2244	5,625	7,762	9,019	17,695
1900	1104	1046	1366	1309	2327	2243	2187	5,529	7,642	8,882	17,460
2000	1068	1011	1326	1270	2269	2186	2131	5,435	7,524	8,747	17,229

Note: Delta II 2920H and Delta III 3940 are not available for WR launches, near 90-deg inclination.

Maximum High-Energy Performance Assumptions (Delta IV)

D1-E1.2-11

D1-E1.2-12

Table E1-9. Maximum High-Energy Mission Payload Capability—Delta II with Star-37FM Upper Stage

C_3 km²/sec²	Separated payload mass (kg)									
	2326 9.5	2326 10	2426 9.5	2426 10	2926 9.5	2926 10	2926 10L	2926H 9.5	2926H 10	2926H 10L
-10	738	708	846	823	1358	1291	1261	1587	1548	1520
-5	653	626	749	727	1204	1145	1118	1411	1375	1350
0	578	553	663	644	1071	1016	992	1255	1223	1200
5	511	488	587	570	953	903	882	1120	1091	1071
10	451	431	520	504	848	803	784	1000	974	956
15	398	380	459	445	756	715	698	894	871	854
20	351	334	406	394	674	637	621	801	779	764
25	308	293	359	347	601	568	553	718	698	685
30	270	256	316	305	538	506	492	644	626	614
35	236	223	277	268	477	450	438	578	562	551
40	205	193	243	234	425	400	389	519	504	494
45	177	166	211	203	379	356	346	466	452	443
50	151	141	183	176	337	315	306	419	406	398
60	107	99	134	128	264	245	238	337	326	319
70	70	63	93	88	203	188	182	270	261	254
80	38	32	59	54	154	141	135	214	206	201
90	11	5	29	25	112	101	96	168	161	157
100	0	0	3	0	77	67	62	129	123	119
110	0	0	0	0	46	37	33	95	90	87
120	0	0	0	0	19	11	8	67	62	59
130	0	0	0	0	0	0	0	41	37	34
140	0	0	0	0	0	0	0	18	14	12
150	0	0	0	0	0	0	0	0	0	0
160	0	0	0	0	0	0	0	0	0	0
170	0	0	0	0	0	0	0	0	0	0
180	0	0	0	0	0	0	0	0	0	0
190	0	0	0	0	0	0	0	0	0	0
200	0	0	0	0	0	0	0	0	0	0

Notes:
1. Delta II payload mass of less than 328 kg will exceed 11-g axial acceleration (shaded area).
2. Masses include nutation control system (NCS)/yo-yo despin/ballast.

Table E1-9A. Maximum High-Energy Mission Payload Capability—Delta II Two-Stage Vehicles

C3 (km²/sec²)	Separated payload mass (kg)									
	2320 9.5	2420 9.5	2920 9.5	2920H 9.5	2320 10	2420 10	2920 10	2920H 10	2920 10L	2920H 10L
-10	332	440	993	1208	295	412	914	1160	881	1127
-5	221	317	821	1016	187	292	749	972	719	941
0	120	203	668	847	88	179	602	807	574	778
5	26	95	531	699	0	72	469	660	443	634
10	0	0	406	566	0	0	346	529	321	504
15	0	0	290	446	0	0	230	411	205	387
20	0	0	180	336	0	0	118	302	94	279
25	0	0	75	233	0	0	0	201	0	177
30	0	0	0	135	0	0	0	104	0	80
35	0	0	0	40	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0

Table E1-10. Maximum High-Energy Mission Payload Capability—Delta II with Star-48B Upper Stage

C_3 km²/sec²	Separated payload mass (kg)									
	2325 9.5	2325 10	2425 9.5	2425 10	2925 9.5	2925 10	2925 10L	2925H 9.5	2925H 10	2925H 10L
-10	*807**	*768**	*958**	*926**	1532	1470	1440	1768	1728	1699
-5	*728**	*692**	865	*838**	1375	1318	1290	1587	1550	1524
0	*656**	*623**	775	753	1235	1183	1158	1426	1393	1370
5	*592**	*561**	694	675	1111	1063	1040	1283	1253	1231
10	*533**	*505**	622	604	1001	957	936	1156	1129	1109
15	478	*453**	557	540	901	861	842	1043	1018	1001
20	426	*406**	497	482	812	775	757	942	919	903
25	379	362	444	430	732	698	682	851	830	815
30	336	320	396	383	660	628	613	769	750	736
35	295	282	352	340	595	565	552	695	677	665
40	260	247	312	301	535	508	495	628	612	601
45	228	215	275	265	481	456	445	568	553	542
50	198	186	242	232	433	409	398	513	499	489
60	145	134	183	175	347	327	317	417	405	397
70	100	90	133	126	276	267	249	337	327	319
80	61	52	90	84	214	199	192	269	260	254
90	26	19	53	47	162	149	143	212	204	199
100	0	0	20	15	118	106	100	163	156	151
110	0	0	0	0	79	68	63	120	114	110
120	0	0	0	0	45	35	31	84	78	74
130	0	0	0	0	15	6	2	51	46	43
140	0	0	0	0	0	0	0	22	17	14
150	0	0	0	0	0	0	0	0	0	0
160	0	0	0	0	0	0	0	0	0	0
170	0	0	0	0	0	0	0	0	0	0
180	0	0	0	0	0	0	0	0	0	0
190	0	0	0	0	0	0	0	0	0	0
200	0	0	0	0	0	0	0	0	0	0

Notes:
1. Delta II payload mass of less than 395 kg will exceed 11-g axial acceleration (shaded area).
2. Masses include NCS/yo-yo despin/ballast.

* = Star-48B offload required (non-standard service).

Table E1-11. Maximum High-Energy Mission Payload Capability—Delta III and Delta IV

C_3 km²/sec²	Separated payload mass (kg)				
	3940 11	4040 12	4240 12	4450 14	4050H 19
-10	3240	3,442	5,006	5,603	11,075
-5	2924	3,077	4,523	5,078	10,117
0	2629	2,735	4,075	4,583	9,306
5	2355	2,417	3,661	4,121	8,545
10	2098	2,117	3,278	3,686	7,812
15	1860	1,833	2,922	3,279	7,107
20	1637	1,567	2,592	2,898	6,436
25	1429	1,319	2,285	2,540	5,809
30	1236	1,086	1,995	2,205	5,228
35	1055	868	1,723	1,884	4,691
40	887	664	1,470	1,583	4,192
45	730	473	1,233	1,300	3,729
50	583	293	1,012	1,035	3,298
60	318	0	610	550	2,521
70	87	0	256	121	1,838
80	0	0	0	0	1,234
90	0	0	0	0	701
100	0	0	0	0	230
110	0	0	0	0	0
120	0	0	0	0	0
130	0	0	0	0	0
140	0	0	0	0	0
150	0	0	0	0	0
160	0	0	0	0	0
170	0	0	0	0	0
180	0	0	0	0	0
190	0	0	0	0	0
200	0	0	0	0	0

Note: Delta IV payload masses shown in the shaded area are less than those analyzed by the Boeing Structural Loads group and are not contractually included.

Maximum Geosynchronous Transfer Orbit Performance Assumptions (Delta II, III)

Maximum Geosynchronous Transfer Orbit Performance Assumptions (Delta IV)

D1-E1.2-16

Table E1-12. Maximum Geosynchronous Transfer Orbit (GTO) Payload Capability for Delta II 2326

Apogee altitude (km)	Separated payload mass (kg)															
	Delta II 2326-9.5								Delta II 2326-10							
	Inclination (deg)								Inclination (deg)							
	28.5	27	25	23	21	19	17	15	28.5	27	25	23	21	19	17	15
100,000	696	691	674	647	610	567	520	470	667	663	647	620	585	543	497	449
90,000	707	703	686	658	620	576	528	477	679	674	658	631	595	552	505	456
80,000	722	717	700	671	632	587	538	486	693	688	671	643	606	563	515	465
70,000	740	735	717	687	648	602	551	498	710	706	688	659	621	577	527	476
60,000	765	759	741	709	668	620	567	513	734	729	711	681	641	594	543	490
50,000	798	792	772	739	696	645	590	533	766	761	741	709	668	619	565	510
40,000	846	840	818	783	736	681	622	561	813	807	786	751	706	654	597	538
35,788	874	868	845	807	758	702	640	577	839	833	811	775	728	673	614	553
30,000	923	916	891	851	798	738	672	606	886	880	856	817	766	708	645	580
20,000	1061	1053	1022	973	909	836	759	682	1020	1012	983	935	873	803	729	654
10,000	1383	1370	1321	1245	1151	1048	943	840	1332	1319	1272	1198	1108	1008	906	807
5,000	**	**	**	*1532**	1407	1263	1123	993	**	**	**	*1468**	1355	1215	1081	954

* = Star-37FM offload required (non-standard service).

** = Maximum Star-37 offload exceeded (154 kg).

Table E1-12A. Maximum Geosynchronous Transfer Orbit (GTO) Payload Capability for Delta II 2325

Apogee altitude (km)	Separated payload mass (kg)															
	Delta II 2325-9.5								Delta II 2325-10							
	Inclination (deg)								Inclination (deg)							
	28.7	27	25	23	21	19	17	15	28.7	27	25	23	21	19	17	15
100000	769*	765*	750*	724*	689*	648*	602*	553*	**	**	**	**	655*	616*	571*	524*
90000	**	776*	760*	734*	699*	657*	610*	560*	**	**	**	**	664*	624*	579*	531*
80000	**	**	773*	746*	710*	667*	620*	569*	**	**	**	**	676*	634*	588*	540*
70000	**	**	**	762*	725*	681*	632*	580*	**	**	**	**	**	647*	600*	551*
60000	**	**	**	**	744*	698*	648*	595*	**	**	**	**	**	664*	616*	565*
50000	**	**	**	**	770*	722*	670*	615*	**	**	**	**	**	**	637*	584*
40000	**	**	**	**	**	756*	701*	642*	**	**	**	**	**	**	666*	610*
35786	**	**	**	**	**	775*	718*	658*	**	**	**	**	**	**	**	625*
30000	**	**	**	**	**	**	748*	685*	**	**	**	**	**	**	**	651*
20000	**	**	**	**	**	**	**	756*	**	**	**	**	**	**	**	**
10000	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
5000	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**

* =Star-48B offload required (non-standard service).
** =Maximum Star-48B offload exceeded (273 kg).

Table E1-13. Maximum GTO Payload Capability for Delta II 2426

Apogee altitude (km)	Separated payload mass (kg)															
	Delta II 2426-9.5								Delta II 2426-10							
	Inclination (deg)								Inclination (deg)							
	28.5	27	25	23	21	19	17	15	28.5	27	25	23	21	19	17	15
100,000	797	792	773	741	699	650	597	540	774	769	751	720	680	632	579	525
90,000	810	805	785	753	711	661	606	549	787	782	763	732	691	642	588	533
80,000	827	821	801	768	725	673	617	559	804	798	779	747	704	654	600	543
70,000	848	842	822	787	742	689	632	572	824	819	799	765	721	670	614	555
60,000	876	870	848	812	765	711	651	589	851	846	825	790	744	690	632	572
50,000	914	907	884	847	797	739	676	611	888	882	860	823	775	718	657	594
40,000	969	962	937	896	843	780	713	644	942	936	911	871	819	759	693	625
35,788	1000	993	967	924	869	804	734	662	973	966	941	899	844	781	713	643
30,000	1056	1048	1020	974	914	845	770	694	1027	1020	992	947	889	821	748	674
20,000	1214	1204	1170	1113	1041	958	870	781	1181	1172	1138	1083	1012	931	845	759
10,000	1584	1568	1513	1426	1318	1200	1079	962	1541	1526	1473	1388	1282	1167	1050	935
5,000	2001*	1978*	1900*	1769	1611	1447	1286	1136	**	1920*	1844*	1722	1568	1408	1251	1105

* = Star-37FM offload required (non-standard service).
** Maximum Star-37 offload exceeded (154 kg).

Table E1-13A. Maximum Geosynchronous Transfer Orbit (GTO) Payload Capability for Delta II 2425

Apogee altitude (km)	Separated payload mass (kg)															
	Delta II 2425-9.5								Delta II 2425-10							
	Inclination (deg)								Inclination (deg)							
	28.7	27	25	23	21	19	17	15	28.7	27	25	23	21	19	17	15
100000	914*	909	890	857	813	762	704	644	884*	879*	862*	833*	791	740	685	626
90000	927*	922*	903	870	825	772	714	653	896*	891*	874*	844*	803	751	694	634
80000	942*	937*	918*	885	840	786	726	664	911*	906*	888*	858*	817	764	706	645
70000	962*	956*	937*	905	858	803	742	678	930*	925*	906*	875*	834*	781	721	659
60000	987*	982*	962*	929*	882	825	762	696	955*	950*	930*	898*	855*	802	741	676
50000	1022*	1016*	995*	961*	915*	855	789	720	989*	983*	963*	929*	884*	831*	767	700
40000	1072*	1066*	1043*	1006*	957*	898	828	755	1037*	1031*	1010*	973*	925*	869*	805	734
35786	1100*	1094*	1071*	1032*	981*	921*	849	774	1065*	1059*	1036*	998*	949*	890*	826	753
30000	1150*	1143*	1118*	1077*	1022*	959*	887	808	**	**	1082*	1042*	989*	927*	860*	785
20000	**	**	**	**	1136*	1062*	982*	898	**	**	**	**	**	1028*	950*	869*
10000	**	**	**	**	**	**	1171*	1066*	**	**	**	**	**	**	**	1031*
5000	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**

* = Star-48B offload required (non-standard service).
** = Maximum Star-48B offload exceeded (273 kg).

Table E1-14. Maximum GTO Payload Capability for Delta II 2926

Apogee altitude (km)	Separated payload mass (kg)															
	Delta II 2926-9.5								Delta II 2926-10							
	Inclination (deg)								Inclination (deg)							
	28.5	27	25	23	21	19	17	15	28.5	27	25	23	21	19	17	15
100,000	1277	1269	1239	1190	1125	1049	965	878	1214	1206	1178	1131	1069	996	916	832
90,000	1298	1290	1259	1209	1143	1065	980	891	1234	1226	1197	1149	1086	1011	929	844
80,000	1324	1316	1284	1232	1164	1085	997	907	1259	1251	1221	1172	1107	1030	946	860
70,000	1358	1349	1316	1262	1192	1110	1020	927	1291	1283	1252	1200	1133	1054	968	879
60,000	1401	1392	1358	1302	1228	1142	1049	953	1333	1324	1292	1238	1167	1085	996	904
50,000	1461	1451	1415	1356	1278	1187	1089	988	1391	1381	1347	1290	1215	1128	1034	938
40,000	1548	1537	1498	1434	1350	1251	1146	1039	1474	1464	1427	1365	1284	1190	1089	986
35,788	1597	1586	1545	1478	1390	1288	1179	1067	1522	1512	1472	1407	1323	1225	1120	1013
30,000	1685	1673	1629	1556	1462	1353	1235	1117	1607	1595	1553	1483	1392	1286	1174	1061
20,000	1936	1921	1865	1776	1661	1530	1392	1252	1849	1834	1781	1694	1583	1458	1324	1190
10,000	2523	2499	2410	2272	2101	1913	1722	1536	2419	2395	2309	2174	2008	1827	1643	1464
5,000	3237	3194	3043	2821	2566	2304	2050	1812	3116	3073	2925	2709	2460	2206	1959	1729

Table E1-15. Maximum GTO Payload Capability for Delta II 2925

Apogee altitude (km)	Separated payload mass (kg)															
	Delta II 2925-9.5								Delta II 2925-10							
	Inclination (deg)								Inclination (deg)							
	28.5	27	25	23	21	19	17	15	28.5	27	25	23	21	19	17	15
100,000	1450	1442	1411	1360	1292	1212	1124	1032	1391	1383	1353	1304	1238	1161	1076	987
90,000	1471	1463	1432	1380	1311	1229	1139	1046	1412	1404	1373	1323	1256	1177	1091	1000
80,000	1498	1489	1457	1404	1333	1249	1158	1062	1438	1429	1398	1346	1278	1197	1109	1017
70,000	1532	1523	1490	1435	1362	1276	1182	1084	1471	1462	1430	1376	1306	1222	1132	1037
60,000	1576	1567	1532	1475	1399	1310	1212	1111	1514	1504	1471	1415	1342	1256	1161	1064
50,000	1637	1627	1590	1530	1450	1357	1254	1148	1572	1563	1527	1469	1392	1301	1202	1099
40,000	1725	1714	1674	1609	1524	1424	1314	1201	1658	1647	1609	1546	1463	1365	1259	1151
35,788	1775	1763	1722	1654	1565	1461	1348	1231	1706	1695	1655	1589	1503	1402	1292	1179
30,000	1863	1851	1806	1733	1638	1527	1407	1283	1792	1780	1737	1666	1573	1466	1349	1229
20,000	2114	2099	2043	1954	1839	1707	1567	1424	2036	2021	1967	1880	1768	1640	1504	1366
10,000	2692	2668	2582	2446	2277	2091	1900	1713	2601	2577	2493	2360	2195	2014	1828	1647
5,000	**	**	**	*2955**	2734	2478	2227	1990	**	**	**	*2849**	*2637**	2391	2146	1915

* = Star-48B offload required (non-standard service).
** = Maximum Star-48B offload exceeded (273 kg).

Table E1-16. Maximum GTO Payload Capability for Delta II 2926 and 2925 with 10L Fairing

Apogee altitude (km)	Separated payload mass (kg)															
	Delta II 2926-10L								Delta II 2925-10L							
	Inclination (deg)								Inclination (deg)							
	28.5	27	25	23	21	19	17	15	28.5	27	25	23	21	19	17	15
100,000	1186	1179	1151	1105	1044	972	894	812	1362	1354	1325	1276	1212	1136	1053	966
90,000	1206	1198	1169	1122	1060	987	907	824	1382	1374	1344	1295	1229	1152	1067	979
80,000	1230	1222	1193	1144	1081	1006	924	839	1408	1399	1369	1318	1251	1172	1085	995
70,000	1261	1253	1223	1172	1107	1029	945	858	1440	1431	1400	1347	1278	1196	1108	1015
60,000	1303	1294	1262	1209	1140	1060	973	882	1482	1473	1440	1386	1314	1229	1137	1041
50,000	1359	1350	1316	1260	1187	1102	1010	915	1540	1530	1495	1438	1362	1273	1176	1076
40,000	1441	1431	1394	1333	1254	1162	1064	963	1623	1613	1575	1513	1432	1337	1233	1126
35,788	1488	1477	1438	1375	1292	1196	1094	989	1671	1660	1621	1556	1471	1372	1265	1154
30,000	1571	1559	1517	1449	1360	1257	1147	1036	1755	1744	1701	1631	1540	1435	1321	1203
20,000	1807	1793	1741	1656	1548	1424	1294	1163	1994	1980	1927	1842	1732	1606	1473	1337
10,000	2366	2342	2258	2126	1963	1786	1606	1430	*2543**	*2523**	2443	2312	2150	1973	1791	1612
5,000	3051	3008	2863	2650	2407	2157	1915	1690	**	**	**	**	*2577**	2343	2102	1876

*= Star-48B offload required (non-standard service).
** = Maximum Star-48B offload exceeded (273 kg).

Table E1-17. Maximum GTO Payload Capability for Delta II 2926H

Apogee altitude (km)	Separated payload mass (kg)															
	Delta II 2926H-9.5								Delta II 2926H-10							
	Inclination (deg)								Inclination (deg)							
	28.5	27	25	23	21	19	17	15	28.5	27	25	23	21	19	17	15
100,000	1467	1458	1423	1366	1291	1202	1106	1007	1429	1420	1387	1331	1257	1171	1077	980
90,000	1491	1482	1446	1388	1311	1221	1123	1022	1453	1444	1409	1352	1277	1189	1094	995
80,000	1521	1511	1475	1415	1337	1244	1143	1040	1482	1473	1437	1379	1302	1211	1113	1012
70,000	1559	1549	1512	1450	1369	1273	1169	1062	1520	1510	1473	1413	1333	1240	1139	1035
60,000	1610	1599	1560	1495	1410	1311	1203	1092	1569	1558	1520	1457	1374	1277	1172	1064
50,000	1679	1667	1626	1557	1468	1363	1249	1133	1636	1625	1585	1518	1430	1328	1216	1103
40,000	1779	1767	1722	1647	1550	1437	1316	1191	1735	1723	1678	1605	1511	1400	1281	1160
35,788	1837	1824	1776	1698	1597	1479	1353	1223	1791	1778	1732	1656	1556	1442	1318	1191
30,000	1940	1925	1874	1789	1680	1554	1419	1281	1891	1877	1827	1744	1637	1514	1382	1248
20,000	2232	2214	2150	2045	1911	1759	1599	1438	2177	2160	2096	1994	1863	1715	1558	1401
10,000	2921	2892	2788	2625	2425	2206	1983	1766	2851	2823	2721	2562	2365	2151	1933	1722
5,000	3765	3714	3535	3272	2972	2663	2366	2087	3677	3626	3451	3194	2900	2599	2307	2035

Table E1-18. Maximum GTO Payload Capability for Delta II 2925H

Apogee altitude (km)	Separated payload mass (kg)															
	Delta II 2925H-9.5								Delta II 2925H-10							
	Inclination (deg)								Inclination (deg)							
	28.5	27	25	23	21	19	17	15	28.5	27	25	23	21	19	17	15
100,000	1664	1654	1619	1560	1483	1391	1289	1183	1625	1616	1581	1524	1448	1358	1258	1155
90,000	1689	1679	1643	1583	1504	1410	1307	1198	1650	1640	1605	1546	1469	1377	1276	1170
80,000	1720	1710	1672	1611	1530	1434	1328	1218	1680	1670	1634	1574	1494	1400	1297	1189
70,000	1759	1748	1710	1647	1563	1464	1356	1242	1718	1708	1671	1608	1526	1430	1324	1213
60,000	1810	1799	1759	1693	1606	1503	1391	1274	1769	1758	1719	1654	1569	1468	1358	1244
50,000	1881	1869	1827	1757	1665	1557	1439	1317	1837	1826	1785	1716	1626	1521	1406	1286
40,000	1983	1971	1924	1849	1749	1634	1508	1378	1938	1925	1880	1806	1709	1596	1473	1346
35,788	2041	2028	1980	1901	1797	1677	1547	1413	1995	1982	1935	1857	1756	1638	1511	1379
30,000	2145	2131	2078	1993	1882	1753	1614	1472	2096	2082	2031	1947	1838	1712	1577	1438
20,000	2438	2420	2356	2251	2116	1962	1799	1634	2383	2365	2302	2200	2068	1917	1758	1596
10,000	3120	3092	2990	2829	2630	2412	2188	1970	3050	3022	2922	2765	2570	2357	2138	1925
5,000	3902*	3860*	3713*	3465	3170	2866	2571	2293	**	3765*	3622*	3388	3099	2802	2513	2241

* = Star-48B offload required (non-standard service).
** = Maximum Star-48B offload exceeded (273 kg).

Table E1-19. Maximum GTO Payload Capability for Delta II 2926H and 2925H with 10L Fairing

Apogee altitude (km)	Separated payload mass (kg)															
	Delta II 2926H-10L								Delta II 2925H-10L							
	Inclination (deg)								Inclination (deg)							
	28.5	27	25	23	21	19	17	15	28.5	27	25	23	21	19	17	15
100000	1403	1394	1361	1306	1234	1149	1057	961	1598	1589	1555	1498	1423	1335	1237	1135
90000	1426	1417	1383	1327	1253	1167	1073	976	1622	1613	1578	1520	1444	1353	1254	1150
80000	1455	1446	1411	1353	1278	1189	1093	993	1652	1642	1606	1547	1469	1376	1275	1168
70000	1492	1482	1446	1387	1308	1216	1117	1015	1689	1679	1642	1581	1501	1406	1301	1192
60000	1540	1530	1492	1430	1349	1253	1150	1044	1739	1728	1690	1626	1542	1443	1335	1222
50000	1606	1596	1556	1490	1404	1303	1194	1082	1807	1796	1755	1687	1599	1495	1382	1264
40000	1703	1691	1648	1576	1483	1375	1257	1138	1905	1893	1849	1776	1680	1569	1448	1323
35788	1758	1746	1700	1625	1528	1415	1293	1169	1961	1949	1902	1826	1726	1611	1485	1356
30000	1857	1843	1794	1712	1607	1486	1357	1224	2061	2047	1997	1915	1808	1684	1550	1414
20000	2138	2121	2059	1958	1829	1683	1530	1375	2343	2326	2264	2163	2033	1885	1728	1570
10000	2801	2773	2673	2516	2323	2113	1898	1691	3000	2972	2874	2719	2528	2318	2103	1892
5000	3613	3563	3391	3139	2849	2553	2266	1999	**	3696*	3556*	3331	3048	2755	2471	2204

* = Star-48B offload required (non-standard service).
** = Maximum Star-48B offload exceeded (273 kg).

Table E1-20. Maximum GTO Payload Capability for Delta III 3940-11

Apogee altitude (km))	Separated payload mass (kg)							
	Inclination (deg)							
	28.5	27	25	23	21	19	17	15
100000	3068	3051	2989	2884	2742	2570	2374	2162
90000	3111	3094	3031	2925	2781	2606	2408	2194
80000	3164	3147	3083	2975	2828	2651	2450	2233
70000	3231	3214	3148	3037	2888	2707	2503	2282
60000	3318	3300	3232	3119	2965	2780	2571	2344
50000	3435	3416	3346	3228	3069	2877	2661	2428
40000	3601	3581	3506	3382	3215	3014	2789	2546
35788	3693	3673	3596	3468	3296	3090	2859	2611
30000	3854	3832	3751	3617	3437	3221	2980	2723
20000	4289	4263	4169	4015	3810	3568	3300	3016
10000	5091	5055	4925	4716	4448	4251	3920	3580
5000	6060	6004	5808	5510	5153	4766	4366	4078

Table E1-21. Maximum GTO Payload Capability for Delta IV 4040 and 4240

Apogee altitude (km))	Separated payload mass (kg)															
	Delta IV 4040-12								Delta IV 4240-12							
	Inclination (deg)								Inclination (deg)							
	28.5	27	25	23	21	19	17	15	28.5	27	25	23	21	19	17	15
100000	3,260	3,237	3,169	3,054	2,897	2,704	2,483	2,241	4,696	4,666	4,576	4,427	4,225	3,977	3,695	3,392
90000	3,311	3,288	3,217	3,102	2,943	2,747	2,524	2,280	4,761	4,730	4,638	4,487	4,282	4,032	3,746	3,437
80000	3,373	3,350	3,278	3,160	3,000	2,801	2,574	2,327	4,840	4,809	4,715	4,562	4,353	4,099	3,808	3,494
70000	3,452	3,427	3,353	3,234	3,070	2,868	2,637	2,385	4,940	4,908	4,812	4,655	4,442	4,182	3,886	3,564
60000	3,553	3,528	3,452	3,328	3,161	2,953	2,717	2,460	5,070	5,037	4,938	4,776	4,557	4,291	3,987	3,656
50000	3,689	3,663	3,584	3,456	3,281	3,068	2,823	2,558	5,246	5,211	5,107	4,940	4,712	4,436	4,121	3,780
40000	3,880	3,852	3,771	3,636	3,451	3,229	2,972	2,695	5,495	5,457	5,348	5,170	4,931	4,640	4,311	3,956
35788	3,987	3,958	3,875	3,736	3,545	3,319	3,054	2,771	5,634	5,595	5,482	5,299	5,052	4,753	4,416	4,054
30000	4,170	4,140	4,053	3,908	3,707	3,473	3,196	2,902	5,876	5,834	5,715	5,521	5,261	4,948	4,596	4,222
20000	4,660	4,627	4,528	4,365	4,145	3,881	3,577	3,253	6,531	6,479	6,340	6,114	5,817	5,461	5,070	4,667
10000	5,683	5,642	5,494	5,285	5,035	4,684	4,332	3,952	7,898	7,822	7,627	7,316	6,923	6,468	5,987	5,524
5000	6,837	6,770	6,560	6,228	5,821	5,376	4,921	4,469	9,325	9,221	8,936	8,505	7,985	7,415	6,825	6,275

Table E1-22. Maximum GTO Payload Capability for Delta IV 4450 and 4050H

Apogee altitude (km))	Separated payload mass (kg)															
	Delta IV 4450-14								Delta IV 4050H-19							
	Inclination (deg)								Inclination (deg)							
	28.5	27	25	23	21	19	17	15	28.5	27	25	23	21	19	17	15
100000	5,343	5,302	5,195	5,027	4,802	4,528	4,215	3,873	10,634	10,575	10,383	10,059	9,616	9,076	8,462	7,797
90000	5,413	5,371	5,262	5,092	4,864	4,586	4,269	3,924	10,778	10,718	10,522	10,193	9,744	9,195	8,573	7,900
80000	5,498	5,456	5,345	5,172	4,940	4,658	4,336	3,987	10,955	10,892	10,691	10,356	9,899	9,341	8,709	8,026
70000	5,605	5,562	5,449	5,272	5,035	4,747	4,420	4,065	11,176	11,109	10,902	10,559	10,092	9,523	8,878	8,182
60000	5,744	5,700	5,584	5,402	5,158	4,863	4,528	4,165	11,459	11,387	11,173	10,819	10,339	9,755	9,094	8,381
50000	5,932	5,885	5,765	5,576	5,324	5,019	4,673	4,299	11,836	11,758	11,532	11,164	10,666	10,062	9,380	8,645
40000	6,198	6,149	6,023	5,823	5,558	5,237	4,876	4,486	12,363	12,276	12,034	11,644	11,121	10,489	9,776	9,012
35788	6,347	6,296	6,166	5,961	5,688	5,358	4,988	4,589	12,654	12,561	12,310	11,908	11,371	10,722	9,993	9,212
30000	6,606	6,553	6,416	6,199	5,912	5,567	5,181	4,766	13,152	13,049	12,783	12,359	11,796	11,120	10,363	9,554
20000	7,309	7,247	7,089	6,837	6,509	6,117	5,686	5,225	14,464	14,331	14,020	13,535	12,902	12,151	11,320	10,438
10000	8,811	8,726	8,503	8,150	7,708	7,202	6,664	6,104	17,077	16,873	16,463	15,837	15,048	14,143	13,162	12,142
5000	10,451	10,332	10,004	9,495	8,886	8,232	7,565	6,907	19,686	19,396	18,872	18,085	17,121	16,052	14,923	13,771

3.0 INSERTION ACCURACIES

The orbit insertion accuracy capabilities of the proposed vehicles are shown in Tables E1-23 through E1-27. Orbit accuracy data for missions using a spinning upper-stage motor are a strong function of the spacecraft's mass properties and energy dissipation. The data presented assume what is expected to be worst-case upper-stage velocity magnitude and pointing errors. The mission-specific orbit dispersions will be defined in the Performance and Guidance Accuracy Analysis (CDRL C4-1).

Table E1-23. Delta 3-Sigma Orbit Dispersions for LEO and Sun-Synchronous Missions

Vehicle	Perigee altitude accuracy (km)	Apogee altitude accuracy (km)	Inclination accuracy (deg)
Delta II	± 10.0	± 10.0	± 0.05
Delta III	± 10.0	± 10.0	± 0.05
Delta IV	± 10.0	± 10.0	± 0.05

Table E1-24. Delta 3-Sigma Orbit Dispersions for High-Energy Missions

C_3 (km^2/sec^2)	0			25			50		
Vehicle	Injection velocity (mps)	Injection velocity direction		Injection velocity (mps)	Injection velocity direction		Injection velocity (mps)	Injection velocity direction	
		In-plane (deg)	Out-of-plane (deg)		In-plane (deg)	Out-of-plane (deg)		In-plane (deg)	Out-of-plane (deg)
Delta II 2326	± 20	± 0.69	± 0.69	± 26	± 0.83	± 0.83	± 32	± 0.95	± 0.95
Delta II 2426	± 18	± 0.63	± 0.63	± 24	± 0.77	± 0.77	± 30	± 0.90	± 0.90
Delta II 2926	± 14	± 0.49	± 0.49	± 19	± 0.63	± 0.63	± 25	± 0.75	± 0.75
Delta II 2926H	± 12	± 0.44	± 0.44	± 17	± 0.57	± 0.57	± 23	± 0.70	± 0.70
Delta II 2325	± 11	± 0.59	± 0.59	± 15	± 0.78	± 0.78	± 18	± 0.78	± 0.78
Delta II 2425	± 11	± 0.58	± 0.58	± 14	± 0.67	± 0.67	± 17	± 0.74	± 0.74
Delta II 2925	± 9	± 0.46	± 0.46	± 12	± 0.55	± 0.55	± 14	± 0.63	± 0.63
Delta II 2925H	± 8	± 0.42	± 0.42	± 11	± 0.51	± 0.51	± 14	± 0.59	± 0.59
Delta III 3940	± 3	± 0.05	± 0.05	± 3	± 0.05	± 0.05	± 3	± 0.05	± 0.05
Delta IV 4040	± 6.5	± 0.13	± 0.06	± 6.5	± 0.13	± 0.06	± 6.5	± 0.13	± 0.06
Delta IV 4240	± 6.5	± 0.13	± 0.06	± 6.5	± 0.13	± 0.06	± 6.5	± 0.13	± 0.06
Delta IV 4450	± 6.5	± 0.13	± 0.06	± 6.5	± 0.13	± 0.06	± 6.5	± 0.13	± 0.06
Delta IV 4050H	± 6.5	± 0.13	± 0.06	± 6.5	± 0.13	± 0.06	± 6.5	± 0.13	± 0.06

Notes:
1. Data based on 99.865% probability of command shutdown (PCS), a 3-sigma performance reserve.
2. 3-sigma injection altitude = ± 10 km.

Table E1-25. Delta 3-Sigma Orbit Dispersions for GTO Missions—Apogee = 100,000 km

Inclination(deg)	28.5		21		15	
Vehicle	Perigee velocity (mps)	Inclination (deg)	Perigee velocity (mps)	Inclination (deg)	Perigee Velocity (mps)	Inclination (deg)
Delta II 2326	± 18	± 0.64	± 49	± 0.65	± 79	± 0.69
Delta II 2426	± 16	± 0.59	± 45	± 0.60	± 74	± 0.64
Delta II 2926	± 13	± 0.45	± 35	± 0.47	± 58	± 0.49
Delta II 2926H	± 11	± 0.41	± 31	± 0.42	± 53	± 0.46
Delta II 2425	± 10	± 0.54	± 39	± 0.55	± 64	± 0.56
Delta II 2925	± 8	± 0.44	± 31	± 0.44	± 52	± 0.46
Delta II 2925H	± 7	± 0.40	± 28	± 0.40	± 48	± 0.42
Delta III 3940	± 5	± 0.05	± 5	± 0.05	± 5	± 0.05
Delta IV 4040	± 5	± 0.05	± 5	± 0.05	± 5	± 0.05
Delta IV 4240	± 5	± 0.05	± 5	± 0.05	± 5	± 0.05
Delta IV 4450	± 5	± 0.05	± 5	± 0.05	± 5	± 0.05
Delta IV 4050H	± 5	± 0.05	± 5	± 0.05	± 5	± 0.05

Notes:
1. Data based on 99.865% PCS, a 3-sigma performance reserve.
2. 3-sigma injection altitude = ± 10 km.

Table E1-26. Delta 3-Sigma Orbit Dispersions for GTO Missions—Apogee = 35,788 km

Inclination(deg)	28.5		21		15	
Vehicle	Perigee velocity (mps)	Inclination (deg)	Perigee velocity (mps)	Inclination (deg)	Perigee velocity (mps)	Inclination (deg)
Delta II 2326	± 16	± 0.59	± 48	± 0.60	± 79	± 0.62
Delta II 2426	± 14	± 0.54	± 44	± 0.54	± 73	± 0.56
Delta II 2926	± 11	± 0.40	± 34	± 0.42	± 57	± 0.45
Delta II 2926H	± 10	± 0.36	± 30	± 0.37	± 51	± 0.40
Delta II 2425	± 9	± 0.48	± 39	± 0.50	± 65	± 0.52
Delta II 2925	± 7	± 0.40	± 31	± 0.40	± 52	± 0.41
Delta II 2925H	± 7	± 0.36	± 28	± 0.36	± 48	± 0.38
Delta III 3940	± 5	± 0.05	± 5	± 0.05	± 5	± 0.05
Delta IV 4040	± 5	± 0.05	± 5	± 0.05	± 5	± 0.05
Delta IV 4240	± 5	± 0.05	± 5	± 0.05	± 5	± 0.05
Delta IV 4450	± 5	± 0.05	± 5	± 0.05	± 5	± 0.05
Delta IV 4050H	± 5	± 0.05	± 5	± 0.05	± 5	± 0.05

Notes:
1. Data based on 99.865% PCS, a 3-sigma performance reserve.
2. 3-sigma injection altitude = ± 10 km.

Table E1-27. Delta 3-Sigma Orbit Dispersions for GTO Missions—Apogee = 5,000 km

Inclination(deg)	28.5		21		15	
Vehicle	Perigee velocity (mps)	Inclination (deg)	Perigee velocity (mps)	Inclination (deg)	Perigee velocity (mps)	Inclination (deg)
Delta II 2326	± 8	± 0.34	± 56	± 0.37	± 83	± 0.35
Delta II 2426	± 8	± 0.33	± 51	± 0.33	± 76	± 0.33
Delta II 2926	± 6	± 0.27	± 37	± 0.24	± 56	± 0.25
Delta II 2926H	± 6	± 0.23	± 32	± 0.21	± 50	± 0.21
Delta II 2425	± 4	± 0.22	± 37	± 0.24	± 65	± 0.28
Delta II 2925	± 4	± 0.22	± 37	± 0.24	± 56	± 0.24
Delta II 2925H	± 4	± 0.22	± 34	± 0.22	± 51	± 0.22
Delta III 3940	± 5	± 0.05	± 5	± 0.05	± 5	± 0.05
Delta IV 4040	± 5	± 0.05	± 5	± 0.05	± 5	± 0.05
Delta IV 4240	± 5	± 0.05	± 5	± 0.05	± 5	± 0.05
Delta IV 4450	± 5	± 0.05	± 5	± 0.05	± 5	± 0.05
Delta IV 4050H	± 5	± 0.05	± 5	± 0.05	± 5	± 0.05

Notes:
1. Data based on 99.865% PCS, a 3-sigma performance reserve.
2. 3-sigma injection altitude = ± 10 km.

4.0 PAYLOAD SEPARATION ATTITUDE ACCURACY AND RATES

Standard payload deployment attitude and rate dispersions are shown in Table E1-28. Dispersions are defined for each vehicle configuration and consist of all known error sources. Dispersions are affected by spacecraft mass properties and CG offsets. Mission-specific attitude and rate dispersions will be defined in the Payload/Expended Stage Separation Analysis (CDRL 4-3).

Table E1-28. Standard Payload Deployment Attitudes/Rates

Vehicle	Configuration	Spinning	Payload adapter (PA)	Payload separation attitude and rate dispersions (3σ values)			
				Attitude (deg)	Rate (dps)	Momentum vector	Cone angle
Delta II	Two-Stage	No	6306, 6019, 6915	< 3.0	< 0.25 (/axis)	-	-
			5624, DPAF	< 0.65	< 3.0 (trans), < 1.0 (roll)	-	-
		Up to 5 rpm (± 1 deg/sec)	DPAF, 5624	-	-	< 5.0 deg	< 5.0 deg
	Three-Stage	Up to 100 rpm (± 15 %)	3712, 3724	-	-	< 10.0 deg	< 6.0 deg
		Despun (0 ± 5 rpm)	3712, 3724	< 10.0	< 7.0 (trans)	-	-
Delta III	Two-Stage	No	1666-4	< 0.65	< 2.0 (trans), < 1.0 (roll)	-	-
		Up to 5 rpm (± 1 deg/sec)	1666-4	< 10.0	< 3.0 (trans)	-	-
Delta IV	Two-Stage	No	1194-5,1194-4, 1575-4	< 1.4	< 2.0 (trans), < 1.0 (roll)	-	-
		Up to 5 rpm (± 1 deg/sec)	1194-5	< 10.0	< 3.0 (trans)	-	-

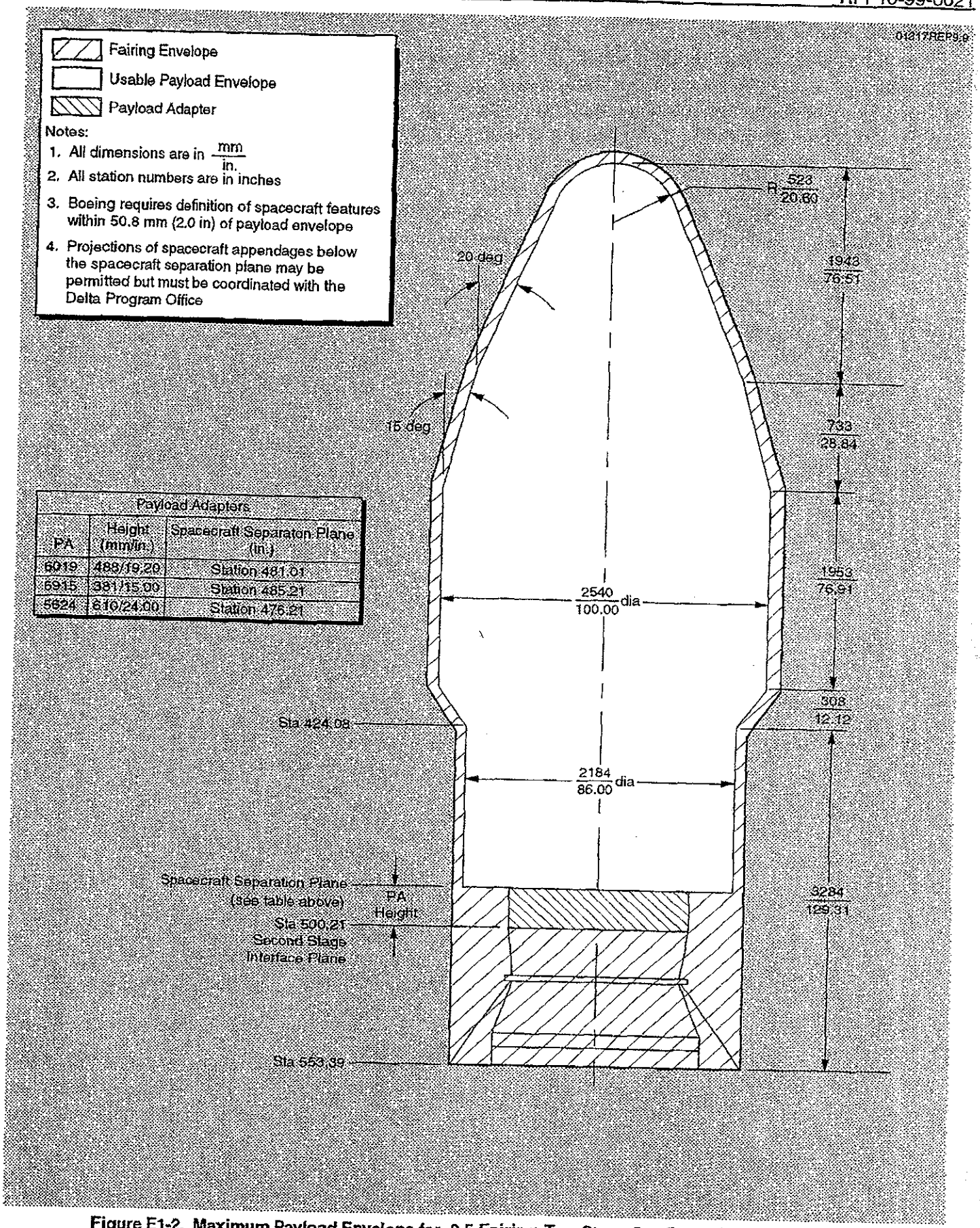
Note: Data provided for three-stage missions assume the following requirements are satisfied.

1. Spacecraft is balanced to a 0.05 in. maximum CG offset and a 0.25-deg maximum spin principal axis misalignment.
2. Worst-case divergent time constants at stage III ignition and burnout are 150 sec and 50 sec respectively for third stages with an active nutation control system.
3. Worst-case divergent time constants at stage III ignition and burnout are 150 sec and 150 sec respectively for third stages without an active nutation control system.
4. Missions using a Star-37FM third stage and requiring a yo-yo despin system also require the active nutation control system.
5. The spacecraft contractor is required to provide the spacecraft roll moment of inertia with a 5% maximum uncertainty when a yo-yo depsin system is requested.

If these requirements are met, then Boeing does only the standard mission specific analyses. If these requirements cannot be met, Boeing will work with KSC and the spacecraft contractor to resolve any potential problems.

5.0 PAYLOAD FAIRING

The combination of the payload fairing (PLF) and PA shown in Figures E1-2 through E1-18 provides the payload static envelopes and the associated dynamic envelopes for a rigid spacecraft hard-mounted to the PA. The envelopes include allowances for relative static/dynamic deflections between the launch vehicle (LV) and payload (PL), assuming that the PL and its appendages comply with the frequency and structural stiffness requirements identified in the Payload Planners Guide for each vehicle. The manufacturing tolerances of the LV and acoustic blanket static and in-flight thickness are also included. The use of these envelopes as the required dynamic envelope for a rigid payload hard-mounted to the PA is conservative.



Payload Adapters		
PA	Height (mm/in.)	Spacecraft Separaton Plane (in.)
6919	488/19.20	Station 481.01
6915	381/15.00	Station 485.21
5624	610/24.00	Station 476.21

Figure E1-2. Maximum Payload Envelope for -9.5 Fairing, Two-Stage Configuration (Various PAs)

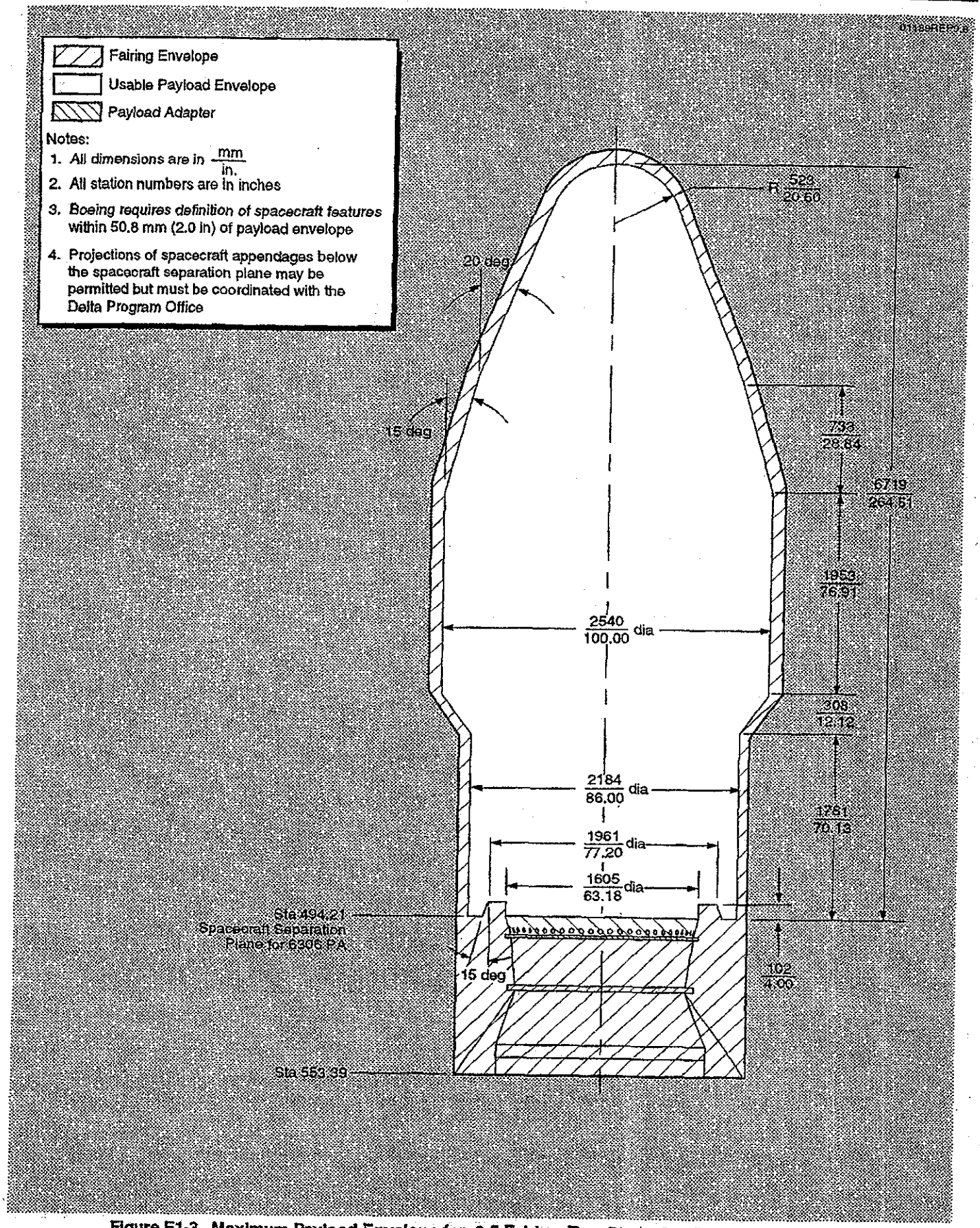
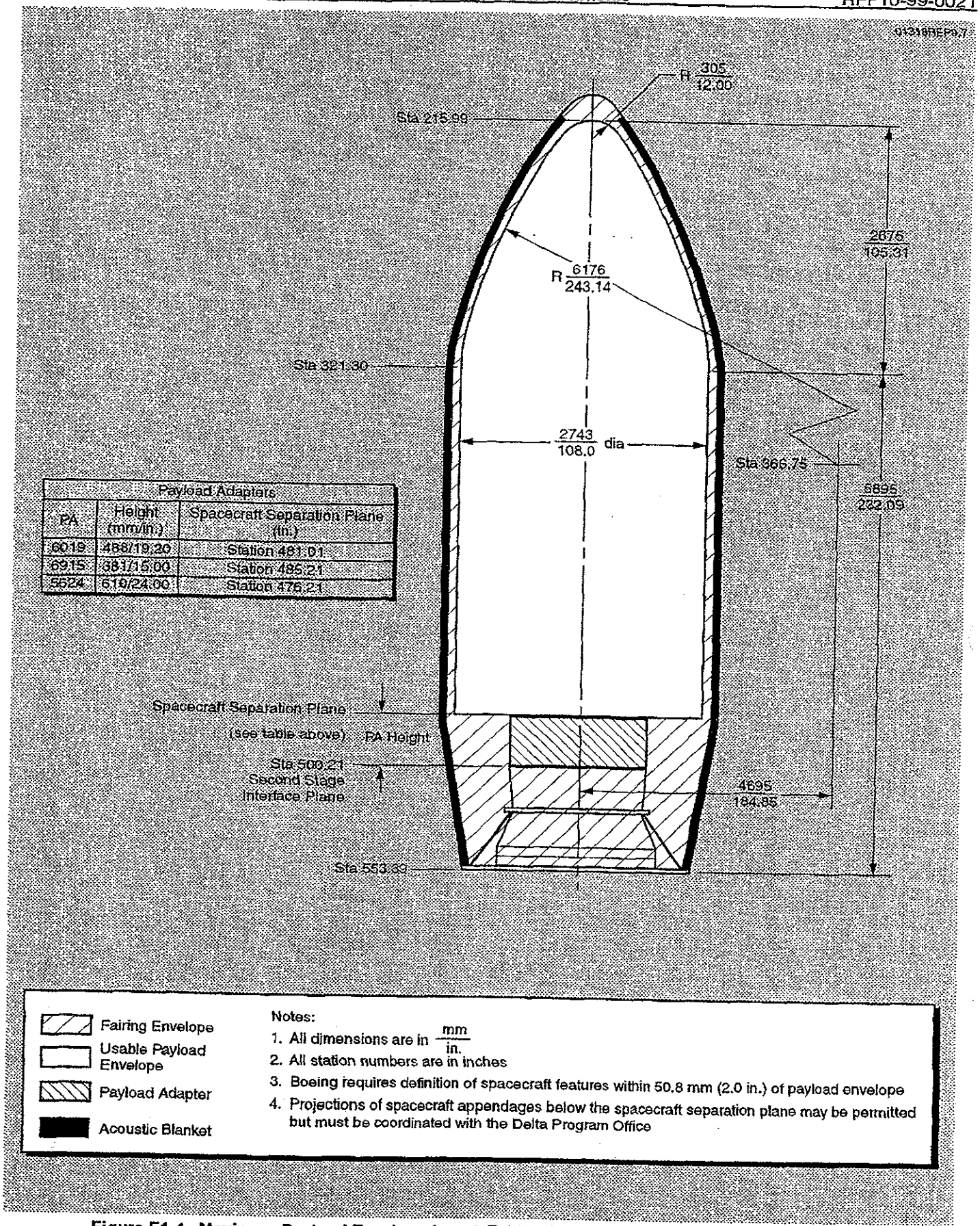


Figure E1-3. Maximum Payload Envelope for -9.5 Fairing, Two-Stage Configuration (6306 PA)



Payload Adapters		
PA	Height (mm/in.)	Spacecraft Separation Plane (in.)
6019	488/19.20	Station 481.01
6915	381/15.00	Station 485.21
5624	610/24.00	Station 476.21

Figure E1-4. Maximum Payload Envelope for -10 Fairing, Two-Stage Configuration (Various PAs)

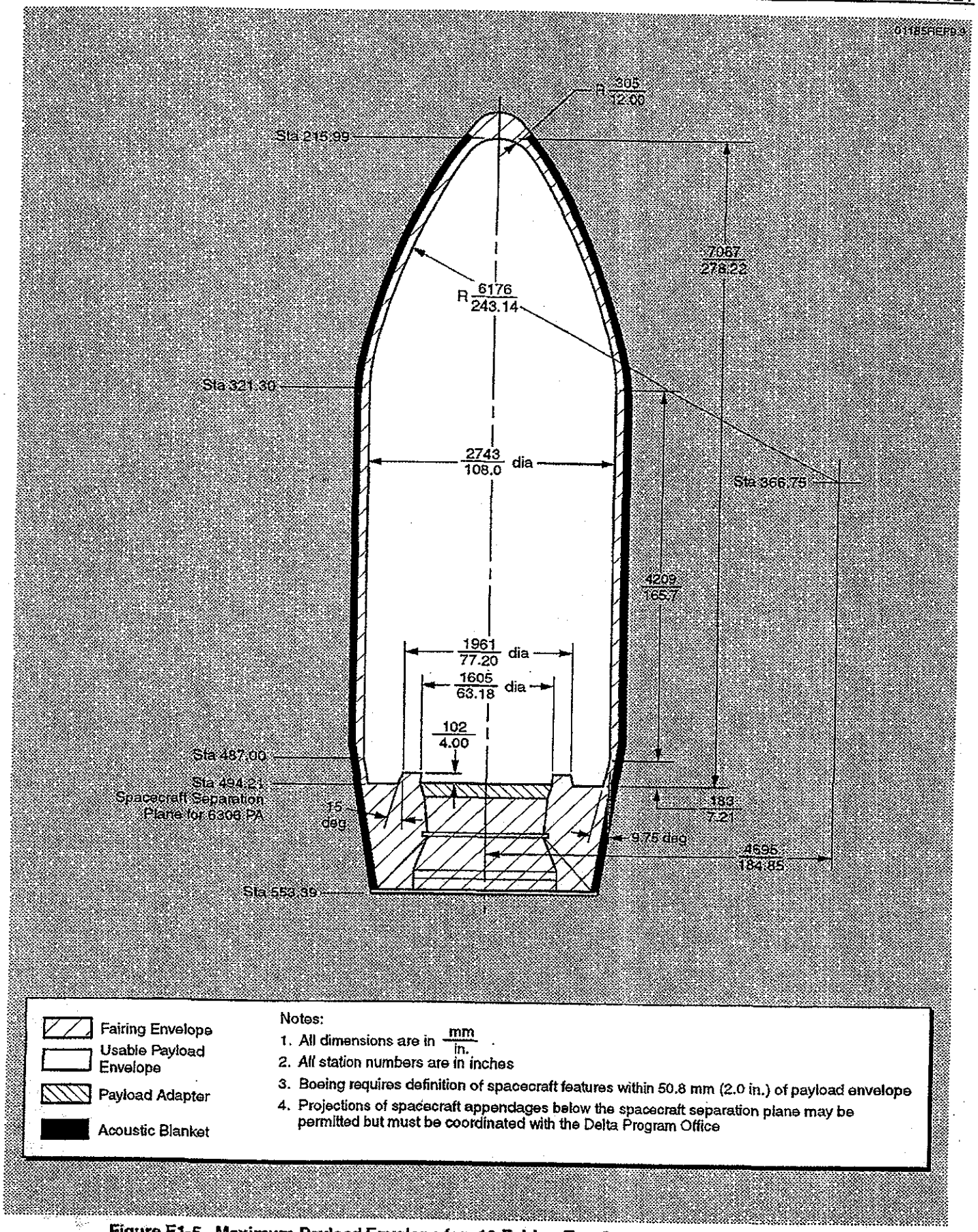
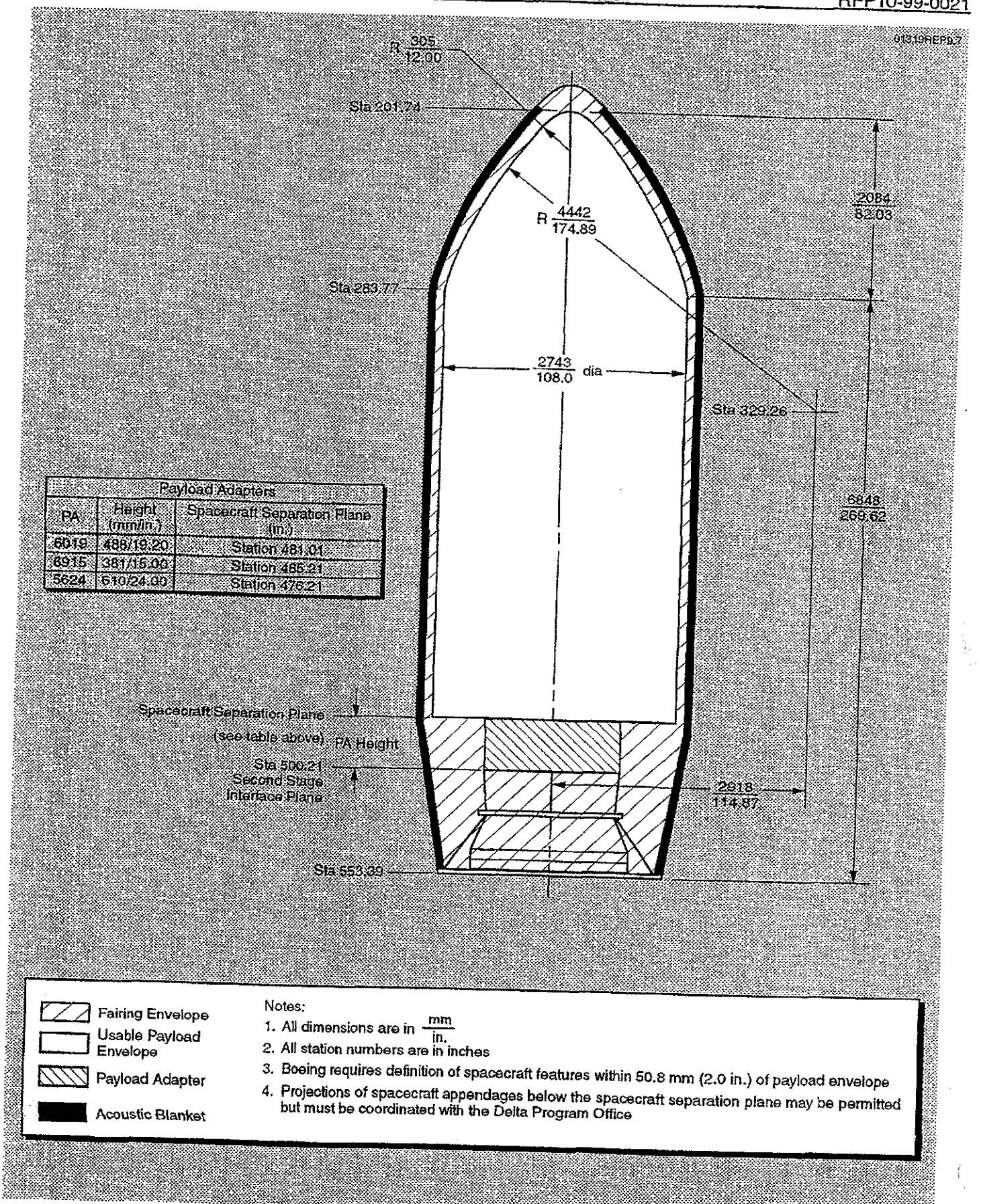


Figure E1-5. Maximum Payload Envelope for -10 Fairing, Two-Stage Configuration (6306 PA)



Payload Adapters		
PA	Height (mm/in.)	Spacecraft Separation Plane (in.)
6019	488/19.20	Station 481.01
6915	381/15.00	Station 485.21
5624	610/24.00	Station 476.21

Figure E1-6. Maximum Payload Envelope for -10L Fairing, Two-Stage Configuration (Various PAs)

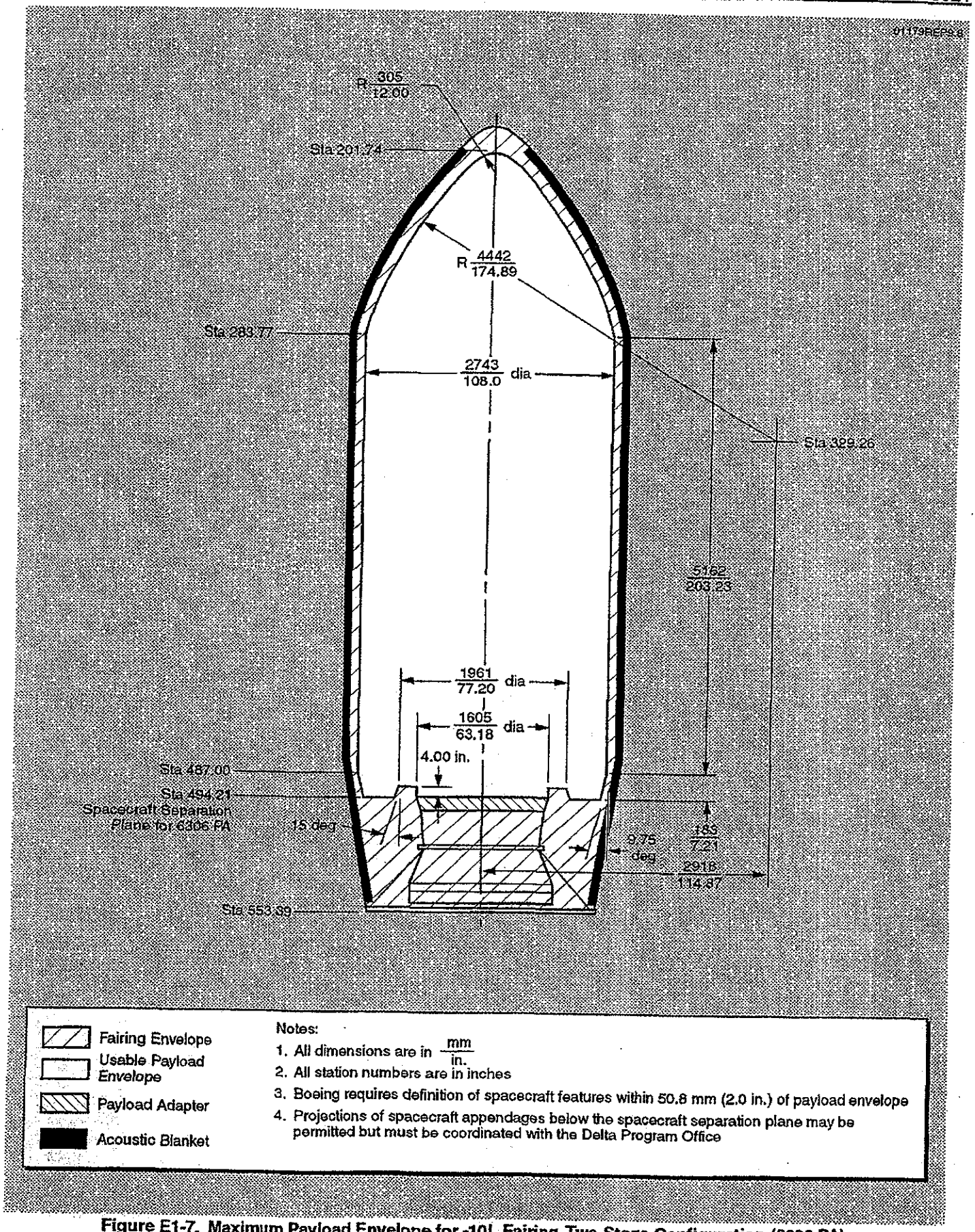


Figure E1-7. Maximum Payload Envelope for -10L Fairing, Two-Stage Configuration (6306 PA)

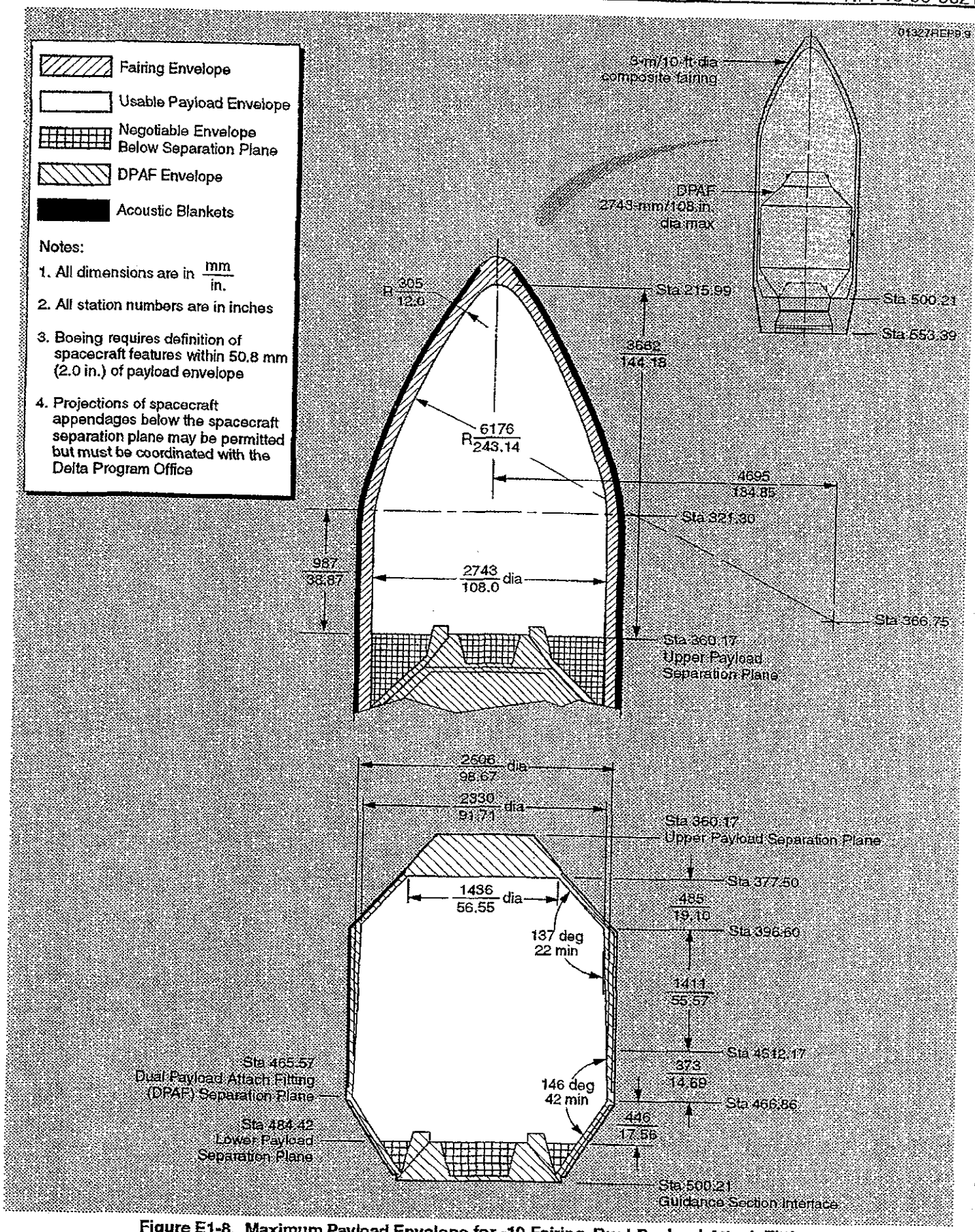


Figure E1-8. Maximum Payload Envelope for -10 Fairing, Dual-Payload Attach Fitting

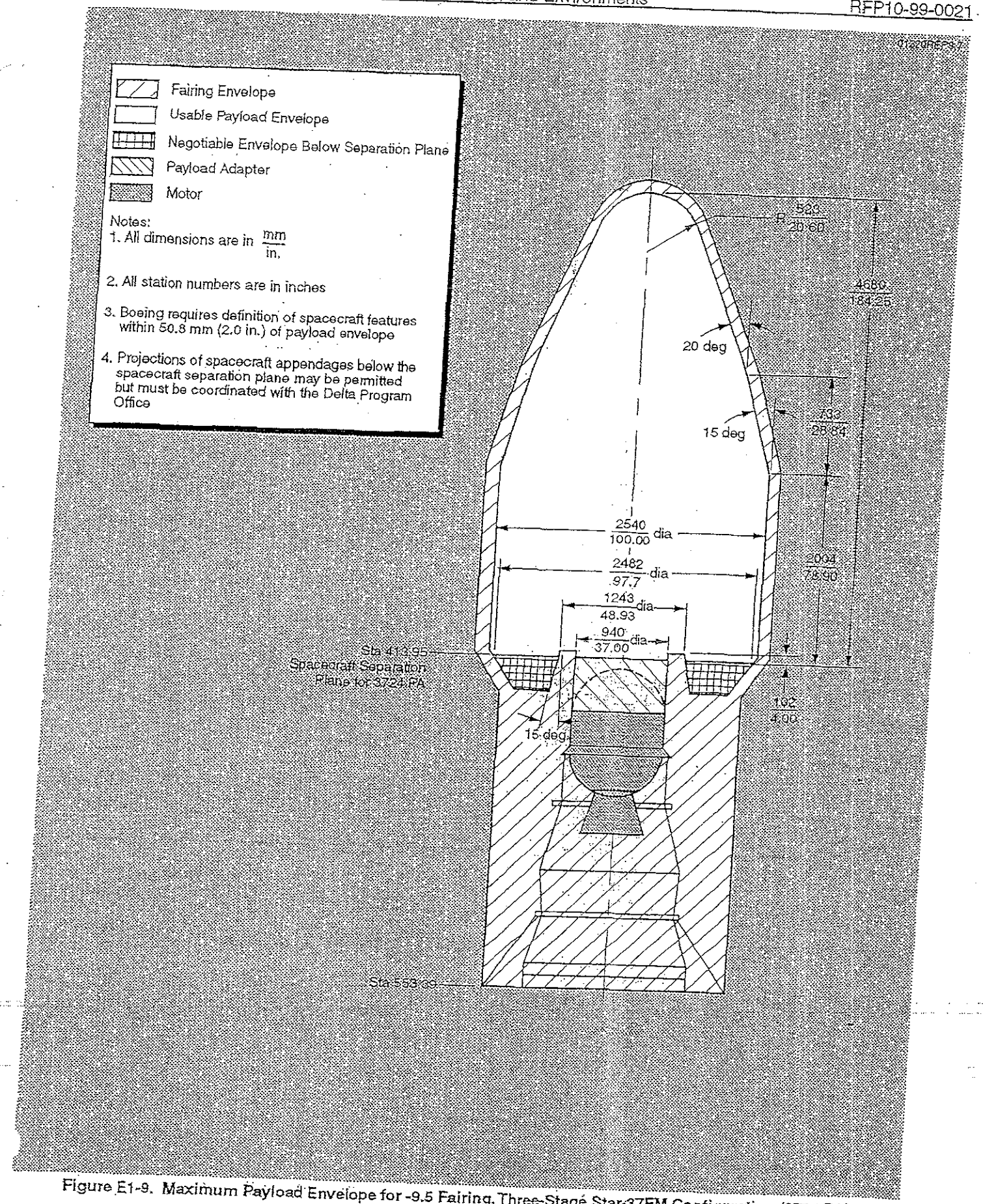


Figure E1-9. Maximum Payload Envelope for -9.5 Fairing, Three-Stage Star-37FM Configuration (3724 PA)

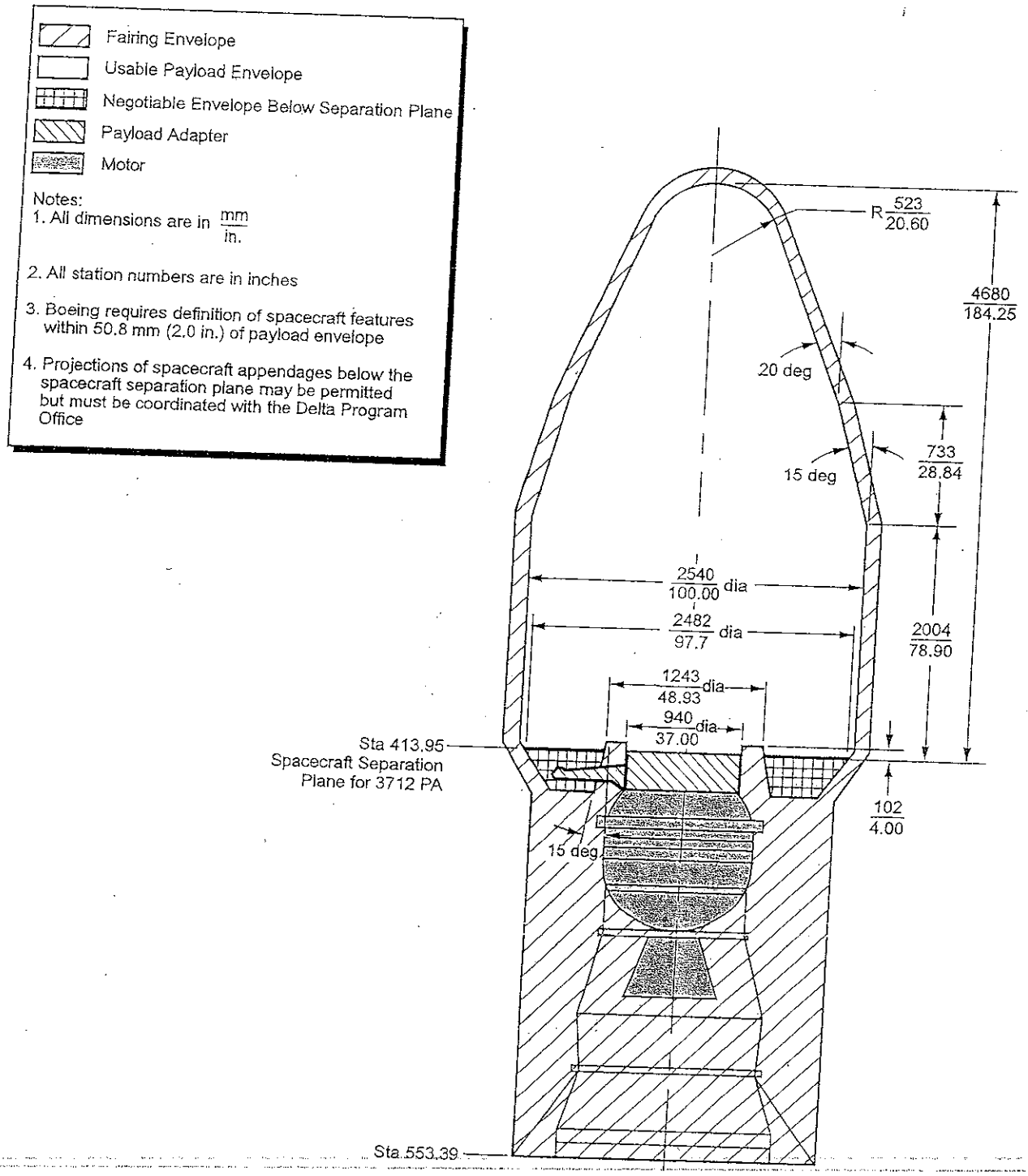


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Figure E1-10. Maximum Payload Envelope for -9.5 Fairing, Three-Stage Star-48B Configuration (3712 PA)

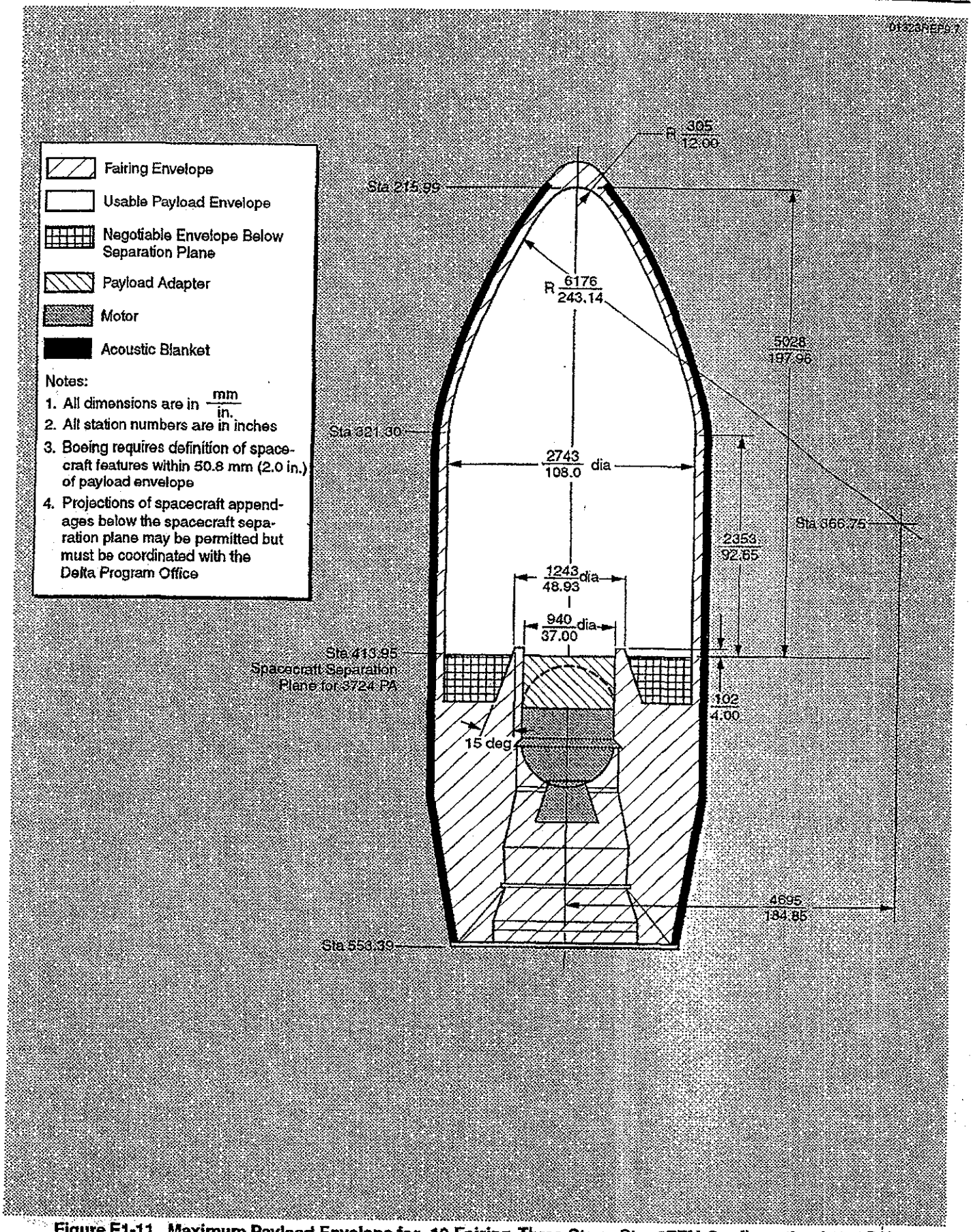


Figure E1-11. Maximum Payload Envelope for -10 Fairing, Three-Stage Star-37FM Configuration (3724 PA)

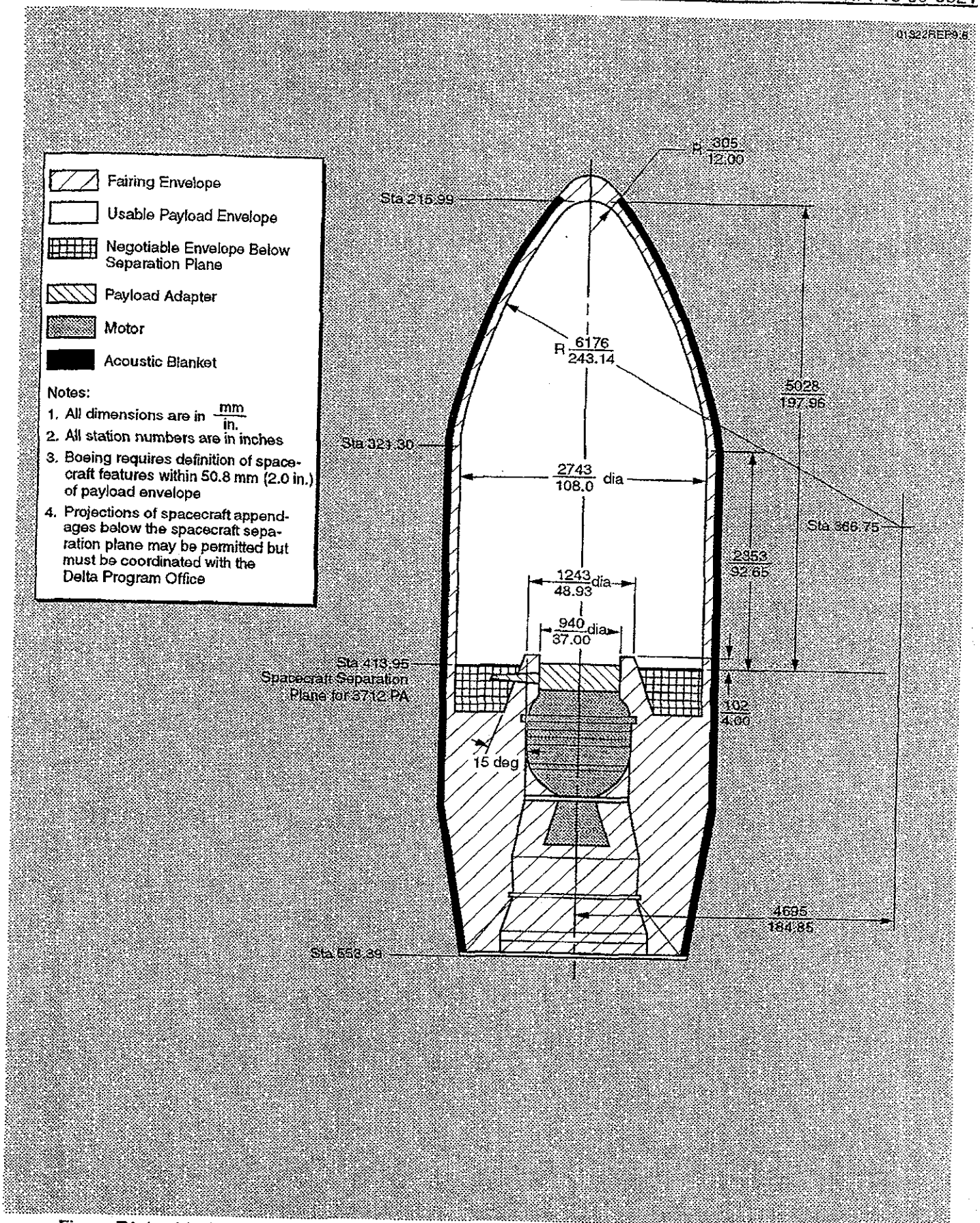


Figure E1-12. Maximum Payload Envelope for -10 Fairing, Three-Stage Star-48B Configuration (3712 PA)

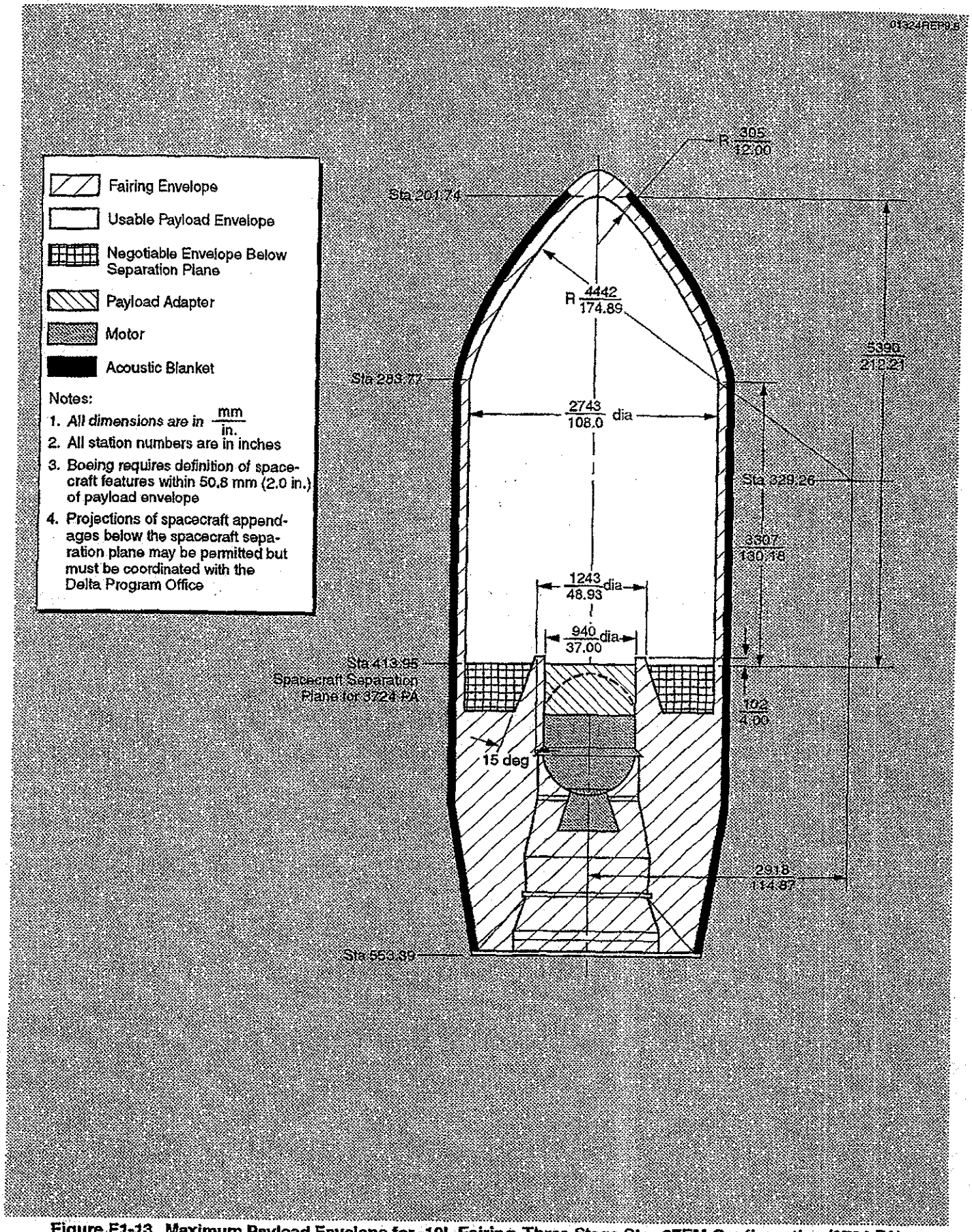


Figure E1-13. Maximum Payload Envelope for -10L Fairing, Three-Stage Star-37FM Configuration (3724 PA)

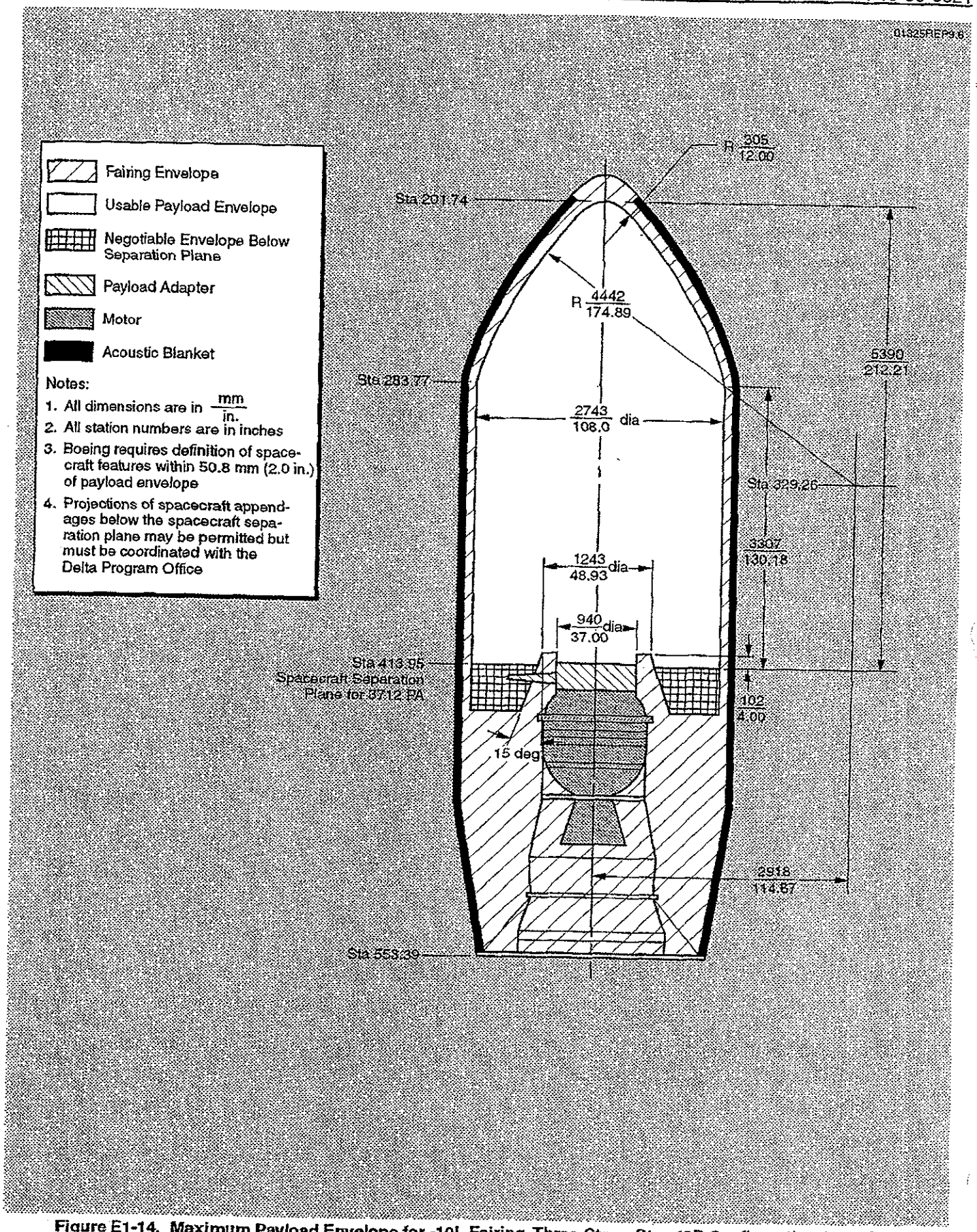


Figure E1-14. Maximum Payload Envelope for -10L Fairing, Three-Stage Star-48B Configuration (3712 PA)

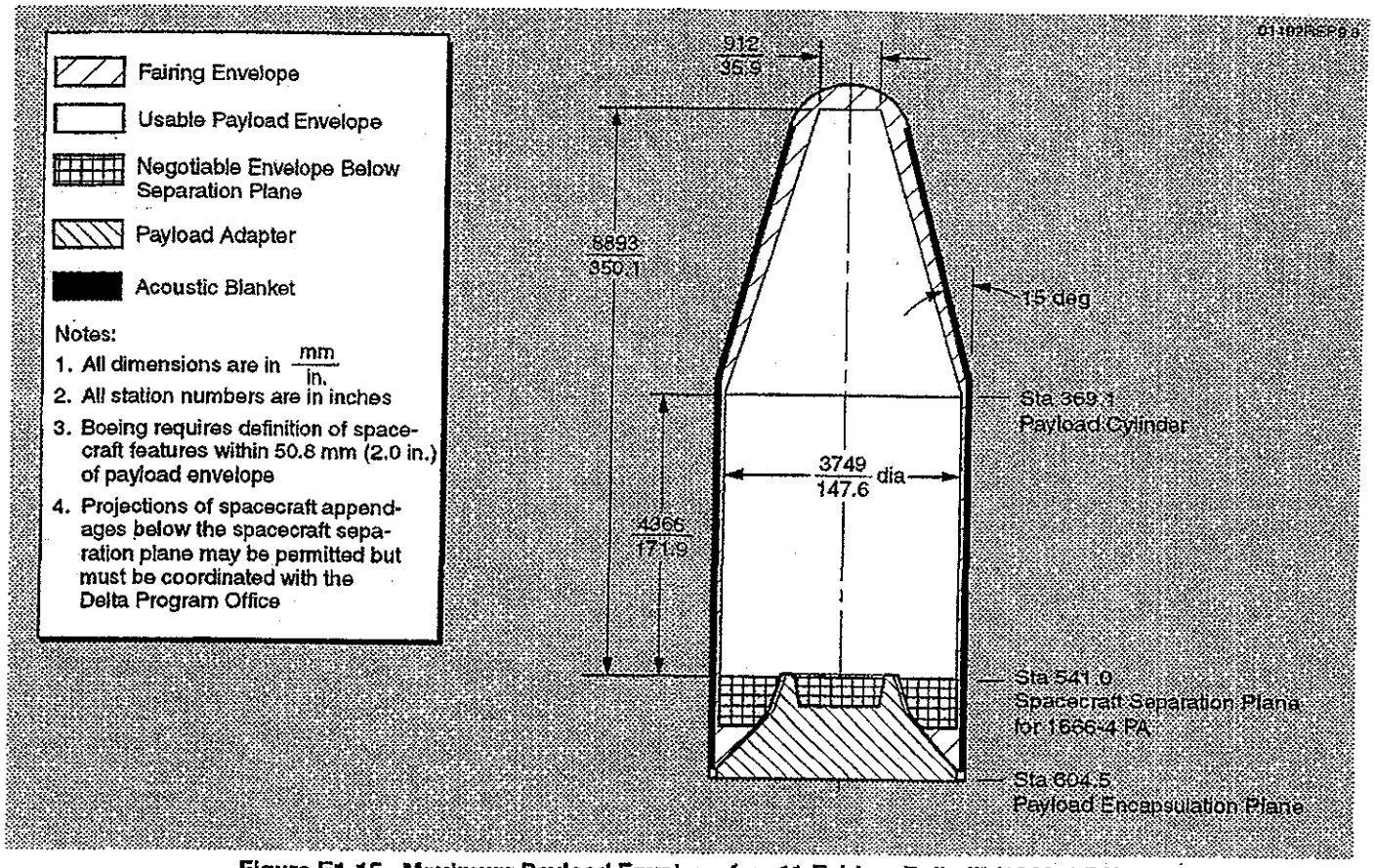
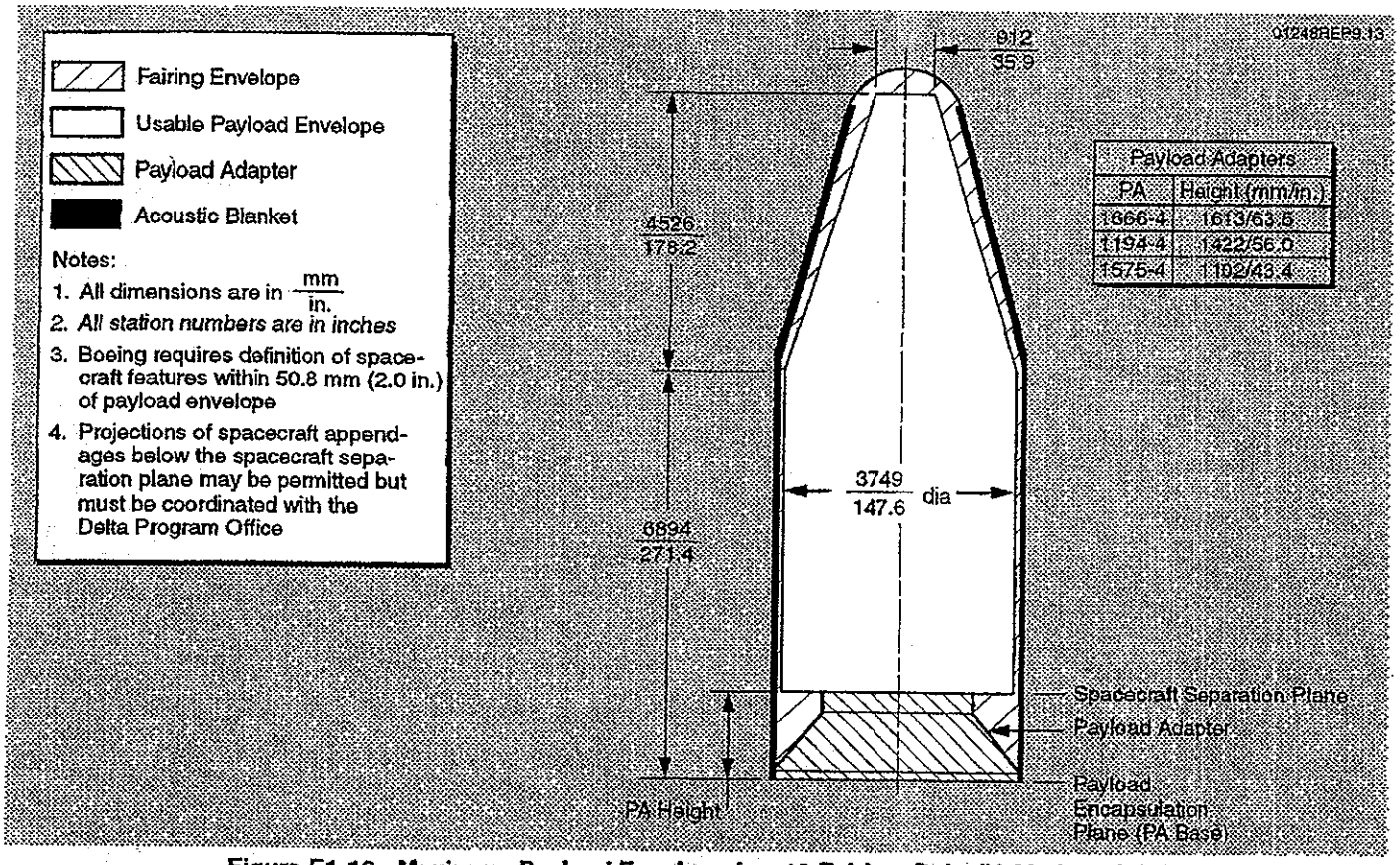


Figure E1-15. Maximum Payload Envelope for -11 Fairing, Delta III (1666-4 PA)



Payload Adapters	
PA	Height (mm/in.)
1666-4	1613/63.5
1194-4	1422/56.0
1575-4	1102/43.4

Figure E1-16. Maximum Payload Envelope for -12 Fairing, Delta IV (Various PAs)

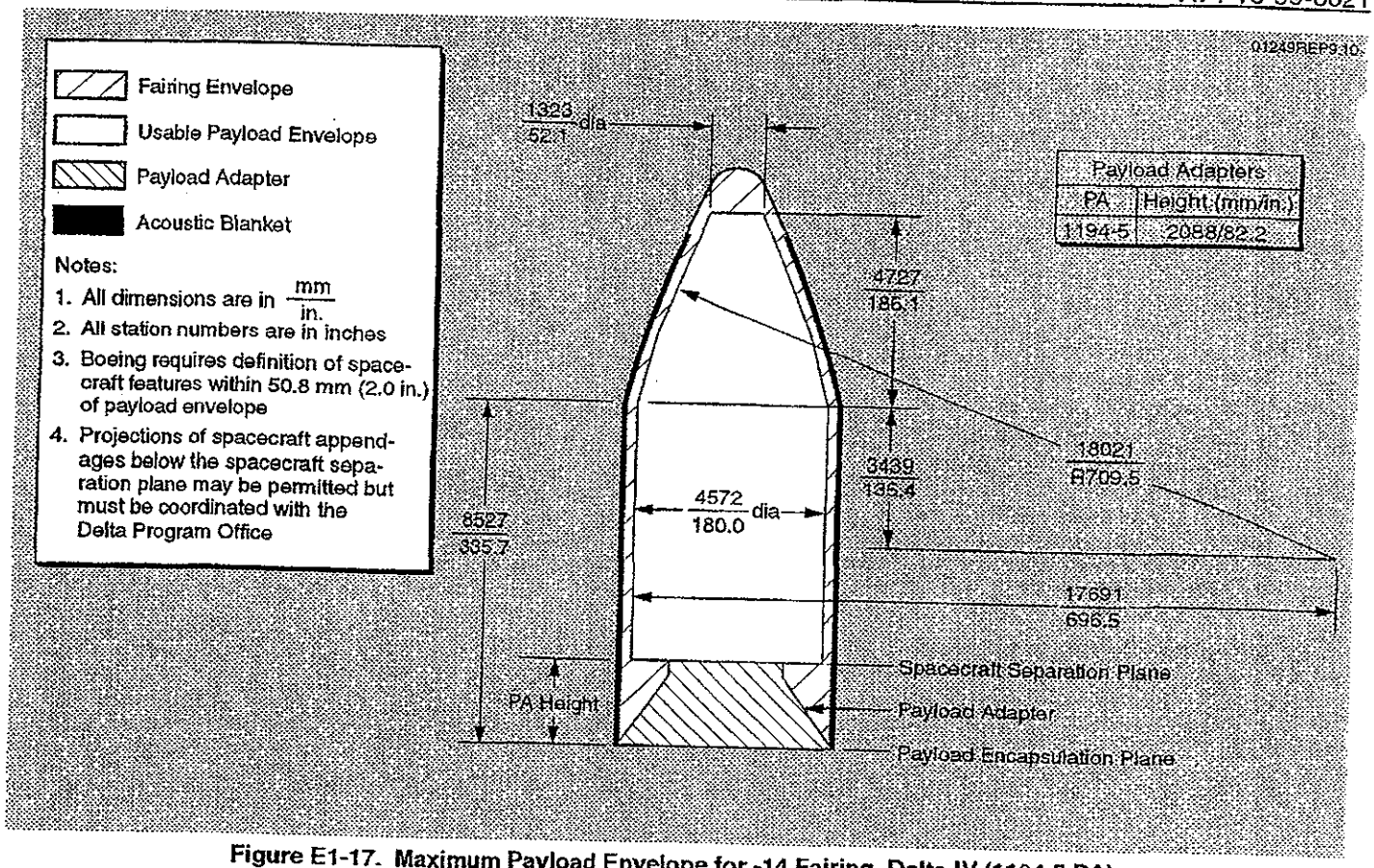


Figure E1-17. Maximum Payload Envelope for -14 Fairing, Delta IV (1194-5 PA)

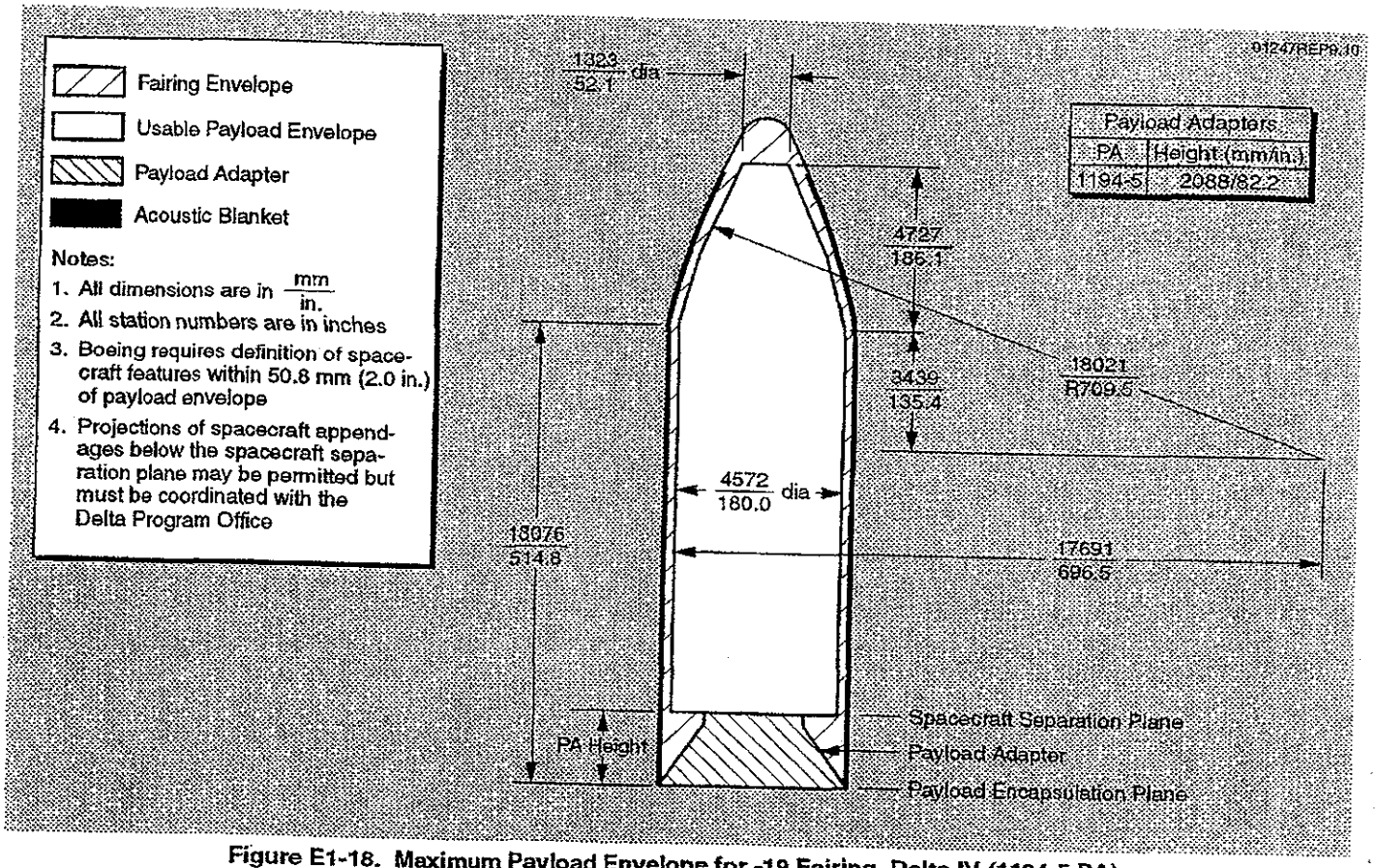


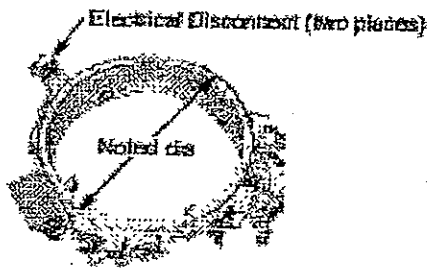
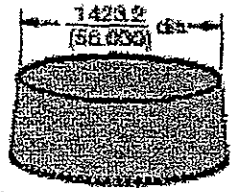
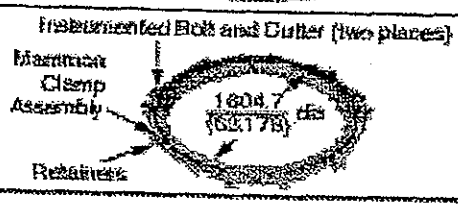
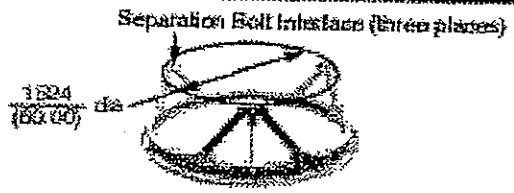
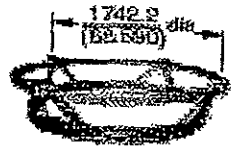
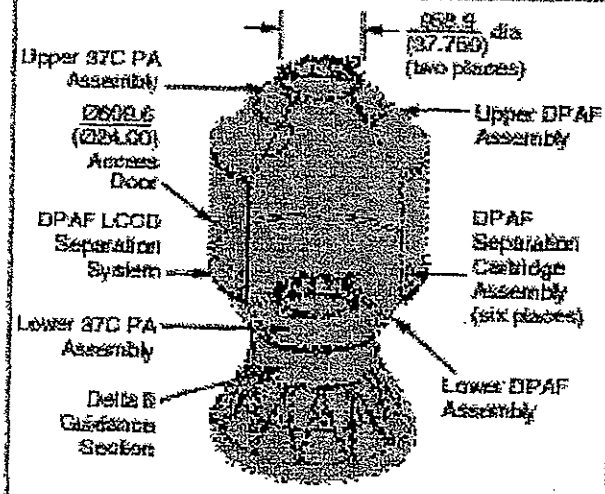
Figure E1-18. Maximum Payload Envelope for -19 Fairing, Delta IV (1194-5 PA)

6.0 MECHANICAL INTERFACE

Payload adapters, separation systems, and interfaces available for Delta II, III, and IV, respectively, are illustrated in Figures E1-19, E1-20, and E1-21. Additional mechanical interfaces may be proposed to accommodate a variety of spacecraft.

The payload adapters use either a clampband or bolts/separation nuts as the primary method of attachment. The clampband stud cutters are booted and produce no debris. Recontact of the separated clampband with the spacecraft is prevented through the use of clampband catchers/retainers on the launch vehicle. In the case of the bolt/separation nut systems, the separation nuts are noncontaminating, and the released bolts are caught in bolt catcher assemblies attached to the spacecraft. The separation velocity imparted by the spring actuators is sufficient to assure 3-sigma probabilities of not recontacting the launch vehicle after separation. For spinning three-stage missions, the yo-tumble system is added to prevent the third stage from recontacting the spacecraft. For missions using the secondary latch system adapters, the second-stage helium blowdown retro system provides sufficient separation velocity to prevent recontact with the spacecraft.

For Delta II two-stage missions not requiring a PA, the "interface" is a circular 68-bolt pattern on a diameter of either 1489.20 mm (58.630 in.) or 1546.12 mm (60.871 in.).

Model	Illustration	Separation Mechanism	Description
3712A 3712B 3712C 3724C		Noted dia Clamp band, Springs	Two instrumented studs verify clamp band preload. Retention system prevents clamp band recontact. Four matched spring actuators minimize separation-induced tipoff rates. Two 37-pin spacecraft interface wire harnesses with the connector across the separation plane. Noted: $\frac{945.3}{(37.215)}$ dia for 3712A $\frac{960.6}{(37.750)}$ dia for 3712B, 3712C, and 3724C
5624		$\frac{1422.2}{(56.000)}$ dia Clamp band	Two instrumented studs verify preload. Matched springs minimize tipoff rates. Two 37-pin spacecraft interface wire harnesses with the connector across the separation plane.
6906		$\frac{1604.7}{(63.178)}$ dia Clamp band	Two instrumented studs verify preload. Secondary latch system employed to minimize tipoff rates. Second stage backed away using helium retro system. Up to two 37-pin spacecraft interface wire harnesses with the electrical connector from the PLF to the spacecraft.
6019		Three Separation Bolts	Three hard-point attachments released by redundantly initiated explosive nuts. Secondary latch system minimizes tipoff rates. Second stage backed away using helium retro system. Up to two 37-pin spacecraft interface wire harnesses with the electrical connector from the PLF to the spacecraft.
6916		Four Separation Bolts	Four hard-point attachments released by four pairs of redundantly initiated explosive nuts. Four matched springs minimize tipoff rates. Secondary latch system available for reduced tipoff rates. Up to two 37-pin spacecraft interface wire harnesses with the electrical connector from the PLF to the spacecraft.
Dual-Payload Attach Fitting		$\frac{959.9}{(37.759)}$ dia Clamp band, Springs	Dual-manifest missions. Connect spacecraft interface on both upper and lower PA assembly. Two instrumented studs verify clamp band preload. Retention system prevents clamp band recontact. Four matched spring actuators minimize separation-induced tipoff rates. Line charge coupling device (LCCD) separates the DPAF structure circumferentially. DPAF structure pushed away using six matched spring cartridge assembly. Two 37-pin spacecraft interface wire harnesses with the connector across the separation plane.

Note: All dimensions are in $\frac{\text{mm}}{(\text{in.})}$

Figure E1-19. Delta II Payload Adapters and Interfaces

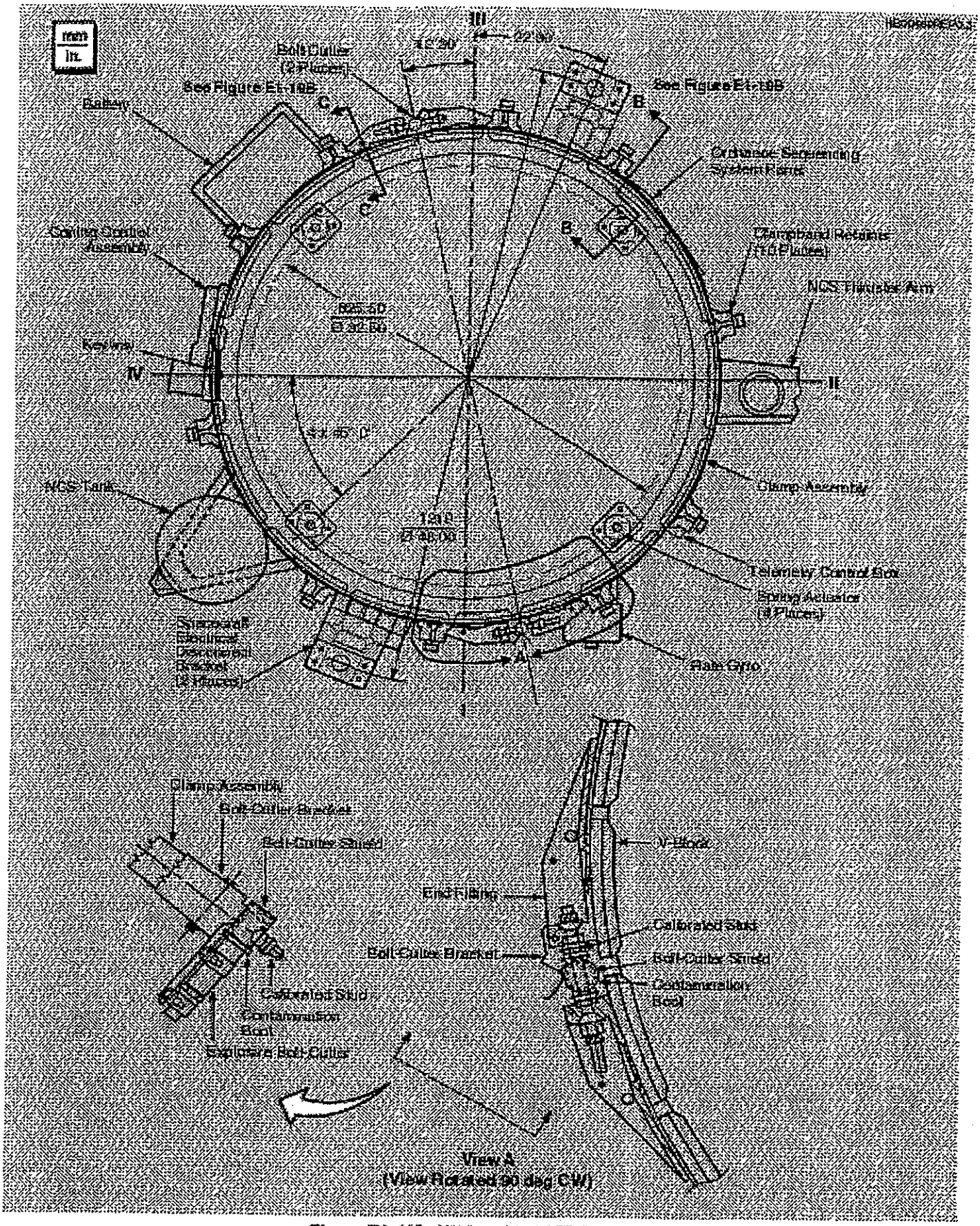


Figure E1-19A. 3712 and 3724 PA Interface

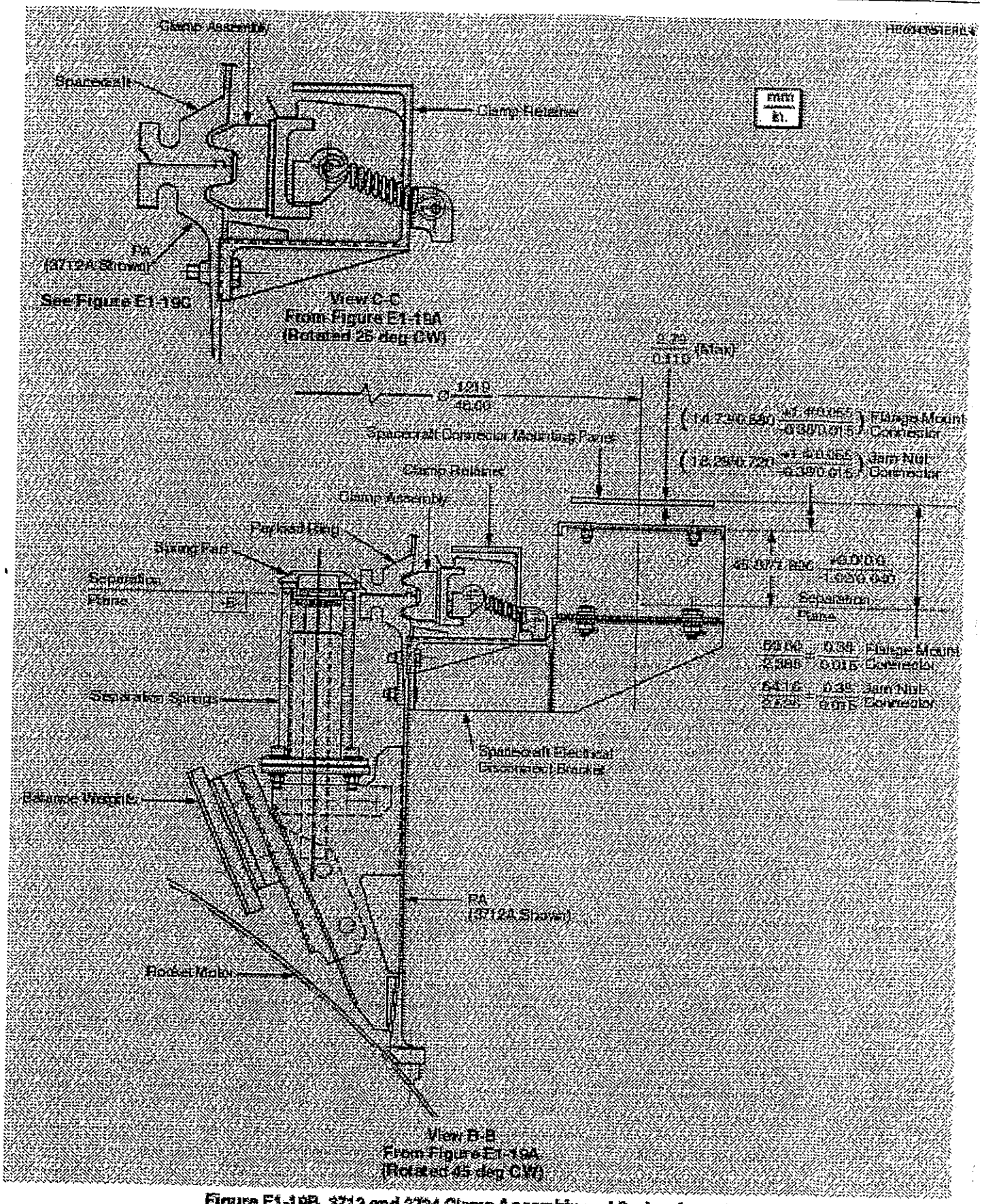


Figure E1-19B. 3712 and 3724 Clamp Assembly and Spring Actuator

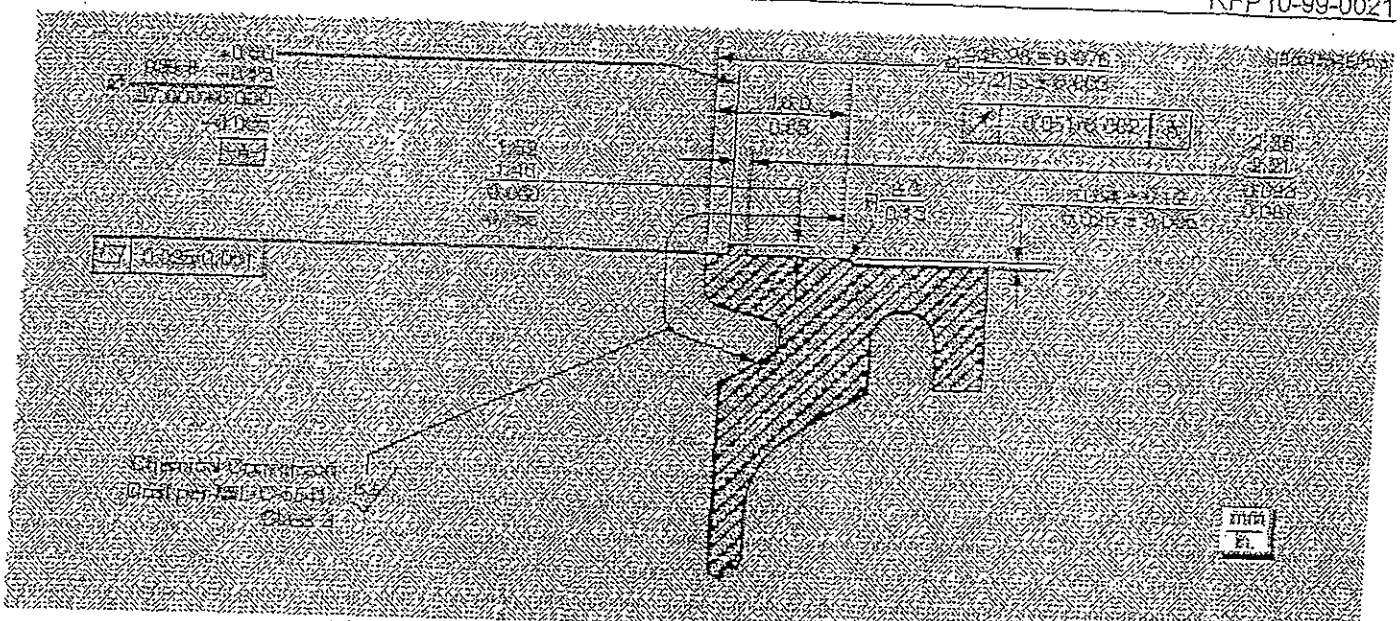


Figure E1-19C. 3712A Launch Vehicle PA Detailed Dimensions

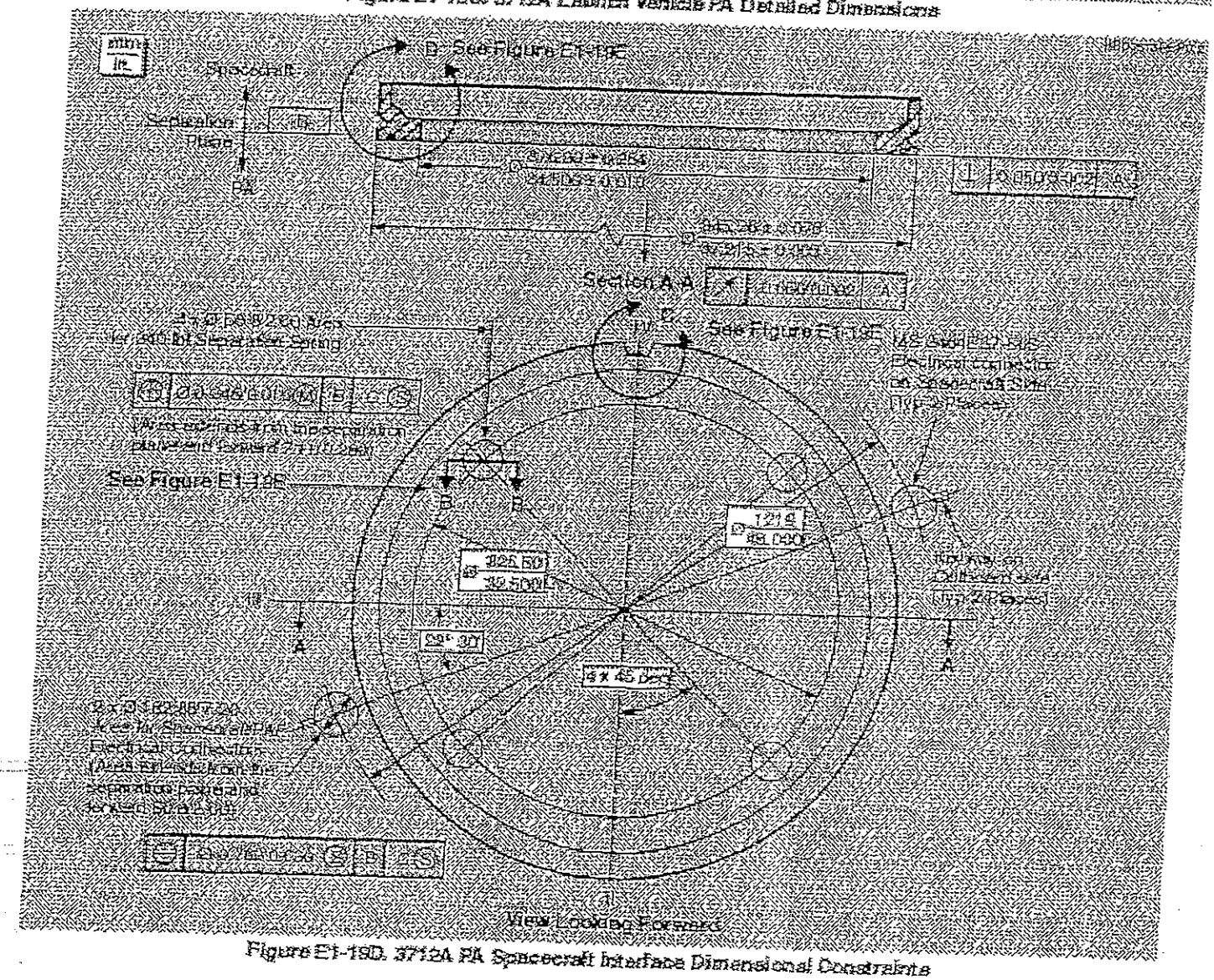


Figure E1-19D. 3712A PA Spacecraft Interface Dimensional Constraints

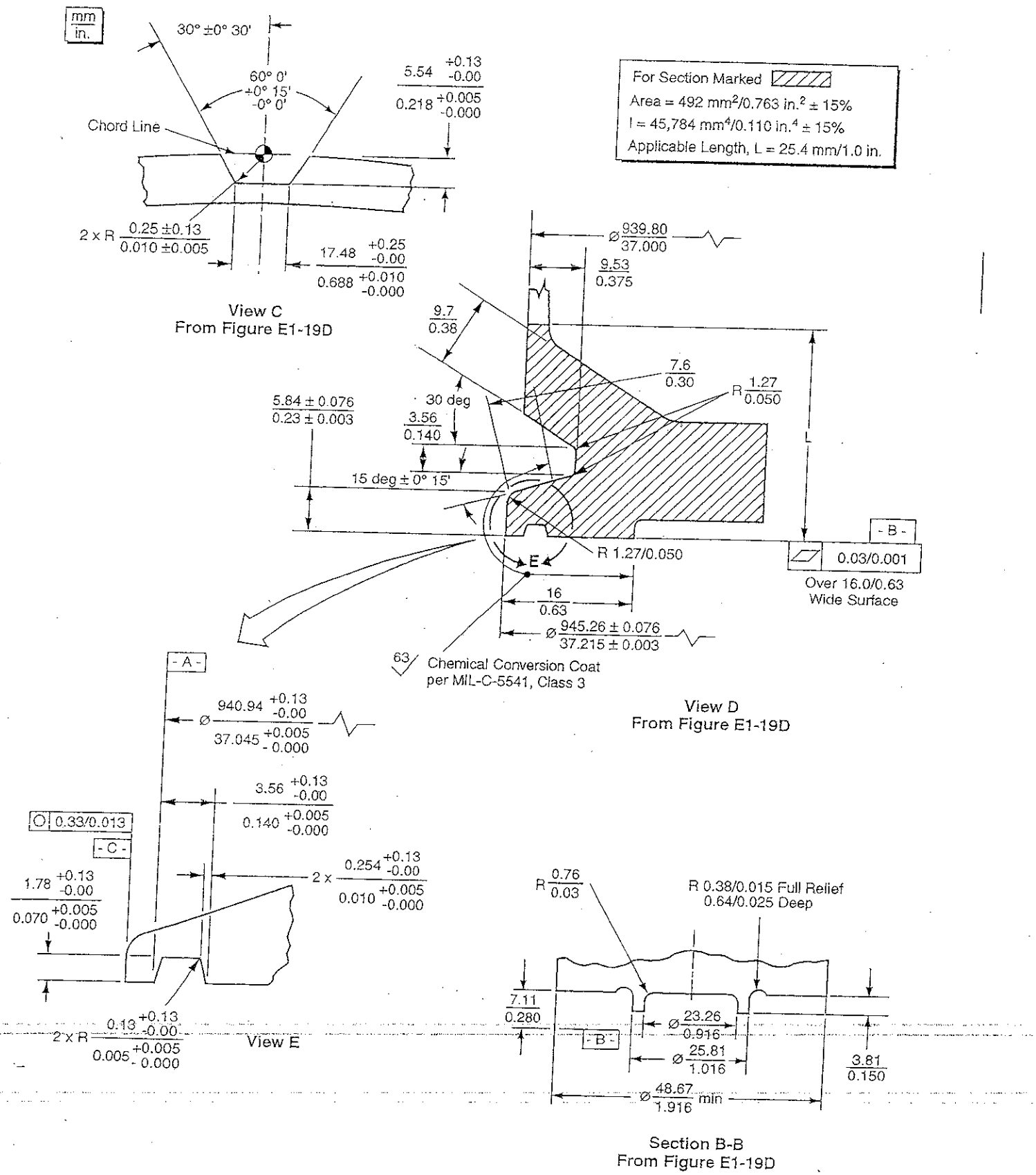


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Figure E1-19E. 3712A PA Spacecraft Dimensional Constraints

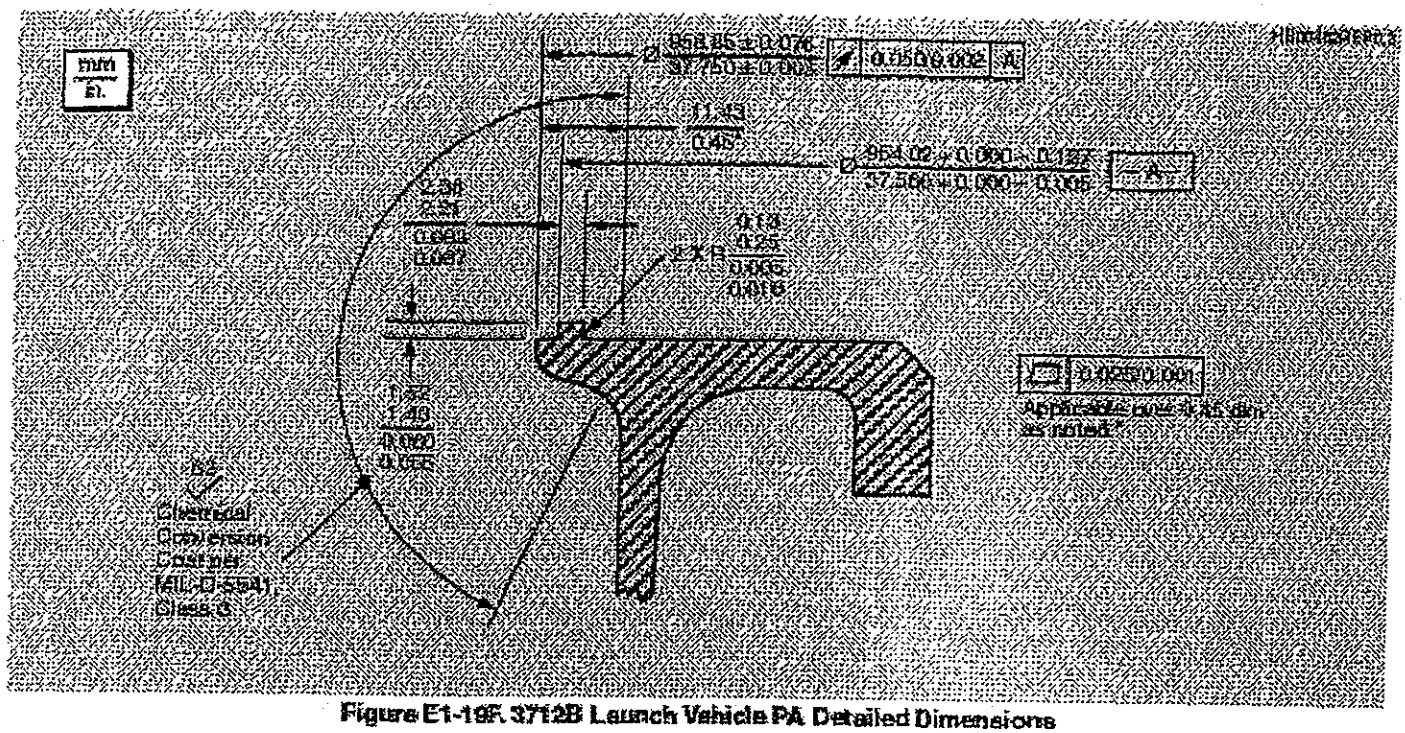

Figure E1-19F. 3712B Launch Vehicle PA Detailed Dimensions

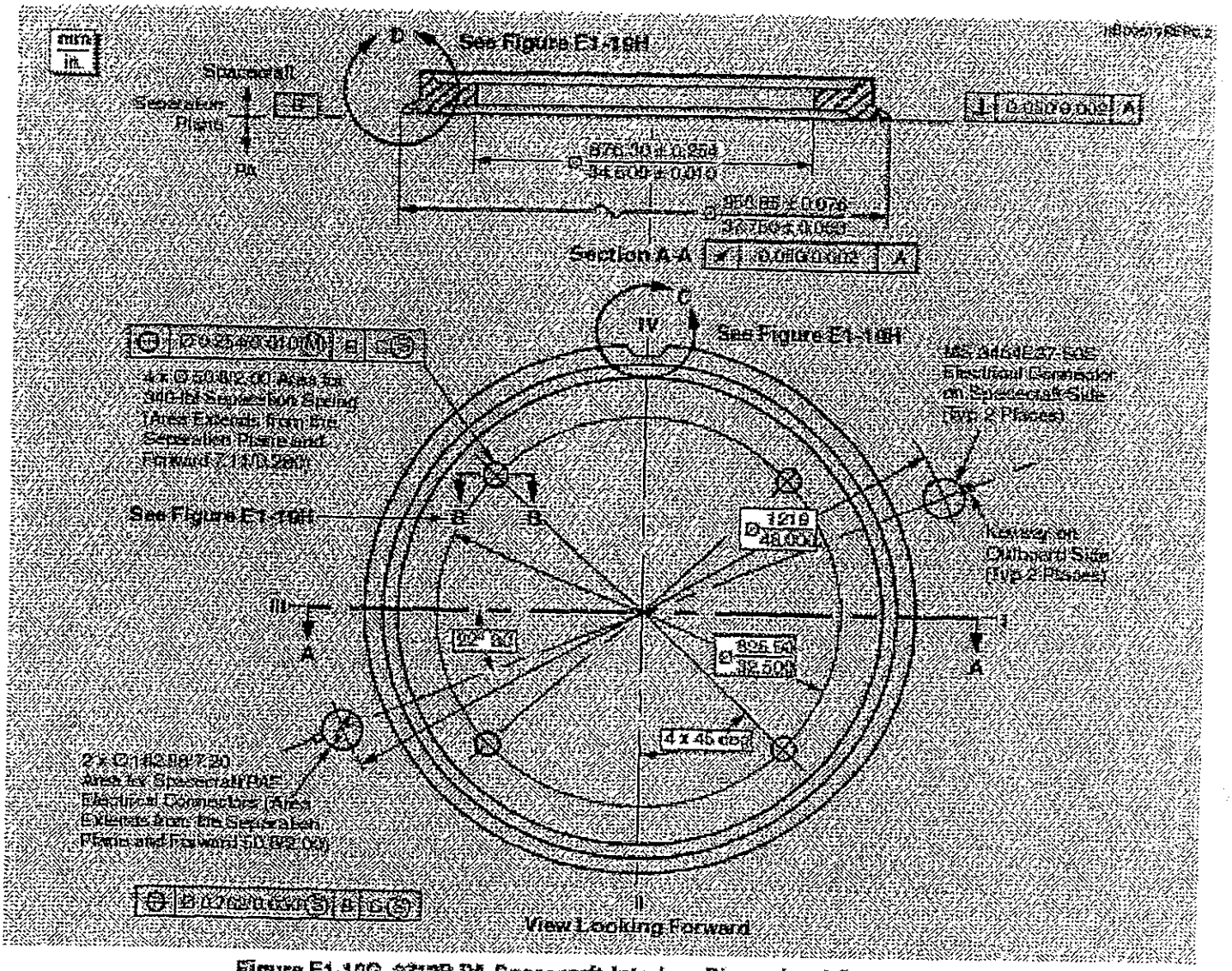

Figure E1-19G. 3712B PA Spacecraft Interface Dimensional Constraints

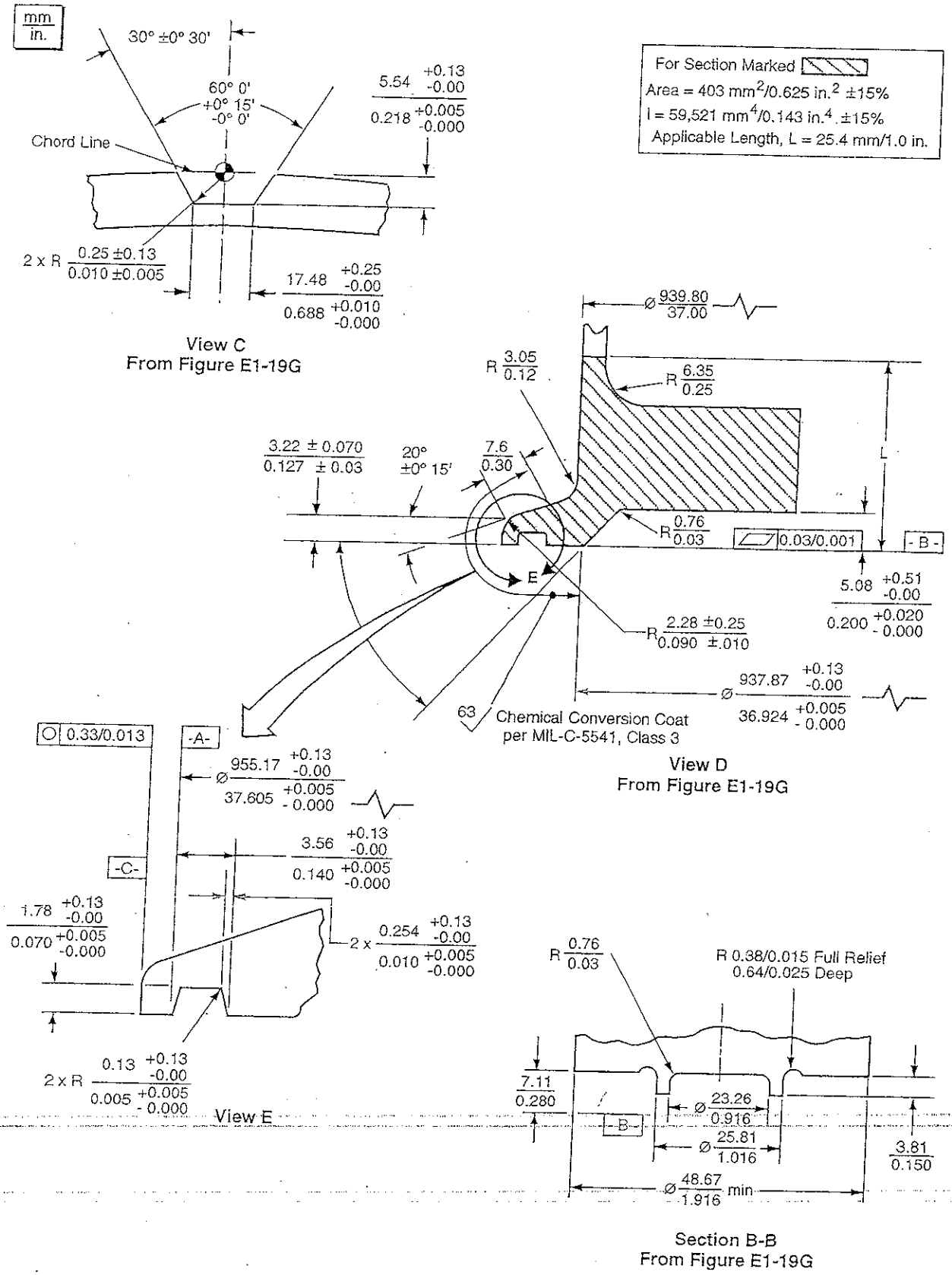

Figure E1-19H. 3712B PA Spacecraft Interface Dimensional Constraints

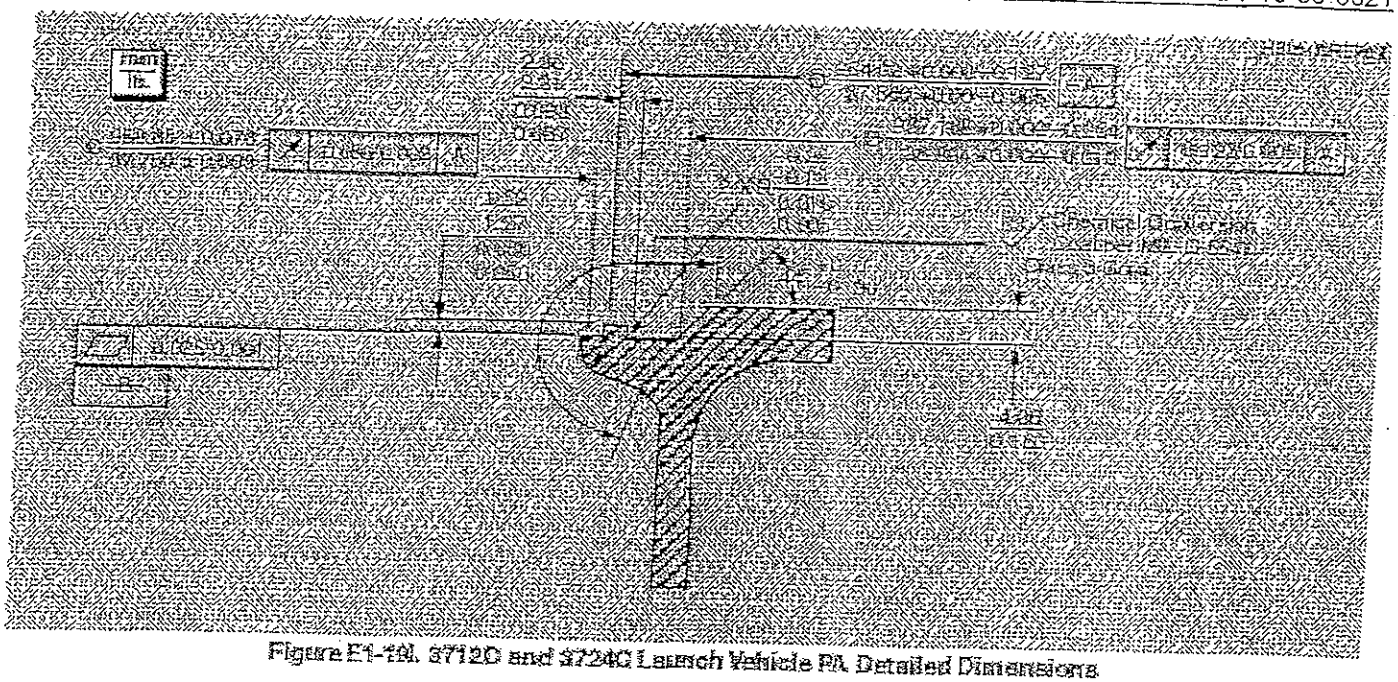

Figure E1-19. S712D and S724D Launch Vehicle PA Detailed Dimensions

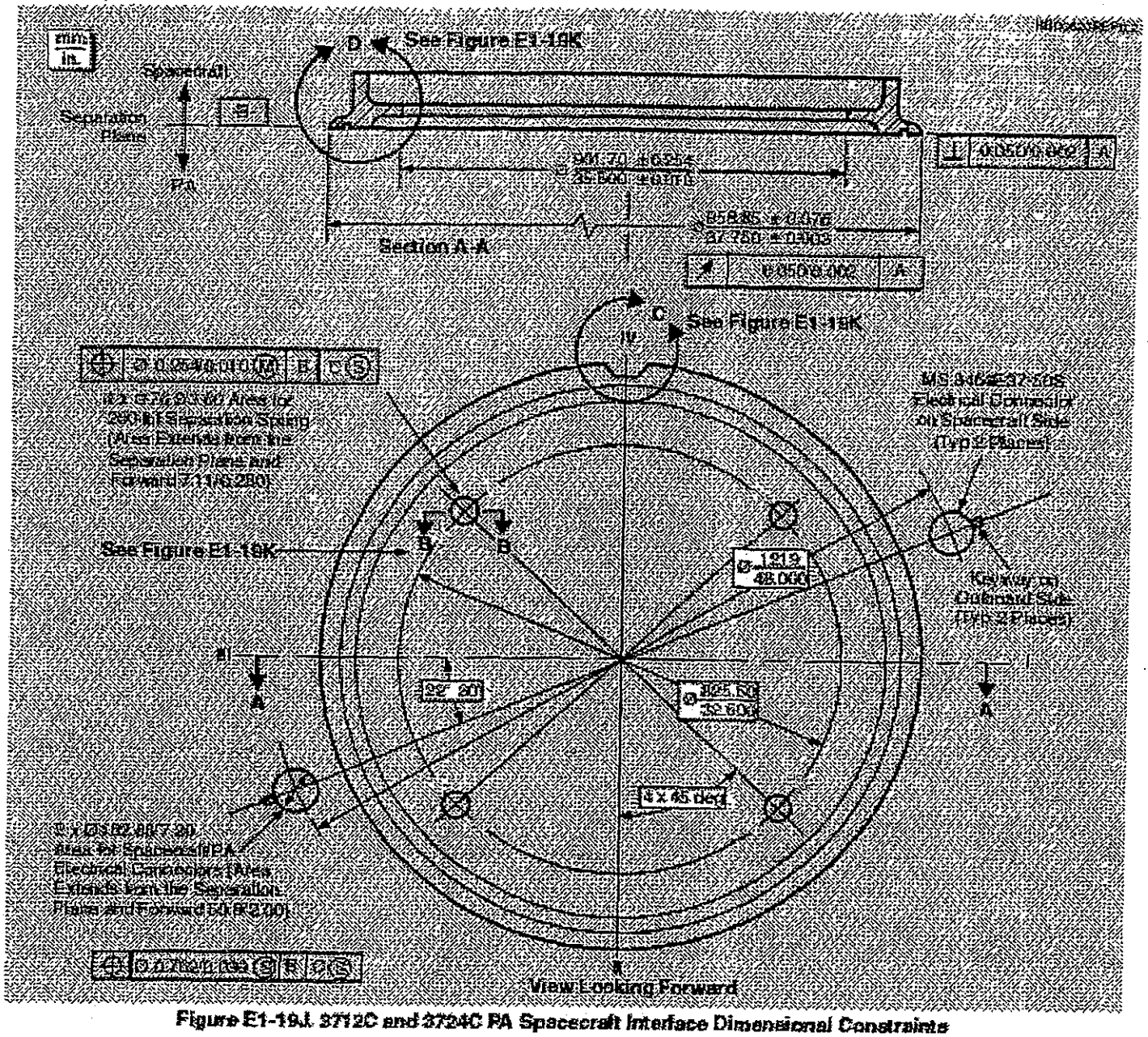

Figure E1-19J. 3712C and 3724C PA Spacecraft Interface Dimensional Constraints

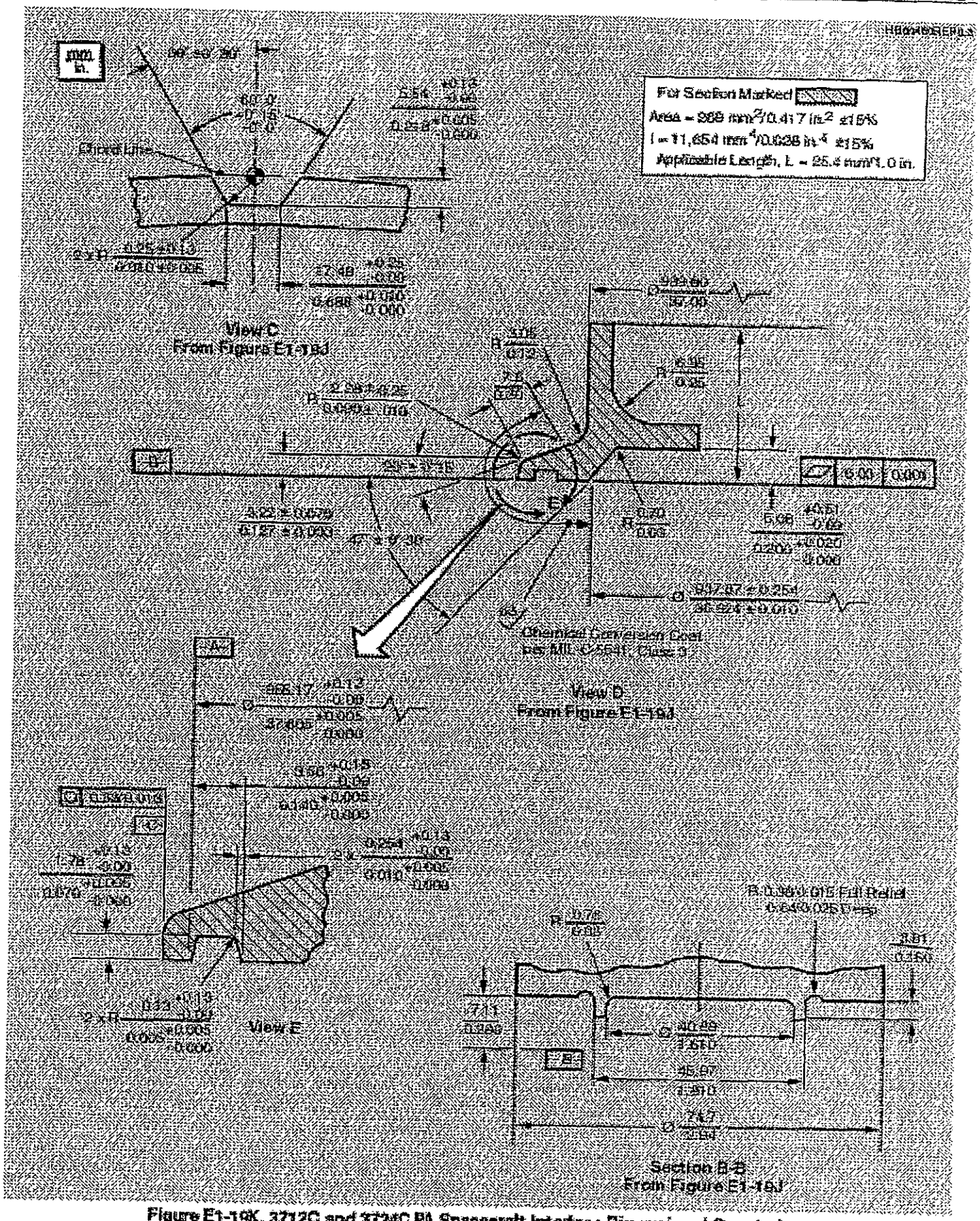

Figure E1-19K. 3712C and 3724C PA Spacecraft Interface Dimensional Constraints

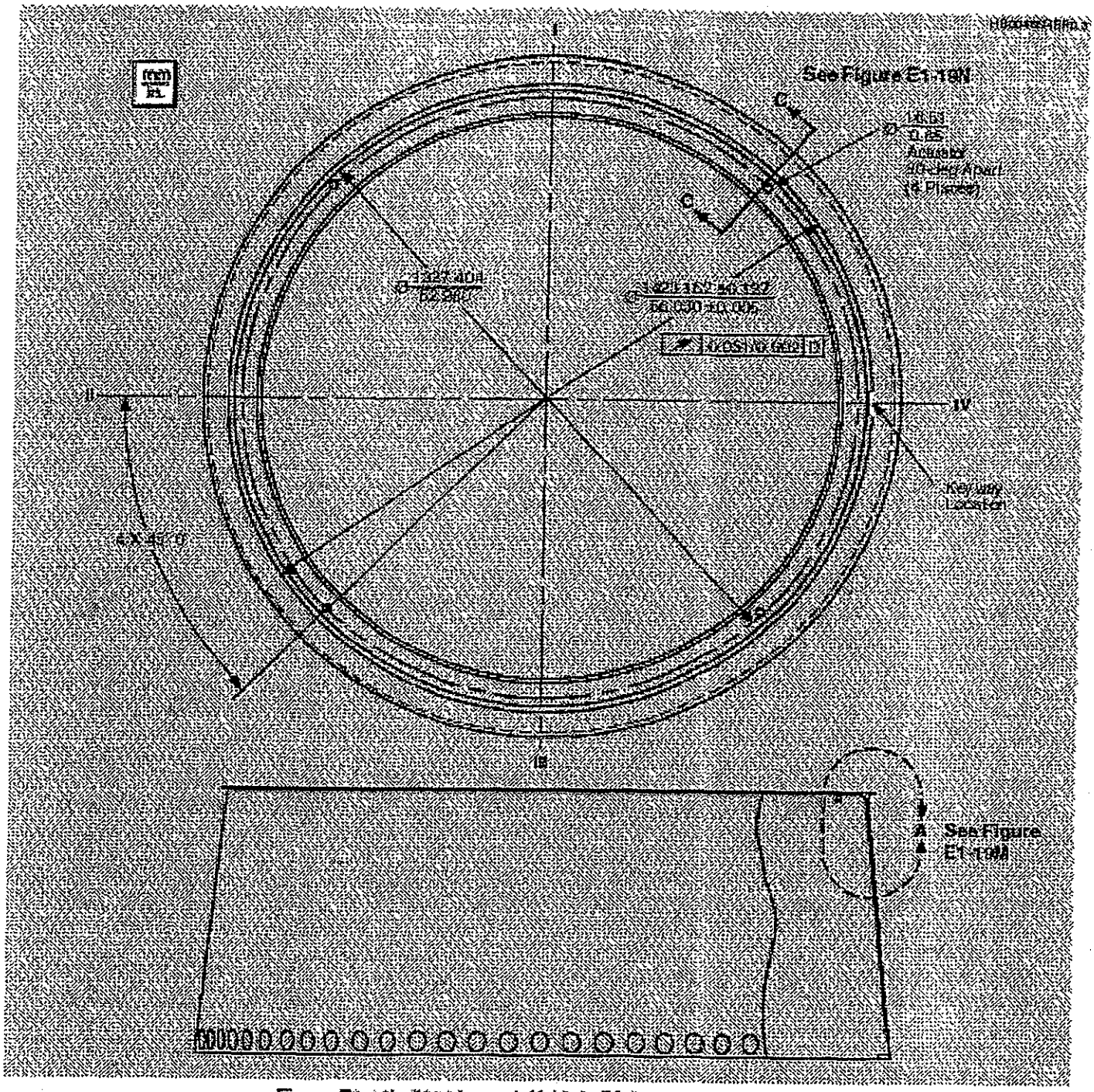

Figure E1-19L. 5624 Launch Vehicle PA Detailed Assembly

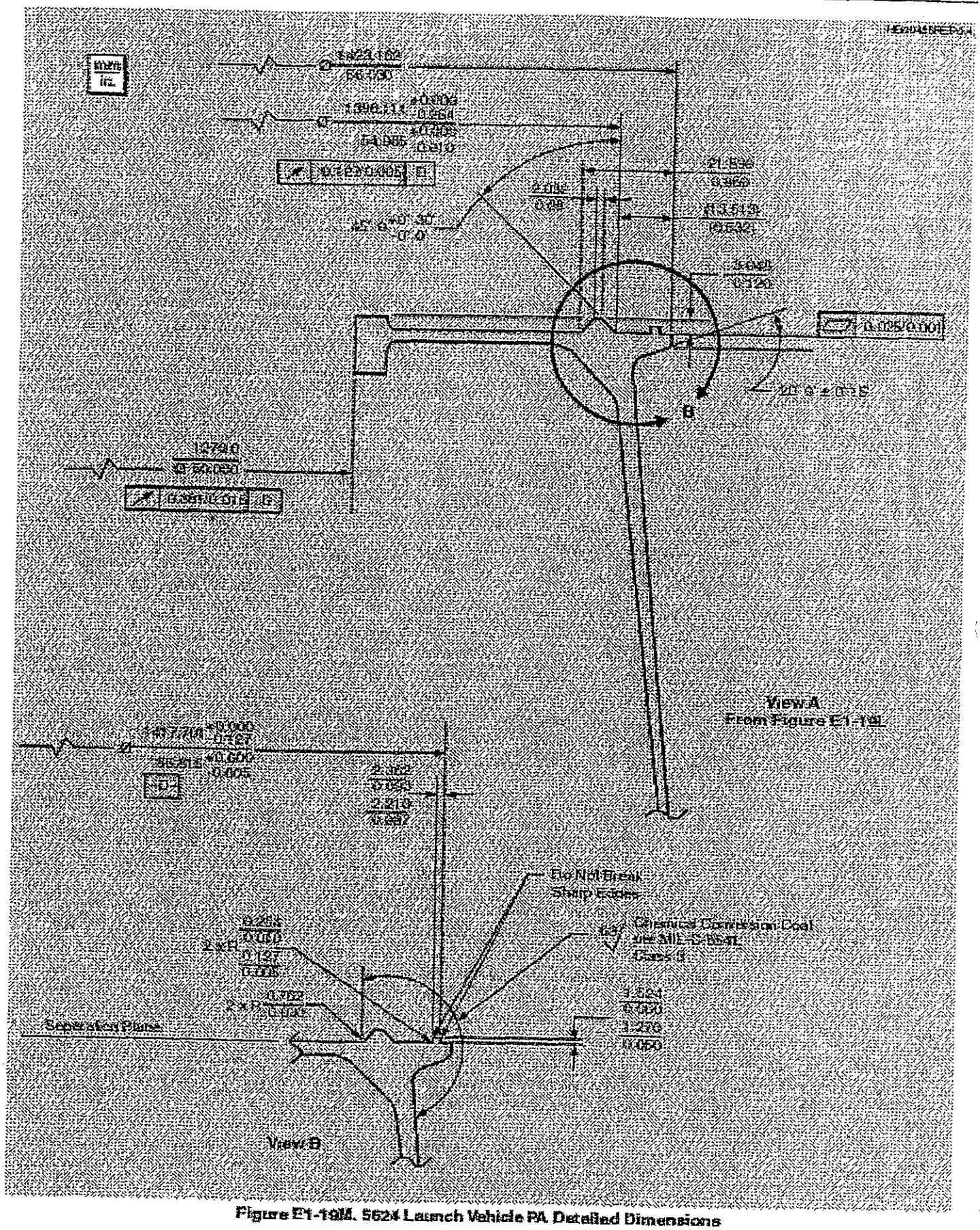

Figure E1-19M. 5624 Launch Vehicle PA Detailed Dimensions

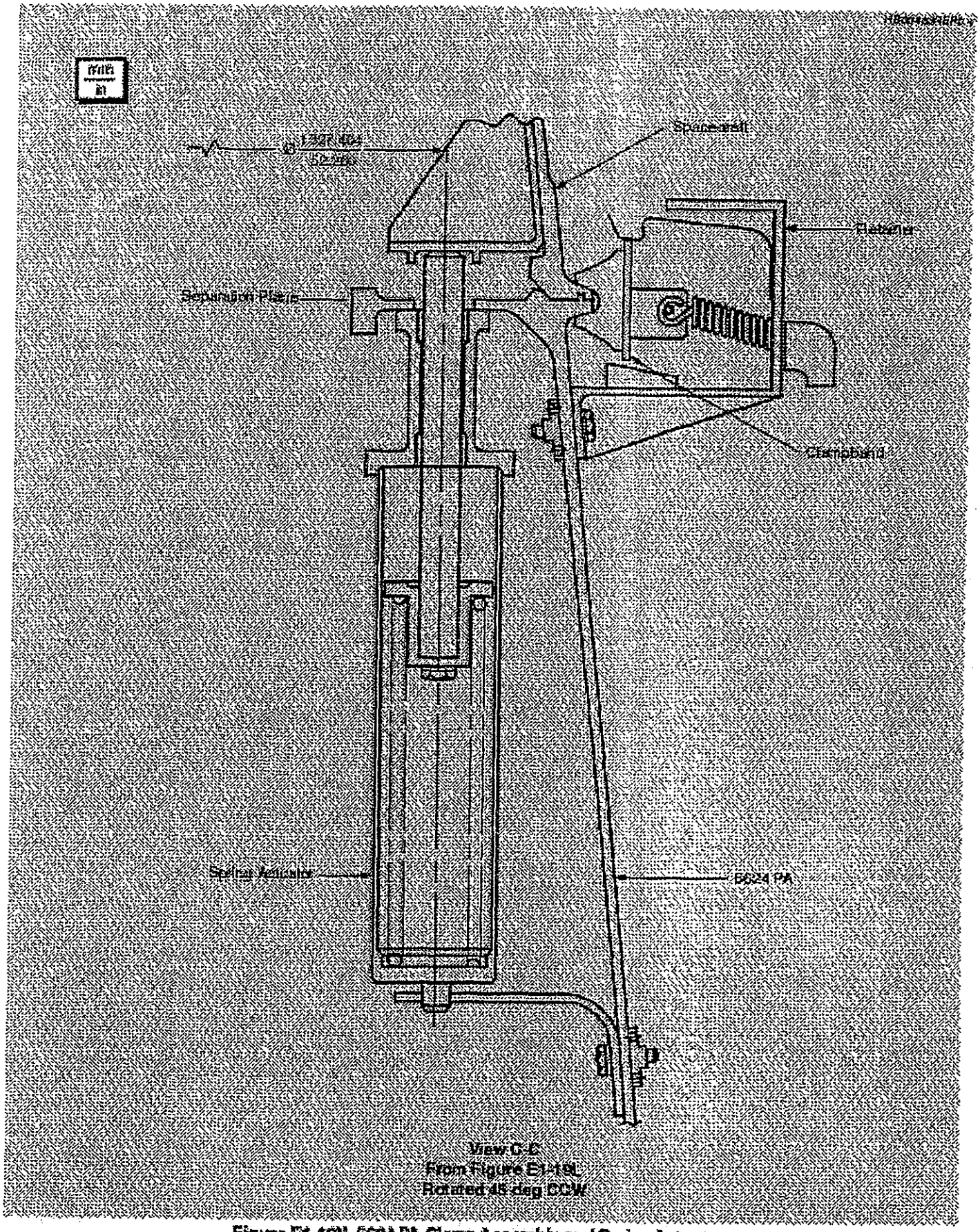

Figure E1-19N. 5624 PA Clamp Assembly and Spring Actuator

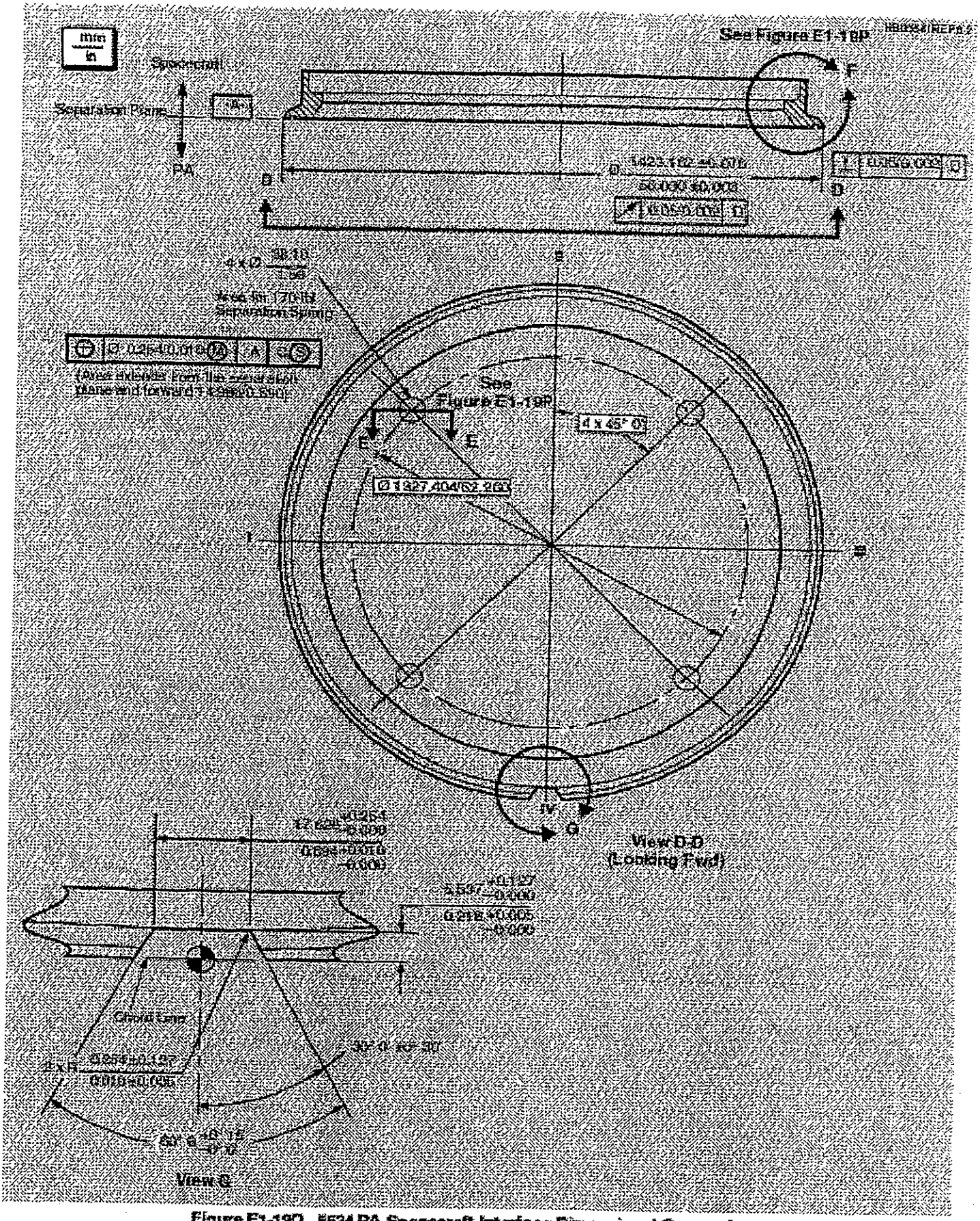

Figure E1-19O. 5624 PA Spacecraft Interface Dimensional Constraints

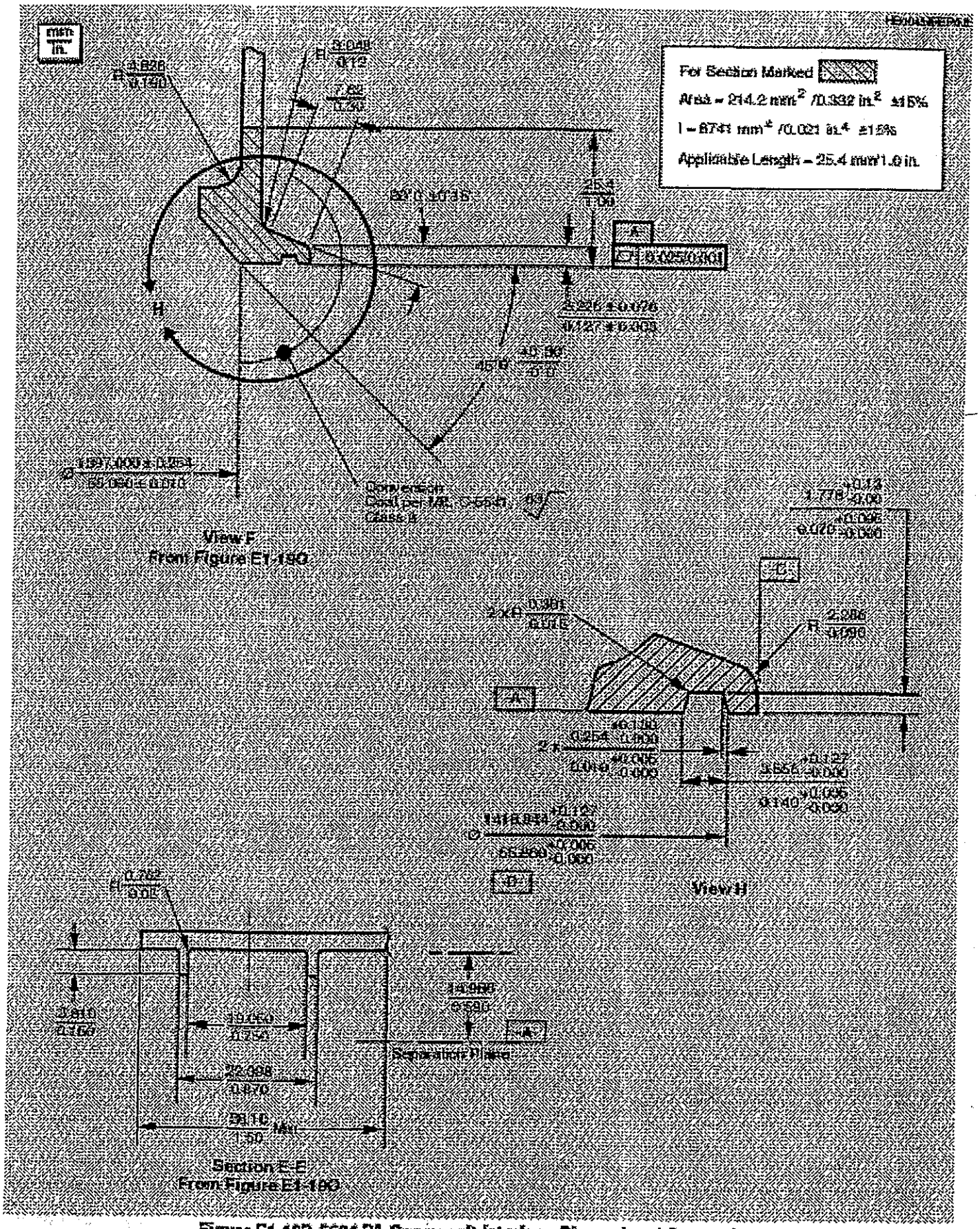

Figure E1-19P. 5624 PA Spacecraft Interface Dimensional Constraints

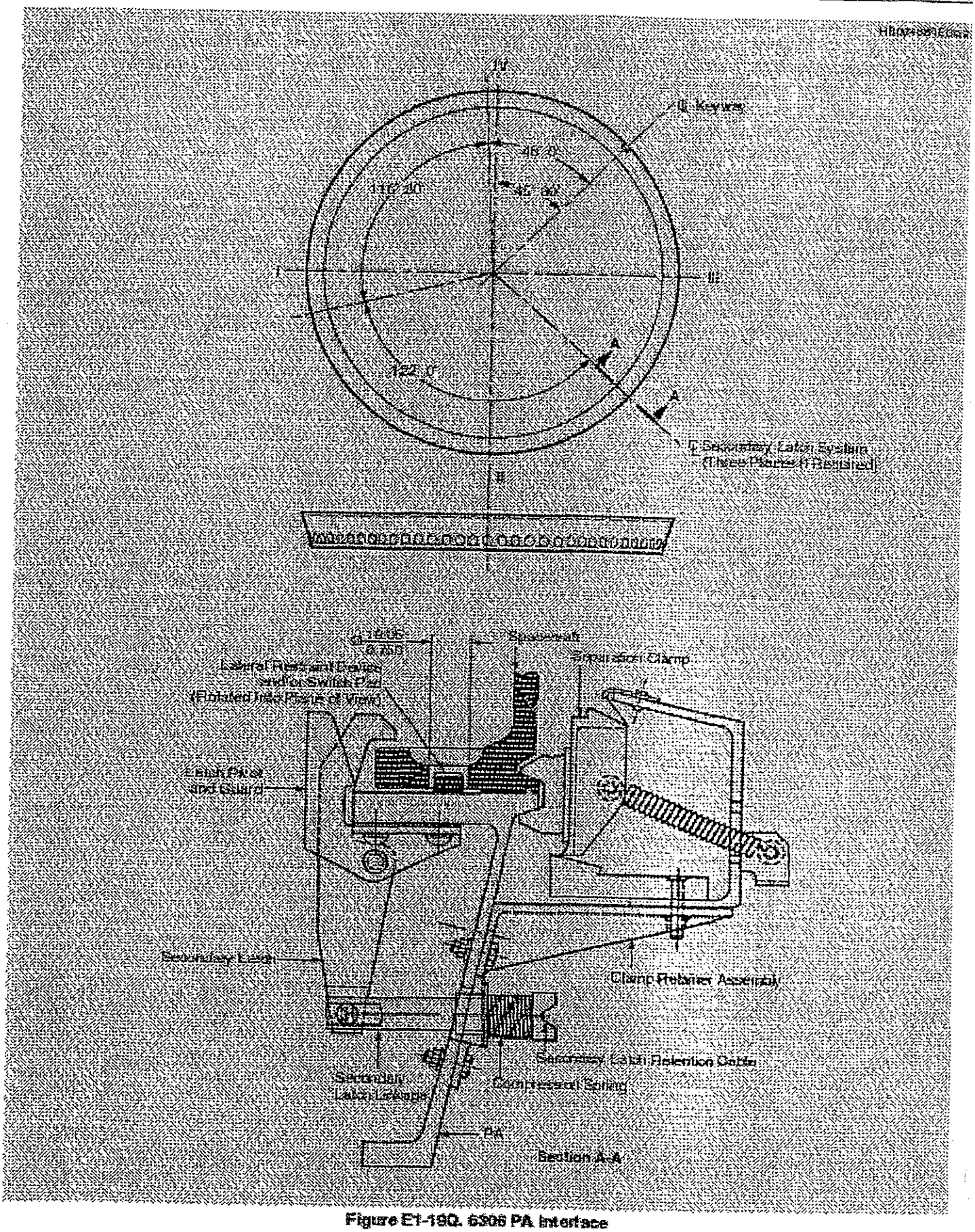

Figure E1-19Q. 6306 PA Interface

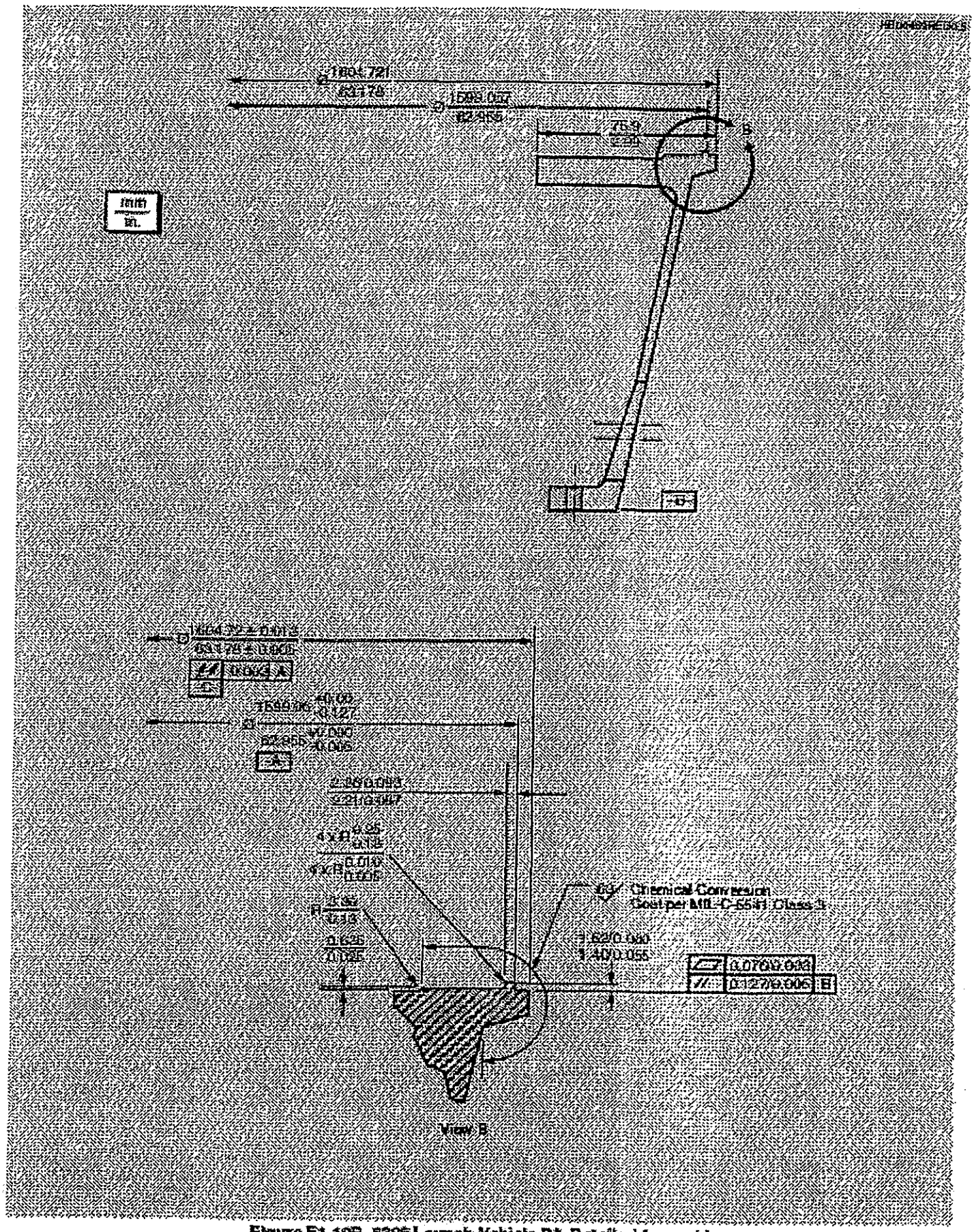

Figure E1-19R. 5305 Launch Vehicle PA Detailed Assembly

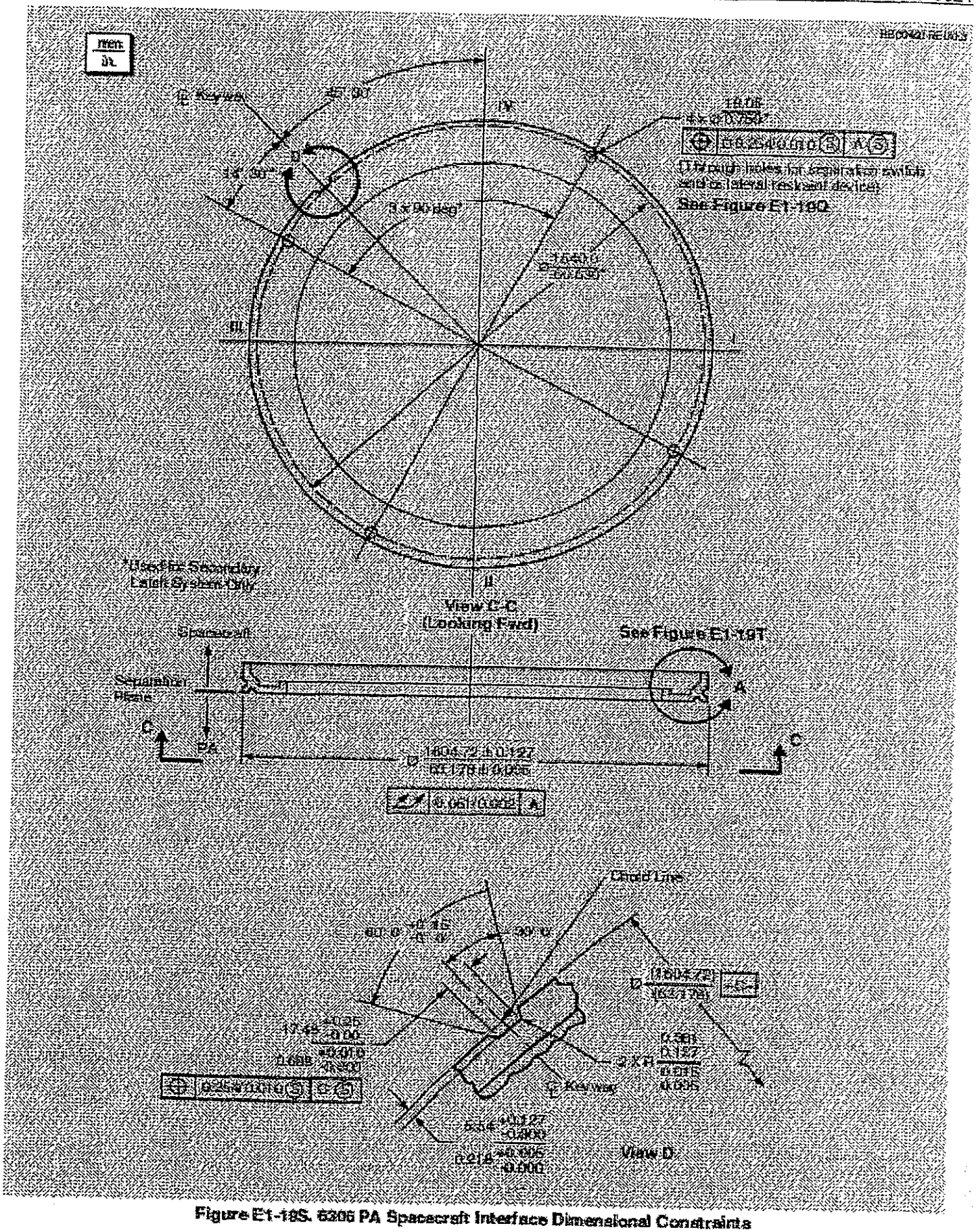

Figure E1-19S. 6206 PA Spacecraft Interface Dimensional Constraints

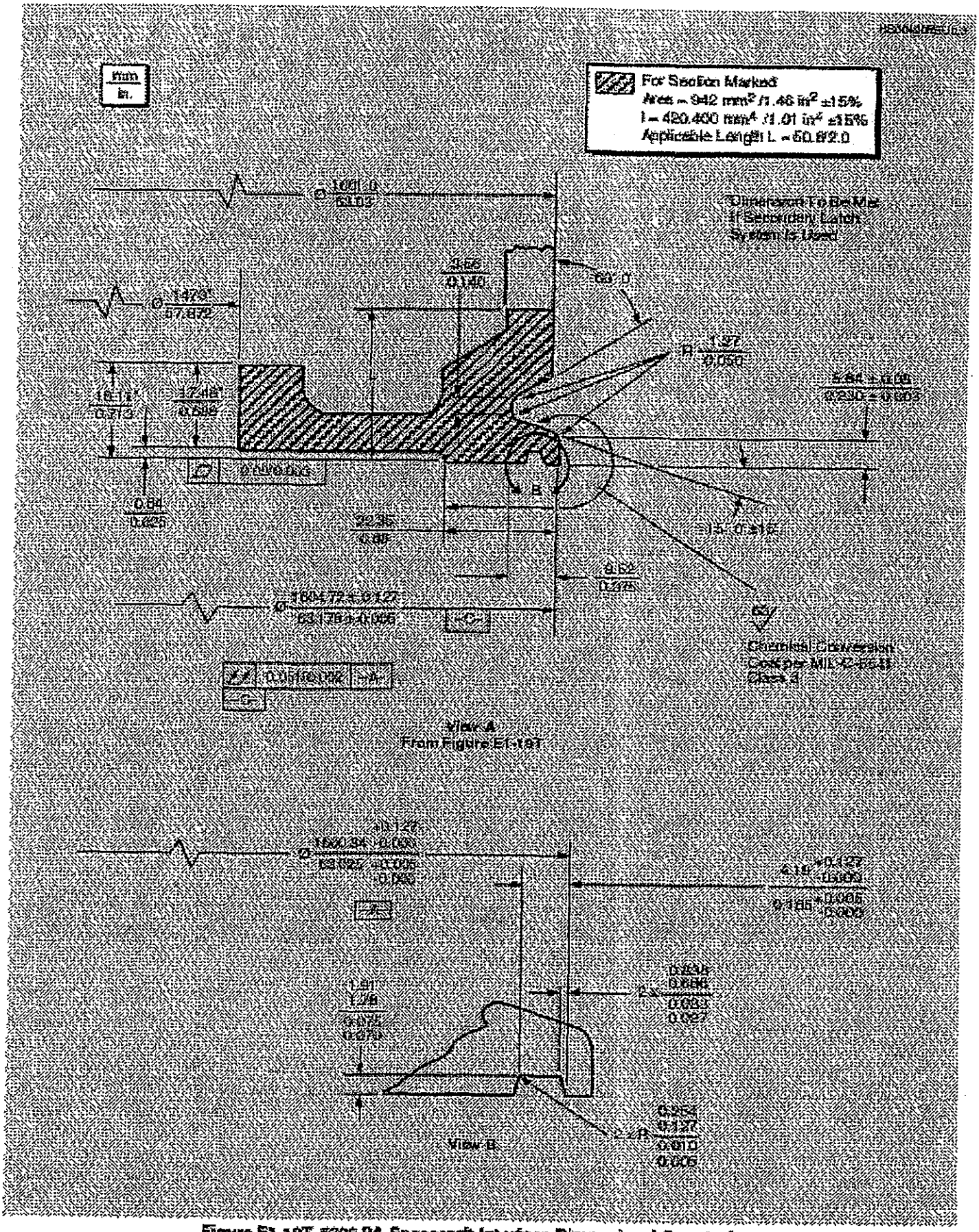

Figure E1-19T. 6205 PA Spacecraft Interface Dimensional Constraints

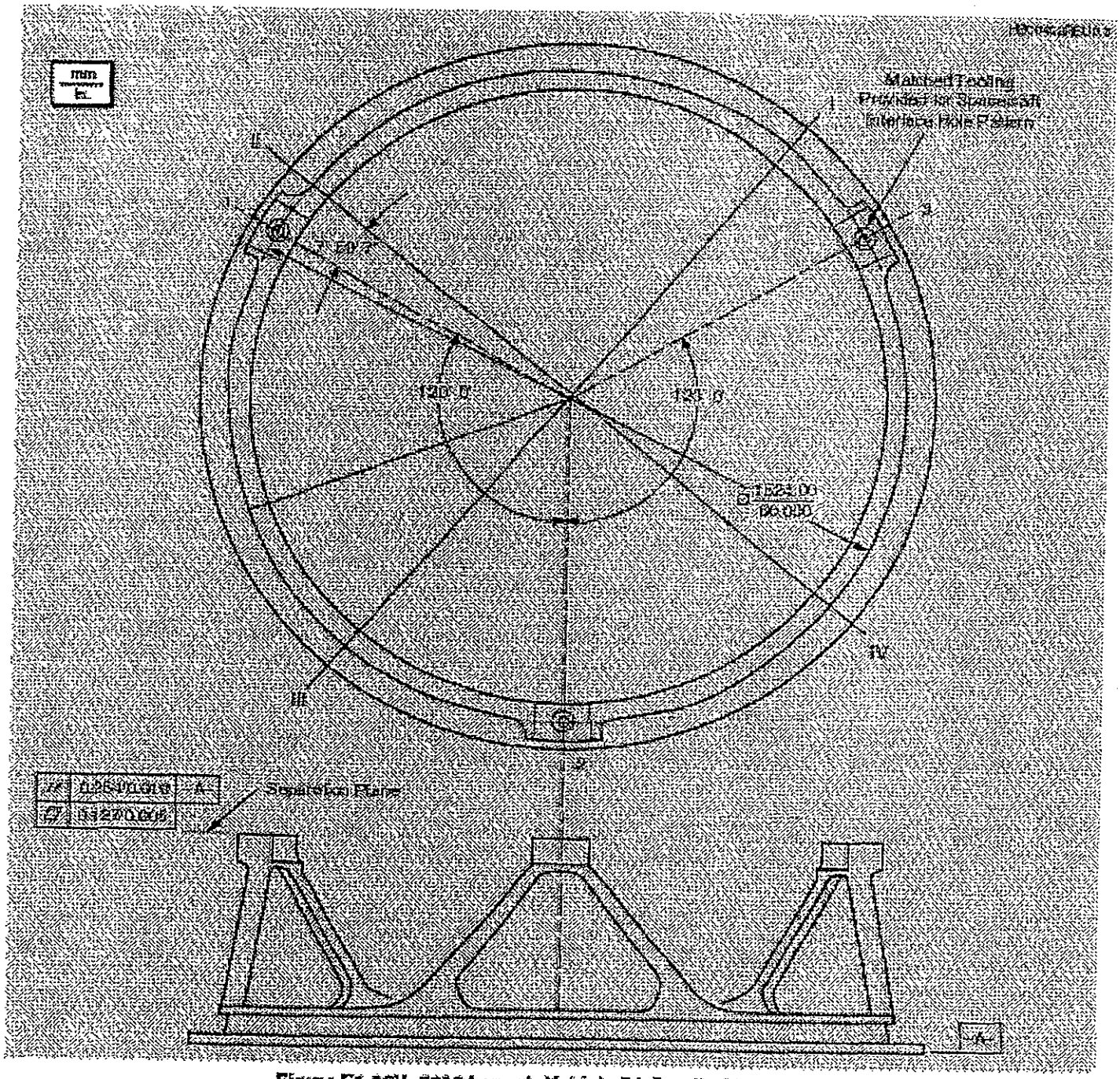

Figure E1-19U, 5019 Launch Vehicle PA Detailed Assembly

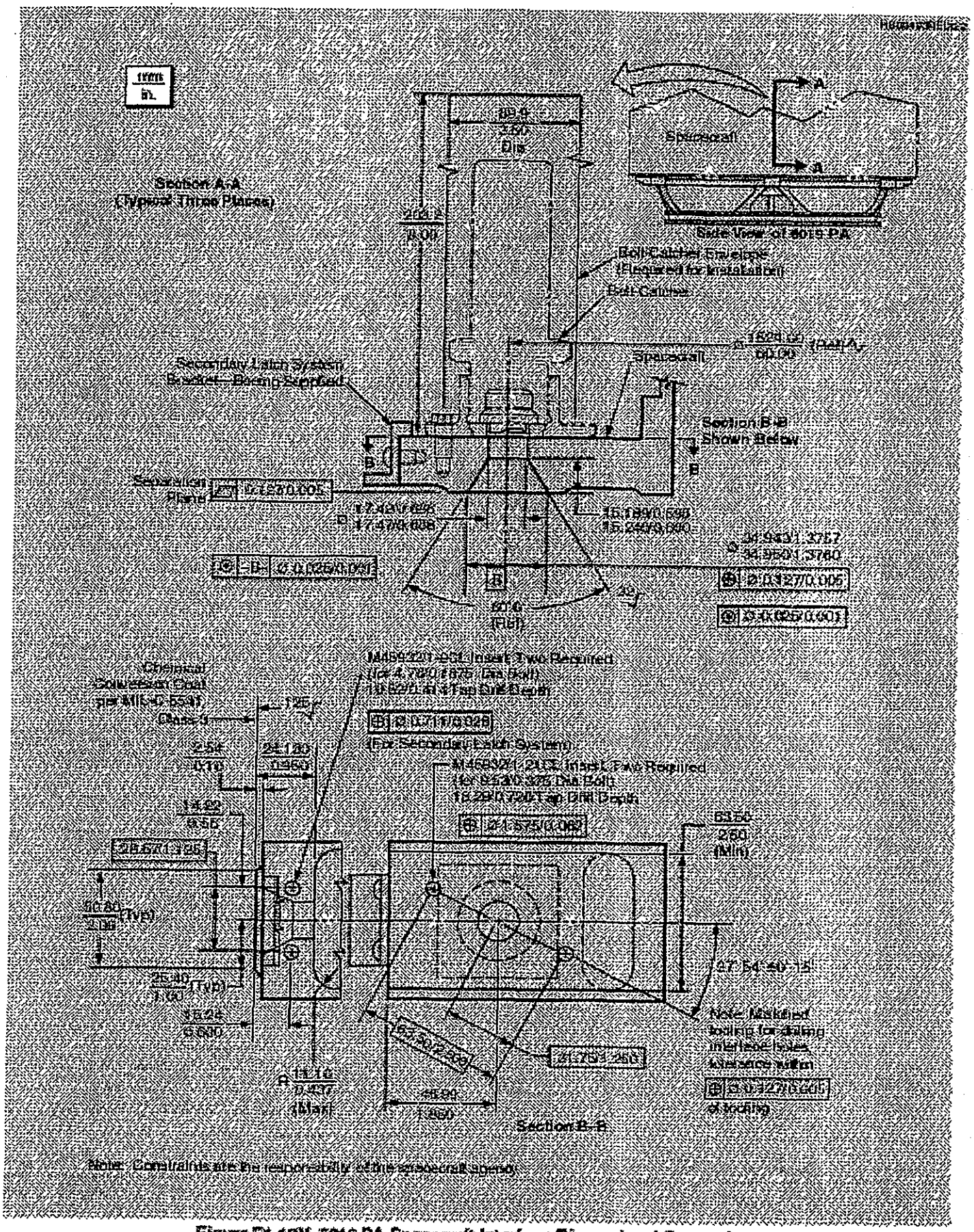

Figure E1-19V. 6019 PA Spacecraft Interface Dimensional Constraints

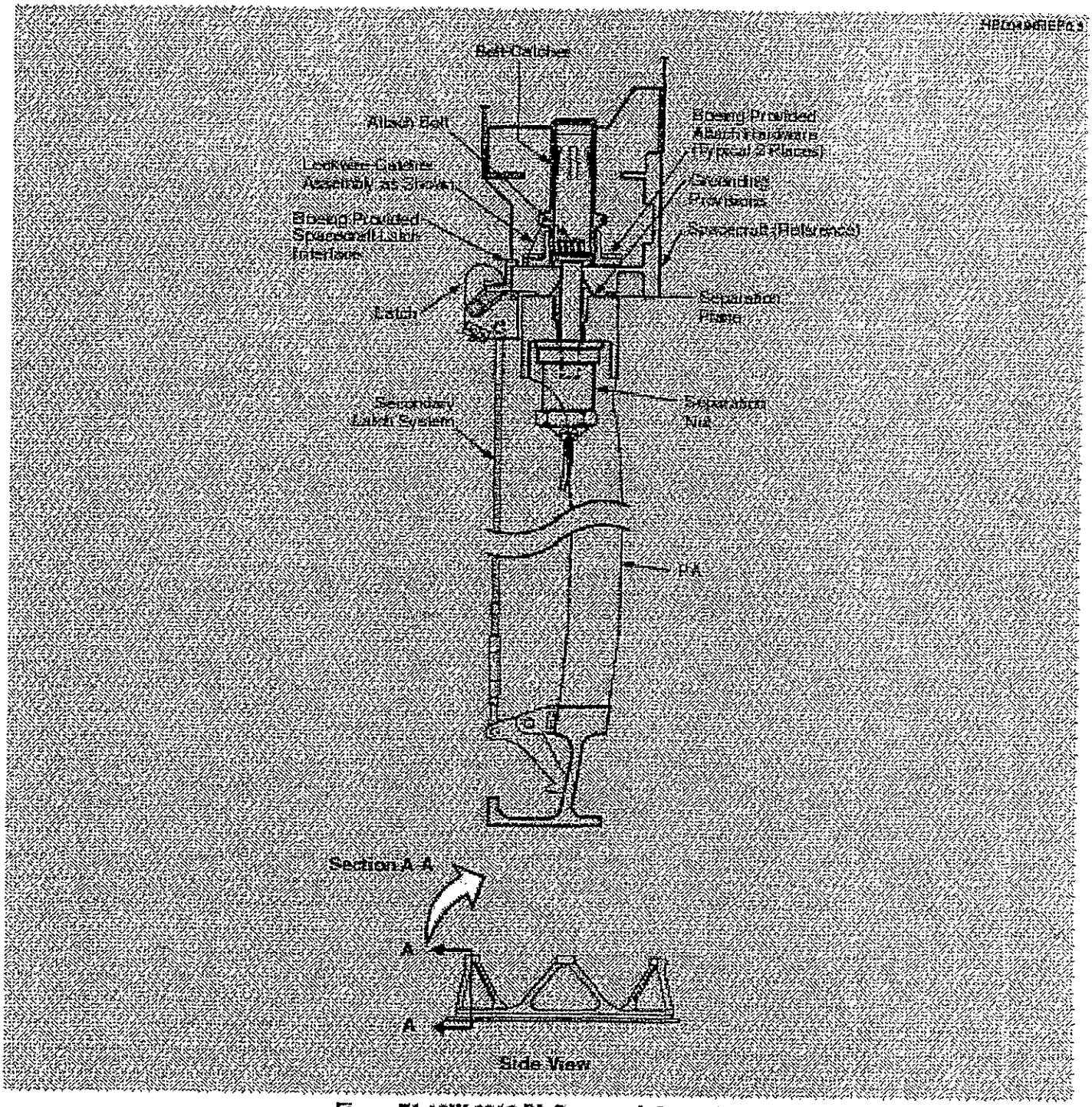

Figure E1-19W 6019 PA Spacecraft Assembly

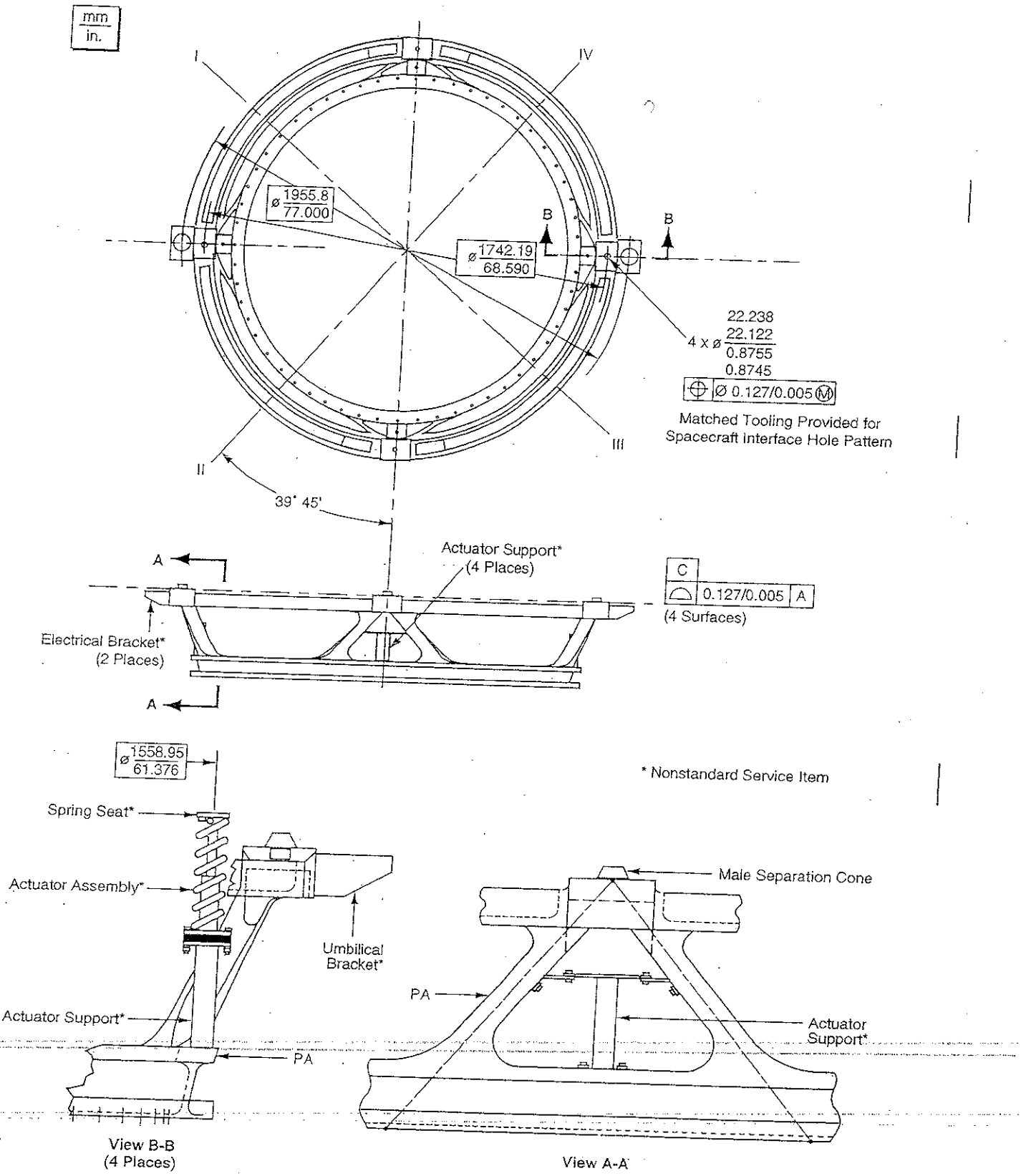

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Figure E1-19X. 6915 Launch Vehicle PA Detailed Assembly

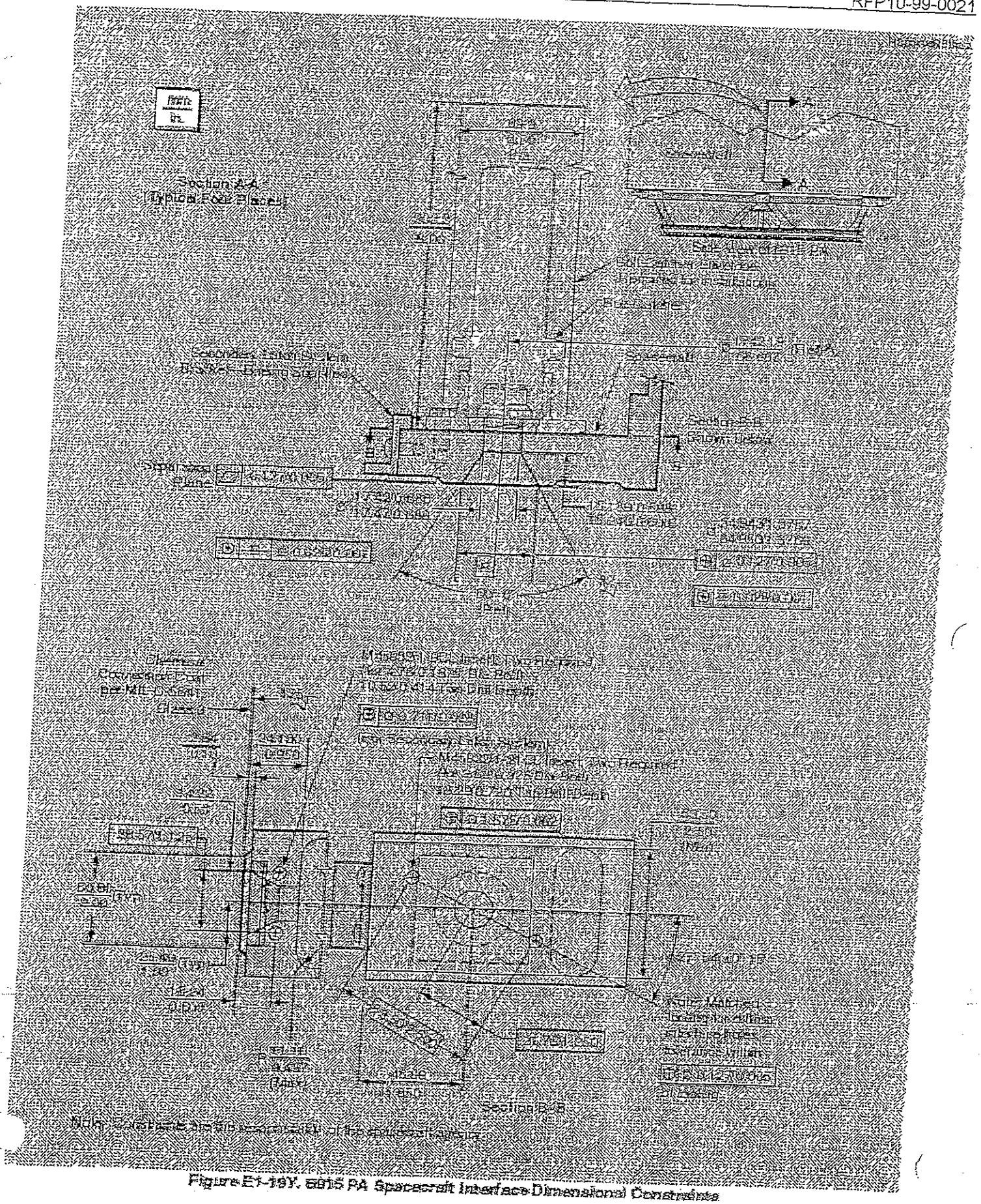


Figure E1-19Y. 6815 PA Spacecraft Interface Dimensional Constraints

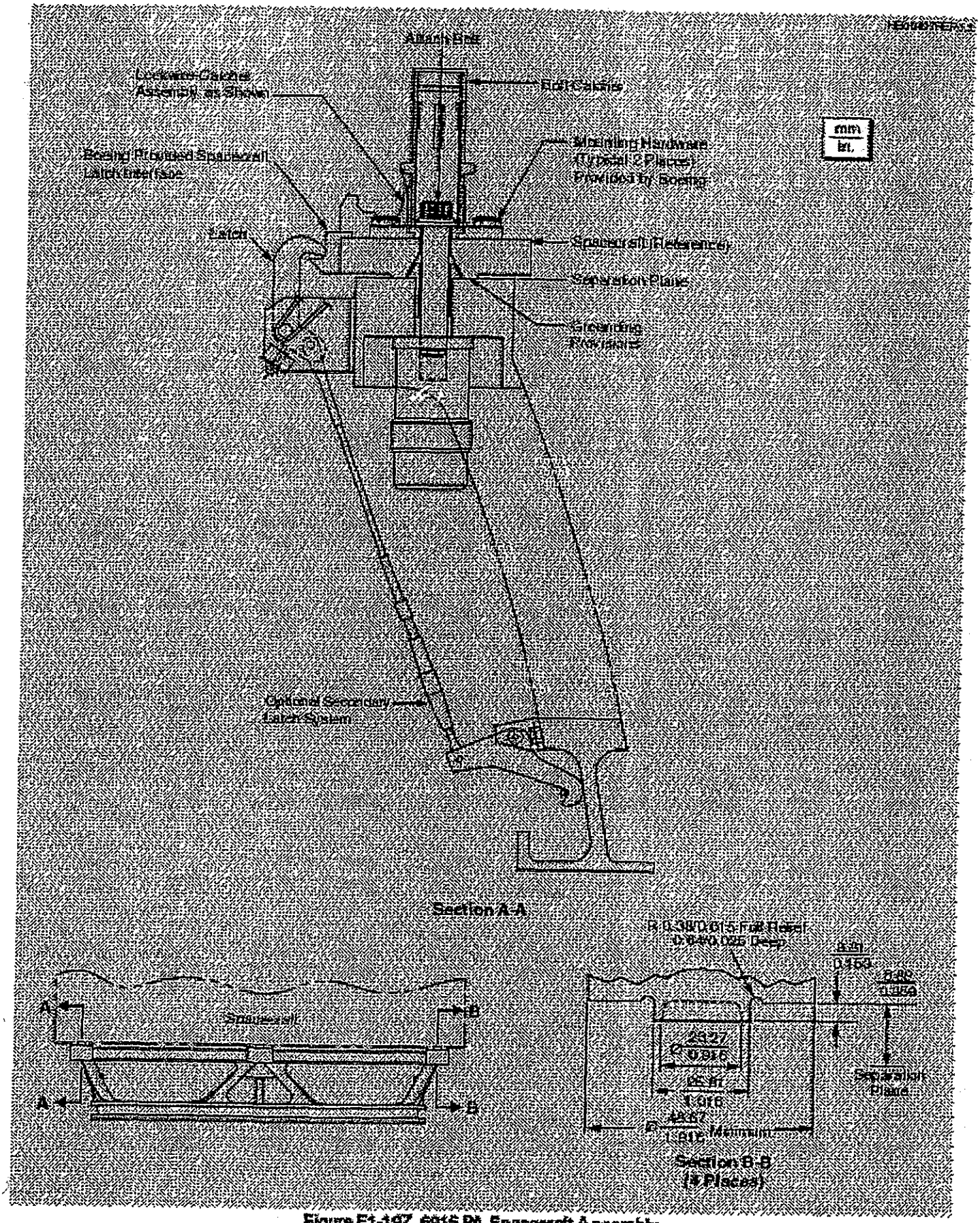


Figure E1-16Z. 6916 PA Spacecraft Assembly

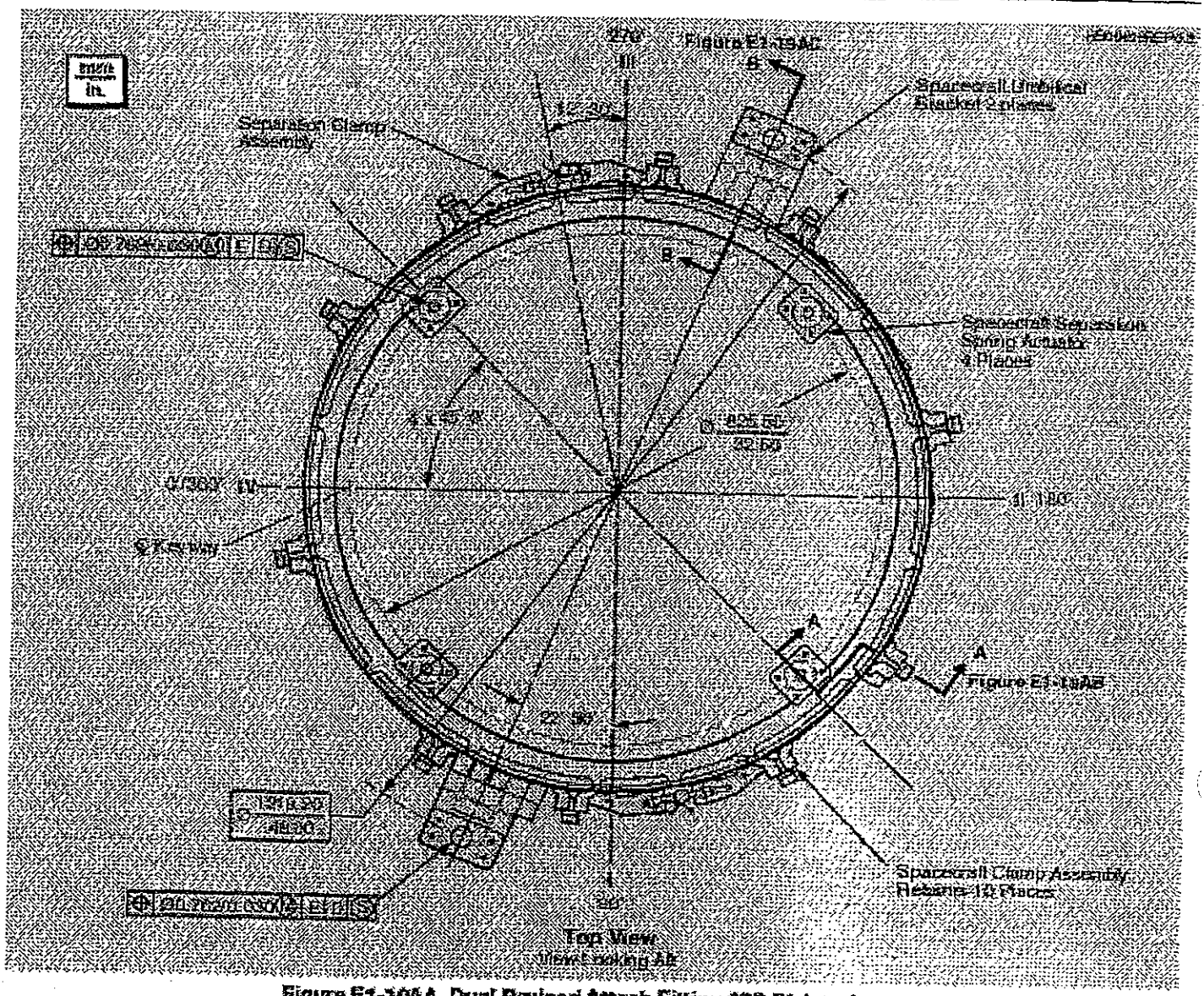


Figure E1-19AA. Dual-Payload Attach Fitting 37C PA Interface

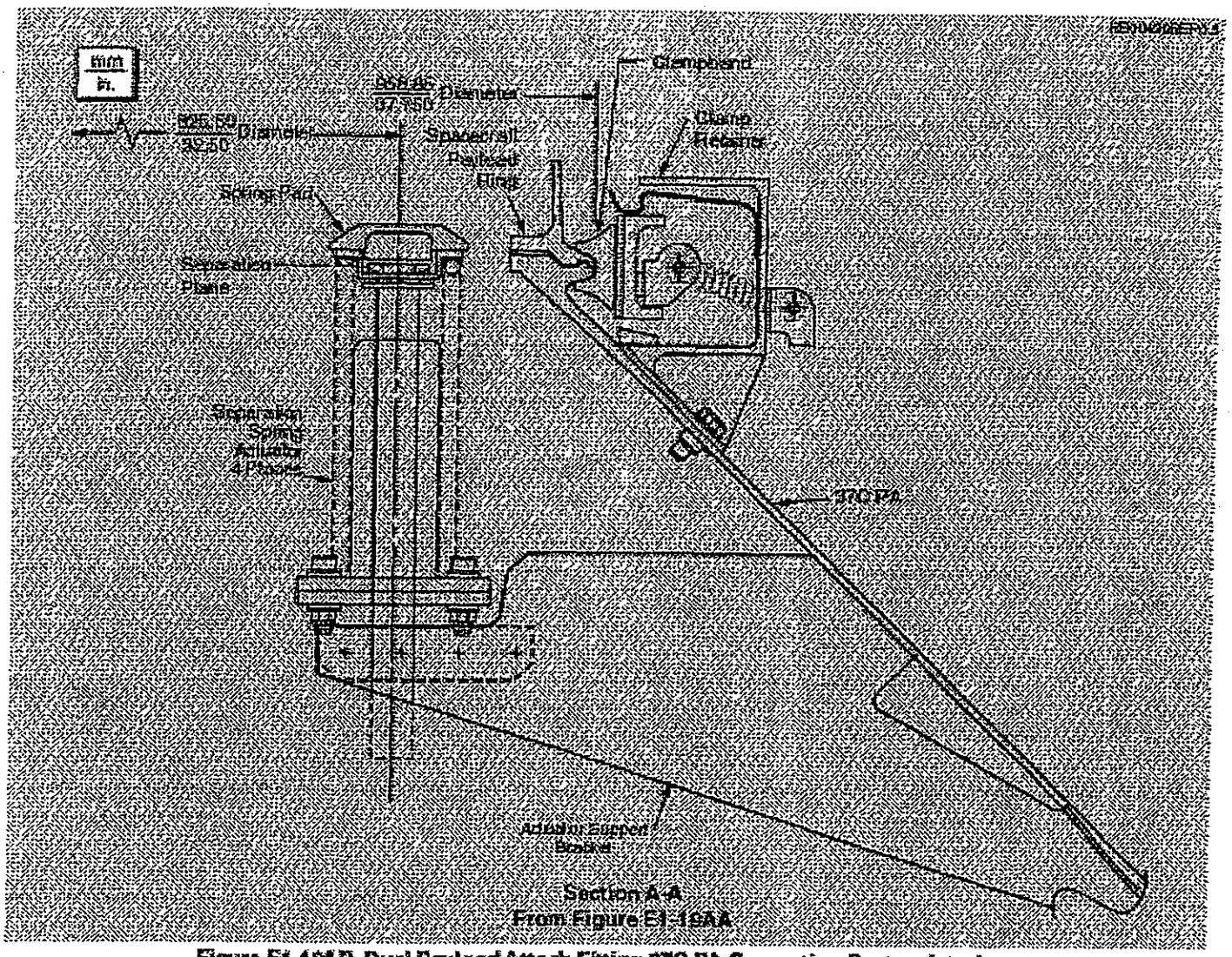


Figure E1-19AB. Dual Payload Attach Fitting 37C PA Separation System Interface

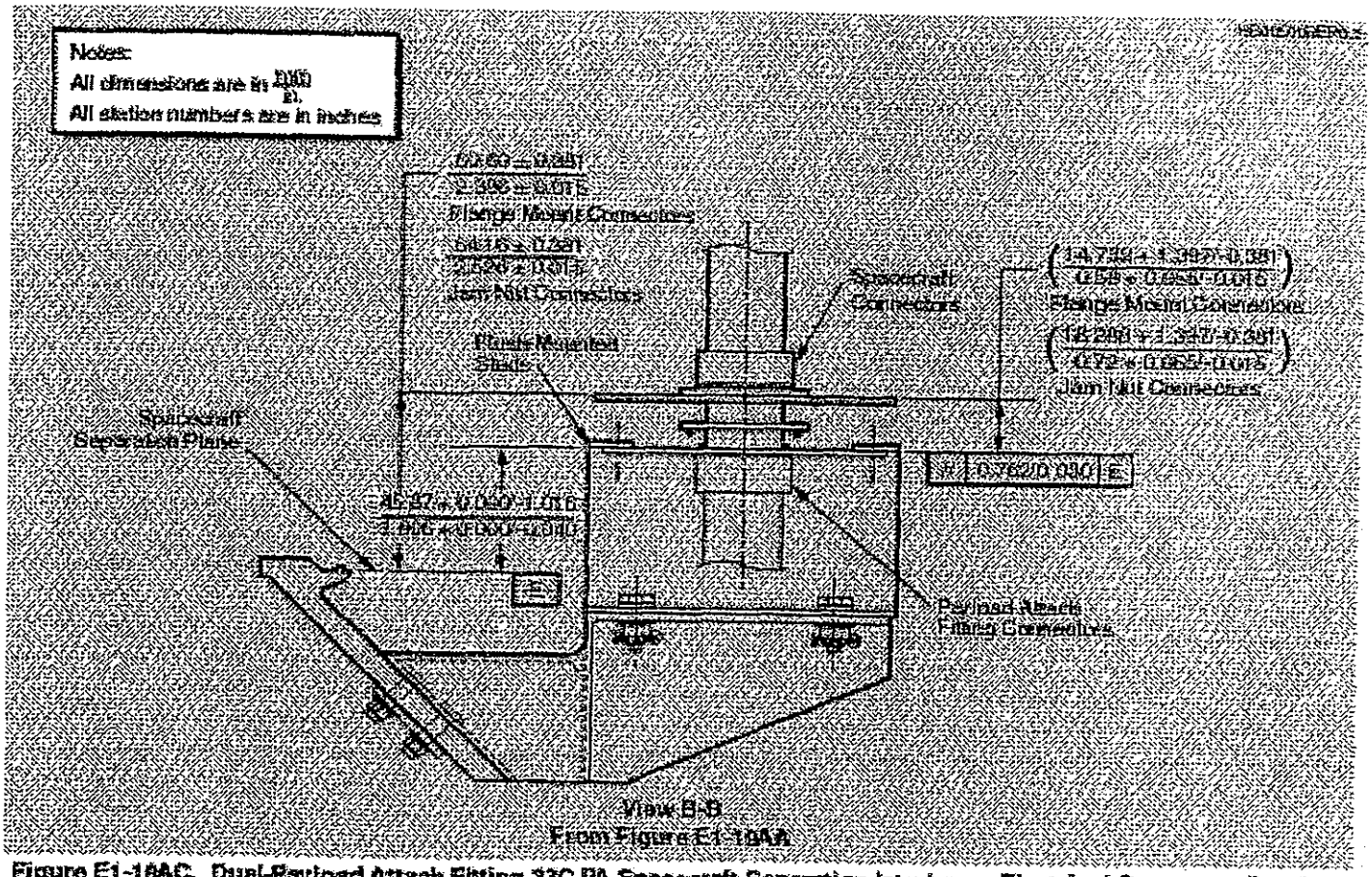


Figure E1-19AC. Dual-Payload Attach Fitting 37C PA Spacecraft Separation Interface – Electrical Connector Bracket

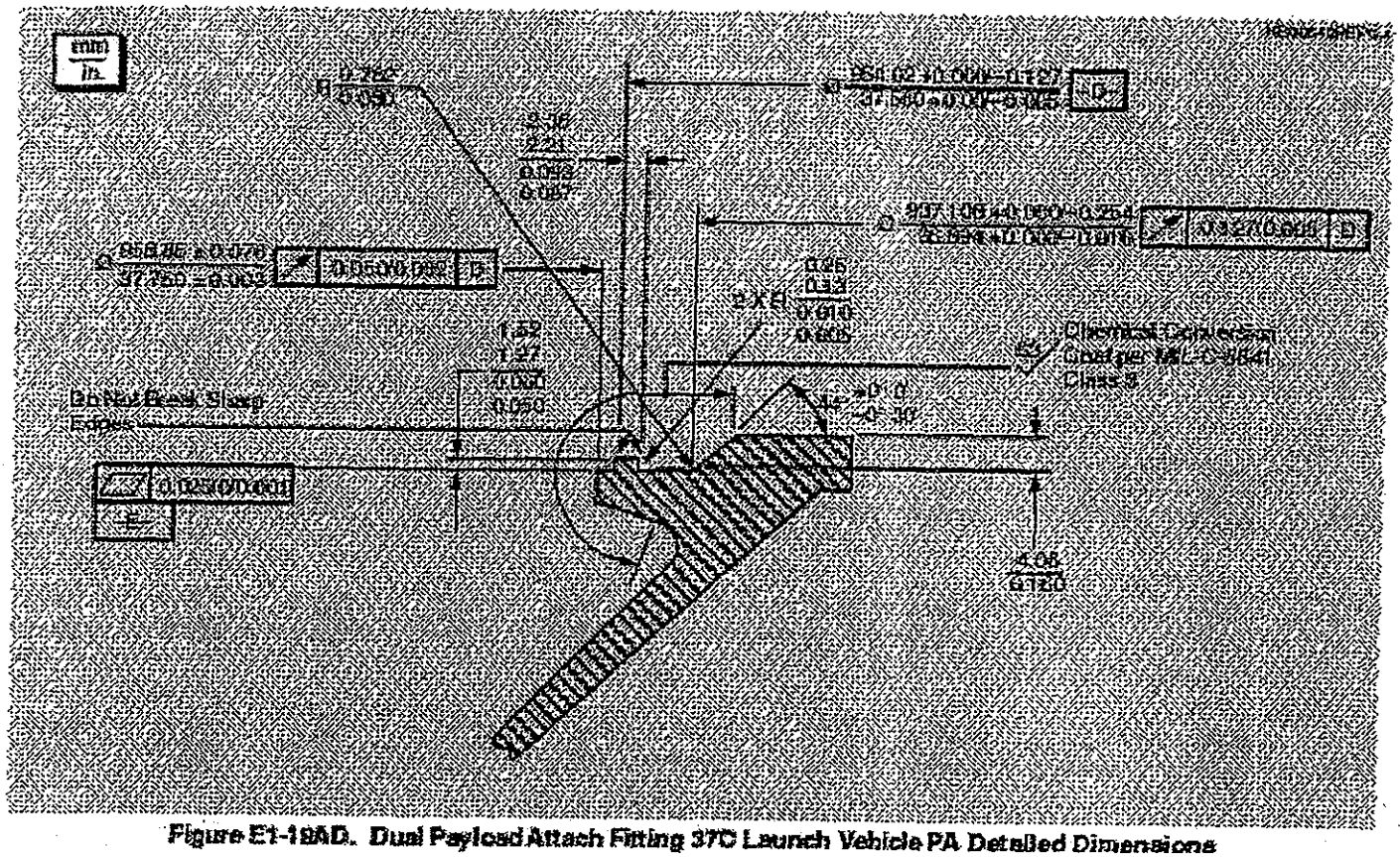


Figure E1-19AD. Dual Payload Attach Fitting 37C Launch Vehicle PA Detailed Dimensions

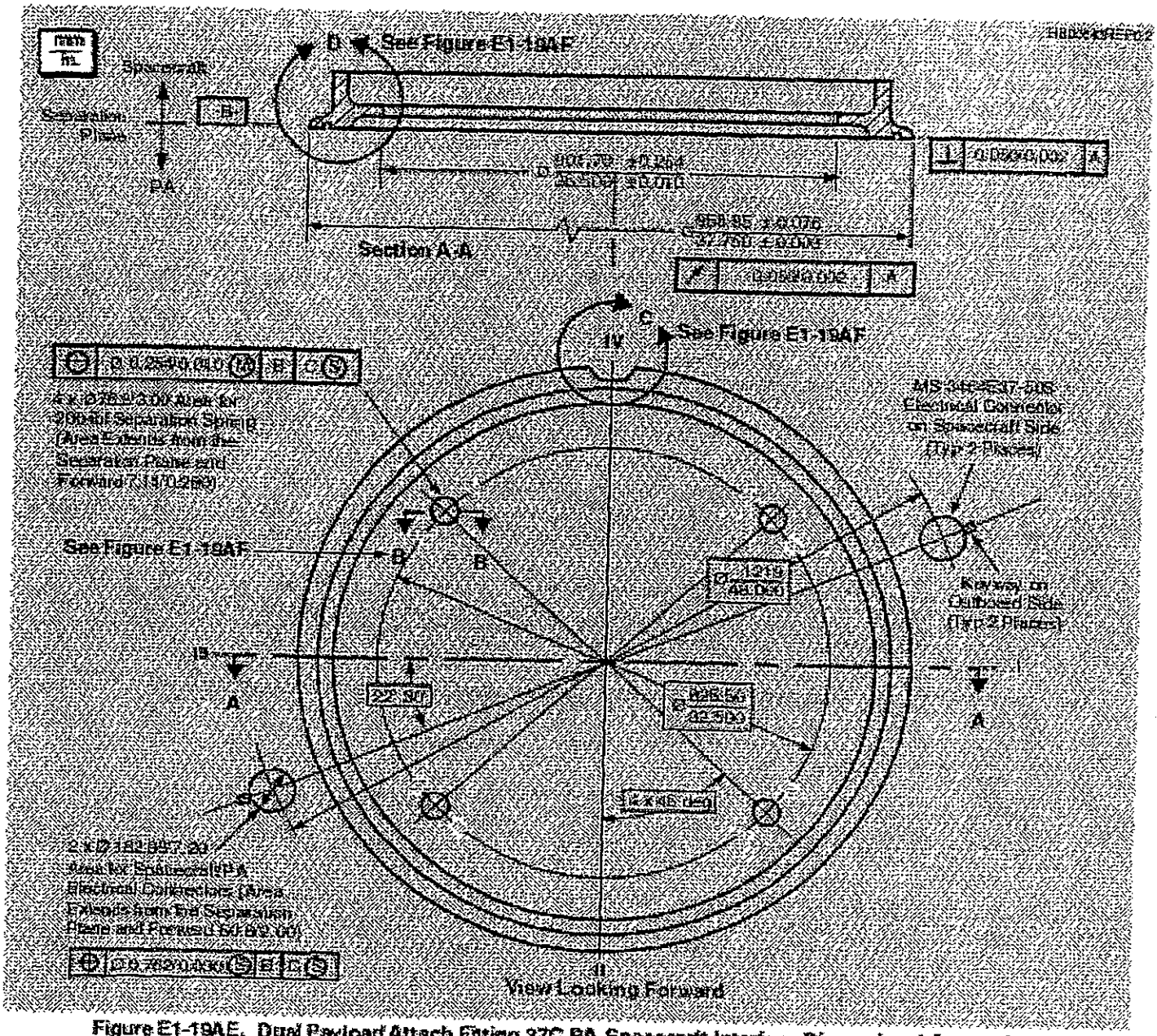


Figure E1-19AE. Dual Payload Attach Fitting 37C PA Spacecraft Interface Dimensional Constraints

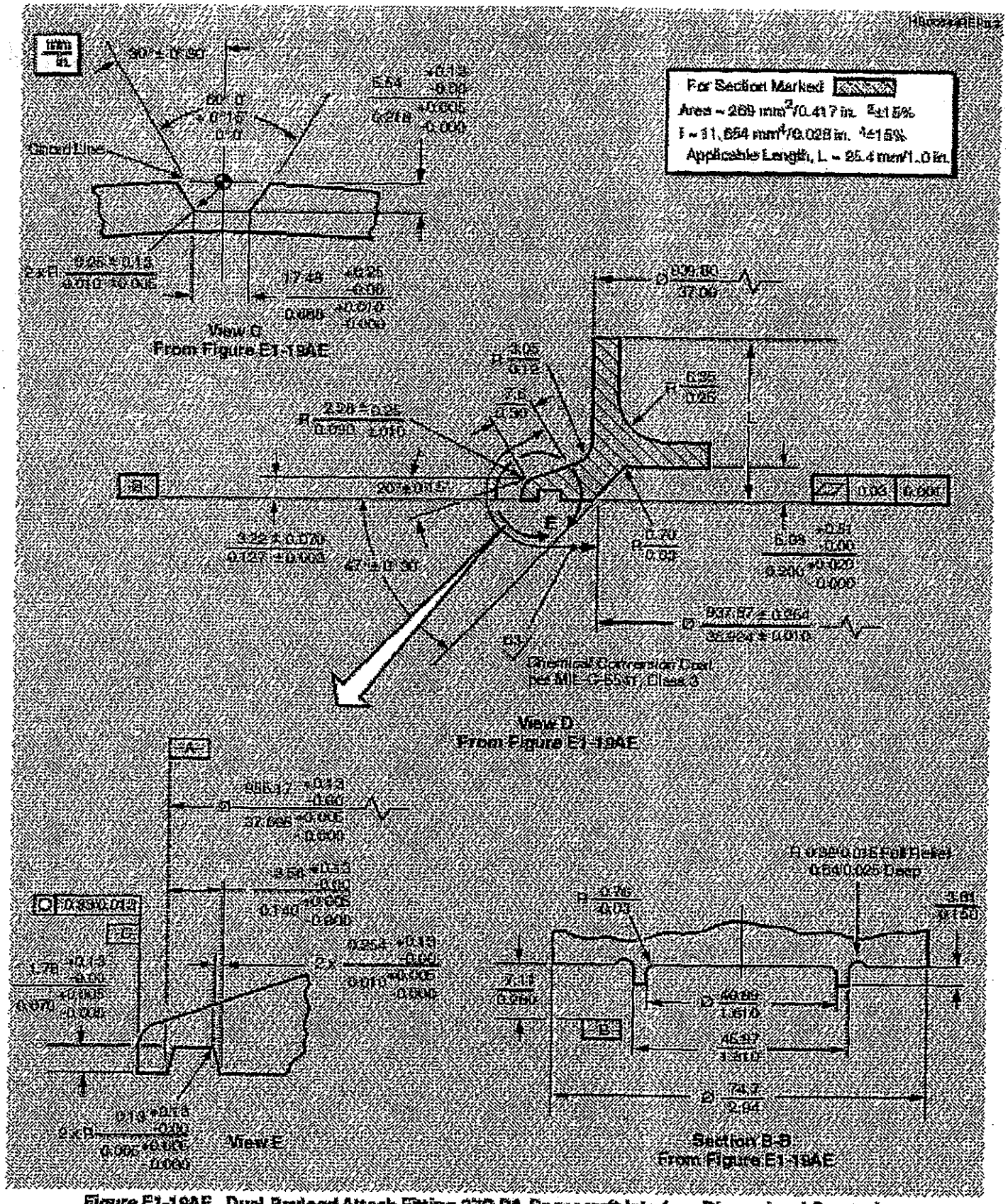
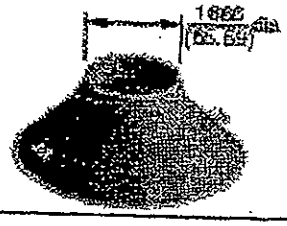
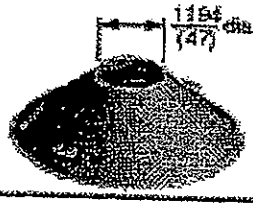
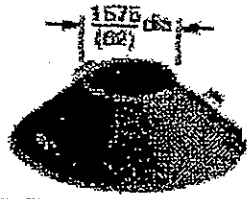


Figure E1-19AF. Dual-Payload Attach Fitting 37C PA Spacecraft Interface Dimensional Constraints (Views B-B, C, D, and E)

Model			
1666-4		1666 (65.59) dia clamp band	Two calibrated spacers to verify clamp band preload. Four matched springs minimize lip-off rates or differential springs to provide different lip-off rate. Retention system prevents clamp band recontact.
1194-4		1194 (47) dia clamp band	Two calibrated spacers to verify clamp band preload. Four matched spring or differential spring actuators to provide different lip-off rate. Retention system prevents clamp band recontact.
1575-4		1575 (62) dia 121 bolts in a 1575 (62) dia bolt circle	62.00 0-in. bolted interface

Note: All dimensions $\frac{\text{mm}}{(\text{in.})}$

Figure E1-20. Delta II and Delta IV Payload Adapters and Interfaces (4-m-dia Fairings)

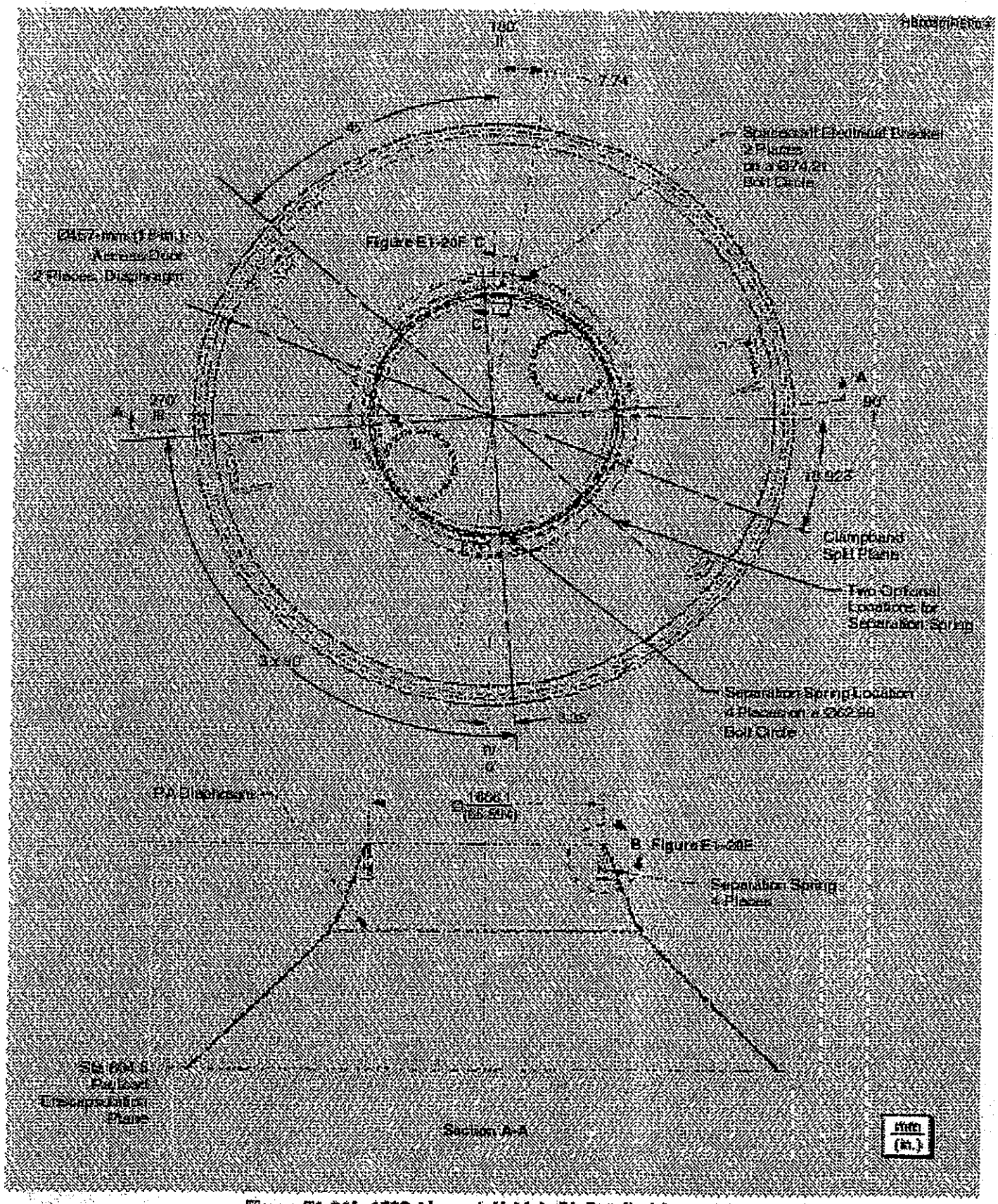


Figure E1-20A. 1666-4 Launch Vehicle PA Detailed Assembly

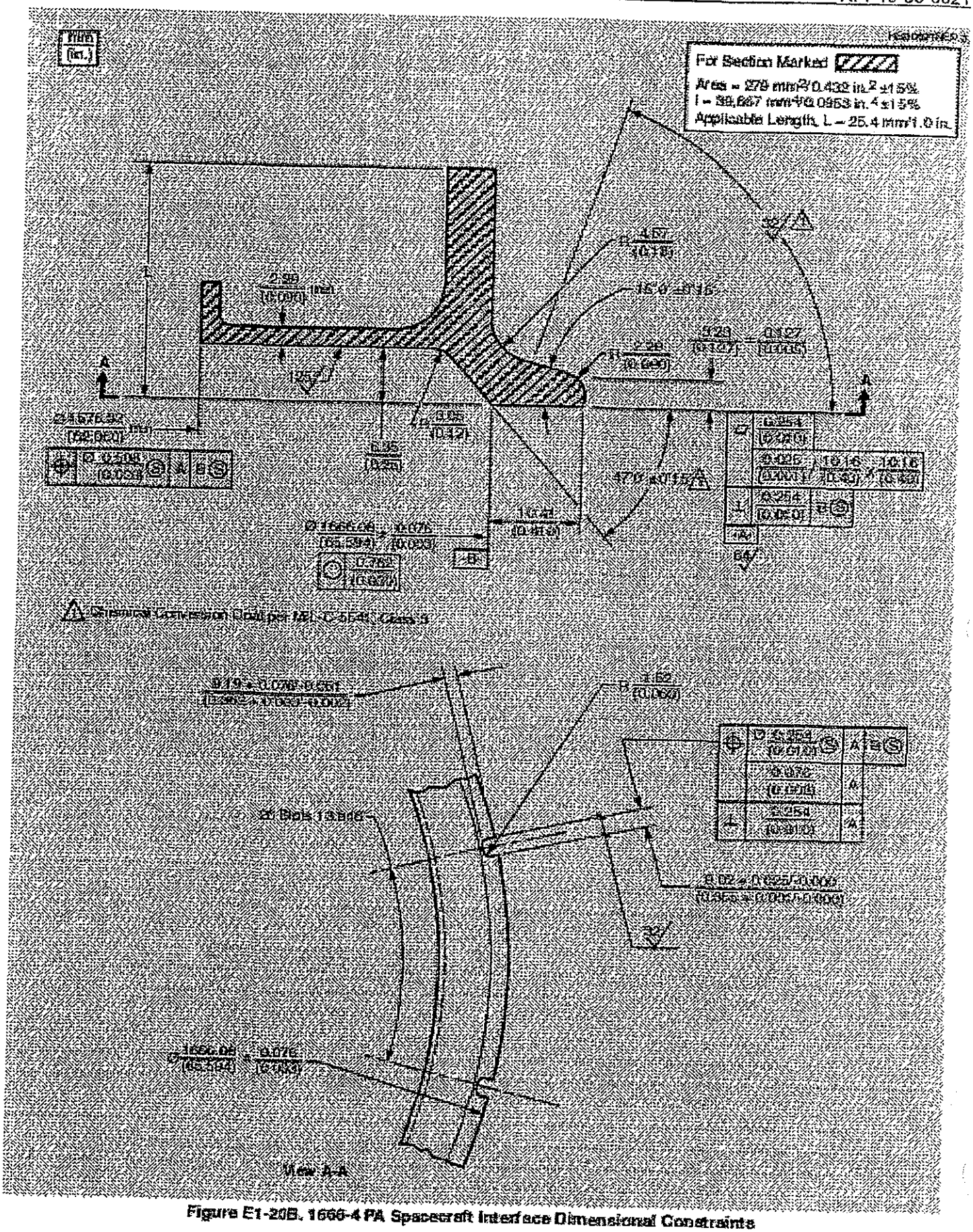


Figure E1-20B. 1666-4 PA Spacecraft Interface Dimensional Constraints

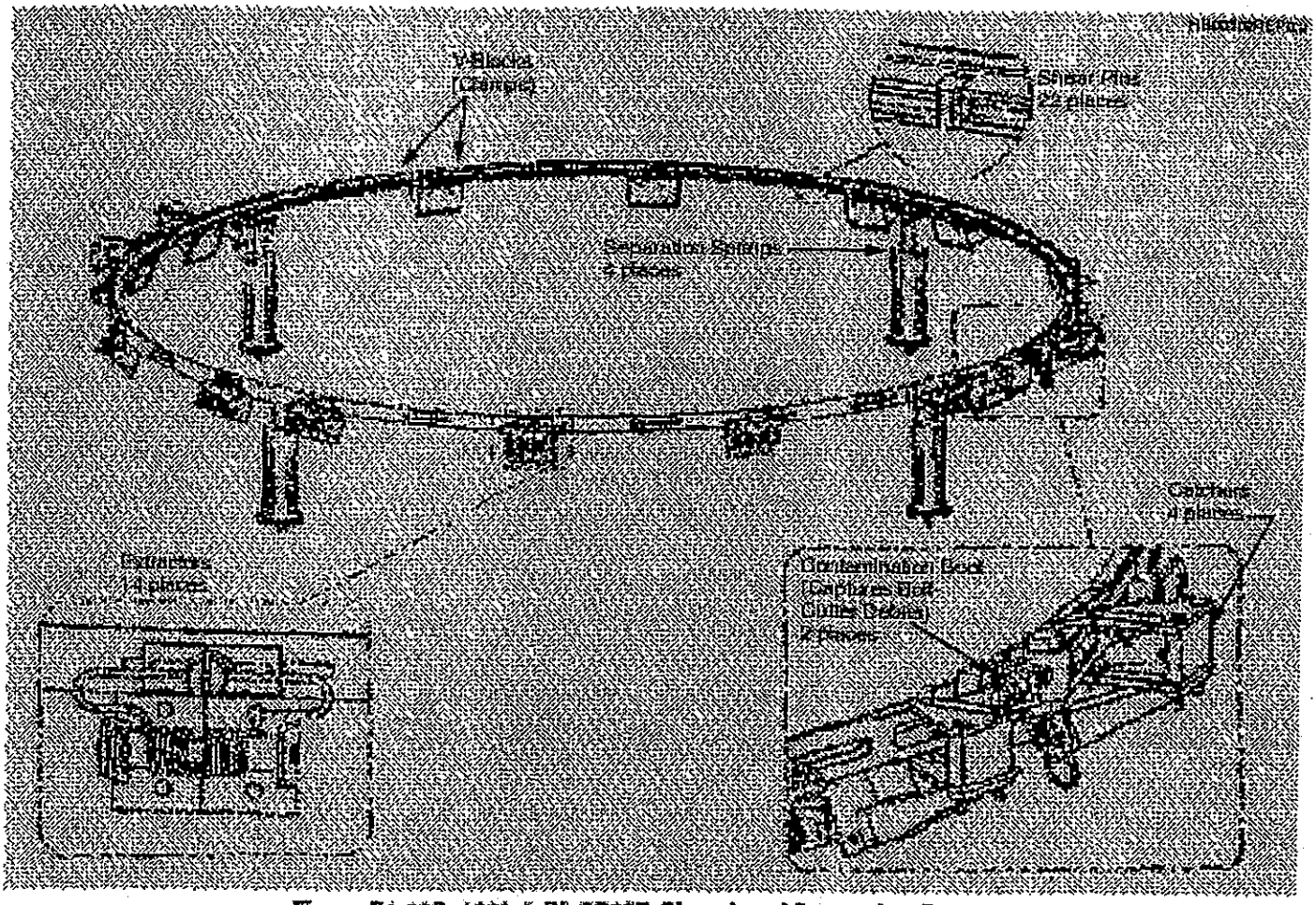


Figure E1-20C. 1666-4. PA SS66D Clampband Separation System

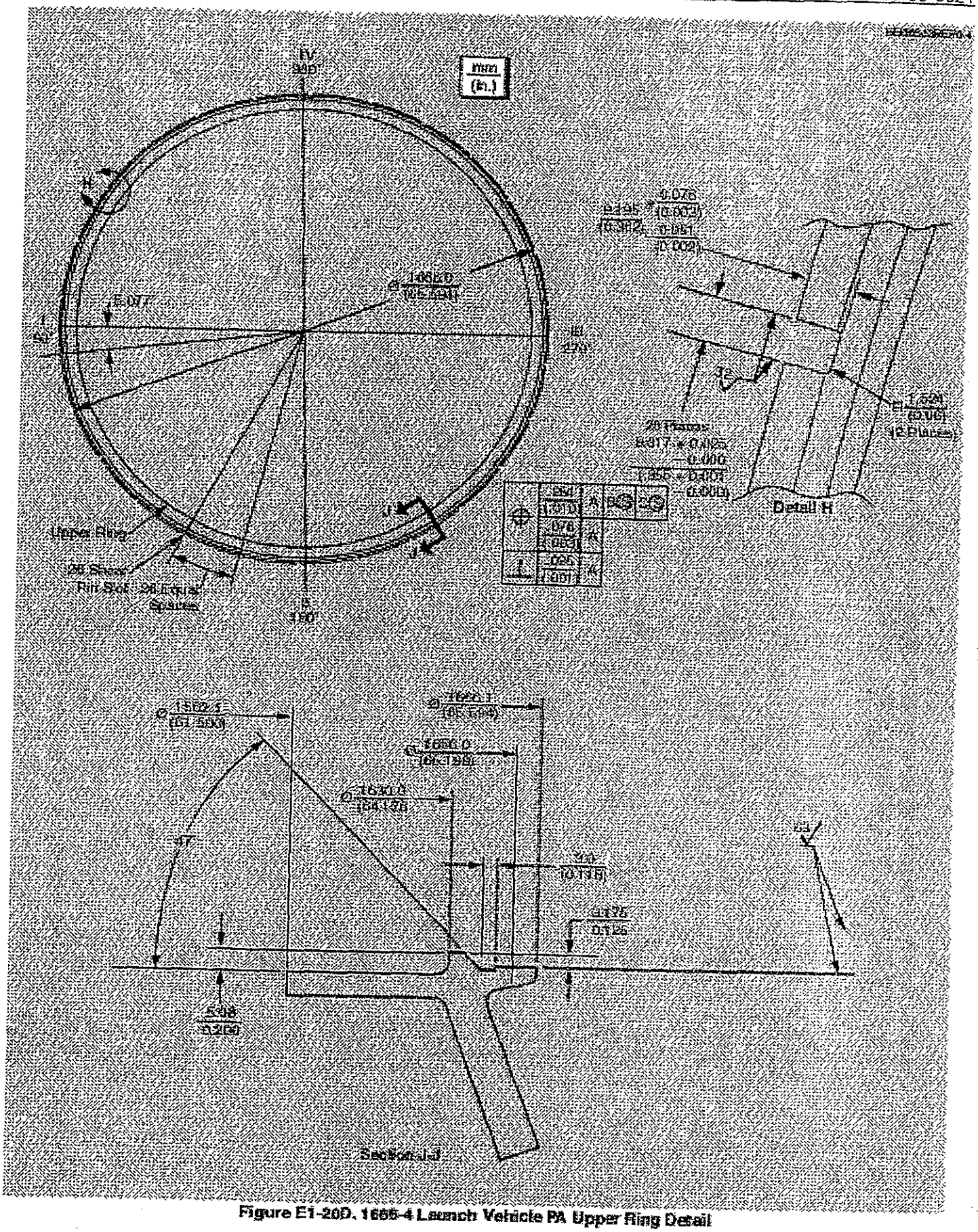


Figure E1-20D. 1665-4 Launch Vehicle PA Upper Ring Detail

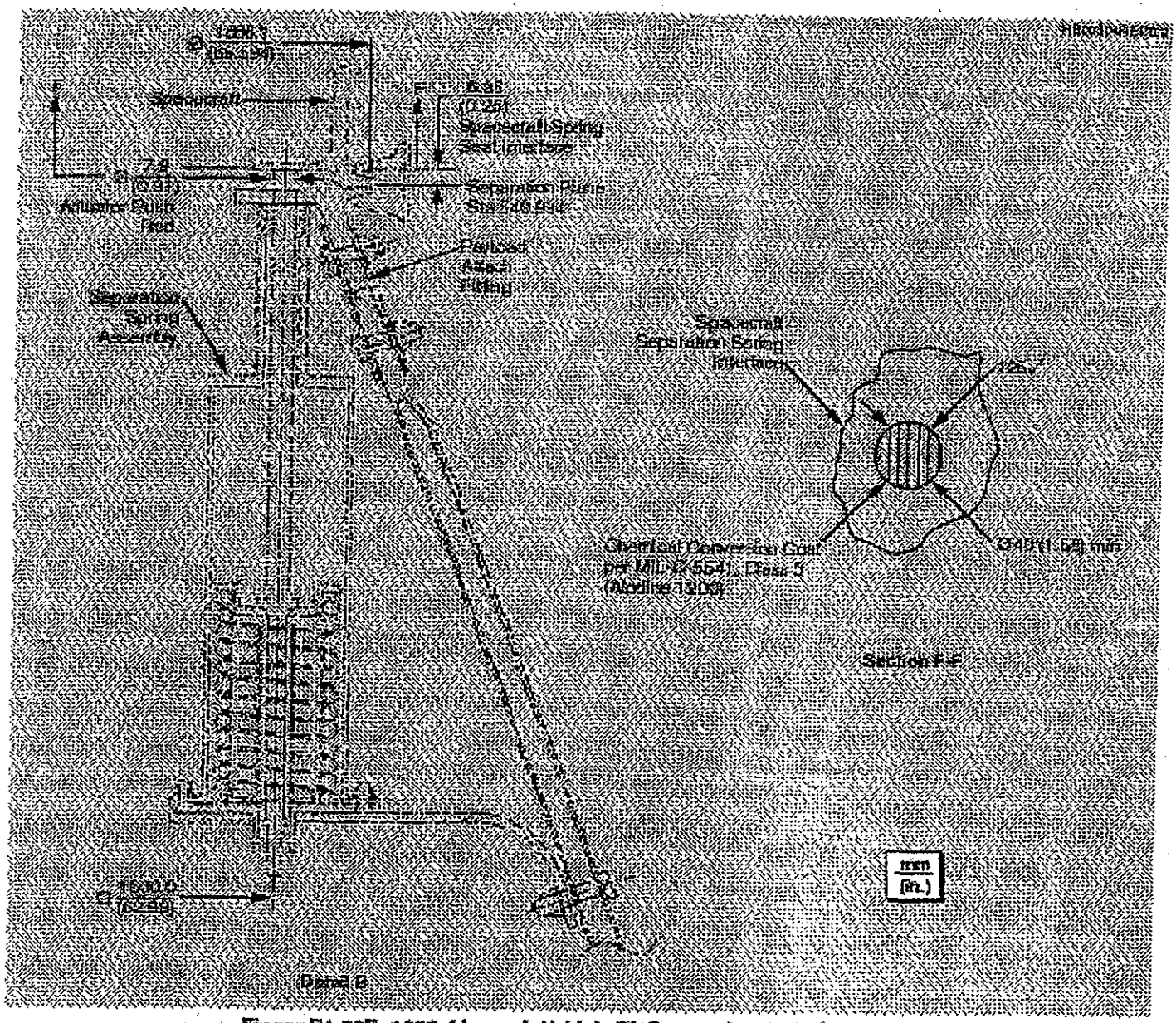


Figure E1-20E. 1666-4 Launch Vehicle PA Separation Spring Interface

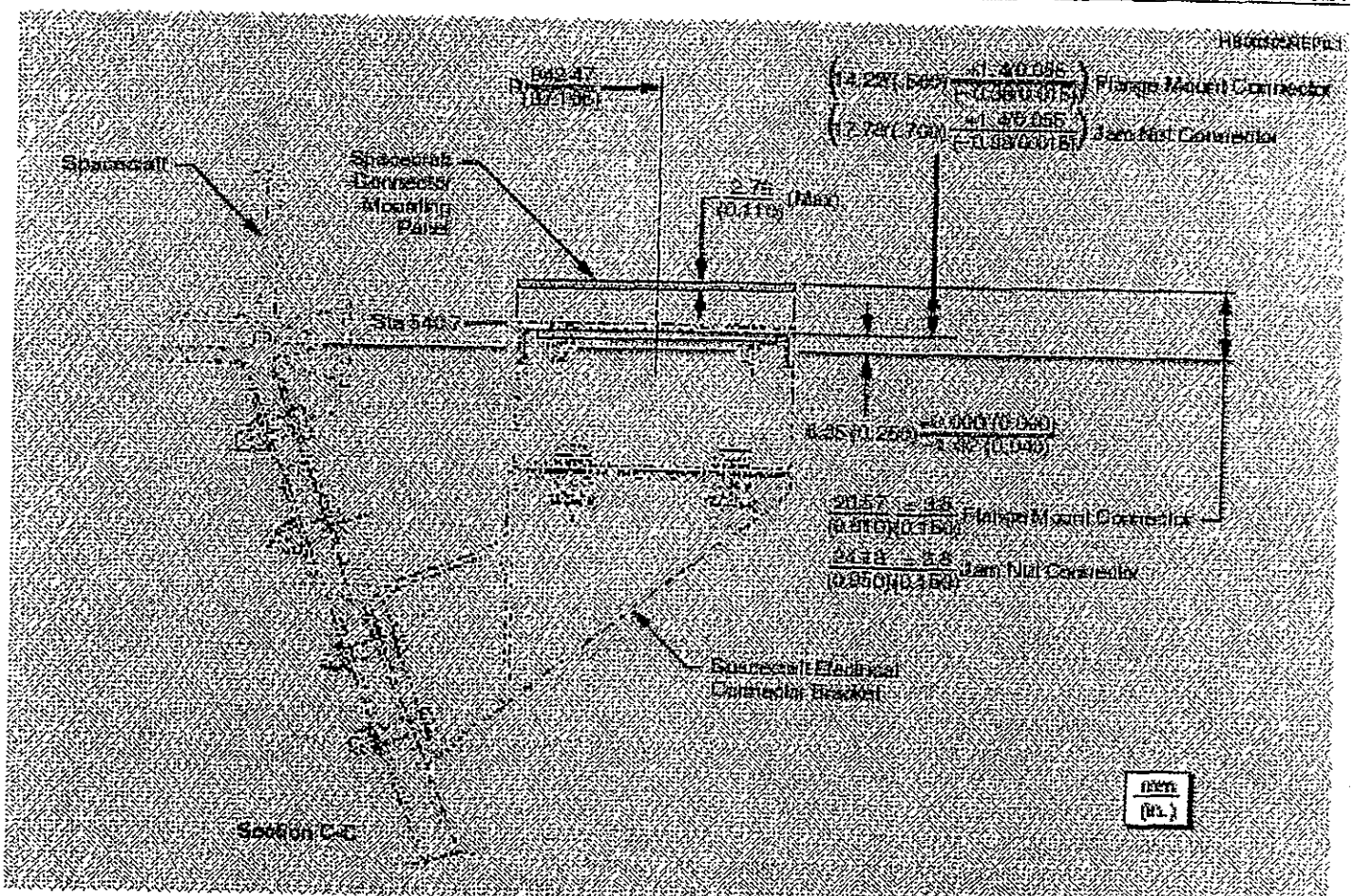


Figure E1-20F. 1666-4 PA Spacecraft Electrical Connector Interface

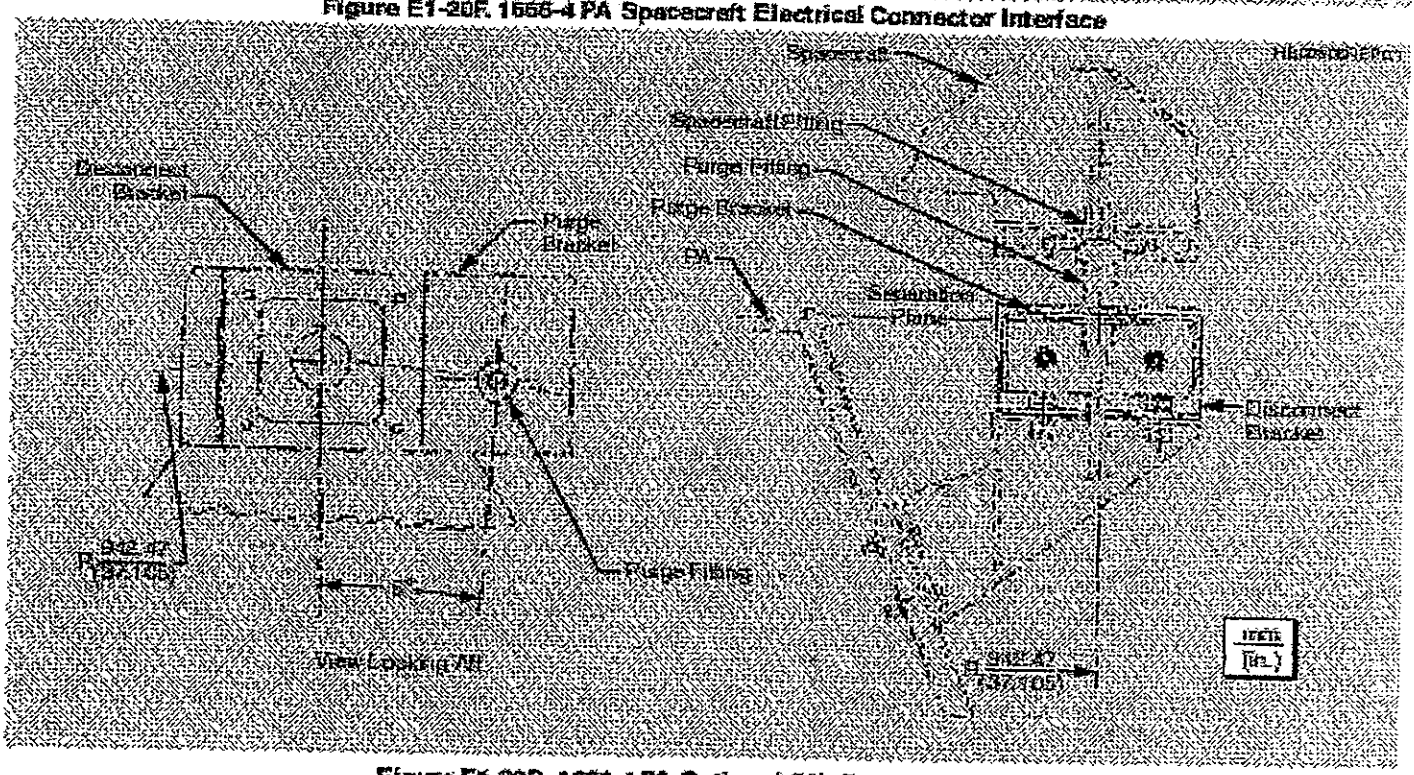


Figure E1-20G. 1666-4 PA Optional GN_2 Purge Interface

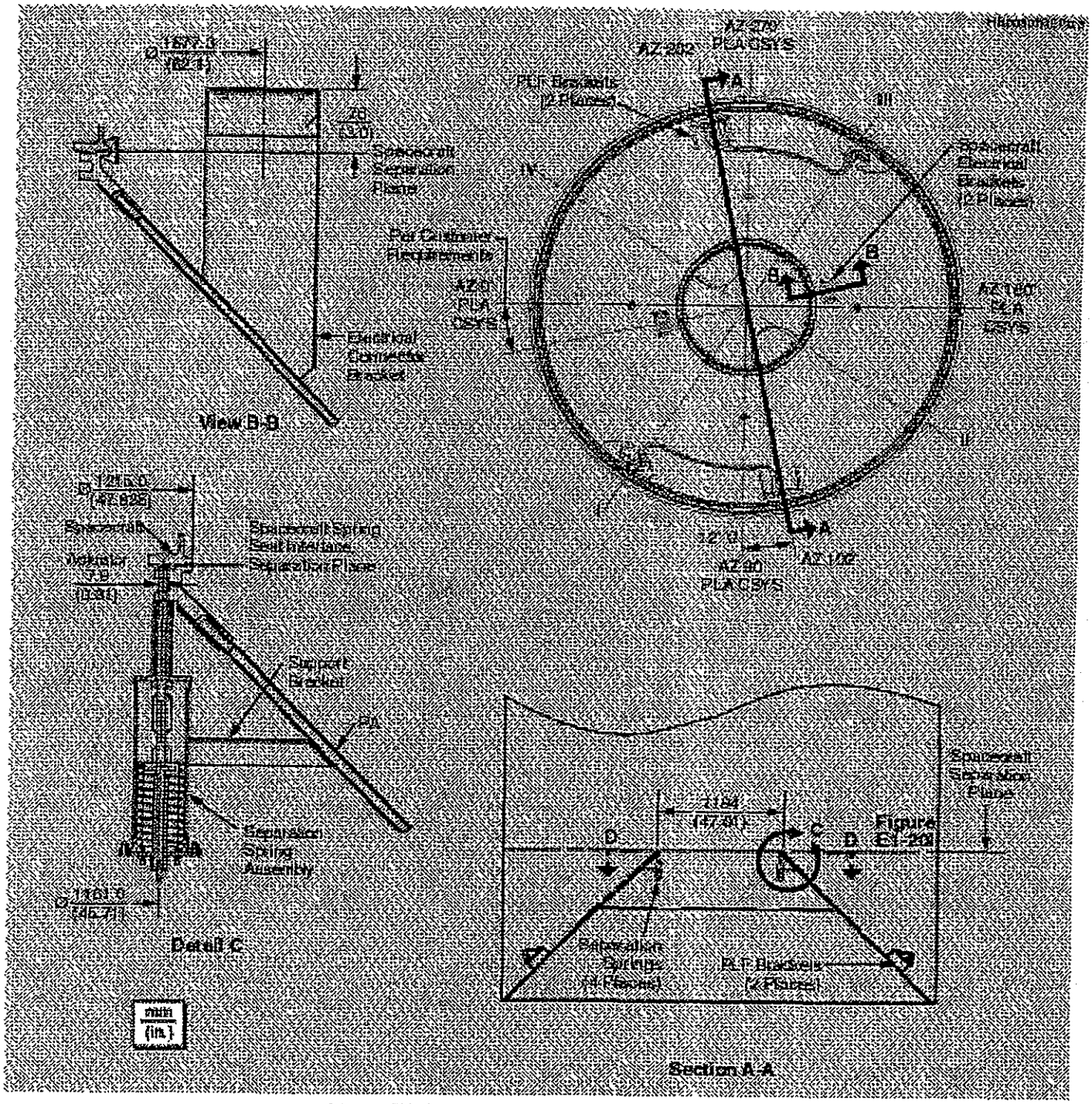


Figure E1-20H. 4-m 1194-4 Launch Vehicle PA

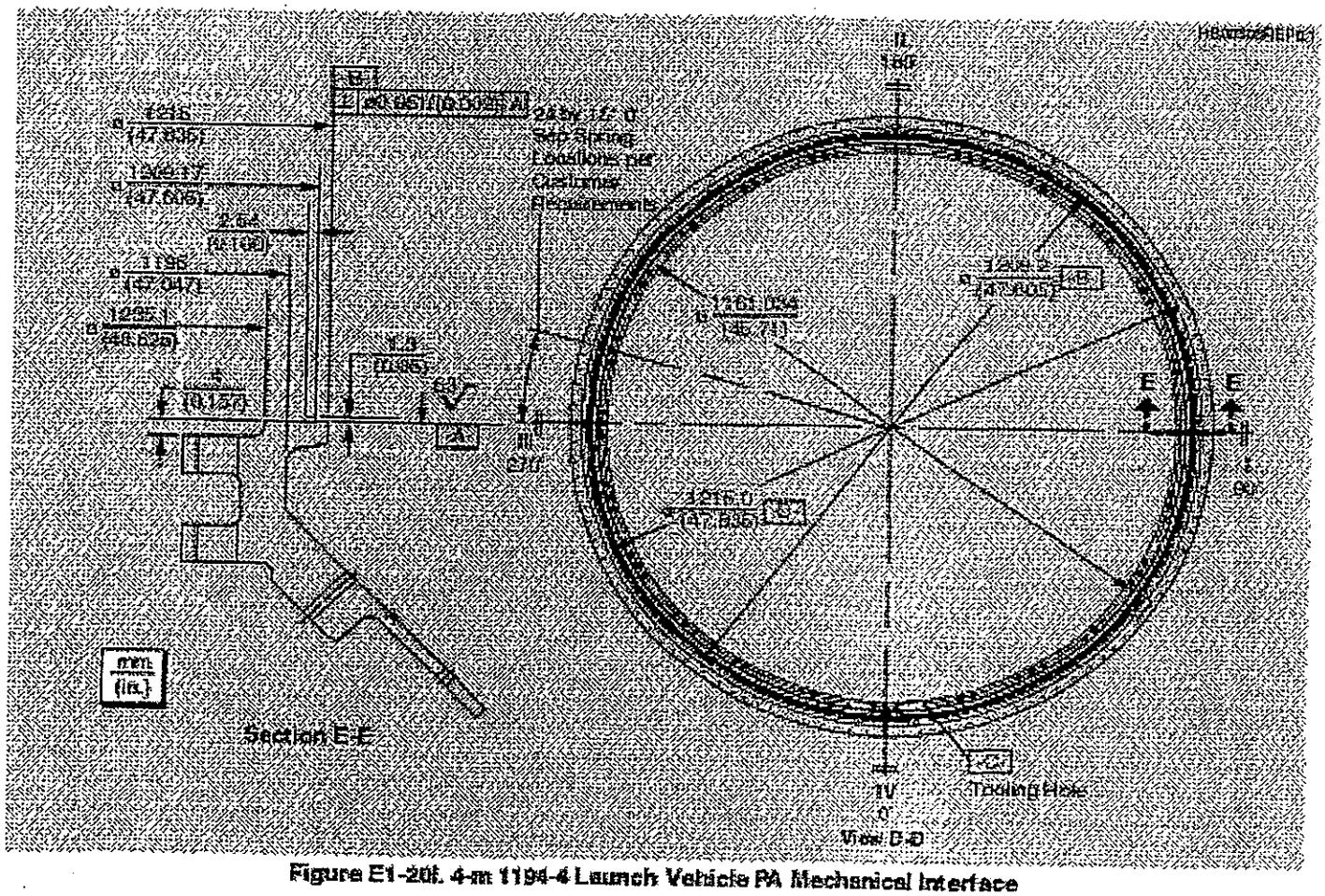


Figure E1-20f. 4-m 1194-4 Launch Vehicle PA Mechanical Interface

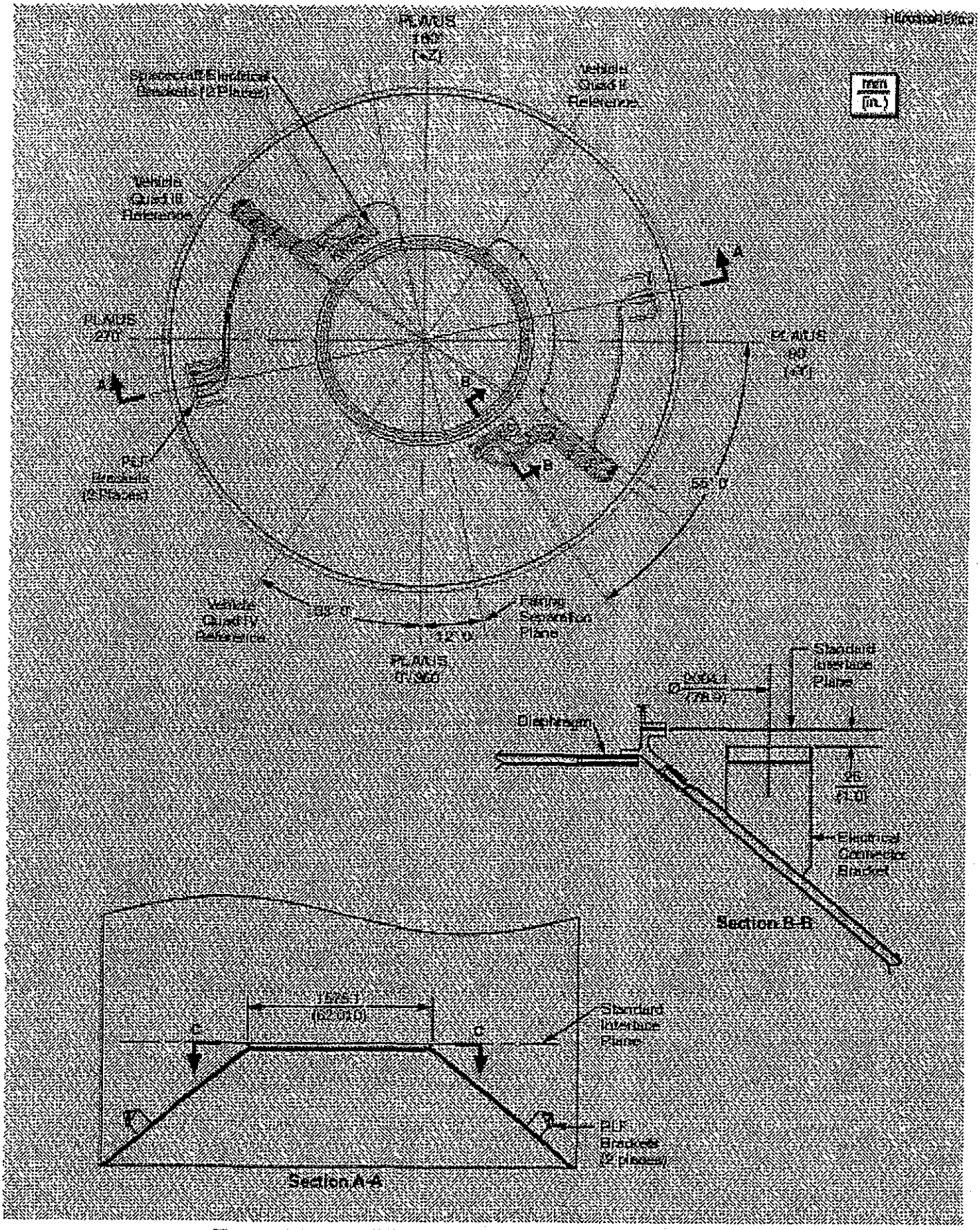


Figure E1-20J. 4-m 1575-4 Launch Vehicle PA Mechanical Interface

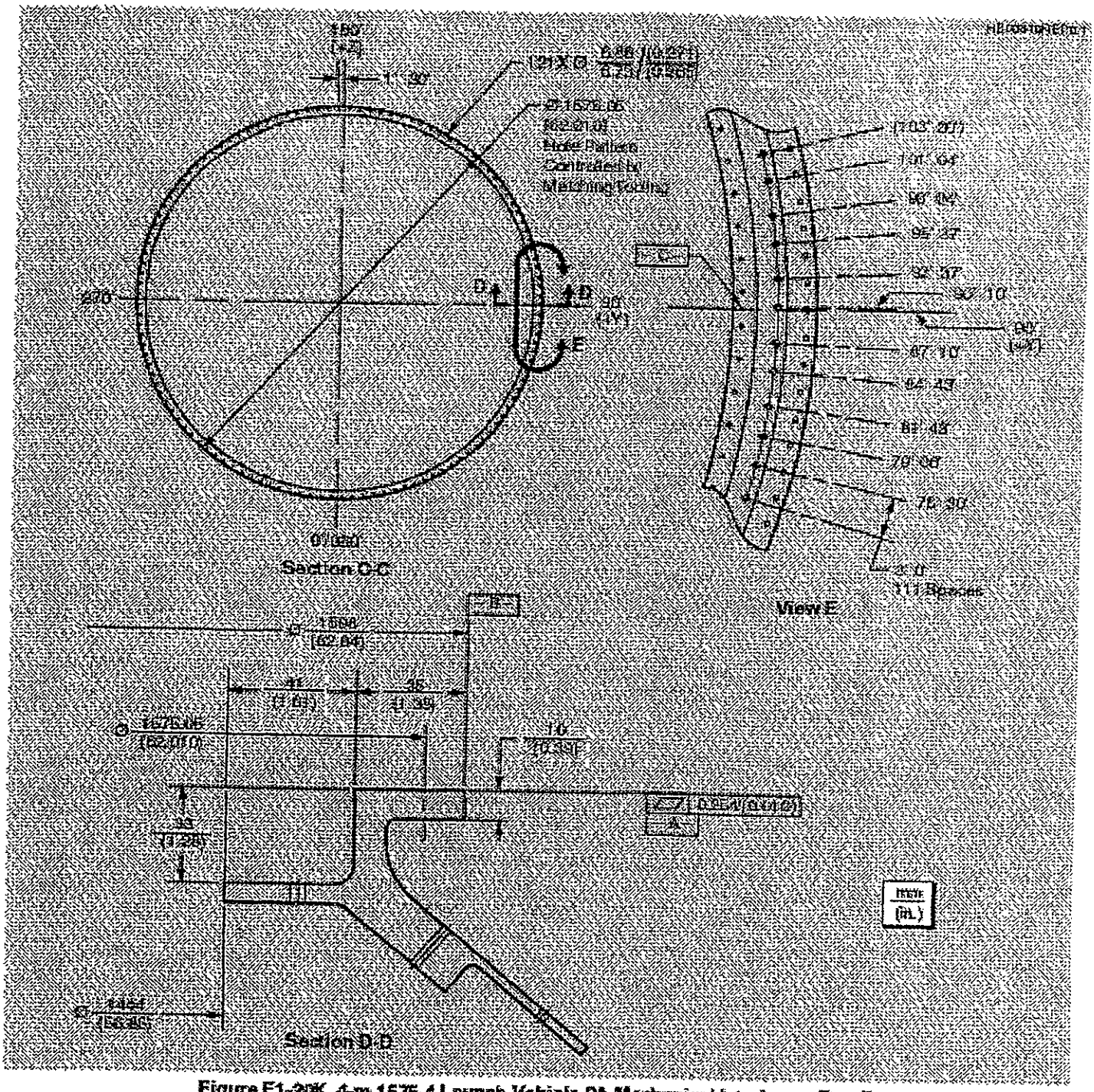
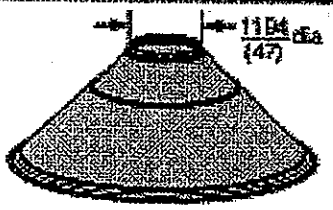


Figure E1-20K. 4-m 1575-4 Launch Vehicle PA Mechanical Interface—Detail

Model		Separation Mechanism	Features
1194-5		1194 (47) dia clamp band	Two differential spacers to verify clamp band preload. Four matched spring or differential spring actuators to provide different tip-off rate. Retention system prevents clamp band recontact

Note: All dimensions mm (in.)

Figure E1-21. Delta IV Payload Adapter and Interfaces (5-m-dia Fairings)

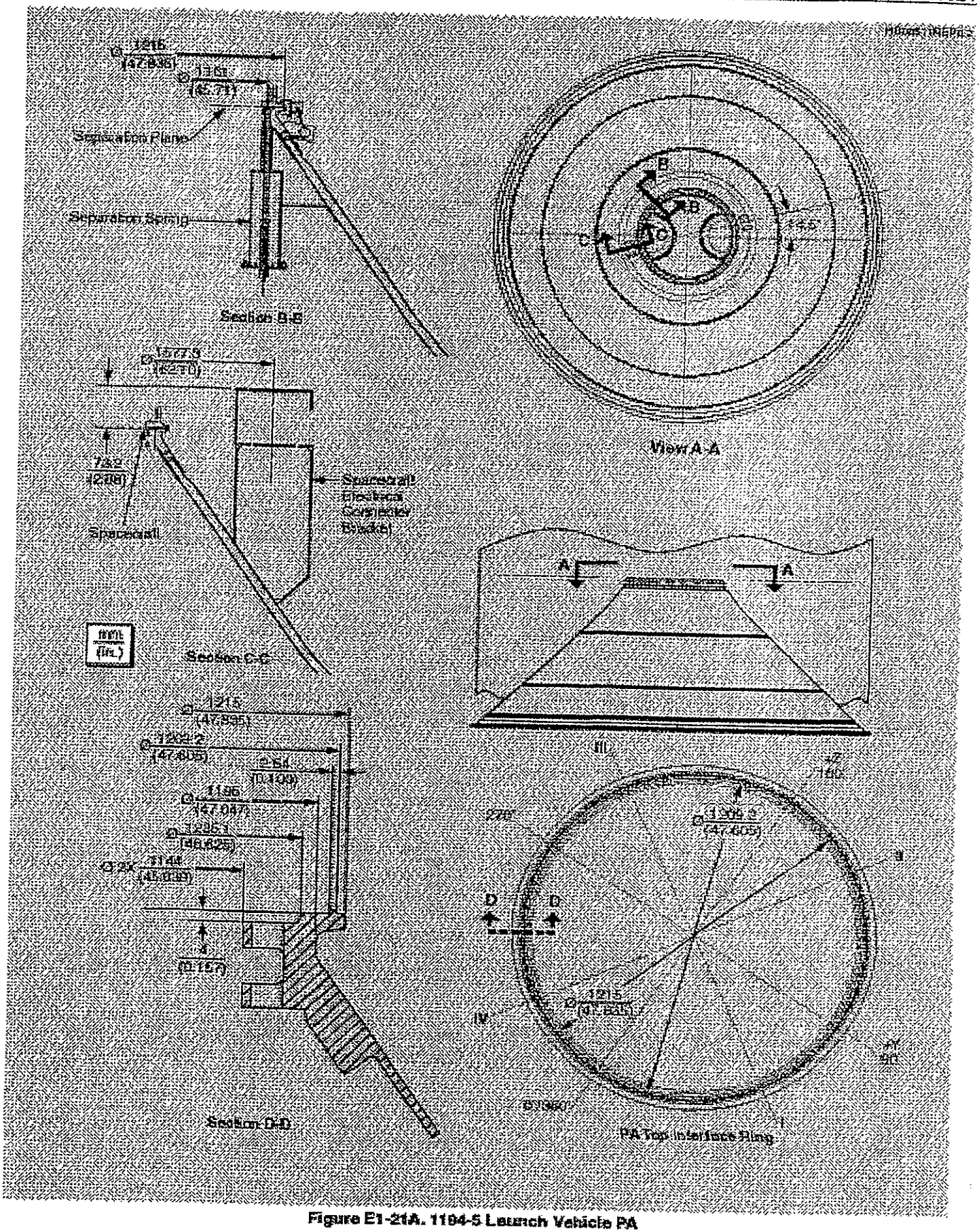


Figure E1-21A. 1194-5 Launch Vehicle PA

7.0 ELECTRICAL INTERFACE

The payload electrical interface will provide for payload separation sensing by the payload. To monitor vehicle/payload separation for Delta II, a separation switch can be installed in the payload. The configuration must be coordinated with the Delta Program Office. The switch should be located to interface with the vehicle at the separation plane or within 25.4 mm (1 in.) below it. A special pad will be provided on the vehicle side of the interface. The design of the switch should provide for at least 6.4 mm (0.25 in.) over-travel in the mated condition. The switch located over the separation spring is the preferred concept. Delta III and IV use a wire harness break wire and not a separation switch.

The payload electrical cables will provide interface connections between the payload and the payload ground support equipment (GSE) for the purpose of providing power, command and control, and payload status monitoring during launch processing and liftoff. The characteristics of these wires are specified in Table E1-29.

As a standard service, the launch vehicle/payload electrical interface provides two 37-pin connectors (74 wires total) for Delta II, and two 61-pin connectors (122 wires total) for Delta III and IV between the launch vehicle and the payload. Wires are provided between the payload J-box on the fixed umbilical tower (FUT) and the payload J-box in the blockhouse to provide the path between the payload and the payload GSE. The overall characteristic of this wiring is specified in Table E1-29. Non-standard services are available on Delta II using 37 or 61 pin connectors of different interface locations and with applicability to two-stage or three-stage missions (reference Attachment D1, Exhibit 3 for specific details).

Table E1-29. Payload Electrical Interfaces (Blockhouse to Fixed Utility Tower)

Function	Number of wires	Peak voltage	Continuous current (A)	Resistance from ground support equipment (GSE) to payload (ohms)	Shielding coverage*
Power (Delta II)	28	600 VDC	15	1.10(10), 1.25(18)	TP, OA
Data (Delta II)	120	600 VDC	6	4.2	TSP, OA
	24	600 VDC	6	6.2	TSP, OA
	5**	5 kV rms	N/A	RG/U 216 (75Ω)	Coax
Power (Delta III)	28	600 VDC	15	1.10 (10), 1.25 (18)	OA
Data (Delta III)	120	600 VDC	6	4.2	TSP, OA
	24	600 VDC	6	6.2	TSP, OA
	8**	5 kV rms	N/A	RG/U 21 (45Ω)	Coax
	8	1 kV rms	N/A	Twinax (78Ω)	TSP,OA
Power (Delta IV)	32	126 VDC	11	0.5 ohms one way	TP, OA
Control/Data (Delta IV)	120	126 VDC	3	2.5 ohms one way	TSP, OA
TM (Delta IV)	8	1 kV rms	N/A	Twinax (78Ω)	TSP, OA
Continuity sense (Delta II, III, IV)	Continuity sense jumpers are limited to the available unused pins in the payload interface connector(s)	600 VDC	2.5	N/A	N/A

*OA = Overall shield; TSP = twisted shielded pair, TP = twisted pair
**Coaxial cables are available between the umbilical J-box in the fixed umbilical tower (FUT) and the blockhouse

For missions with low tip-off requirements, switches may be required on either the payload or launch vehicle. Mounting details will be specified in the interface control drawing (ICD).

8.0 PAYLOAD ENVIRONMENT

Maximum environmental levels for payloads to be flown on the proposed vehicle(s) are shown in this section. The electromagnetic radiation levels encountered on Delta payloads are listed in Table E1-30.

Table E1-30. Maximum Electromagnetic Radiation Levels Encountered on Delta Payloads

Frequency	Two-Stage Delta II E-field (V/m)	Three-Stage Delta II E-field (V/m)
14 KHz to 2.2 GHz	20	20
2.2 GHz to 2.3 GHz*	20	40
2.3 GHz to 5.762 GHz	20	20
5.762 GHz to 5.768 GHz**	40	40
5.768 GHz to 40 GHz	20	20

*Third-stage S-band telemetry transmitter

**Second-stage C-band transponder

1. RF environment is applicable to Launch Complex (LC)-17 at Cape Canaveral Air Force Station (CCAFS) and Space Launch Complex (SLC)-2W at Vandenberg air Force Base (VAFB).
2. RF environment is the result of launch vehicle transmitters and range radars.
3. RF environment does not include radio frequency (RF) radiation by unauthorized/uncontrolled sources such as marine radars and aircraft overhead.
4. Environment is defined as at the launch vehicle/payload separation interface with the fairing off. (Composite fairing will provide at least 30 dB of attenuation.)
5. Reduced RF environment may be negotiated specific frequency bands.

Frequency	Two-Stage Delta III E-field (V/m)
14 KHz to 2.2 GHz	20
2.2 GHz to 2.3 GHz*	14
2.3 GHz to 5.762 GHz	20
5.762 GHz to 5.768 GHz**	40
5.768 GHz to 40 GHz	20

*Second-stage S-band telemetry transmitter

**Second-stage C-band transponder

1. RF environment is applicable to LC-17 at CCAFS.
2. RF environment is the result of launch vehicle transmitters and range radars.
3. RF environment does not include RF radiation from unauthorized/uncontrolled sources such as marine radars and aircraft overhead.
4. Environment is defined as at the launch vehicle/payload separation interface with the fairing off.
5. RF environment assumes protective masking of range radars.

Frequency	Two-Stage Delta IV E-field (V/m)
14 KHz to 2.2 GHz	10
2.2 GHz to 2.3 GHz*	14
2.3 GHz to 5.762 GHz	10
5.762 GHz to 5.768 GHz**	40
5.768 GHz to 40 GHz	10

*Second-stage S-band telemetry transmitter

**Second-stage C-band transponder

1. RF environment is applicable to LC-37B at CCAFS and SLC-6 at VAFB.
2. RF environment is the result of launch vehicle transmitters and range radars.
3. RF environment does not include RF radiation from unauthorized/uncontrolled sources such as marine radars and aircraft overhead.
4. Environment is defined as at the launch vehicle/payload separation interface with the fairing off.
5. Reduced RF environment may be negotiated specific frequency bands.

The payload depressurization profiles and maximum rates are shown in Figures E1-22 through E1-27.

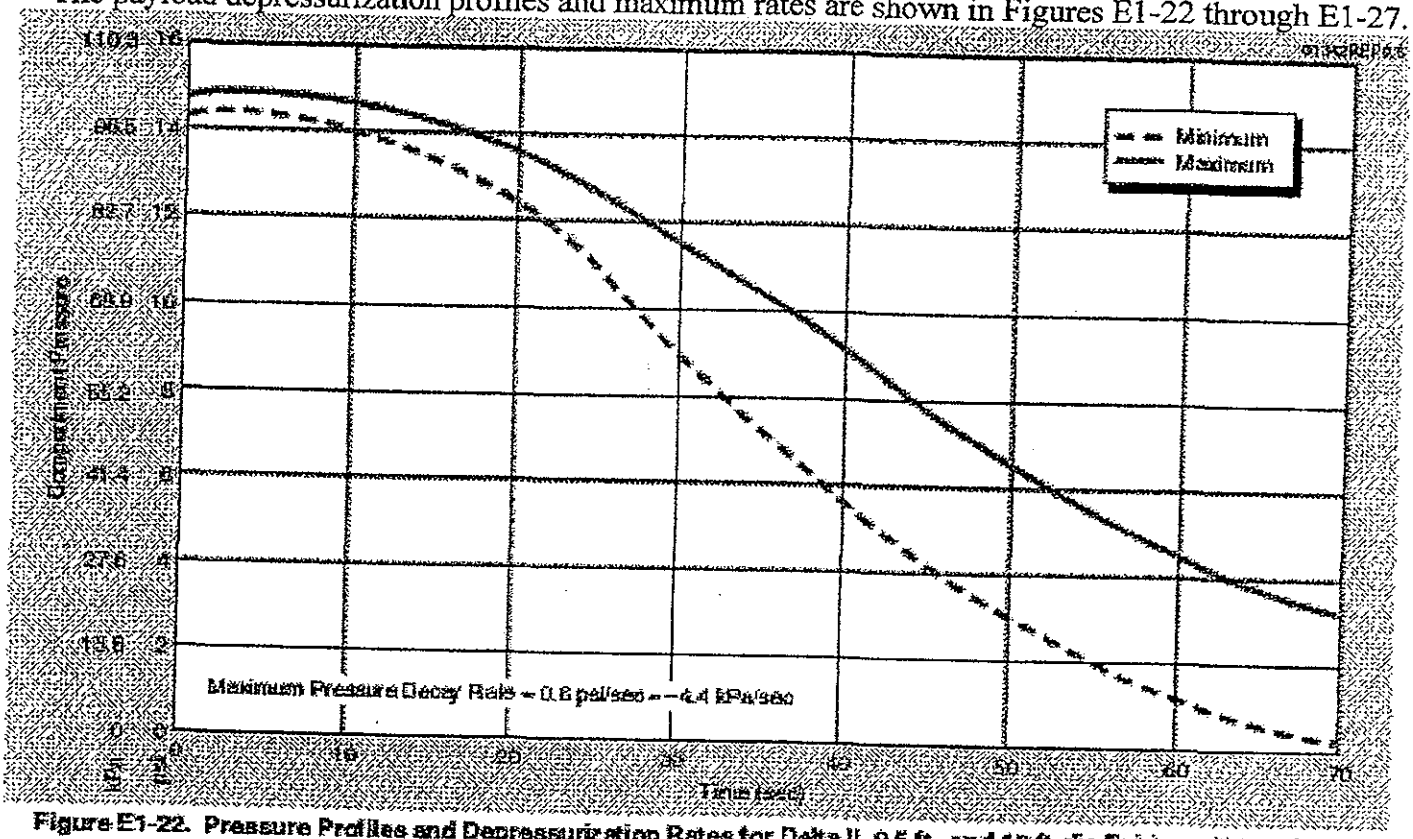


Figure E1-22. Pressure Profiles and Depressurization Rates for Delta II, 9.5-ft- and 10-ft-dia Fairings (10 and 10L)

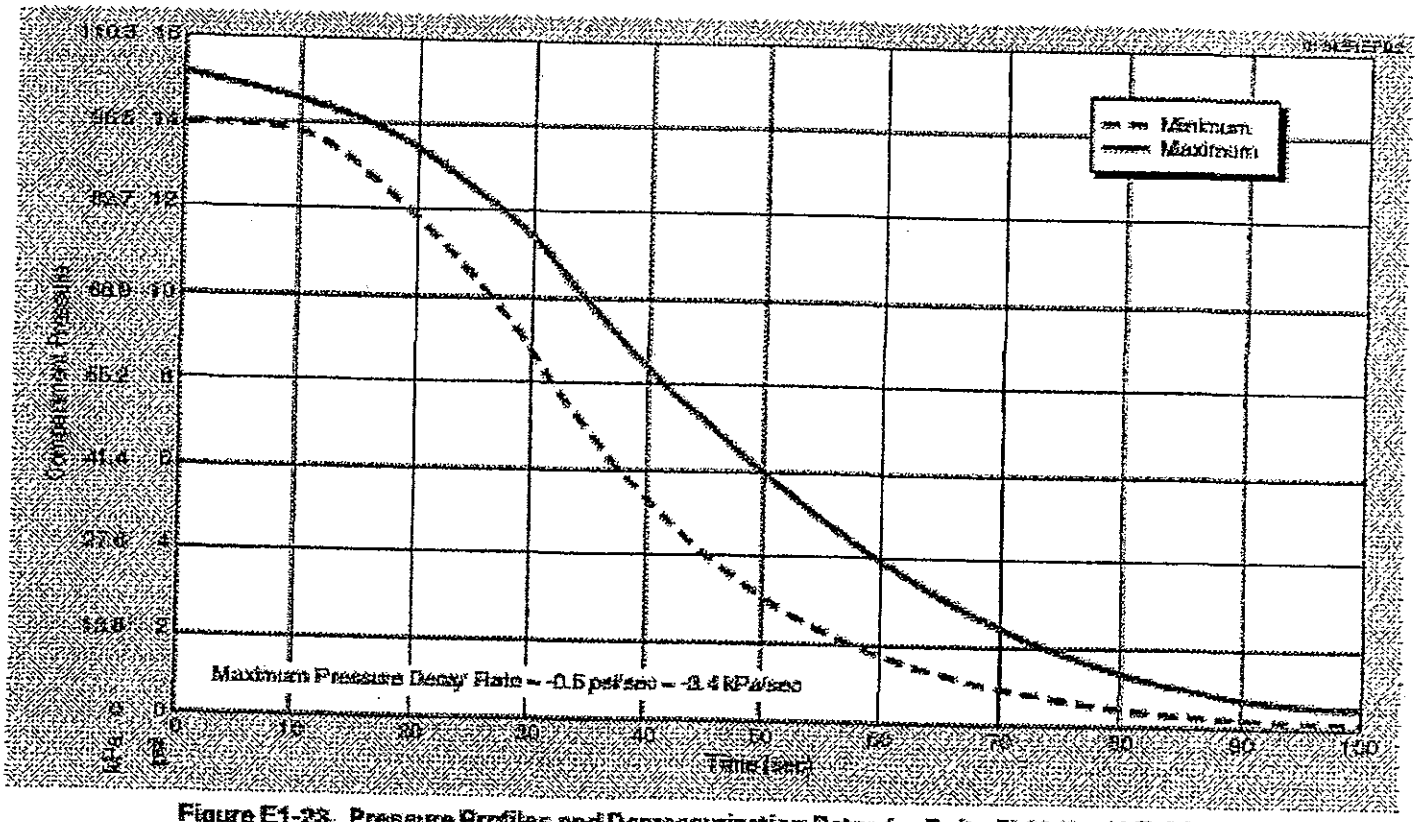


Figure E1-23. Pressure Profiles and Depressurization Rates for Delta II 3940, -11 Fairing

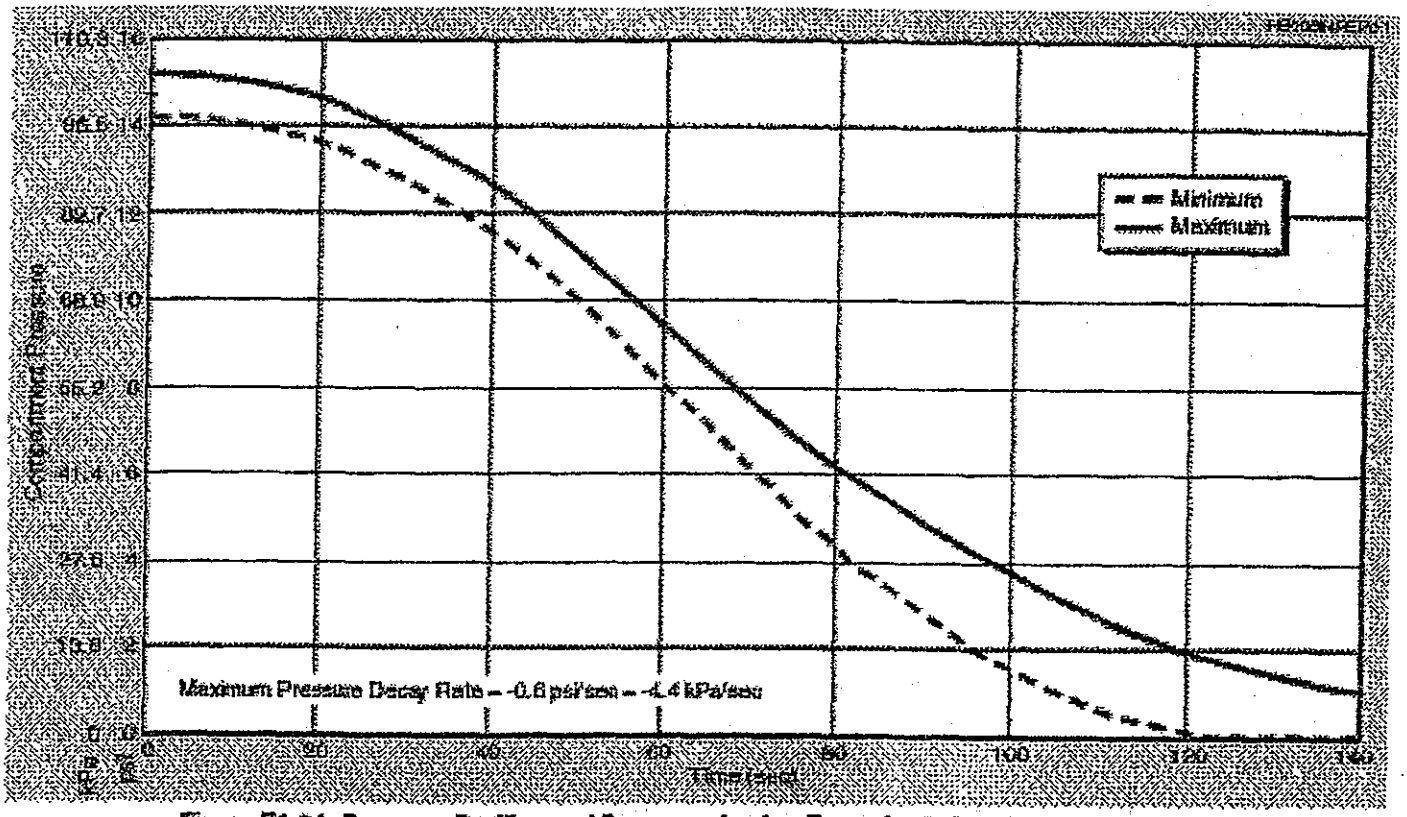


Figure E1-24. Pressure Profiles and Depressurization Rates for Delta IV 4040, -12 Fairing

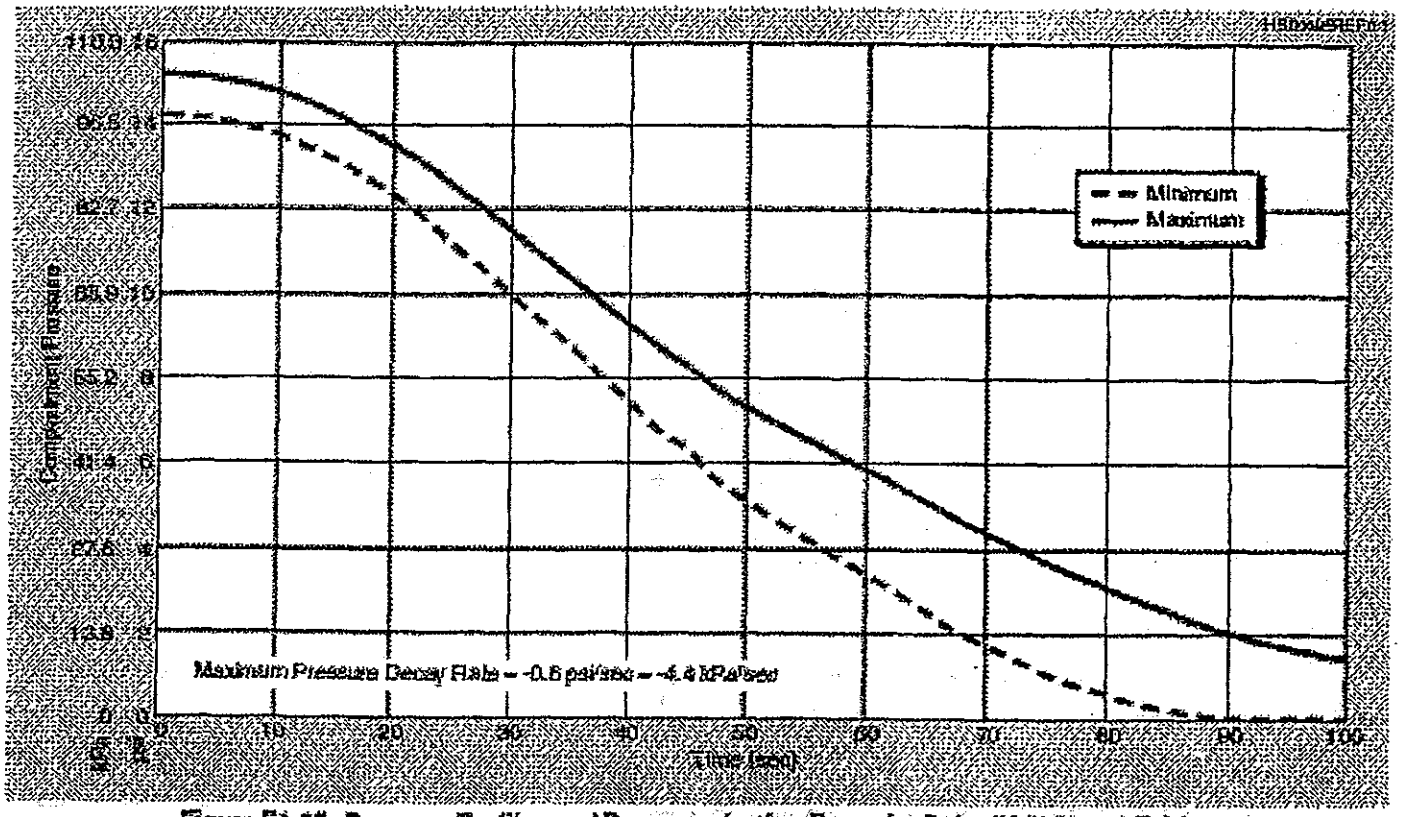


Figure E1-25. Pressure Profiles and Depressurization Rates for Delta IV 4240, -12 Fairing

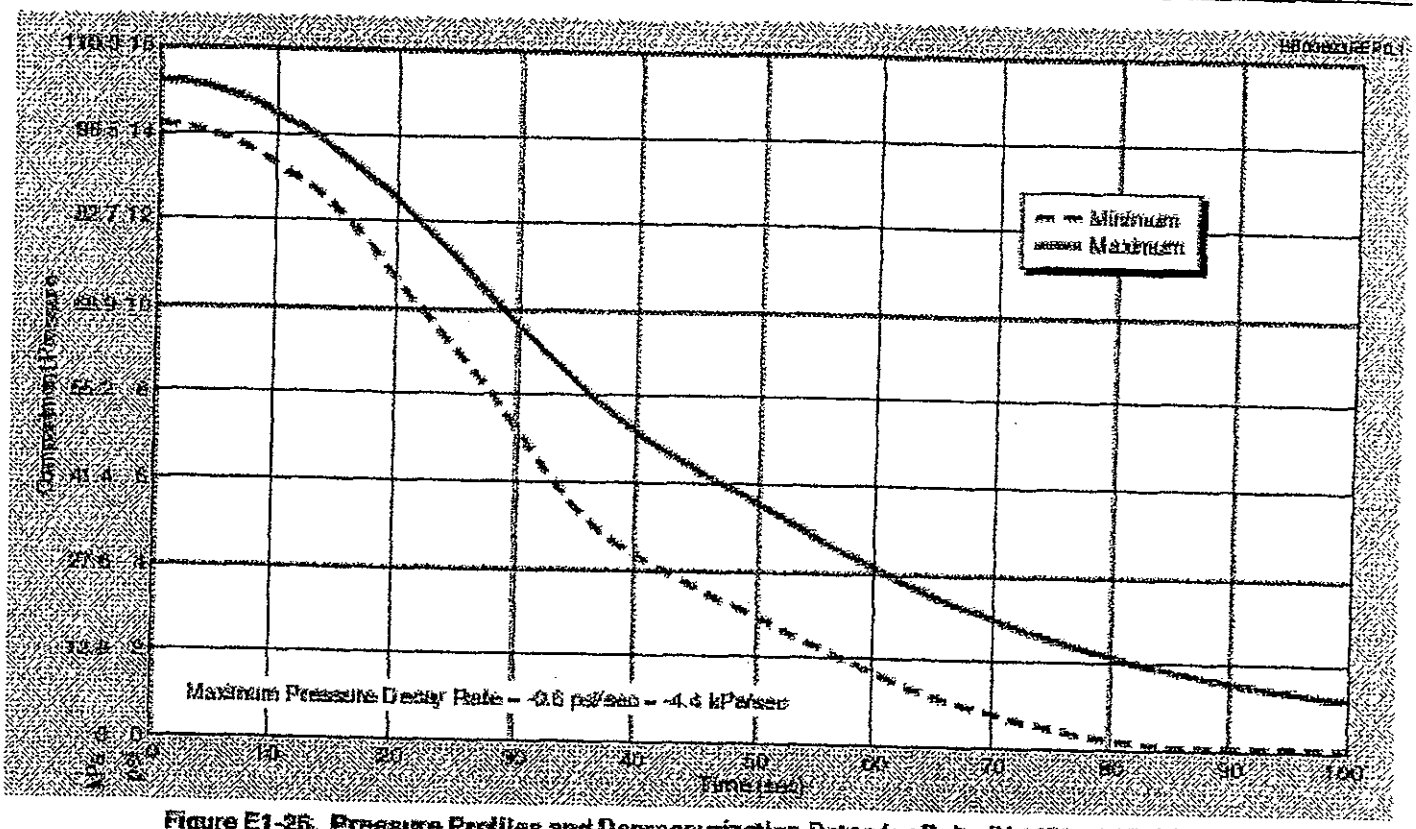


Figure E1-26. Pressure Profiles and Depressurization Rates for Delta IV 4450, -14 Fairing

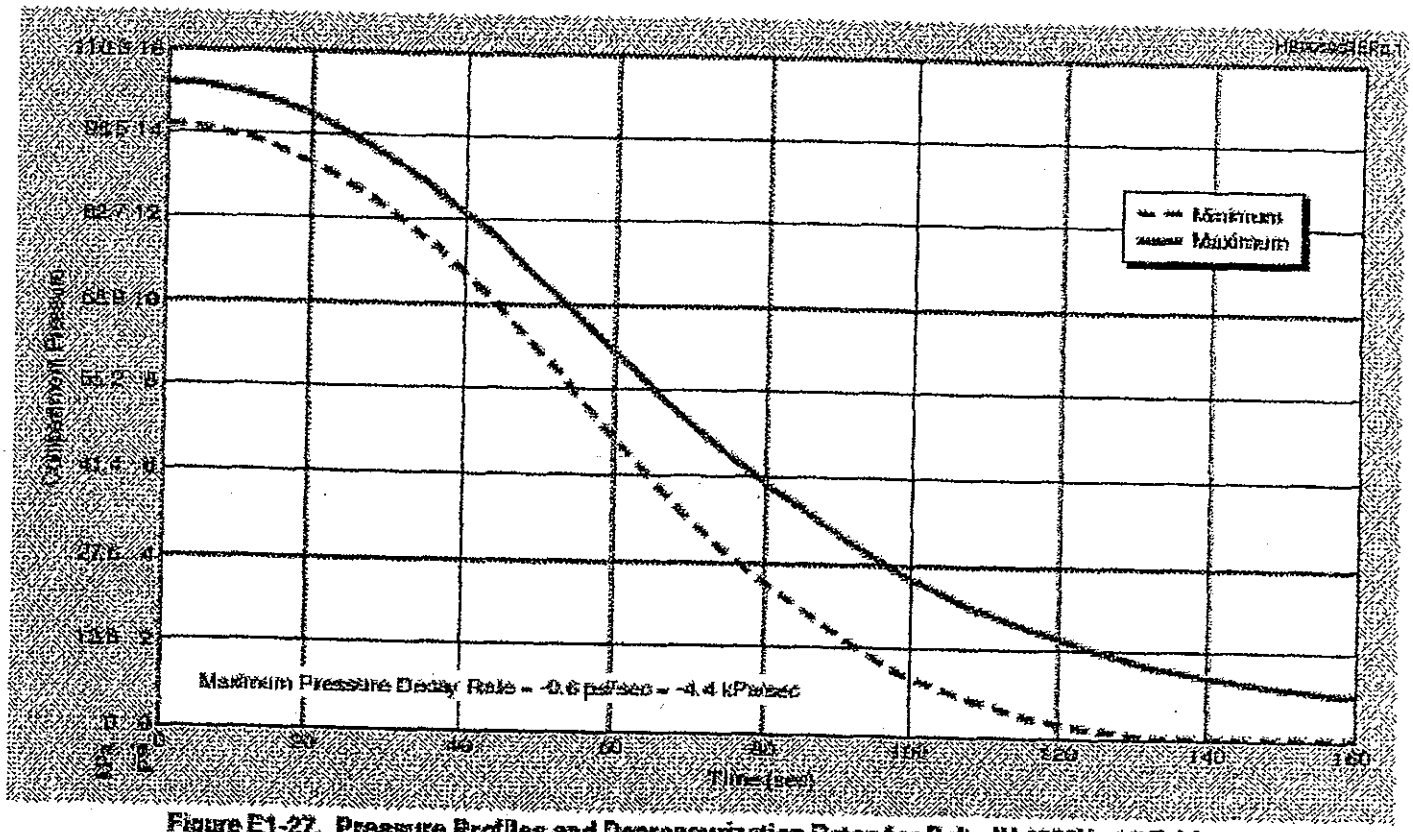
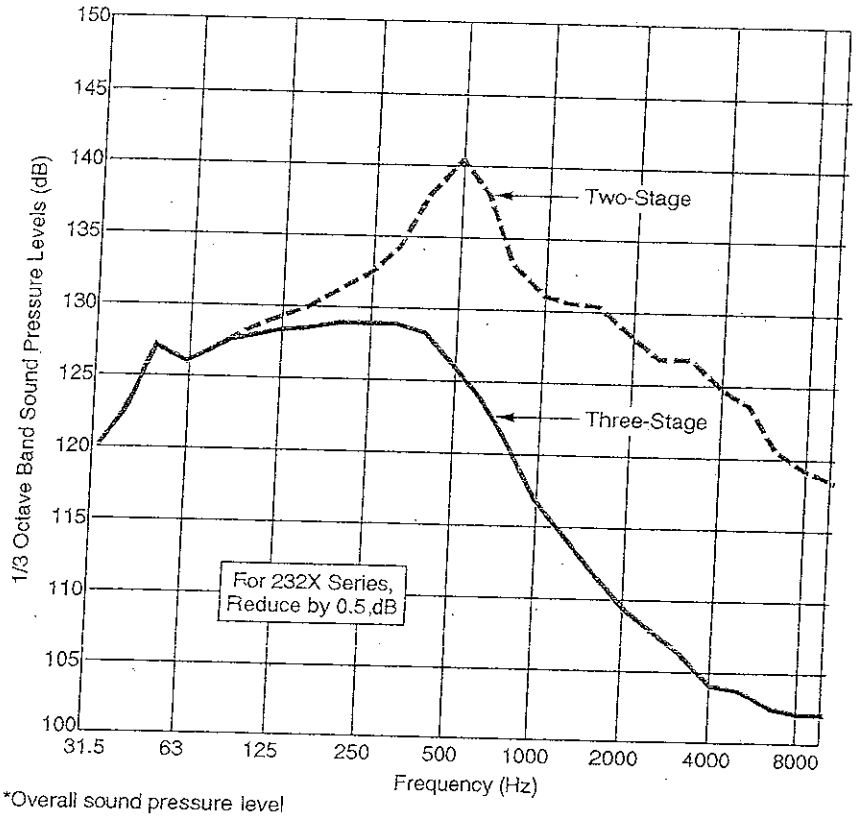


Figure E1-27. Pressure Profiles and Depressurization Rates for Delta IV 4050H, -19 Fairing

The maximum predicted flight-level acoustic environments for the payload are shown in Figures E1-28 through E1-34. The Delta II 2320 series acoustic environments are 0.5 dB lower than 2420 series acoustic environments. Delta II 2920H series environments are 2 dB higher than 2920 series acoustic environments..The maximum predicted flight levels represent the P95/50 acoustic environment (95th percentile environment with 50% confidence level) for a payload with up to a 60% fill factor.

Random vibration environments are not presented in the proposal because they are a function of both the acoustic environment and the payload structure. Since the mass, surface area, and stiffness of the payload vary from mission to mission, there are no standard random vibration environments. Further, because structure-borne random vibration is much lower than the acoustic-induced vibration, our acoustic and sinusoidal vibration testing envelops the entire vibration environment for the payload.

The maximum flight-level payload interface shock response spectrum for each configuration is shown in Figures E1-35 through E1-36.



*Overall sound pressure level

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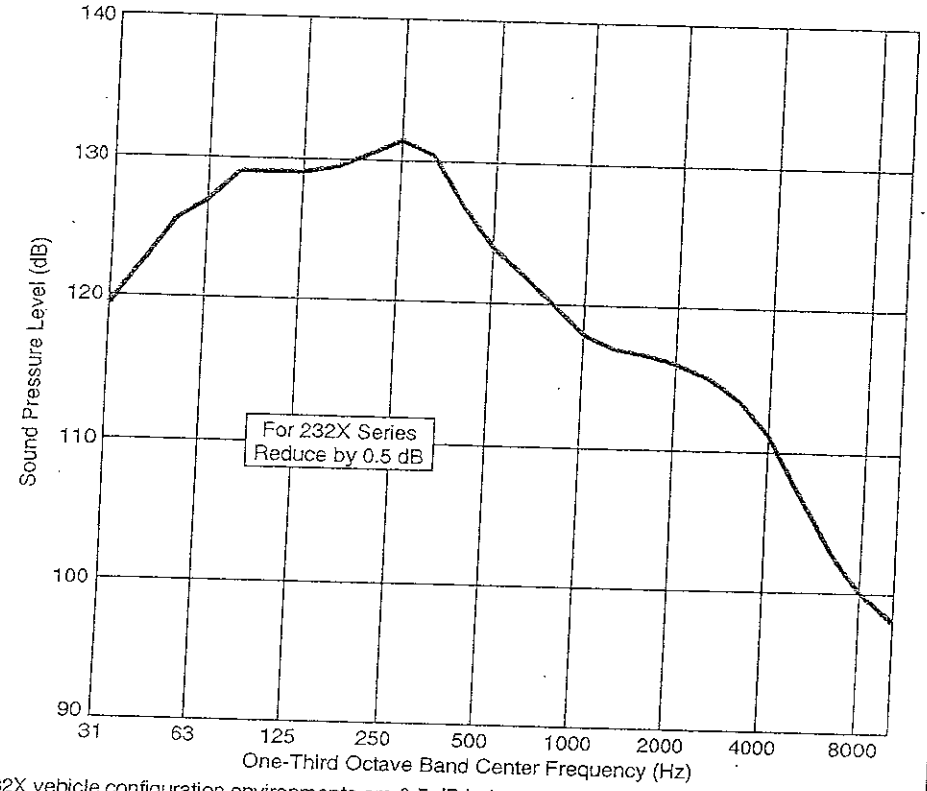
Maximum Flight Levels (dB)		
One-Third Octave Center Frequency (Hz)	Three-Stage Mission	Two-Stage Mission
31.5	119.9	119.9
40	122.5	122.5
50	127.0	127.0
63	126.1	126.1
80	127.2	127.2
100	127.8	128.3
125	128.3	129.3
160	128.4	129.9
200	129.0	131.0
250	129.1	132.1
315	129.1	134.1
400	128.2	138.2
500	126.5	140.5
630	124.0	138.0
800	121.0	133.0
1,000	117.0	131.0
1,250	114.5	130.5
1,600	112.0	130.5
2,000	109.5	128.5
2,500	108.0	127.0
3,150	106.5	127.0
4,000	104.5	125.0
5,000	104.0	124.0
6,300	103.0	120.5
8,000	102.5	119.5
10,000	102.5	118.5
OASPL*	138.9	146.2
Duration	10 sec	10 sec

Figure E1-28. Maximum Flight-Level Payload Acoustic Environment for Delta II 242X, -9.5 Fairings

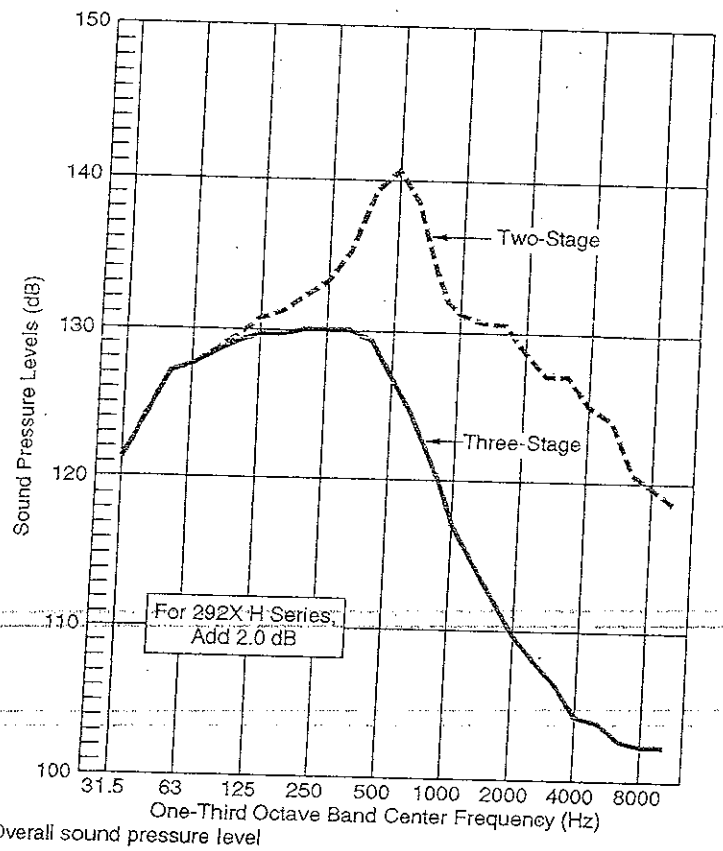


Maximum Flight Levels (dB)	
One-Third Octave Center Frequency (Hz)	Two Stage and Three Stage Mission
31	119.5
40	122.5
50	125.5
63	127
80	129
100	129
125	129
160	129.5
200	130.5
250	131.5
315	130.5
400	127
500	124
630	122
800	120
1,000	118
1,250	117
1,600	116.5
2,000	116
2,500	115
3,150	113.5
4,000	111
5,000	107
6,300	103
8,000	100
10,000	98
OASPL	139.7
Duration	5 sec

232X vehicle configuration environments are 0.5 dB below 242X vehicle configuration environments.

4T168007

Figure E1-29. Maximum Flight-Level Acoustic Environment for Delta II 242X-10 Fairings (10 and 10L)

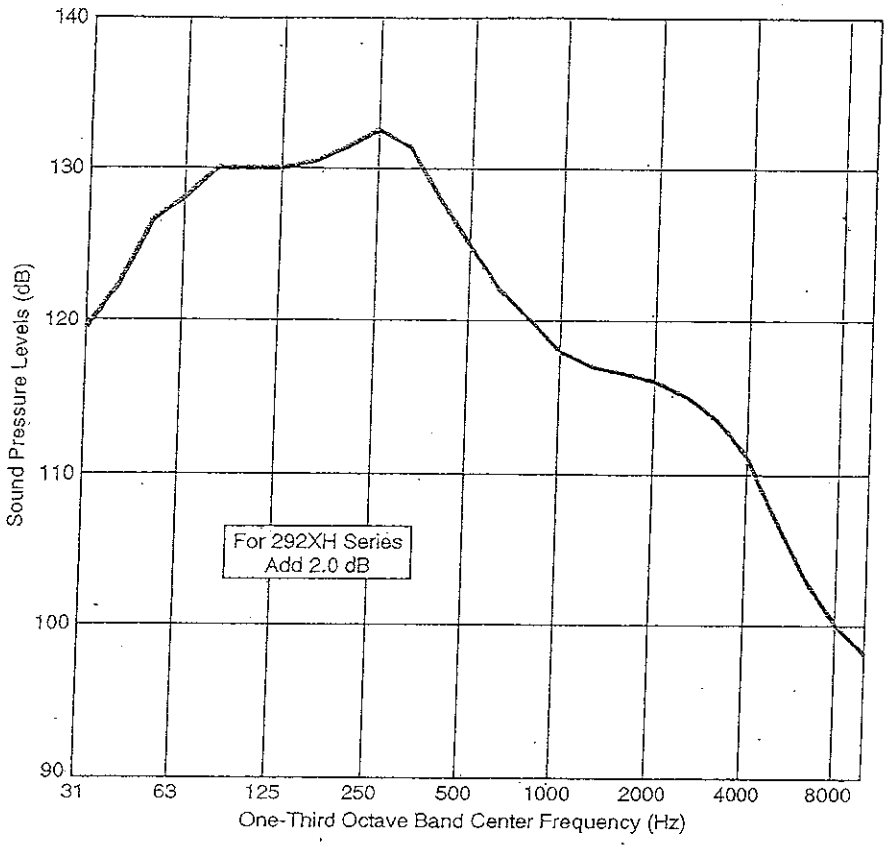


Maximum Flight Levels (dB)		
One-Third Octave Center Frequency (Hz)	Three-stage Mission	Two-stage Mission
31.5	121.5	121.5
40	124	124
50	127	127
63	127.5	127.5
80	128.5	128.5
100	129	129.5
125	129.5	130.5
160	129.5	131
200	130	132
250	130	133
315	130	135
400	129	139
500	126.5	140.5
630	124	138
800	121	133
1000	117	131
1250	114.5	130.5
1600	112	130.5
2000	109.5	128.5
2500	108	127
3150	106.5	127
4000	104.5	125
5000	104	124
6300	103	120.5
8000	102.5	119.5
10,000	102.5	118.5
OASPL*	139.8	146.6
Duration	10 sec	10 sec

*Overall sound pressure level

4T169009

Figure E1-30. Maximum Flight-Level Payload Acoustic Environment for Delta II 292X, -9.5 Fairings



Maximum Flight Levels (dB)	
One-Third Octave Center Frequency (Hz)	Two Stage and Three Stage Missions (dB)
31	119.5
40	122.5
50	126.5
63	128
80	130
100	130
125	130
160	130.5
200	131.5
250	132.5
315	131.5
400	128
500	125
630	122
800	120
1000	118
1250	117
1600	116.5
2000	116
2500	115
3150	113.5
4000	111
5000	107
6300	103
8000	100
10,000	98
OASPL	140.6
Duration	5 sec

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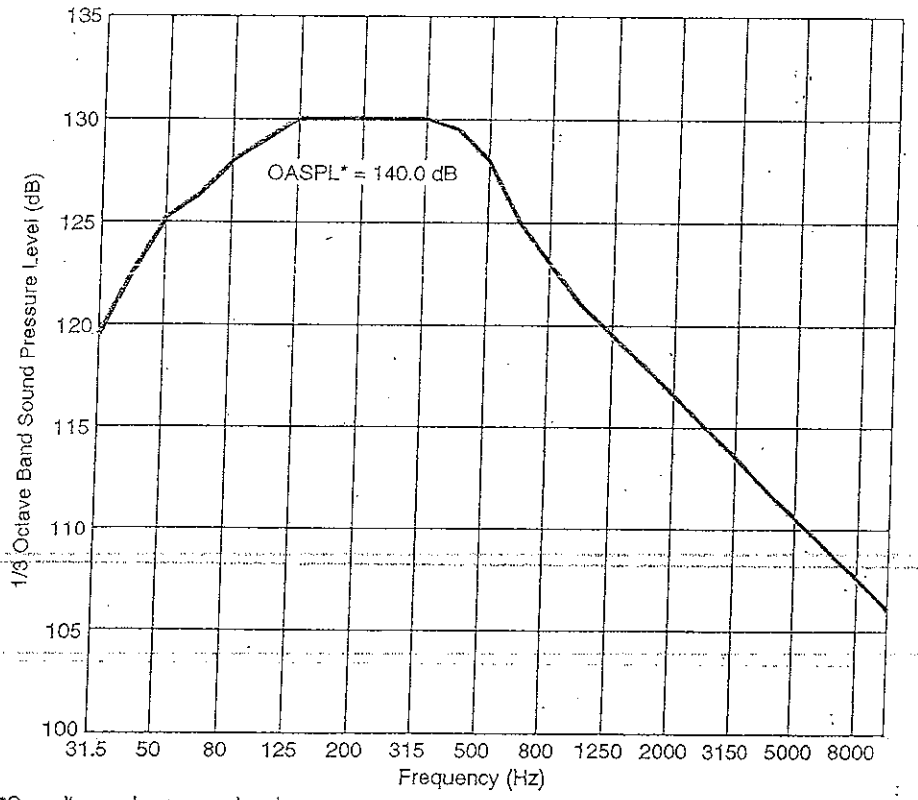
Figure E1-31. Maximum Flight-Level Payload Acoustic Environment for Delta II 292X, -10 Fairings (10 and 10L)

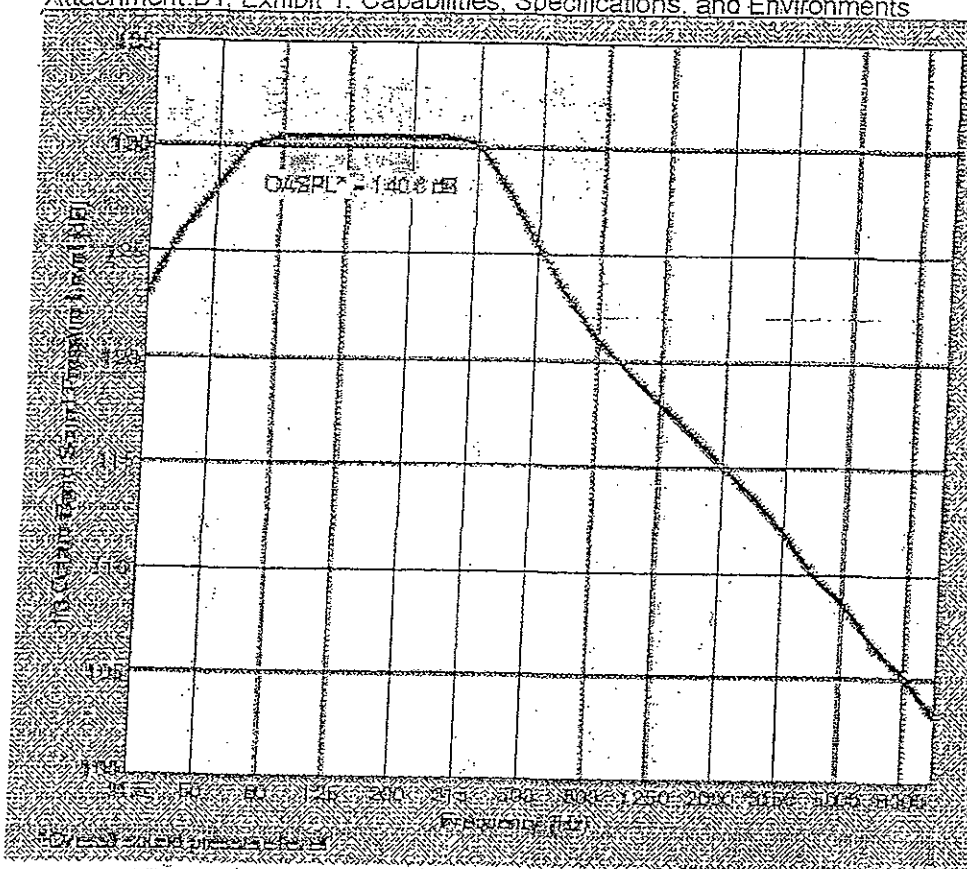
02811REP9.3



*Overall sound pressure level

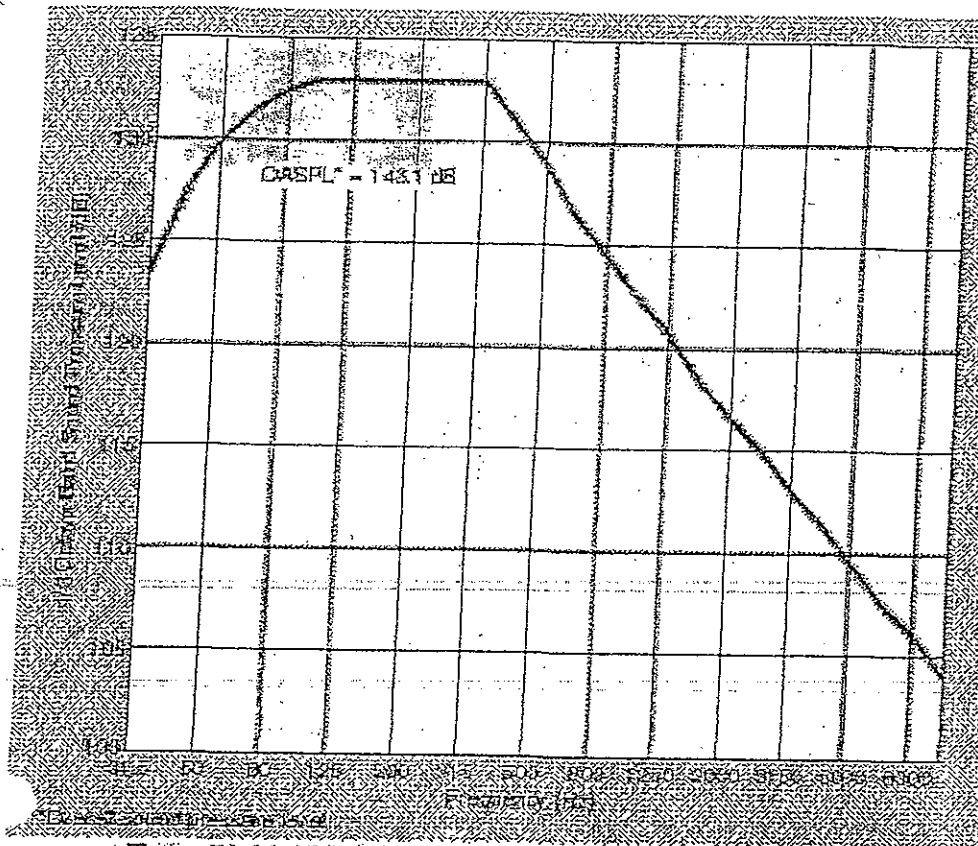
Maximum Flight Levels (dB)	
One-Third Octave Center Frequency (Hz)	4-m-dia PLF Mission
31.5	119.5
40	122.5
50	125.2
63	126.3
80	128.0
100	129.0
125	130.0
160	130.0
200	130.0
250	130.0
315	130.0
400	129.5
500	128.0
630	125.0
800	123.0
1,000	121.0
1,250	119.5
1,600	118.0
2,000	116.5
2,500	115.0
3,150	113.5
4,000	112.0
5,000	110.5
6,300	109.0
8,000	107.5
10,000	106.0
OASPL*	140.0
Duration	60 sec

Figure E1-32. Maximum Flight-Level Payload Acoustic Environment for Delta III and Delta IV 4-m-dia Fairings



31.5	123.0
40	126.0
50	128.0
63	130.0
80	130.5
100	130.5
125	130.5
160	130.5
200	130.5
250	130.5
315	130.5
400	128.0
500	125.5
630	123.0
800	121.0
1,000	119.5
1,250	118.0
1,600	116.5
2,000	115.0
2,500	113.5
3,150	112.0
4,000	110.0
5,000	108.5
6,300	106.5
8,000	105.0
10,000	103.0
OASPL*	140.8
Duration	60 sec

Figure E1-33. Maximum Flight-Level Payload Acoustic Environment for Delta IV 4450, -14 Fairing



31.5	123.5
40	127.5
50	130.0
63	131.5
80	132.5
100	133.0
125	133.0
160	133.0
200	133.0
250	133.0
315	133.0
400	131.0
500	129.0
630	126.5
800	124.5
1,000	122.5
1,250	120.7
1,600	118.0
2,000	116.5
2,500	115.0
3,150	113.0
4,000	111.5
5,000	109.5
6,300	107.5
8,000	106.0
10,000	104.0
OASPL*	143.1
Duration	60 sec

Figure E1-34. Maximum Flight-Level Payload Acoustic Environment for Delta IV 4050H, -19 Fairing

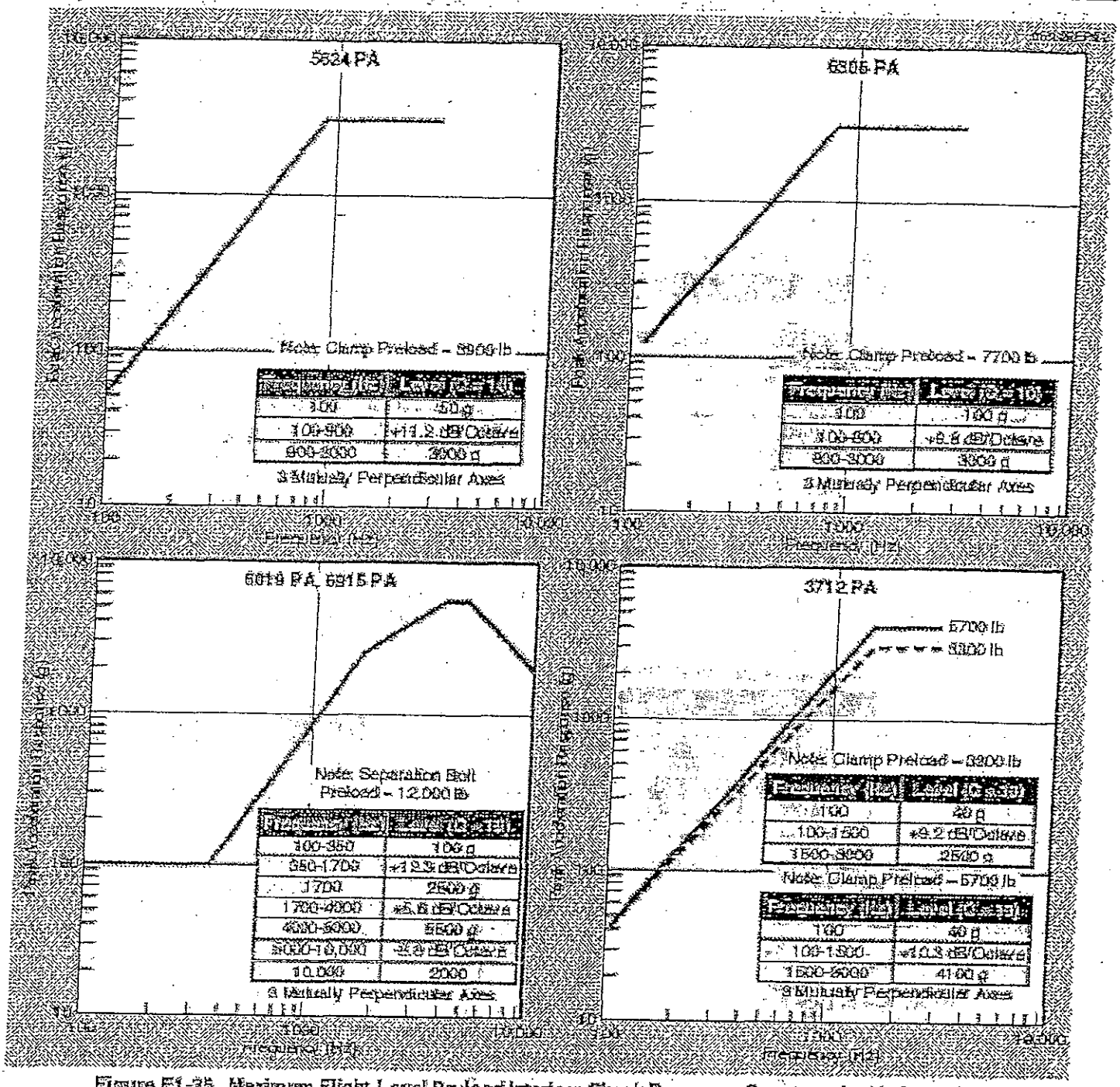


Figure E1-35. Maximum Flight-Level Payload Interface Shock Response Spectrum for Various PAs

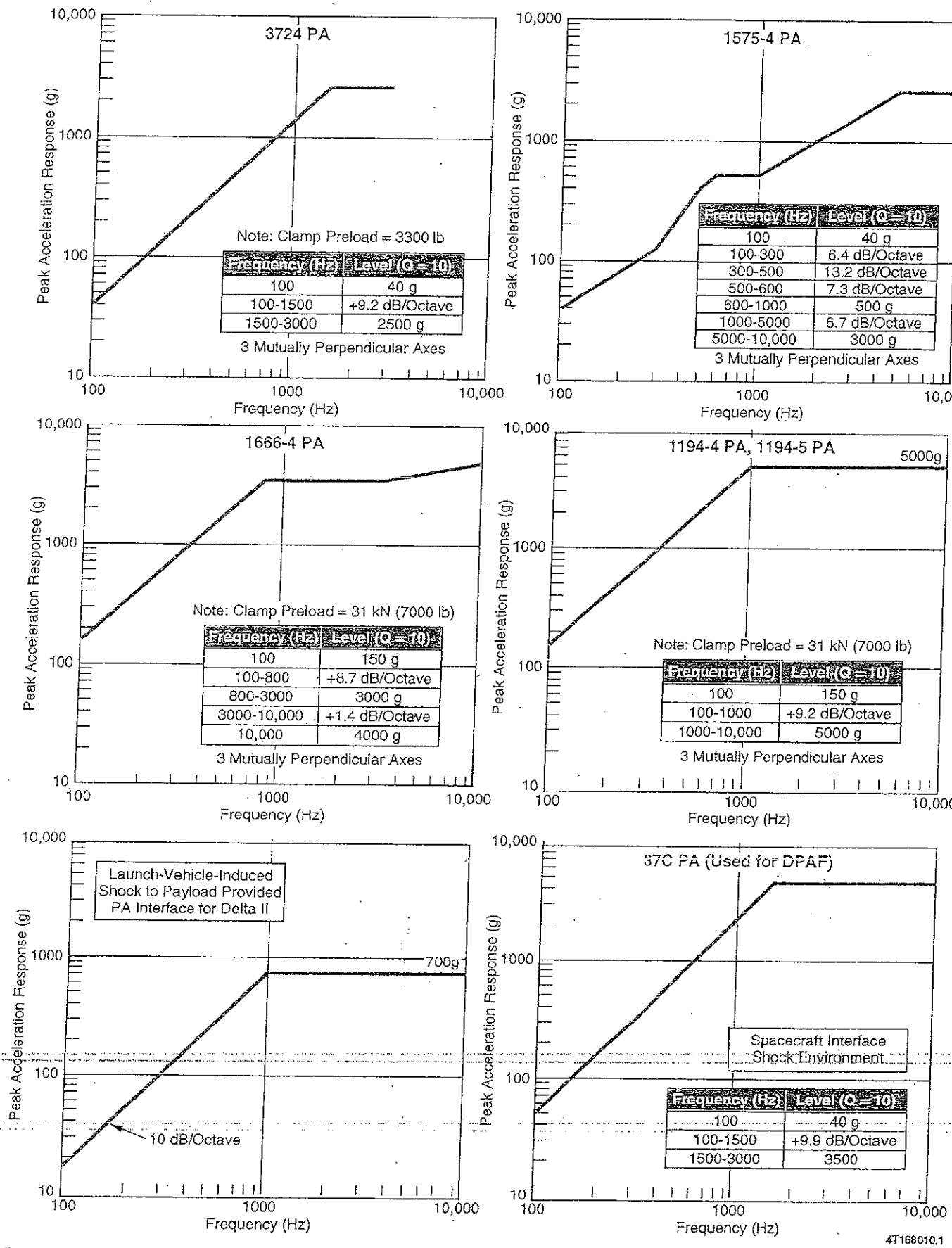


Figure E1-36. Maximum Flight-Level Payload Interface Shock Response Spectrum for Various PAs and the PA Interface

The levels provided in Tables E-31 and E1-32 are maximum expected limit level accelerations and should be multiplied by the appropriate qualification factor when used for spacecraft qualification.

Table E1-31 Delta II/III Payload Design CG Limit Load Factors, Maximum Acceleration

	Spacecraft weight (kg)											
	362.8-680.3		680.3-907.2		907.2-1134.0		1134.0-2268.0		2268.0-2812.2		>2812.2	
	Axial (g)	Lateral (g)	Axial (g)	Lateral (g)	Axial (g)	Lateral (g)	Axial (g)	Lateral (g)	Axial (g)	Lateral (g)	Axial (g)	Lateral (g)
Liftoff/aero	+2.8/ -0.2	±4.5	+2.8/ -0.2	±4.0	+2.8/ -0.2	±3.5	+2.8/ -0.2	±3.0	+2.8/ -0.2	±2.5	+2.8/ -0.2	±2.0
Delta II MECO	A±0.6	±0.2	A±0.6	±0.2	A±0.6	±0.2	A±0.6	±0.2	A±0.6	±0.2	A±0.6	±0.2
Delta III MECO	B±1.5	±0.5	B±1.5	±0.5	B±1.5	±0.5	B±1.5	±0.5	B±1.5	±0.5	B±1.5	±0.5
Delta II TECO	C	±0.1	C	±0.1	C	±0.1	C	±0.1	C	±0.1	C	±0.1

Notes:
1. Positive axial load denotes compression.
2. Lateral load factor provides proper bending moment at the payload-to-launch-vehicle interface.
3. For 3-sigma steady-state axial accelerations, select a value for A for Delta II from Figure E1-37, B for Delta III from Figure E1-38, and C for Delta II third-stage engine cutoff (TECO) from Figure E1-43.
4. Assumes that the payload meets the minimum frequency requirements specified in the Delta II/Delta III Payload Planners Guides, and that the spacecraft cg offset from the vehicle centerline is less than 0.8 in.

Table E1-32. Delta IV Payload Design CG Limit Load Factors, Maximum Acceleration

	Spacecraft weight (kg)											
	362.8-680.3		680.3-907.2		907.2-1134.0		1134.0-2268.0		2268.0-2812.2		>2812.2	
	Axial (g)	Lateral (g)	Axial (g)	Lateral (g)	Axial (g)	Lateral (g)	Axial (g)	Lateral (g)	Axial (g)	Lateral (g)	Axial (g)	Lateral (g)
Liftoff/aero	+3.5/ -0.2	±4.5	+3.5/ -0.2	±4.0	+3.5/ -0.2	±3.5	+3.5/ -0.2	±3.0	+3.5/ -0.2	±2.5	+3.5/ -0.2	±2.0 ±2.5[5]
Min Axial	-2.0	±0.5	-2.0	±0.5	-2.0	±0.5	-2.0	±0.5	-2.0	±0.5	-2.0	±0.5
4040 at Max G	D±1.0	±0.5	D±1.0	±0.5	D±1.0	±0.5	D±1.0	±0.5	D±1.0	±0.5	D±1.0	±0.5
4240 at Max G	E±1.0	±0.5	E±1.0	±0.5	E±1.0	±0.5	E±1.0	±0.5	E±1.0	±0.5	E±1.0	±0.5
4450 at Max G	F±1.0	±0.5	F±1.0	±0.5	F±1.0	±0.5	F±1.0	±0.5	F±1.0	±0.5	F±1.0	±0.5
4050H at Max G	G±1.0	±0.5	G±1.0	±0.5	G±1.0	±0.5	G±1.0	±0.5	G±1.0	±0.5	G±1.0	±0.5

Notes:
1. Positive axial load denotes compression.
2. Lateral load factor provides proper bending moment at the payload-to-launch-vehicle interface.
3. For Delta IV 3-sigma steady-state axial accelerations, select a value for D for a 4040 from Figure E1-39, E for a 4240 from Figure E1-40, F for a 4450 from Figure E1-41, and G for a 4050H from Figure E1-42.
4. Assumes that the payload meets the minimum frequency requirements specified in the Delta IV Payload Planners Guides.
5. For Delta IV 4050H.

The maximum expected sinusoidal vibrations at the base of the payload adapters are listed in Table E1-33 for the entire Delta family of vehicles. These sinusoidal vibration levels provide general envelope low-frequency flight dynamic events such as liftoff transients, transonic/maximum Q oscillations, pre-MECO sinusoidal oscillations, MECO transients, and second/third-stage events.

Table E1-33. Maximum Expected Sinusoidal Vibrations at the Base of the PA for Delta II, Delta III, and Delta IV

Axis	Frequency (Hz)	Maximum Flight Levels
Axial	5 to 6.2	1.27 cm (0.5 in.) double amplitude
	6.2 to 100	1.0 g (zero to peak)
Lateral	5 to 100	0.7 g (zero to peak)

Sweep rate = 4 octaves / minute

Additionally Delta II payloads will experience higher frequency sinusoidal vibration inputs during flight as a result of the MECO shutdown transient. The maximum flight level sinusoidal vibration inputs for this event are defined in Table E1-33a at the base of the payload attach fitting.

Table E1-33a. Recommended MECO Levels Sinusoidal Vibration Levels (Q=10) for all Delta II Vehicles at MECO

Axis	Frequency (Hz)	Maximum flight levels (g)
Two Stage Delta II Vehicles and Lower DPAF		
Axial	85	1.30
	90	1.75
	105	1.75
	110	2.20
	120	2.20
	140	1.50
Lateral	85	0.35
	90	0.50
	105	0.65
	110	0.85
	120	0.85
	140	0.45
Three Stage Delta II Vehicles		
Axial	110	0.5
	125	0.5
Pitch	110	0.2
	125	0.2
Yaw	110	0.2
	125	0.2
Upper DPAF—Please contact Delta Program Office for assistance		

The sinusoidal vibration levels in Tables E1-33 and E1-33a are not intended for use in the design of spacecraft primary structure; limit load factors for spacecraft primary structure design are specified in Tables E1-31 and E1-32.

The sinusoidal vibration levels should be used in conjunction with the results of the coupled dynamic loads analysis to aid in the design of secondary structure (e.g., solar arrays, antennae, appendages) that may experience dynamic loading due to coupling with the launch vehicle low-frequency dynamic oscillations. Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis and consultation with Delta Engineering.

The maximum quasi-steady acceleration as a function of separated payload mass is shown in Figures E1-37 through E1-43.

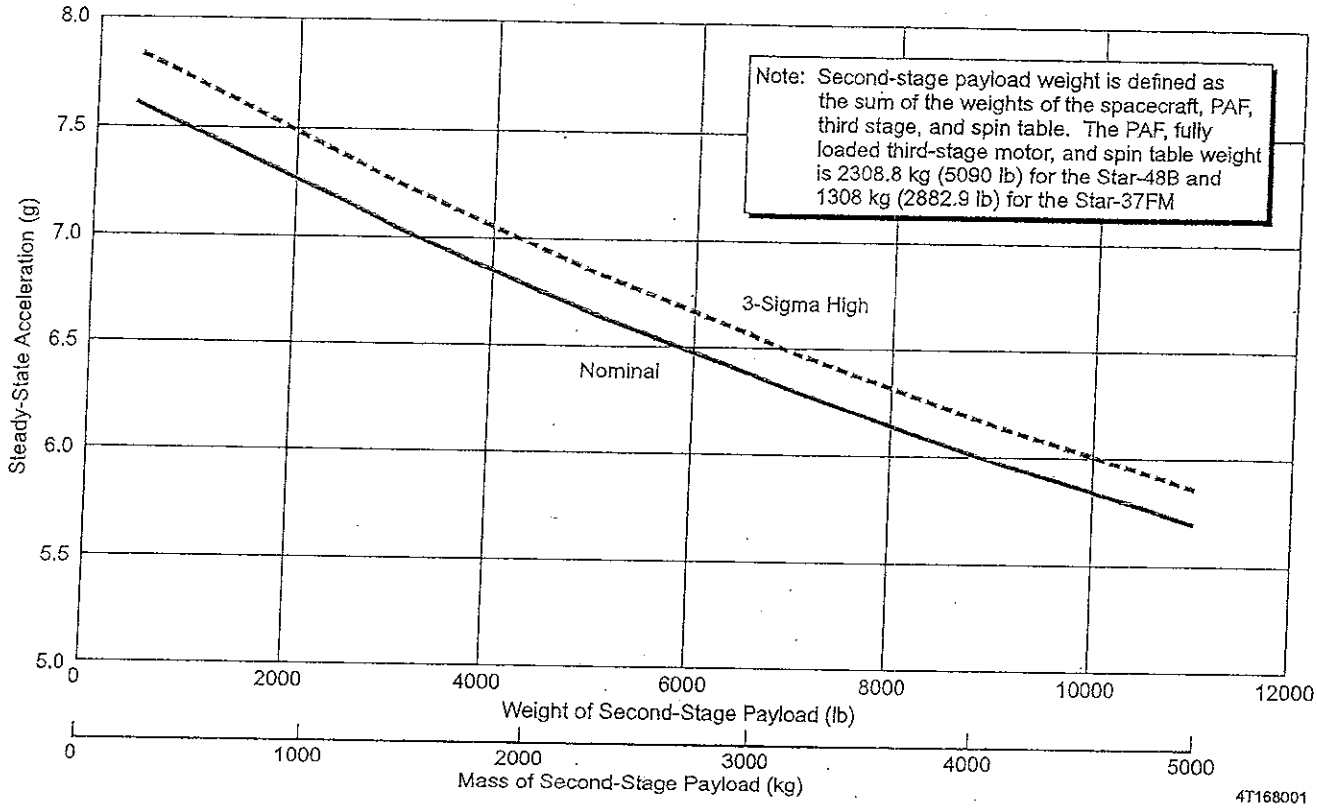


Figure E1-37. Maximum Quasi-Steady Acceleration as a Function of Payload Separated Mass for Delta II

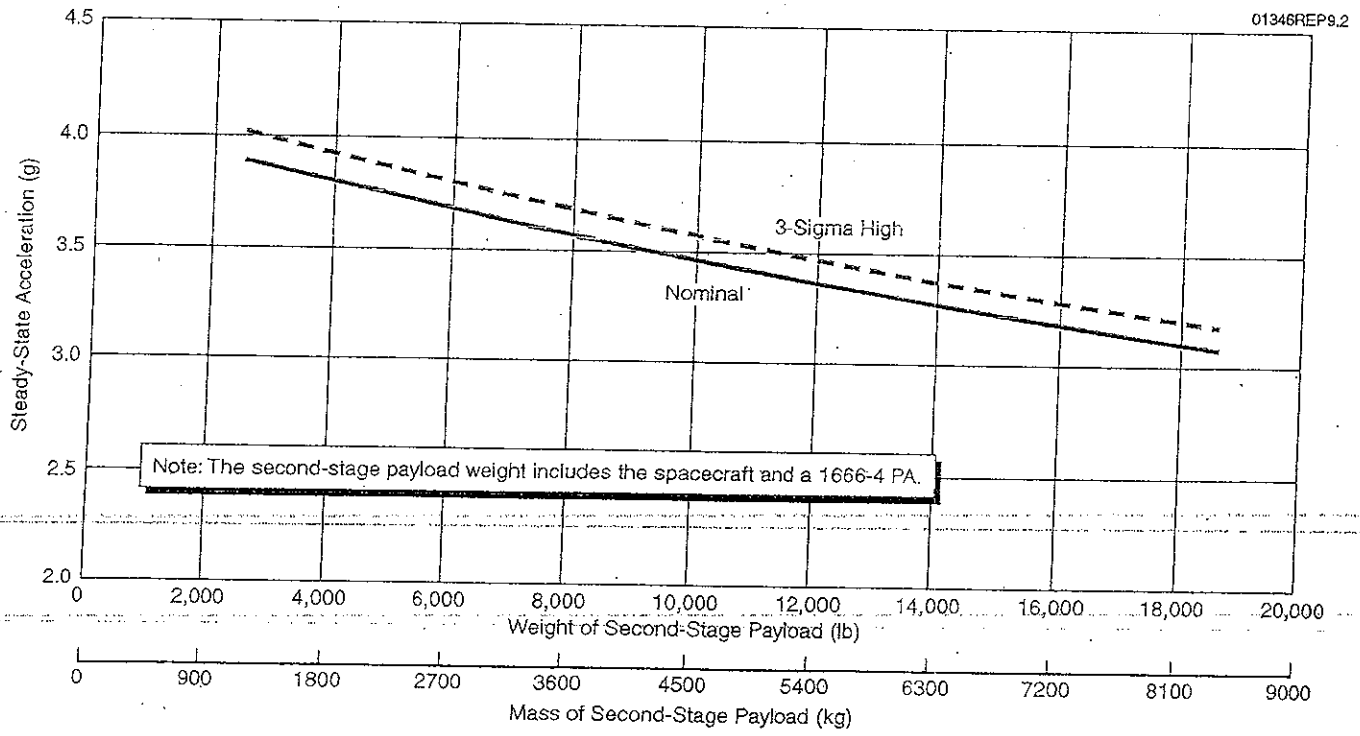


Figure E1-38. Maximum Quasi-Steady Acceleration as a Function of Payload Separated Mass for Delta III

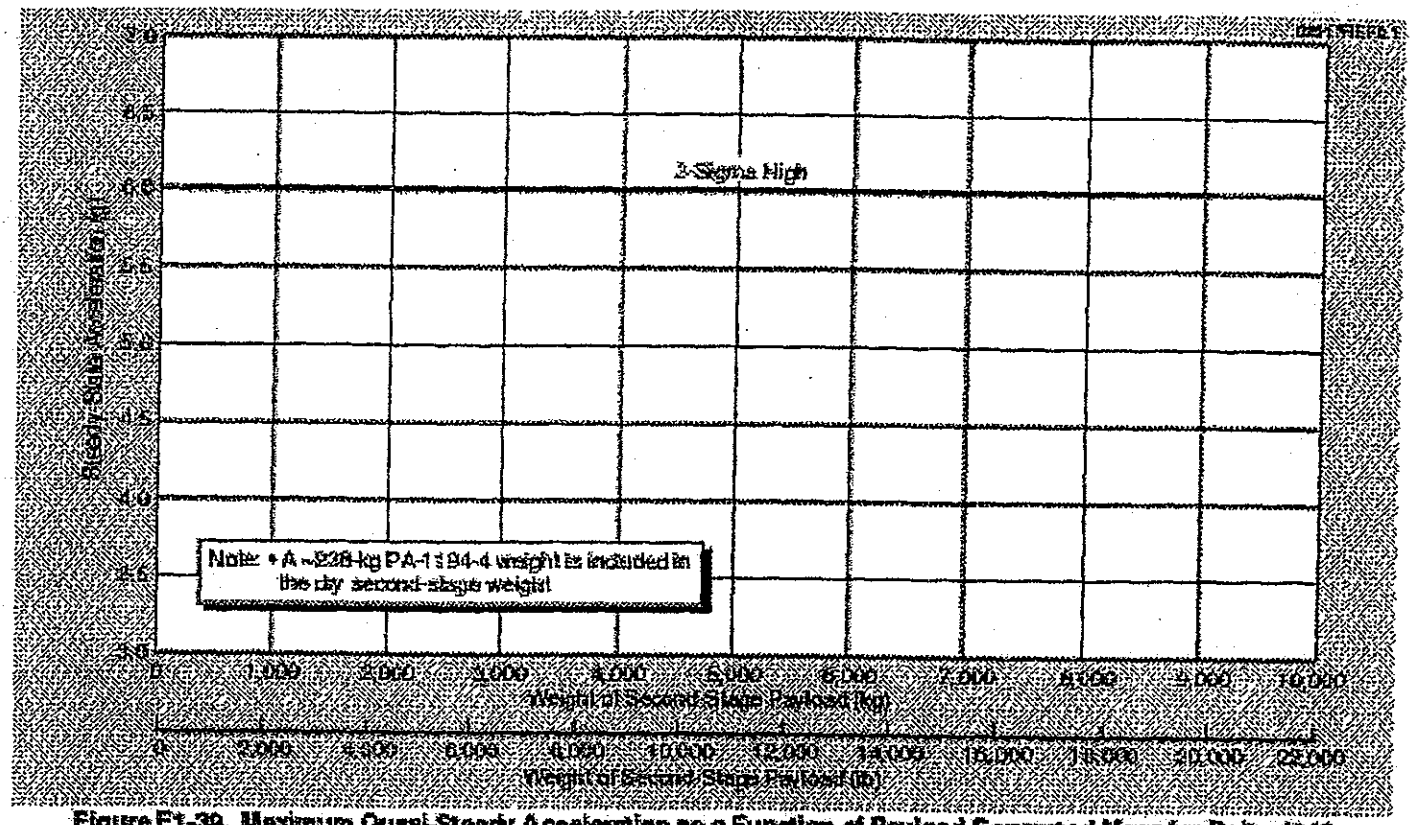


Figure E1-39. Maximum Quasi-Steady Acceleration as a Function of Payload Separated Mass for Delta 4040

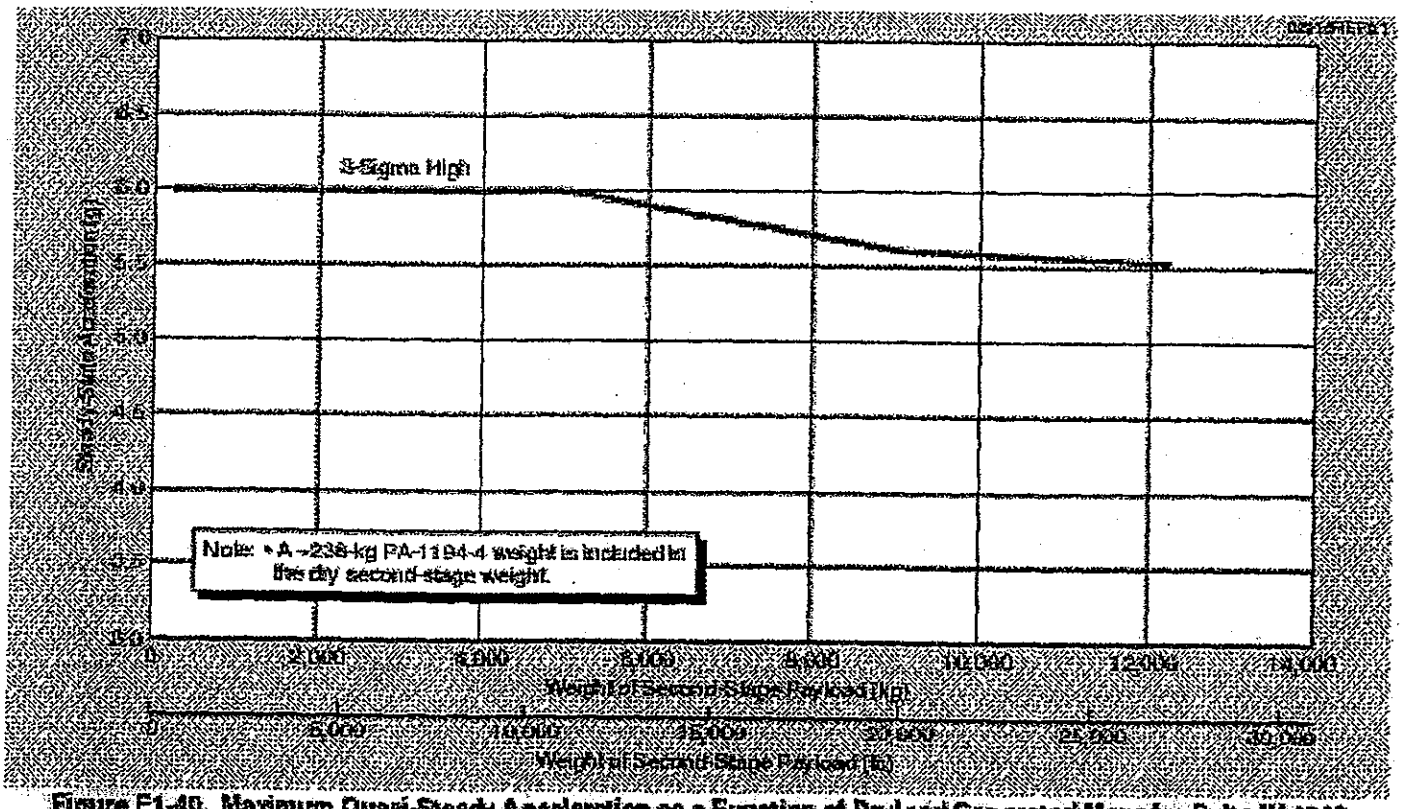


Figure E1-40. Maximum Quasi-Steady Acceleration as a Function of Payload Separated Mass for Delta IV 4240

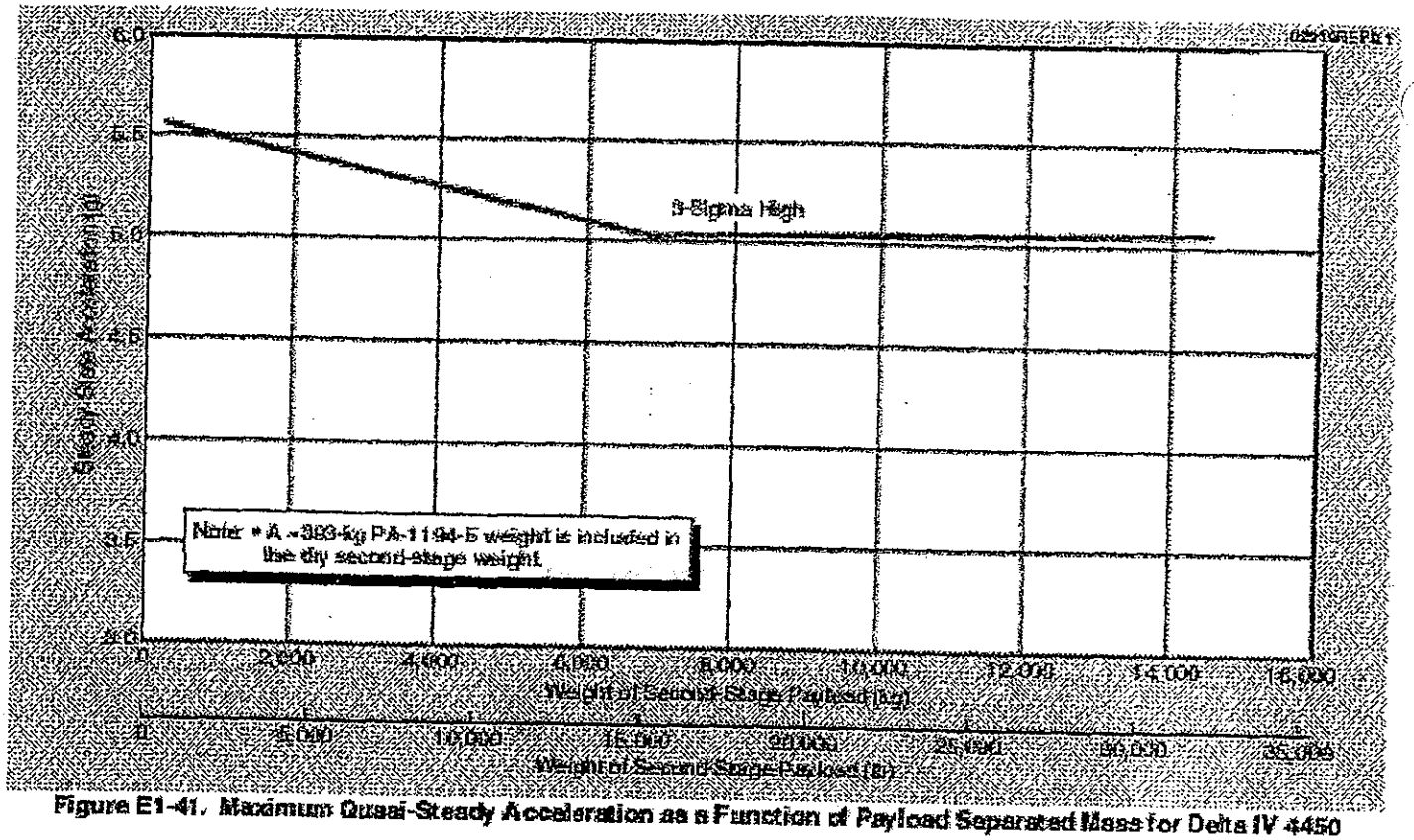


Figure E1-41. Maximum Quasi-Steady Acceleration as a Function of Payload Separated Mass for Delta IV 4450

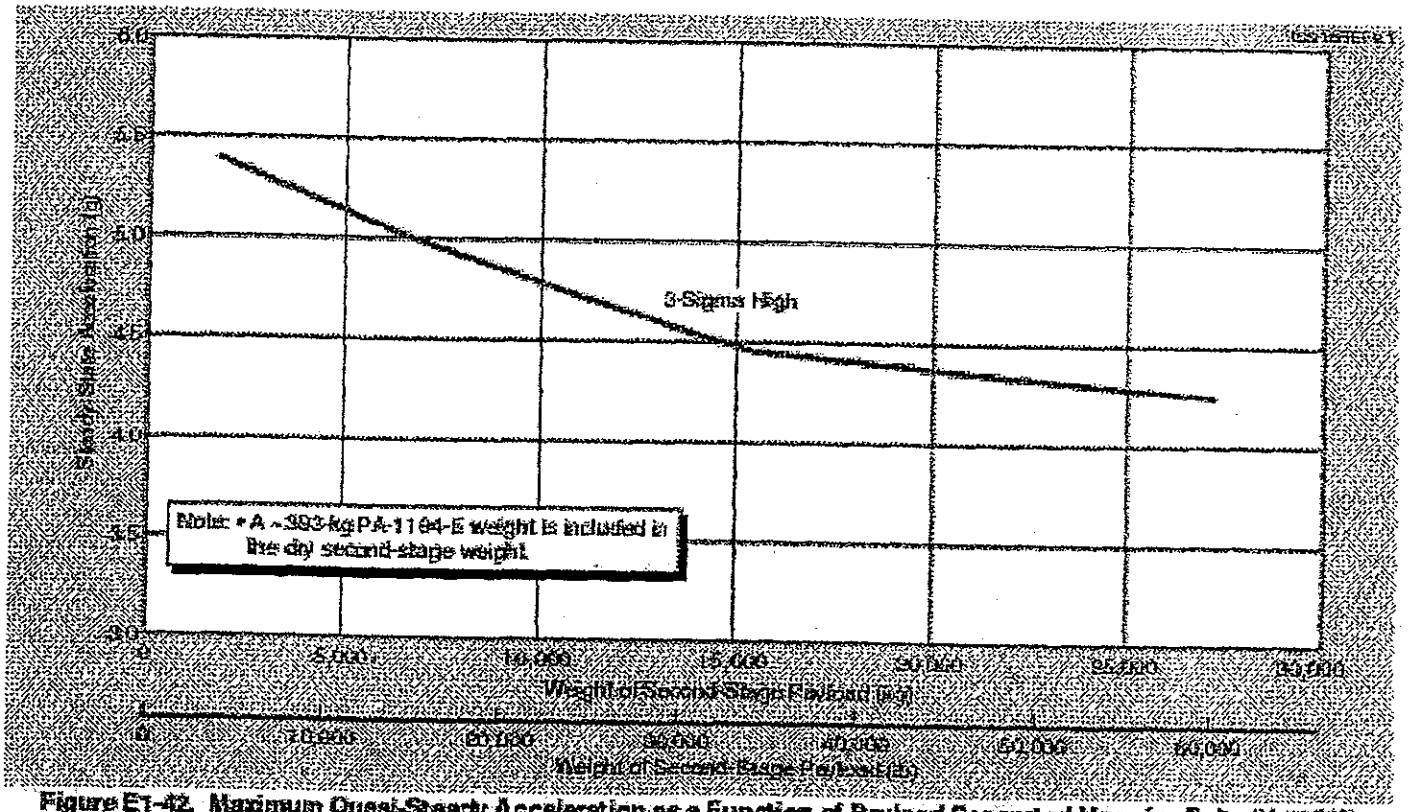


Figure E1-42. Maximum Quasi-Steady Acceleration as a Function of Payload Separated Mass for Delta IV 4050H

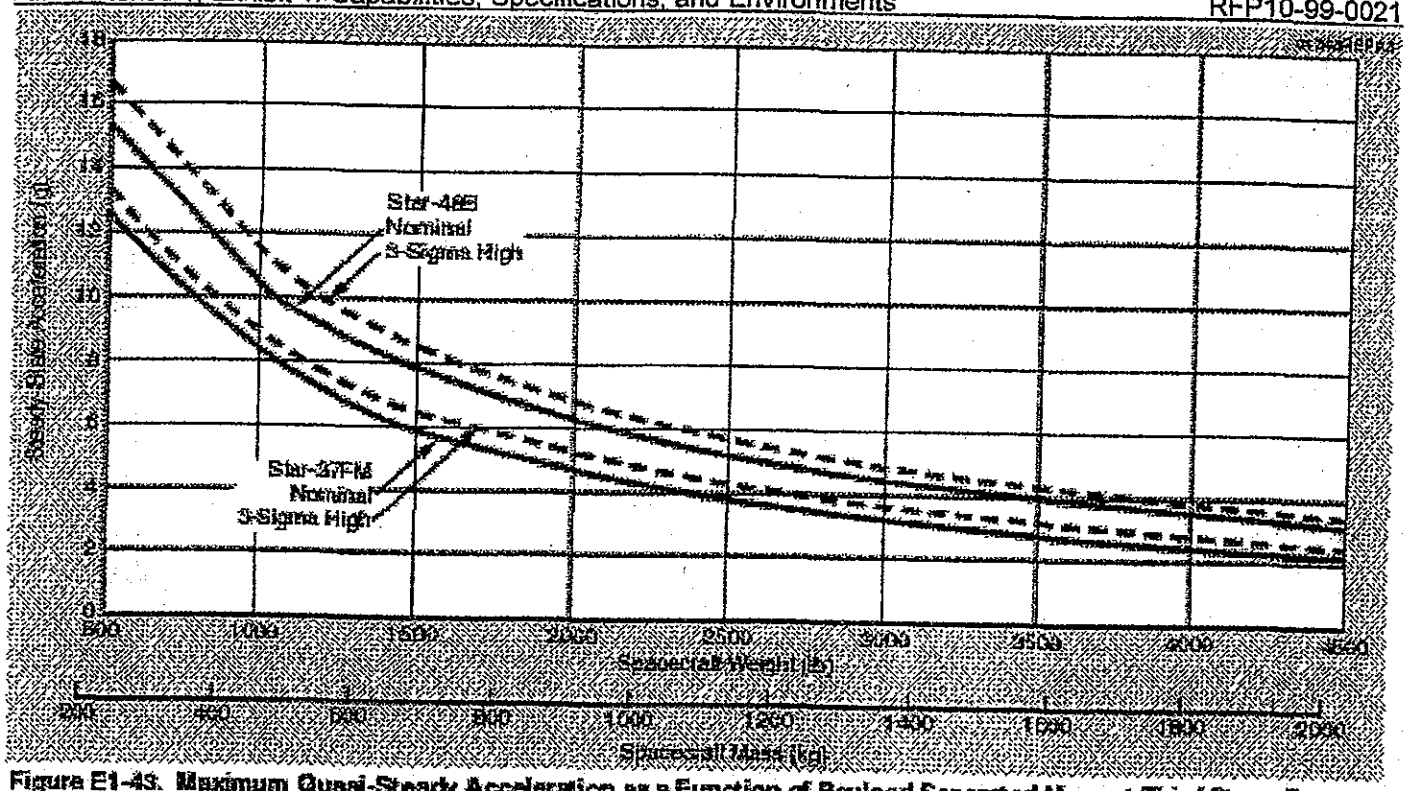


Figure E1-43. Maximum Quasi-Steady Acceleration as a Function of Payload Separated Mass at Third-Stage Burnout for Delta II

FAIRING THERMAL ENVIRONMENT

The ascent maximum temperature histories for the fairing surfaces facing the spacecraft are shown in Figure E1-43A for the Delta II 9.5-ft aluminum and 10-ft composite fairings and for the Delta III 4-m composite fairing. Also shown are the associated surface emissivities. Figure E1-43B provides similar temperature histories and surface emissivities for Delta IV 4-m and 5-m composite fairings. For each fairing, the temperature history is based on a depressed vehicle trajectory and design conditions that produce a worst-case aerodynamic environment.

For the 9.5-ft aluminum fairing, the maximum fairing skin temperature is 260°C (500°F). This temperature is representative of mission-specific unblanketed areas such as access doors and blanket cutout regions. Although the aluminum skin temperature is relatively high, the surface emissivity is low, so the energy transfer to the spacecraft surface remains low. The acoustic blankets, which cover the majority of the fairing surface area, provide a relatively cool radiation environment, with temperatures remaining below 65°C (150°F). If an RF window is required in the nose cone, then the adjacent blanket surfaces will have higher temperatures. The maximum acoustic blanket temperature, located at an RF window, is 150°C (302°F).

For the Delta II, III, and IV composite fairings, the thermal environment is moderated by both the composite fairing inner surface and the acoustic blankets. The inner composite surface, acoustic blanket, or separation rail maximum temperatures will not exceed 71°C (160°F). This maximum temperature is applicable for all composite fairings, because the fairings all have similar construction, and the separation rails must maintain the maximum design allowable of 160°F.

The third-stage motor case soakback radiation environment to the spacecraft has a maximum temperature range of 343°C to 443°C (650°F to 830°F). The temperature is determined by the weight of slag (unexpelled combustion products) retained in the motor case, which, in turn, is dependent on the payload weight. This radiative environment is moderated by the low emissivity of the motor cases, resulting in a relatively low heat flux to the spacecraft. The temperature histories and corresponding motor surface emissivities are shown in Figure E1-43C.

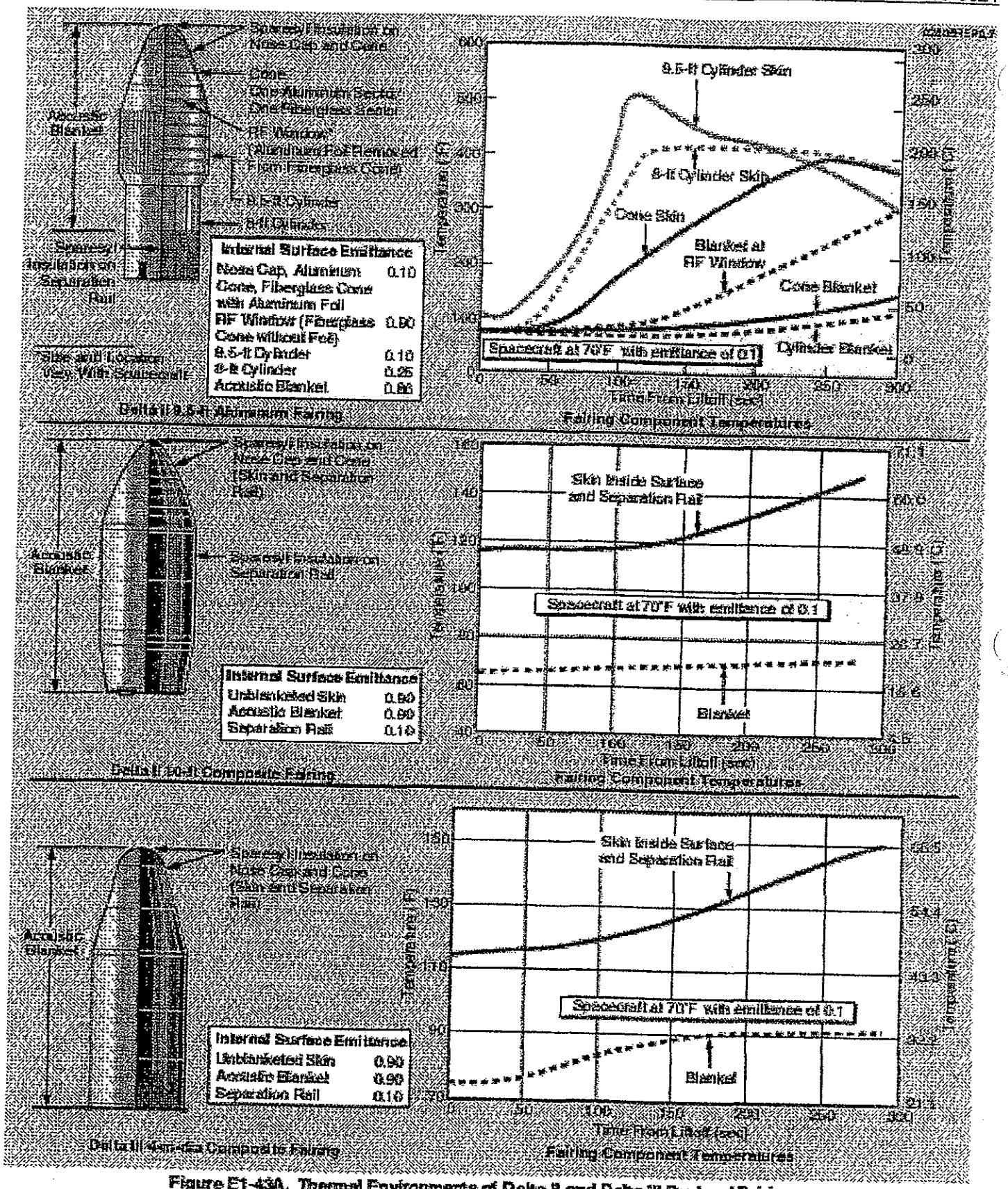


Figure E1-43A. Thermal Environments of Delta II and Delta III Payload Fairings

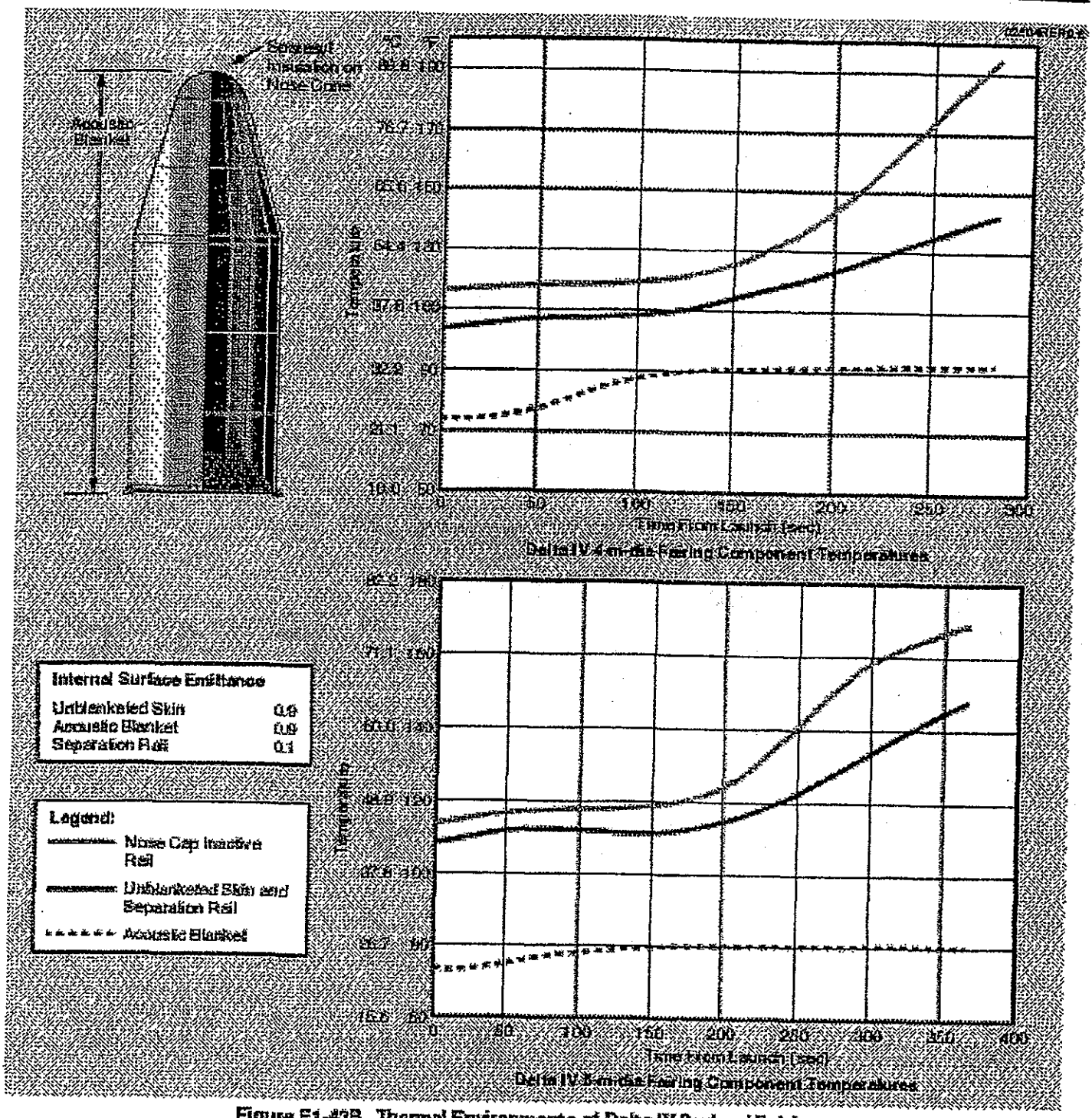


Figure E1-43B. Thermal Environments of Delta IV Payload Fairings

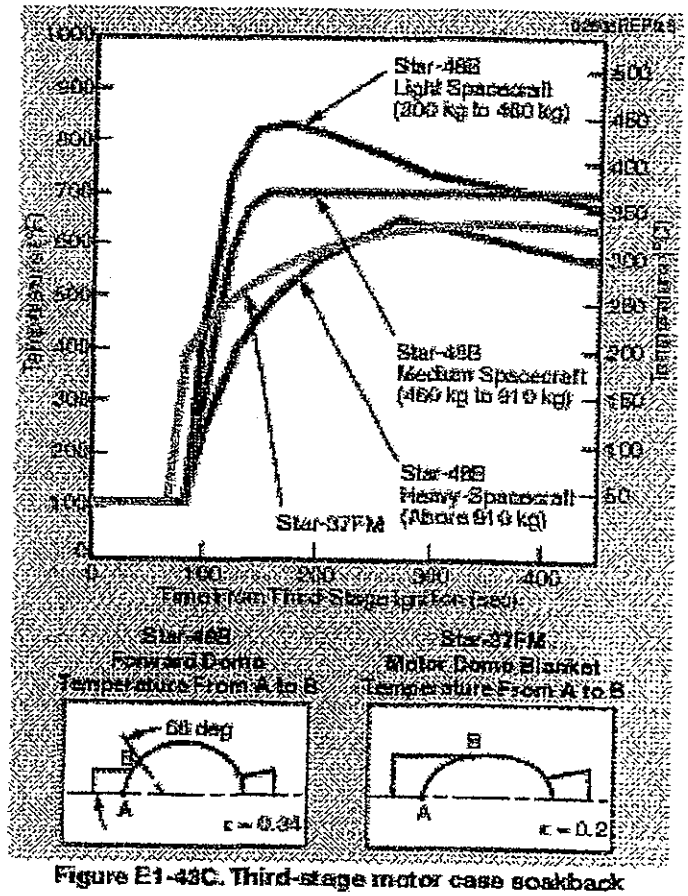


Figure E1-43C. Third-stage motor case soakback temperature history is well characterized

9.0 PAYLOAD ENVIRONMENT INSTRUMENTATION

The flight instrumentation as listed in Tables E1-34 and E1-35 provides data on vehicle acceleration, acoustic, pressure, and thermal environments in the payload area during flight. These data are used to support mission success determination (Section C, Clause 24.0). Measurements are made at payload and other key vehicle locations.

Table E1-34. Contractor-Provided Payload Environment Instrumentation for Delta II

Environment	Type	Number and locations	Range, sensitivity, BW
Acoustics	Microphone	(1) Microphone mounted on the fairing in the payload area	+/- 850 N/m², 6.80 N/m²/bit 5000 samples per second (sps)
Loads and dynamics	Accelerometer	Two-stage missions (1) Accelerometer (DC) mounted in the thrust direction on the PA (3) Accelerometers (AC) mounted in a triax arrangement on the second-stage cross beam intersection	Two-stage missions -5 to +10g, 0.06 g/bit, 400 sps Thrust: +/- 5 g, 0.04 g/bit, 1000 sps Pitch and yaw: +/- 2 g, 0.016 g/bit, 1000 s
		Three-stage missions (1) Accelerometer (DC) mounted in the thrust direction and (2) Accelerometers (DC) at 90 deg mounted in the radial direction on the PA for three-stage missions	Three-stage missons Thrust: -3 to +12 g continuous, 120 Hz, 0.06 g/bit Radial: -4 to +6 g continuous, 120 Hz
Static pressure	Pressure transducer	(1) Pressure sensor mounted on the fairing in the payload area	0-15 psia, 0.06 psia/bit, 20 sps
Temperature	Temperature patch	(1) Temperature patch mounted on the fairing in the payload area	0-150 °F, 0.6 °F/bit, 20 sps

Table E1-34A. Contractor-Provided Payload Environment Instrumentation for Delta III

Environment	Type	Number and locations	Range, sensitivity, BW
Acoustics	Microphone	(1) Microphone mounted on the fairing in the payload area	+/- 850 N/m², 6.80 N/m²/bit 10,000 sps
Loads and dynamics	Accelerometer	(1) Accelerometer (DC) mounted in the thrust direction on the PA (3) Accelerometers (DC) mounted in the tangential direction on the PA (1) Accelerometer (AC) mounted in the radial direction on the PA	Thrust: +/- 7g, 0.056 g/bit, 400 sps Tangential: +/- 4g, 0.032 g/bit, 400 sps Radial: +/-40g, 0.32 g/bit, 5000 sps
Static pressure	Pressure transducer	(1) Pressure sensor mounted on the fairing in the payload area	0-15 psia, 0.06 psia/bit, 20 sps
Temperature	Temperature patch	(1) Temperature patch mounted on the fairing in the payload area	0-150 °F, 0.6 °F/bit, 20 sps

Table E1-35. Contractor-Provided Payload Environment Instrumentation for Delta IV

Environment	Type	Number and Locations	Range, sensitivity, BW
Acoustics	Microphone	(2) Microphones mounted on the outside of the fairing near the mid-cylindrical fairing section	166 db SPL, 45.2 N/m²/bit 4000 sps
	Microphone	(2) Microphones mounted inside the fairing near the mid-cylindrical fairing section	149.5 db SPL, 6.8 N/m²/bit 8000 sps
	Accelerometer	(1) AC accelerometer mounted to the PA separation plane	Delta IV Heavy +/- 200g, 1.69/bit Delta IV Medium +/- 100g, 0.8g/bit
Loads and dynamics	Accelerometer	(4) DC accelerometers mounted on the PA, one in the thrust direction and three in the lateral direction	-5 to +5 g lateral, -3 to +7 g axial, 0.04 g/bit, 200 sps
Static pressure	Pressure transducer	(1) Pressure sensor mounted on the PA	0-16 psia, 0.064 psia/bit, 20 sps
Temperature	Temperature sensor	(1) Temperature sensor mounted on the PA	-10.5 to 155 °F, 0.662 °F/bit, 20 sps

10.0 GENERIC SECONDARY PAYLOAD CHARACTERISTICS/INTERFACE

Where volume permits, provisions to accommodate two types of secondary payloads—separating and nonseparating—may be provided. This is currently available on Delta II only; however, Delta III has reserved an area on the second-stage equipment shelf that could accommodate secondary payloads. The allowable characteristics of generic secondary payloads are specified in Table E1-36.

Table E1-36. Generic Secondary Payload Characteristics

Characteristics	Separating	Nonseparating
Weight/CG distance from separation plane (not to exceed)	45.4 kg (100 lb)/11.4 cm (4.5 in.)	69.8 kg (154 lb)/17.8 cm (7.0 in.)
Volume (not to exceed)	47.8 by 34.8 by 29.3 cm 18.82 by 13.68 by 11.54 in.	47.5 by 33.6 by 35.5 cm 18.71 by 13.23 by 13.96 in.
Electrical interface	None	None
Attachment	24.1-cm (9.5 in.)-dia clampband (See Figure E1-44)	Bolted (see Figure E1-45)
Coupled frequency (coupled to Delta II second stage)	> 35 Hz	> 35 Hz

The mechanical interface, allowable mass properties, and envelope shall be standardized for both separating and nonseparating secondary payloads. There will be sufficient clearance between the secondary payload envelope and the launch vehicle to eliminate the need to measure the secondary payload relative to the PLF. The standard separation system available for separating secondary payloads is shown in Figure E1-44. The separation event is sequenced and controlled by the launch vehicle. The interface for non-separating payloads is shown in Figure E1-45.

No electrical interface is available between the vehicle and the secondary payloads. Secondary payloads may require a battery trickle charge through an existing fairing access door. Charging will be available until fairing close-out. Charging equipment and cabling will be provided by the secondary payload customer.

We conduct a fit check of the secondary payload flight interfaces. This includes an interface fit check and access verification for connectors and the payload installation clearance and interference. These checks are for mechanical interfaces only. These checks are generally done in the factory prior to shipping the launch vehicle (and spacecraft) to the launch site.

If there is an electrical payload interface, it will be tested during horizontal testing and also during on-pad pre-launch testing. At a minimum, such testing will include the separation command (part of command sequencing), but might also include spacecraft power-on or similar commands.

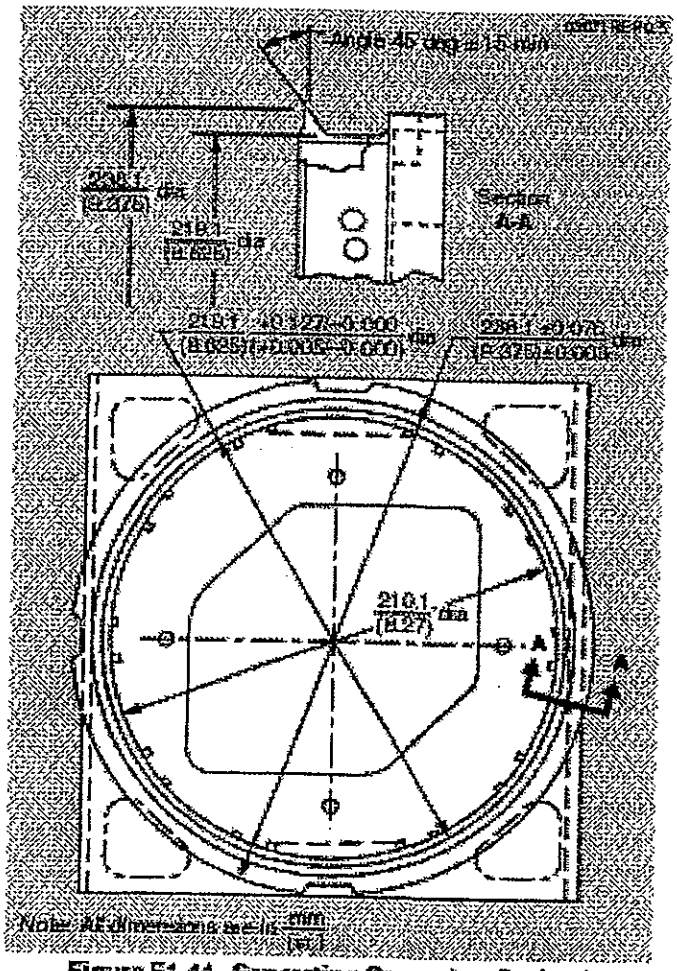


Figure E1-44. Separating Secondary Payload Standard Interface

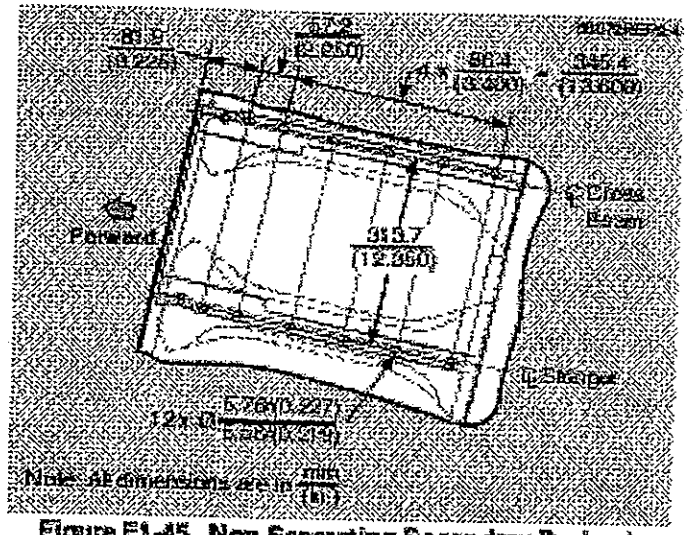


Figure E1-45. Non-Separating Secondary Payloads Standard Mounting Interface

Exhibit 2
STANDARD LAUNCH SERVICES LIST

The contractor shall provide all necessary services, test hardware and software, and mission-specific elements required to integrate the payload(s) with the launch vehicle systems. The standard service shall be fully compliant with the statement of work (SOW) including the contract data requirements list (CDRL) in Attachment D2 and the supplemental data list (SDL) in Attachment D3. All standard launch service tasks contained in SOW paragraph 2, and the capabilities and conditions identified as standard launch services in Exhibit 1 that pertain to the services listed herein, shall apply. NASA insight and approval of the specific areas identified in Section C, Clause 25.0, is part of the Standard Launch Service. Attachment D7, Table 2, is intended to identify and focus on those activities that support insight and approval of quality-related activities. If there are contractor-initiated changes to the configuration, vendor, or design from that which is described in this SOW, after mission ATP, there shall be no adjustment to the price and shall be subject to the written approval of the Contracting Officer.

Standard Launch Services List

		Delta II two-stage missions	Delta II three-stage missions	Delta III	Delta IV
2.1 LAUNCH VEHICLE (LV)					
2.1A	Launch timing capabilities				
	(ii) Multiple re-launch attempts	Approximately 24 hr	Approximately 24 hr	Approximately 24 hr unless scrub occurs past last recycle point (approximately T-20 sec) within terminal count (T-4 min), then 48 hr	From T-5 min to T-3 min and 32 seconds, recycle within 15 minutes; from T-3 min and 32 seconds, through T-14.5 seconds (or through T-22.5 seconds for Delta IV M+ vehicles) recycle within 30 minutes; after T-14.5 seconds (or T-22.5 seconds for M+) recycle within 72 to 96 hours
	(iii) Instantaneous launch windows	1-sec duration	1-sec duration	1-sec duration	1-sec duration
	(iv) Days between simultaneous plane tary launch campaigns	10 days assuming typical integrated spacecraft testing and processing on separate pads	10 days assuming typical integrated spacecraft testing and processing on separate pads	60 days assuming typical integrated spacecraft testing	14 days assuming typical integrated spacecraft testing
	(v) Trajectory target ing at multiple flight azimuths	Two flight azimuths per day with injection targets for a 21-day launch period	Two flight azimuths per day with injection targets for a 21-day launch period	Two flight azimuths per day with injection targets for a 21-day launch period	Two flight azimuths per day with injection targets for a 21-day launch period
2.1B	Standard launch vehicles	2320-10 2420-10 2920-10	2325-9.5 2425-9.5 2925-9.5	3940-11	4040-12 4240-12 4450-14 4050H-19
	Payload adapters (PA) and separation system	6915 - Low tip-off as shown in Exhibit 1	3712 As shown in Exhibit 1	1666 As shown in Exhibit 1	1194-4 (Delta 4040 and Delta 4240) As shown in Exhibit 1 1194-5 (Delta 4450 and Delta 4050H) As shown in Exhibit 1
	Spacecraft electrical interfaces	Up to two 37-pin space craft electrical cables interface from the fairing as defined in Exhibit 1, Section 7.0	Two 37-pin spacecraft electrical cables inter face across the space craft separation plane as defined in Exhibit 1, Section 7.0	Two 61-pin spacecraft electrical cables inter face across the space craft separation plane as defined in Exhibit 1, Section 7.0	Two 61-pin spacecraft electrical cables inter face across the space craft separation plane as defined in Exhibit 1, Section 7.0
2.1C	Payload separation system				
	(iii) Redundant pay load separation indications	Redundant switches of the type described in Section 7 of Exhibit 1	Redundant switches of the type described in Section 7 of Exhibit 1	Redundant switches of the type described in Section 7 of Exhibit 1	Redundant switches of the type described in Section 7 of Exhibit 1

Standard Launch Services List (Continued)

		Delta II two-stage missions	Delta II three-stage missions	Delta III	Delta IV
2.1D	Payload fairing (PLF)	10-ft-dia composite fairing Refer to Exhibit 1	9.5-ft metallic fairing Refer to Exhibit 1	3940-11: 4-m-dia fairing 10.8-m (35.5-ft) long Refer to Exhibit 1	4040-12: 4-m-dia fairing 11.7-m (38.5-ft) long 4240-12: 4-m-dia fairing 11.7-m (38.5-ft) long 4450-14: 5-m-dia fairing 14.3-m (47-ft) long 4050H-19: 5-m-dia fairing 19-m (62.7-ft) long Refer to Exhibit 1
	(i) Payload access doors (quantity: up to three)	24-in. dia Located per Note 2	9 by 13 in. 21.48 by 24.8 in. 10.5 in. 18 by 18 in. 21.86 by 24.8 in. 25 by 25 in. Located per Note 1	18-in. dia 24-in. dia Located per Note 3	18-in. dia 24-in. dia Located per Note 4
2.1E	Flight instrumentation	Temperature (1) Acoustic microphone (1) Pressure (1) Accelerometer (4)	Temperature (1) Acoustic microphone (1) Pressure (1) Accelerometer (3)	Temperature (1) Acoustic microphone (1) Pressure (1) Accelerometer (5)	Temperature (1) Acoustic microphone (4) Pressure (1) Accelerometer (5)
2.1F	Spin/despin capability	Minimum range of 0 to 30 deg/sec (5 rpm) with an accuracy of +/- 1 deg/sec	Spin rates up to 600 deg/sec (100 rpm) with an accuracy of 90 deg/sec (15 rpm). Yo-yo despin capable of despin to 0 deg/sec with an accuracy of +/-30 deg/sec (5 rpm)	Minimum range of 0 to 30 deg/sec (5 rpm) with an accuracy of +/-1 deg/sec	Minimum range of 0 to 30 deg/sec (5 rpm) with an accuracy of +/- 1 deg/sec
2.1I	Logo	2.44 m by 2.44 m (8 ft by 8 ft)	2.44 m by 2.44 m (8 ft by 8 ft)	2.44 m by 2.44 m (8 ft by 8 ft)	3.67 m by 3.67 m for 5 m (12 ft by 12 ft for 5 m) 3.05 m by 3.05 m for 4 m (10 ft by 10 ft for 4 m)
2.1J	Test Payload Adapter (TPA)	Includes: 1 Test PAF (TPA) and separation system for shock/ environmental testing (supports two (2) shock fire tests)	Includes: 1 Test PAF (TPA) 1 Clampband for shock/ environmental testing (supports two (2) shock fire tests)	Includes: 1 Test PAF (TPA) 1 Clampband for shock/ environmental testing (supports two (2) shock fire tests)	Includes: 1 Test PAF (TPA) 1 Clampband for shock/ environmental testing (supports two (2) shock fire tests)
2.2 PROGRAM MANAGEMENT					
2.2.1	Formal reviews				
2.2.1.2	Design reviews mission unique	For anticipated mission-unique modifications (not previously flown) in Exhibit 5	For anticipated mission-unique modifications (not previously flown) in Exhibit 5	For anticipated mission-unique modifications (not previously flown) in Exhibit 6	For anticipated mission-unique modifications (not previously flown) in Exhibit 6
2.3 MISSION INTEGRATION SERVICES					
2.3.2	Mission analysis	As per Table D1-A in the SOW	As per Table D1-A in the SOW	As per Table D1-A in the SOW	As per Table D1-A in the SOW
2.4 LAUNCH SITE SUPPORT					
2.4.1 Prelaunch Checkout and Launch Support					
2.4.1.1	Launch vehicle preparation and launch	Eastern Range (ER)	ER	ER	ER
2.4.1.2.1	Baseline vehicle support	Launch site baseline vehicle support begins at initial vehicle power application at Delta mission checkout (DMCO) and subsequently at the pad	Launch site baseline vehicle support begins at initial vehicle power application at DMCO and subsequently at the pad	Launch site baseline vehicle support begins at initial vehicle power application at DMCO and subsequently at the pad	Launch site baseline vehicle support begins at initial vehicle power application at the pad
2.4.1.2.3	Launch countdown and flight support	Two consoles in the engineering support area (ESA) in the launch control center for up to four NASA personnel	Two consoles in the engineering support area (ESA) in the launch control center for up to four NASA personnel	Two consoles in the engineering support area (ESA) in the launch control center for up to four NASA personnel	Two consoles in the engineering support area (ESA) in the launch control center for up to four NASA personnel

Standard Launch Services List (Continued)

		Delta II two-stage missions	Delta II three-stage missions	Delta III	Delta IV
2.4.1.3	Launch dress rehearsal	Typically three days prior to launch	Typically three days prior to launch	Typically three days prior to launch	Typically three days prior to launch
2.4.2 Launch Site Payload Support					
2.4.2.1	Payload processing facility	NASA payload processing facility must be a hazardous payload processing facility rated for both ordnance and propellant loading	NASA payload processing facility must be a hazardous payload processing facility rated for both ordnance and propellant loading	NASA payload processing facility must be a hazardous payload processing facility rated for both ordnance and propellant loading	NASA payload processing facility must be a hazardous payload processing facility rated for both ordnance and propellant loading
2.4.2.2	Launch site payload integration support clarification definition	The term "provision for" is defined as the contractor will enable NASA to per form the stated operation. The term "provision of" is defined as the contractor will provide the stated service	The term "provision for" is defined as the contractor will enable NASA to per form the stated operation. The term "provision of" is defined as the contractor will provide the stated service	The term "provision for" is defined as the contractor will enable NASA to per form the stated operation. The term "provision of" is defined as the contractor will provide the stated service	The term "provision for" is defined as the contractor will enable NASA to per form the stated operation. The term "provision of" is defined as the contractor will provide the stated service
2.4.2.2E	Provision for contin gency off-loading of propellants	Off-load will be performed by the customer, using the customer's procedures	Off-load will be performed by the customer, using the customer's procedures	Off-load will be performed by the customer, using the customer's procedures	Off-load will be performed by the customer, using the customer's procedures
2.4.2.2F	Provisions of payload requirements	Power: MST-120 V, 15 A, single phase. No DC power Blockhouse -120 V, 60 Hz -208 V, 3 phase -440/480 V, 3 phase A/C, humidity, and clean-liness: controlled to meet payload requirements in accordance with this Exhibit 2.4.2.3 Provision of Grade B GN2/GHe purge lines and control panels, if needed, through fairing A/C duct into the fairing envelope to the payload purge connect with the dimen-sional restrictions in Note 5. Grade B GN2 will be provided	Power: MST-120 V, 15 A, single phase. No DC power Blockhouse -120 V, 60 Hz -208 V, 3 phase -440/480 V, 3 phase A/C, humidity, and clean-liness: controlled to meet payload requirements in accordance with this Exhibit 2.4.2.3 Provision of Grade B GN2/GHe purge lines and control panels, if needed, through fairing A/C duct into the fairing envelope to the payload purge connect with the dimen-sional restrictions in Note 5. Grade B GN2 will be provided	Power: MST-120 V, 15 A, single phase. No DC power Blockhouse -120 V, 60 Hz -208 V, 3 phase -440/480 V, 3 phase A/C, humidity, and clean-liness: controlled to meet payload requirements in accordance with this Exhibit 2.4.2.3 Provision of GN2/GHe purge during transport and erection.	Power: MST-120 V, 15 A, single phase. No DC power SEB -120 V, 60 Hz -208 V, 3 phase A/C, humidity, and clean-liness: controlled to meet payload requirements in accordance with this Exhibit 2.4.2.3 Provision of GN2/GHe purge during transport and erection.
2.4.2.2K	Provisions of payload protective cover	Class-100,000 space craft environment	Class-100,000 space craft environment	Class-100,000 space craft environment	Class-100,000 space craft environment
2.4.2.3 Contamination and Environmental Control					
2.4.2.3A	Payload/vehicle integration environment	SLC-17A and SLC-17B white rooms: Temperature: 21.1°C ± 2.8°C (70°F ± 5°F) Relative humidity: 35 to 50%	SLC-17A and SLC-17B white rooms: Temperature: 21.1°C ± 2.8°C (70°F ± 5°F) Relative humidity: 35 to 50%	SLC-17A and SLC-17B white rooms: Temperature: 21.1°C ± 2.8°C (70°F ± 5°F) Relative humidity: 35 to 50%	SLC-37 Portable clean environmental shelter (PCES) (see note below). Temperature: 15.6°C –29.4°C (60–85°F) Relative humidity: 75% Max Note: The DIV PCES pro vides Class-5000 envi-ronmentally controlled access through PLF doors. No additional con-trol of temperature or humidity is required for the MST environment

Standard Launch Services List (Continued)

		Delta II two-stage missions	Delta II three-stage missions	Delta III	Delta IV
2.4.2.3B	Transportation environment	Handling can encapsulation: Temperature: -1.1 to 32.2°C (30 to 90°F) Relative humidity: 50% Max Dry gaseous nitrogen purge per MIL-P-27401C, Type 1, Grade B.	Handling can encapsulation: Temperature: -1.1 to 32.2°C (30 to 90°F) Relative humidity: 50% Max Dry gaseous nitrogen purge per MIL-P-27401C, Type 1, Grade B.	Payload fairing encapsulation: Temperature: -1.1 to 32.2°C (30 to 90°F) Relative humidity: 50% Max Dry gaseous nitrogen purge per MIL-P-27401C, Type 1, Grade B.	Payload fairing encapsulation (mobile environmental control unit [ECU] with PLF): Temperature: 18.3 to 29.4°C ± 2.8°C (65 to 85°F ± 5°F) Relative humidity: 50% Max Particulate class 5000 at inlet (verified/sampled at duct outlet; demonstrated by test)
2.4.2.3C	Fairing environment	Payload fairing air-conditioning and environmental shroud: Supply Temperature: 7.2 to 26.7°C ± 1.1°C (45 to 80°F ± 2°F) Fairing Internal Temperature (Blanket temp patch): 11.1 to 21.1°C(1)(2) (52 to 70°F) Relative humidity: 30 to 50 ± 5% Particulate class: 5000 (verified/sampled at duct outlet; demonstrated by test)	Payload fairing air-conditioning and environmental shroud: Supply Temperature: 7.2 to 26.7°C ± 1.1°C (45 to 80°F ± 2°F) Fairing Internal Temperature (Blanket temp patch): 11.1 to 21.1°C(1)(2) (52 to 70°F) Relative humidity: 30 to 50 ± 5% Particulate class: 5000 (verified/ sampled at duct outlet; demonstrated by test)	Payload fairing air-conditioning: Supply Temperature: 7.2 to 26.7°C ± 1.1°C (45 to 80°F ± 2°F) Fairing Internal Temperature (Blanket temp patch): 11.1 to 21.1°C (52 to 70°F) Relative humidity: 30 to 50 ± 5% Particulate class: 5000 (verified/sampled at duct outlet; demonstrated by test)	Payload fairing air-conditioning Supply Temperature: 10.0 to 29.4°C ± 2.8°C (50 to 85°F ± 5°F) Relative humidity: 20–50% Control Setpoint ± 10% Particulate class: 5000 (verified/sampled at duct outlet; demonstrated by test)
2.4.2.3D	Fairing internal surface cleaning	MIL-STD-1246C Level 750A	MIL-STD-1246C Level 750A	MIL-STD-1246C Level 750A	MIL-STD-1246C Level 750A
2.4.2.3E	Cleanroom garments	40 maximum for 100,000 class clean missions to be available at any given time after spacecraft erection	40 maximum for 100,000 class clean missions to be available at any given time after spacecraft erection	40 maximum for 100,000 class clean missions to be available at any given time after spacecraft erection	40 maximum for 100,000 class clean missions to be available at any given time after spacecraft erection
2.6	Analytical models and support services	Provide models and data in Boeing standard format for the configuration authorized, as defined in Note 6. Provide 100 hr of engineering support for clarification, description, and/or coordination per Note 7.	Provide models and data in Boeing standard format for the configuration authorized, as defined in Note 6. Provide 100 hr of engineering support for clarification, description, and/or coordination per Note 7.	Provide models and data in Boeing standard format for the configuration authorized, as defined in Note 6. Provide 100 hr of engineering support for clarification, description, and/or coordination per Note 7.	Provide models and data in Boeing standard format for the configuration authorized, as defined in Note 6. Provide 100 hr of engineering support for clarification, description, and/or coordination per Note 7.

(1) The fairing internal temperature is controlled by the supply temperature setpoint.
(2) A specific customer fairing temperature range of 8 degrees, within the allowable fairing internal temperature range, must be coordinated with the Delta Program Office.

NOTES

NOTE 1: 9.5-FT ALUMINUM PAYLOAD FAIRING DOOR LOCATIONS

Doors in the 9.5-ft payload fairing are located as follows:

(1) 21.48 by 24.8-in., 21.86 by 24.8-in., 25 by 24.8-in., and 9 by 13-in. doors installed in the 9.5-ft-dia section of the fairing shall be located as follows:

Axial location (station):

- η Circumferential centerline for the 21.48 by 24.8-in. door shall be located at Delta II station 400.48.
- η Circumferential centerline for the 21.86 by 24.8-in. door shall be located at Delta II station 346.42.
- η Circumferential centerline for the 25 by 24.8-in. door shall be located at Delta II stations 373.22 or 389.22.
- η Circumferential centerline for the 9 by 13-in. doors shall be located at Delta II stations 341.19, 357.22, 373.22, 389.22, or 405.36; 9 by 13-in. doors are centered between ring frames. Any set of two 9 by 13-in. doors with identical axial centerlines must have at least one stringer separating the two doors. Any set of two 9 by 13-in. doors with identical circumferential location may be installed in two adjacent axial bays.

Circumferential location (clocking):

- η 21.48 by 24.8-in. door and 25 by 24.8-in. door (at station 389.22) axial centerlines shall be 28.74 deg to 151.26 deg for the light half and between 208.74 deg and 331.26 deg for the heavy half (Quad IV=0 deg, Quad I=90 deg) in increments of 6.13 deg (=6.1 in.).
- η 25 by 24.8-in. door (at station 373.22) axial centerlines shall be 28.74 deg to 102.25 deg and 157.38 deg for the light half and between 208.74 deg and 331.26 deg for the heavy half (Quad IV=0 deg, Quad I=90 deg) in increments of 6.13 deg (=6.1 in.).
- η 21.86 by 24.8-in. door axial centerlines shall be 28.74 deg to 102.25 deg for the light half and between 208.74 deg and 331.26 deg for the heavy half (Quad IV=0 deg, Quad I=90 deg) in increments of 6.13 deg (=6.1 in.).
- η 9 by 13-in. doors (located at stations 389.22 and 405.36) axial centerlines shall be 22.62 deg to 157.38 deg for the light half and between 202.62 deg and 337.38 deg for the heavy half (Quad IV=0 deg, Quad I=90 deg) in increments of 6.13 deg (=6.1 in.).
- η 9 by 13-in. doors (located at stations 341.19, 357.22, and 373.22) axial centerlines shall be 22.62 deg and 114.51 deg or 151.26 deg and 157.38 deg for the light half and between 202.62 deg and 337.38 deg for the heavy half (Quad IV=0 deg, Quad I=90 deg) in increments of 6.13 deg (=6.1 in.).

Door-to-door spacing:

- η 21.48 by 24.8-in., 21.86 by 24.8 in. and 25 by 24.8-in. doors' circumferential center-to-center spacing between doors shall be a minimum of 36.8 deg (=36.6 in.).
- η 9 by 13 in. door circumferential center-to-center spacing between two 9 by 13-in. doors or between a 9 by 13-in. door and the air conditioning door shall be a minimum of 24.5 deg (=24.4 in.). This applies to doors in the same bay.

Door orientation:

- η 21.48 by 24.8-in., 21.86 by 24.8-in., and 25 by 24.8-in. doors are oriented with their 21.48/21.86/25-in.-long sides parallel to the axial direction.
- η 9 by 13-in. doors are oriented with their 9-in.-long sides parallel to the axial direction.

(2) A 10.5-in.-dia door shall be located in the 8-ft cylindrical section of the 9.5-ft metallic payload fairing and must not interfere with the two standard (18 by 18-in.) second-stage access doors and tension fittings that are also located in the 8-ft cylindrical section. The door centerline must be located at a node point.

Note: this is the potential centerline zone but must avoid the second-stage access doors and tension fittings.

- Axial location (station): Sta. 442.10 to Sta. 537.57.
- Circumferential location (clocking): 16.9 deg to 163.1 deg for Quad I fairing half; 196.9 deg to 343.1 deg for Quad III fairing half.

(3) An 18 by 18-in. door shall be located in the 8-ft cylindrical section of the 9.5-ft metallic payload fairing and must not interfere with the two standard (18 by 18-in.) second-stage access doors and tension fittings that are also located in the 8-ft cylindrical section. The door centerline must be located at a node point.
Note: this is the potential centerline zone but must avoid the second-stage access doors and tension fittings.

- Axial location (station): Sta. 459.78 to Sta. 519.89.
- Circumferential location (clocking): 24.21 deg to 155.79 deg for Quad I fairing half; 204.21 deg to 335.79 deg for Quad III fairing half.

NOTE 2: 10-FT-DIA COMPOSITE FAIRING DOOR LOCATIONS

Doors in the Delta II 10-ft-dia composite (10C) payload fairing shall be located only in the cylindrical section of the fairing as follows:

- Axial location: Door circumferential centerlines shall be located at least 18.0 in. above the boattail transition and at least 45.72 cm (18.0 in.) below the nose cone transition. Door circumferential centerlines shall be at least 57.15 cm (22.5 in.) from the air conditioning door doubler edge.
- Circumferential location: Door axial centerlines shall be at least 58.67 cm (23.1 in.) from Quad II and IV axial centerlines with the exception that doors with circumferential centerlines between 45.72 cm (18.0 in.) and 143.51 cm (56.5 in.) aft of the nose cone transition shall have axial centerlines at least 106.68 cm (42.0 in.) from the Quad II and IV axial centerlines. Door axial centerlines shall be at least 50.80 cm (20.0 in.) from the air-conditioning door doubler edge.
- Door-to-door spacing: The center-to-center spacing between doors shall be at least 121.92 cm (48 in.).

NOTE 3: DELTA III 4-M COMPOSITE PAYLOAD FAIRING DOOR LOCATIONS

Doors in the Delta III 4-m-dia composite payload fairing shall be located only in the cylindrical section of the fairing as follows:

- Axial location: Door circumferential centerlines shall be located at least 140.79 cm (55.43 in.) above the fairing separation plane (station 604.49) and at least 57.12 cm (22.49 in.) below the nose cone transition. Door circumferential centerlines shall be at least 84.33 cm (33.2 in.) from the air-conditioning door doubler edge.
- Circumferential location: Door axial centerlines shall be at least 57.15 cm (22.5 in.) from separation rail axial centerlines with the exception that doors with circumferential centerlines between 57.12 cm (22.49 in.) and 95.38 cm (37.55 in.) aft of the nose cone transition shall have axial centerlines at least 110.54 cm (43.52 in.) from the separation rail axial centerlines. Door axial centerlines shall be at least 76.2 cm (30.0 in.) from the air-conditioning door doubler edge.
- Door-to-door spacing: The center-to-center spacing between doors shall be at least 121.92 cm (48 in.).

NOTE 4: DELTA IV COMPOSITE PAYLOAD FAIRING DOOR LOCATIONS

(1) Doors in the Delta IV 4-m-dia composite payload fairing shall be located only in the cylindrical section of the fairing as follows:

- Axial location for 0.46-m (18-in.)-dia doors: Door circumferential centerlines shall be located at least 129.0 cm (50.8 in.) from the aft shell surface and at least 57.1 cm (22.5 in.) below the nose cone transition. Door circumferential centerlines shall be at least 84.4 cm (33.2 in.) from the air-conditioning door cutout center. Near handling points, the door centerlines shall be set back farther.

n Axial location for 0.61-m (24-in.)-dia doors: Door circumferential centerlines shall be located at least 136.7 cm (53.8 in.) from the aft shell surface and at least 64.8 cm (25.5 in.) below the nose cone transition. Door circumferential centerlines shall be at least 92.0 cm (36.2 in.) from the air-conditioning door cutout center. Near handling points, the door centerlines shall be set back farther.

n Circumferential location for 0.46-m (18-in.)-dia doors: Door axial centerlines shall be located at least 54.0 cm (21.3 in.) from the Quad II and IV rail split lines that create the edge of the shell.

n Door axial centerlines shall be located at least 80.0 cm (31.5 in.) from the air-conditioning door cutout center. Near handling points, the door centerlines shall be set back farther.

n Circumferential location for 0.61-m (24-in.)-dia doors: Door axial centerlines shall be located at least 61.6 cm (24.3 in.) from the Quad II and IV rail split lines that create the edge of the shell.

n Door axial centerlines shall be located at least 87.6 cm (34.5 in.) from the air-conditioning door cutout center. Near handling points, the door centerlines shall be set back farther.

n Minimum door-to-door spacing is 121.92 cm (48 in.).

(2) Doors in the Delta IV 5-m, 14.32-m (47-ft)-long composite payload fairing shall be located only in the cylindrical section of the fairing as follows:

n Axial location for 0.46-m (18-in.)-dia doors: Door circumferential centerlines shall be located at least 169.3 cm (66.7 in.) from the aft shell surface and at least 61.0 cm (24.0 in.) below the nose cone transition. Door circumferential centerlines shall be at least 91.4 cm (36.0 in.) from the air-conditioning door cutout center. Near handling points, the door centerlines shall be set back farther.

n Axial location for 0.61-m (24-in.)-dia doors: Door circumferential centerlines shall be located at least 176.9 cm (69.7 in.) from the aft shell surface and at least 68.6 cm (27.0 in.) below the nose cone transition. Door circumferential centerlines shall be at least 99.1 cm (39.0 in.) from the air-conditioning door cutout center. Near handling points, the door centerlines shall be set back farther.

n Circumferential location for 0.46-m (18-in.)-dia doors: Door axial centerlines shall be located at least 61.6 cm (24.3 in.) from the Quad II and IV rail split lines that create the edge of the shell.

n Door axial centerlines shall be located at least 95.2 cm (37.5 in.) from the air-conditioning door cutout center. Near handling points, the door centerlines shall be set back farther.

n Circumferential location for 0.61-m (24-in.)-dia doors: Door axial centerlines shall be located at least 69.2 cm (27.3 in.) from the Quad II and IV rail split lines that create the edge of the shell.

n Door axial centerlines shall be located at least 102.9 cm (40.5 in.) from the air-conditioning door cutout center. Near handling points, the door centerlines shall be set back farther.

n Minimum door-to-door spacing will be provided with initial Delta IV launch services proposal (LSP).

(3) Doors in the Delta IV 5-m-dia, 19.11-m (62.7-ft)-long composite payload fairing shall be located only in the cylindrical section of the fairing as follows:

n Axial location for 0.46-m (18-in.)-dia doors: Door circumferential centerlines shall be located at least 169.3 cm (66.7 in.) from the aft shell surface and at least 61.0 cm (24.0 in.) below the nose cone transition. Door circumferential centerlines shall be at least 81.3 cm (32.0 in.) from the air-conditioning door cutout center. Near handling points, the door centerlines shall be set back farther.

n Axial location for 0.61-m (24-in.)-dia doors: Door circumferential centerlines shall be located at least 176.9 cm (69.7 in.) from the aft shell surface and at least 68.6 cm (27.0 in.) below the nose cone transition. Door circumferential centerlines shall be at least 88.9 cm (35.0 in.) from the air-conditioning door cutout center. Near handling points, the door centerlines shall be set back farther.

n Circumferential location for 0.46-m (18-in.)-dia doors: Door axial centerlines shall be located at least 61.6 cm (24.3 in.) from the Quad II and IV rail split lines that create the edge of the shell.

- Door axial centerlines shall be located at least 95.2 cm (37.5 in.) from the air-conditioning door cutout center. Near handling points, the door centerlines shall be set back farther.
- Circumferential location for 0.61-m (24-in.)-dia doors: Door axial centerlines shall be located at least 69.2 cm (27.3 in.) from the Quad II and IV rail split lines that create the edge of the shell.
- Door axial centerlines shall be located at least 102.9 cm (40.5 in.) from the air-conditioning door cutout center. Near handling points, the door centerlines shall be set back farther.
- Minimum door-to-door spacing will be provided with initial Delta IV LSP.

NOTE 5: PAYLOAD PURGE CONNECT DIMENSIONAL RESTRICTIONS

The purge connect shall be within 5 deg of the fairing sector centerline. The face of the purge connect shall be within 2 deg of being perpendicular to the centerline. There shall be no surrounding spacecraft intrusion within a 30-deg half-cone angle separation clearance envelope at the mated purge connect.

NOTE 6:

Analytical models and modeling data will be provided for the following analyses. The data will be provided electronically or on paper, in the same format used by Boeing engineers performing the analyses. Per NASA direction, no user documentation will be provided Codes and tools used by Boeing are not included in the standard service.

Flight Design: trajectory design groundrules, assumptions, and constraints; weight characteristics; propulsion characteristics for all stages; aerodynamic data; sequence data; dispersion data

Dynamic Loads: launch vehicle structural dynamic models; launch vehicle forcing functions

Thermal Analysis: internal and external launch vehicle geometric models; launch vehicle thermal math models; launch vehicle aeroheating modeling data

Guidance, Navigation, and Controls: vehicle modeling data including liquid/slag slosh modeling data, propulsion data including RCS/ACS, and simplified models for linear control stability analysis

Flight Software: flight software design documents, flight software problem reports/change requests, as generated.

The first mission of a launch vehicle configuration (i.e., Delta II, Delta III, Delta IV) will include the following:

Actuator Models (i.e., block diagrams)

GNC Avionics: component models and parameters.

NOTE 7:

The engineering support will be used to assist NASA in meeting the requirements of Clause 25.0 of Section C for insight and approval of mission unique analyses. Additional effort over and above the 100 hr may be obtained under a change order at a later date.

Section D, Attachment D1, Exhibit 3, "Non-Standard Launch Services List.

All information contained in this section is being withheld per:

FOIA Exemption 3/Procurement Integrity Act

Pages D1-E3-I through D1-E3-A1-ii

STATEMENT OF WORK

Withheld in its entirety per 5 U.S.C. Sec. 552 (b) (4)

STATEMENT OF WORK

Withheld in its entirety per 5 U.S.C. Sec. 552 (b) (4)

STATEMENT OF WORK

Withheld in its entirety per 5 U.S.C. Sec. 552 (b) (4)

Section D, Attachment D1, Exhibit 3, "Non-Standard Launch Services List.

All information contained in this section is being withheld per:

FOIA Exemption 3/Procurement Integrity Act

Pages D1-E3-I through D1-E3-A1-ii

EXHIBIT 4

FLIGHT CERTIFICATION DOCUMENT FOR SAMPLE MISSION

The following agencies certify that the necessary launch test operations to date have been completed for the launch vehicle and payload. Pending satisfactory closure of in-line work and any open items identified in the Launch Readiness Review, the launch vehicle, spacecraft, and all supporting systems are ready for the launch operation.

_____
The Boeing Company

_____
Expendable Vehicles
NASA/KSC ELVPO

_____
Sample Mission Program
NASA

The following Government agencies, involved in supporting this Delta mission, certify that all requirements to date have been met and that all Government support elements are making final preparations to support this mission. Pending satisfactory closure of in-line work to prepare for support of this mission and any open items identified in the Launch Readiness Review, all Government support elements are ready for the launch operation. Furthermore, pending satisfactory closure of in-line launch vehicle and spacecraft processing and any open items identified in the Launch Readiness Review, the Space Wing (45th or 30th) foresees no national resource protection or Range Safety issues, which would preclude launch.

_____
NASA/GSFC (Goddard Network Support)

_____
(45th or 30th) Space Wing

Date: _____

Attachment D1, Exhibit 5

FIRMS/OPTIONS
MISSION SOLUTIONS

Exhibit 5
FIRMS/OPTIONS MISSION SOLUTIONS

INTRODUCTION

The accompanying tables offer our solutions to the firm and option missions defined in the NASA Launch Services (NLS) manifest. All mission solutions use the highly reliable Delta II launch vehicle, which meets all qualification criteria. We offer the most cost-effective solution for each mission by capitalizing on the flexibility of the Delta II vehicles. Vehicle numerical identification is explained in Figure E5-1. Proven processes, experienced personnel, and the infrastructure required are in place to assure mission success.

Our solution format provides a one-for-one comparison between the mission requirement, the Delta solution, and the technical acceptability rationale. Also reflected are representative spacecraft depicted with the selected launch vehicles.

Specific assumptions have been made in developing the lowest cost solutions shown in Table E5-1. We assume that the spacecraft mass identified in the mission data sheets is the maximum expected spacecraft mass reflecting reasonable growth margins. Should the spacecraft exceed current mass values, increased launch vehicle performance may be achieved by lowering the second-stage probability of command shutdown (PCS). Delta II performance is typically based on a 99.7% PCS. Delta II has flown >20 missions at a lower than 99.7% PCS (95% minimum). This is a low-risk option as no Delta II mission flown with a reduced PCS has depleted second-stage propellants prior to achieving the desired orbit. It should be noted that the three sigma (3-σ) orbit dispersions for reduced PCS missions will not increase due to PCS effects unless commanded shutdown is not achieved. Performance margin values for this PCS reduction are shown in the mission solution tables for the applicable missions.

If payload growth in excess of the PCS reduction capability is required, Table E5-1 also identifies an applicable growth accommodation vehicle.

The Delta vehicle performance documented in Exhibit 5 is based on the mission-specific requirements provided in the NLS request for proposal (RFP). These performance levels exceed the generic levels documented in Exhibit 1, which retain margin for undefined (but anticipated) mission-unique requirements and vehicle constraints.

Table E5-1. Our Delta family offers NASA the flexibility required to meet NLS mission requirements and to mitigate growth risk

*West Coast 292XH vehicle available only after nonrecurring expense for facility modifications

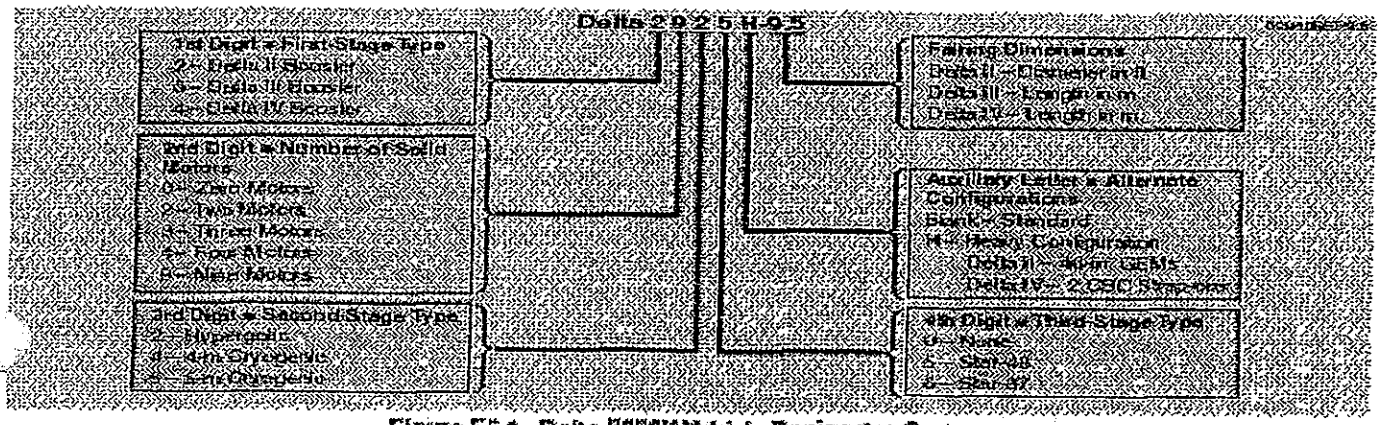


Figure E5-1. Delta II/III/IV Vehicle Designator System

Exhibit 8 – Mission Interface Control Documents

(redacted in its entirety)

Mission Requirements:

Requirement	Solution
Payload Risk Category: 3	Delta II 2920-10L Launch Vehicle.
Launch Date: December 2002	Delta On-Time Launch Service.
Launch Site: No mission requirement specified.	Non-Standard Service: Delta II Western Range launch site (Vandenberg Air Force Base Space Launch Complex 2 (SLC-2) (NSS 27.1, Western Range [WR] Launch Incremental).
Payload Mass: 3100 kg. Orbit: 705 km circular at 98.2 deg inclination (Sun synchronous).	Delta II 2920-10L with nine GEM-40 thrust augmentation solid motors and a 10L stretched length composite payload fairing (NSS 2.1.1). Includes all the standard services associated with the 2920-10 basic vehicle. Delta II Mission-Unique Service (MUS): A scope reduction credit for multiple trajectories/dual launch windows will be provided (MUS 1.1).
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in Performance and Guidance Accuracy Analysis (CDRL C4-1).
Separation Attitude Accuracy and Rates: No mission requirements specified.	Delta II vehicle standard second-stage low-tip-off payload deployment: attitude (deg): < 3.0 (per axis), rate (deg per second): < 0.25 (per axis) with 6306 payload adapter. (See statement of work [SOW] Exhibit 1, Section 4, Table E1-28.)

Payload Accommodation Requirements:

Requirement	Solution
Third-stage Motor: No mission requirement specified.	Not required.
Payload Interface: 63-inch dia payload adapter and soft separation (LV final stage separation retro). The spacecraft hydrazine thruster may be fired within one minute after payload separation.	Delta II 6306 payload adapter non-standard service, which includes a separation clampband, secondary latches, and second-stage retro system. Note: No price increase or decrease is associated with this non-standard service (NSS 3.2.1). (See SOW Exhibit 1, Section 6, Figure E1-19.) CG vertical limit (above separation plane) for payload mass based on generic load factors = 228.6 cm (90.0 in.). CG capability may be increased through the mission-specific coupled loads process.
Spinup/Spindown: No mission requirements specified.	N/A.
Payload Envelope: Spacecraft Overall Dimensions in Launch Configuration: Cylindrical dia = 272 cm and height = 531 cm; upper conic base dia = 272 cm, top dia = 60 cm, and height =160 cm.	Delta II 10L composite payload fairing (stretch length) with provision for a 0.64-cm (0.25-in.) GN_2 purge line. Local blanket modifications (thickness reduction or removal) are required to accommodate the payload envelope. Delta II Non-Standard Service: Replace the baseline Delta II 2920 10-ft (3-m) composite payload fairing with a 10-ft (3-m) stretched-length (10L) composite payload fairing (NSS 2.1.1).
Payload Access: No mission requirements specified.	Up to three Delta II standard service payload access doors are available for use by the payload. (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors.)
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 1 DC accelerometer, 3 AC accelerometers, 1 pressure transducer, 1 temperature patch. (See Technical Acceptability Volume 1, Section 2.1.5, and SOW Exhibit 1, Section 9, Table E1-34, for a detailed description.)
Electrical Interface: No mission requirements specified.	Delta II Standard Service: Two 37-pin payload interface connectors at one location and disconnected by the fairing; 61-pin connectors may be provided as a non-standard service. Payload wiring is routed to ground support equipment via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Section 7, Table E1-29, for a detailed description of available electrical interfaces.)

Payload Environmental Requirements:

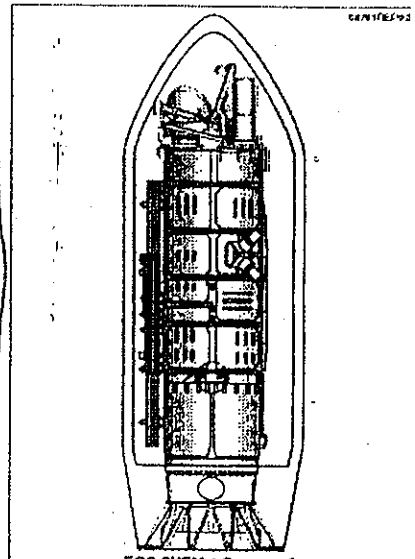
Requirement	Solution
Thermal: See CLIN 1 DATA SHEET – Figure D1-10; EOS CHEM-1 Payload Fairing Thermal Environment.	The Delta II 10L composite fairing payload thermal environment complies with the specified requirement. (See SOW Exhibit 1, Section 8, Figure E1-43A and Exhibit 2 for established ranges and additional information.) Figure E1-43A represents conservative composite fairing design temperatures. The environments have combined the skin surface with the higher rail temperature history for simplicity. Note: the skin temperature history is in compliance with the requirements specified in CLIN-1 data sheet (Figure D1-10). The skin surface (high emissivity) thermal flux to the spacecraft envelops the separation rail (low emissivity) flux when calculations are made at the appropriate temperature histories and complies with the EOS CHEM-1 requirements.

Exhibit 5
NLS MISSION SOLUTION
CLIN 1—EOS CHEM-1

SPACECRAFT AND MISSION DESCRIPTION

The EOS CHEM-1 mission will fly an Eart orbiter designed to capture Earth atmospher composition measurements. The mission will la approximately 5 years and will be flown i support of the goals of the NASA Earth Scienc enterprise. The spacecraft will consist of a da bus system, which has been demonstrated in tl EOS PM-1 mission.

The Boeing solution for this mission is tl low-risk Delta II 2920-10L vehicle, with stretched 10-ft- (3-m)-dia composite paylo fairing that is being used for the EOS PM- mission. This mission will be launched from tl Delta II Western Range launch site. Specif details regarding the solution for all current identified mission requirements, together with tl corresponding rationale for technic acceptability, are described in the accompanyir tables.

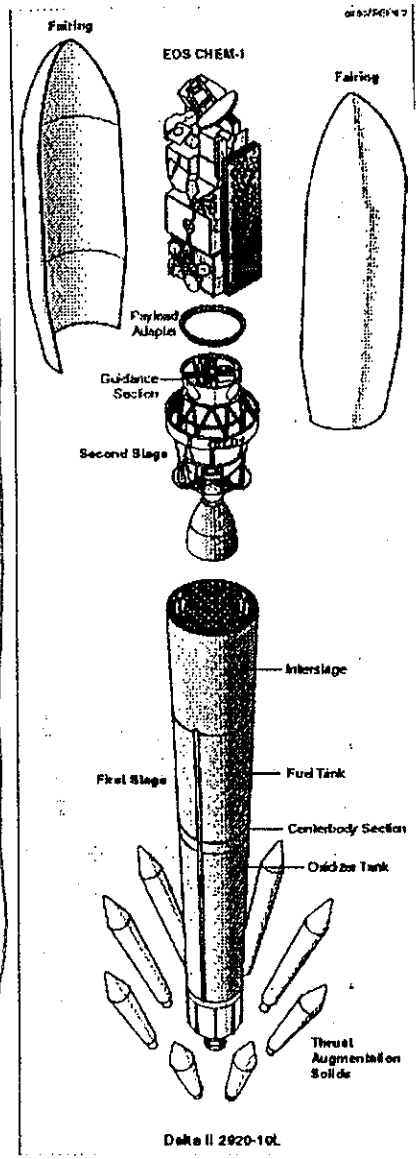


EOS CHEM-1 Spacecraft

Payload Environmental Requirements (continued):

Requirement	Solution
Dynamic Loads: See CLIN 1 DATA SHEET, Table D1-T: EOS CHEM-1 Flight Loads.	Payload Loads: An EOS CHEM-1/Delta 2920 coupled-loads analysis prepared under separate task assignment from NASA (Contract NAS5-30722, Task No. 235) yielded the following predicted CG loads. All are within the EOS CHEM-1 load requirements specified in Table D1-T. Axial (g) / Lateral (g) / Torsion (rad/sec²) Max axial at main engine cutoff (MECO): +6.4 ±0.6 / ±0.2 / N/A Max lateral: +2.7 / ±1.6 / ±5.0 Max lateral: +0.0 / ±1.6 / ±5.0 Maximum quasi-steady acceleration is a function of payload separated mass (See SOW Exhibit 1, Section 8, Figure E1-37, for maximum values if mass changes.) Maximum expected sinusoidal vibration at the base of the PA: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz), 1.0 g zero to peak (6.2-100 Hz); lateral: 0.7 g zero to peak (5-100 Hz). (See SOW Exhibit 1, Table E1-33, for additional information.) Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.
Dynamic Environments: See CLIN 1 DATA SHEET, Table D1-U: EOS CHEM-1 Maximum Expected Acoustic Environment Flight Levels within Payload Fairing, Figure D1-8, EOS CHEM-1 Shock Response at LV/Spacecraft Interface.	Delta II 2920-10L maximum flight level payload acoustic environment: overall sound pressure level (OASPL) = 140.8 dB. (See SOW Exhibit 1, Section 8, Figure E1-31, for maximum levels across the frequency spectrum; complies with Table D1-U requirements.) Based upon experience with the EOS PM-1 spacecraft (common EOS bus with fill factor >60%), a mission-specific analysis may be required for EOS CHEM-1. A mission-specific analysis was performed for EOS PM-1, and resulting environments were found to be acceptable. Delta II 6306 PA maximum flight-level payload interface shock response spectrum: 100 g (100 Hz), +9.8 dB/octave (100-800 Hz), 3000 g (800-3000 Hz) complies with the specified requirement. (See SOW Exhibit 1, Section 8, Figure E1-35, for additional information.)
Radio Frequency: No mission requirements specified.	Delta II Standard Service: 20 V/m across the range of 14 KHz to 40 GHz with 40 V/m between 5.762 and 5.768 GHz. RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section 8, Table E1-30, for additional information.)
Payload Compartment Venting: See CLIN 1 DATA SHEET, Figure D1-9, EOS CHEM-1 Ascent Pressure Profile.	Delta II pressure profiles and depressurization rates comply with the specified requirement. (See SOW Exhibit 1, Section 8, Figure E1-22, for established maximum and minimum values.)
Launch Site Facility Environments: Spacecraft continuous instrument GN_2 purge through liftoff.	Standard Service: Spacecraft GN_2 purge is provided at the Western Range facility. (See Technical Acceptability Volume 1, Sections 5.2.3.1 and 5.2.3.2, and SOW Exhibit 2 for more information.)
Launch Site Facility Environments: Temperature, relative humidity, and filtration. No mission requirements specified.	Delta II Standard Service: Western Range facility environments. (See Technical Acceptability Volume 1, Section 5.2.3, Table 5-9, and SOW Exhibit 2 for established ranges.)
Contamination Control: Fairing internal surface cleanliness must meet level 600Å surface cleanliness per MIL-STD-1246C, at a minimum. Any helium gas within the payload fairing is considered detrimental to the payload inertial reference unit.	Delta II Standard Service: Contamination Control Plan: Fairing will be cleaned and visually inspected per MDC STP0407-06 (VC-6), incident light plus UV. (NSS 11.2 Enhanced Fairing Internal Surface Cleaning.) Helium environment: A T-0 nitrogen purge of the spacecraft sensitive instruments will be used.
Safety: The on-board propulsion system will contain hydrazine and will be used to maintain spacecraft orbit.	Space Wing Safety Regulations require that liquid propellants aboard the spacecraft be removable from tanks, piping, or other components during any stage of prelaunch processing. (See Technical Acceptability Volume 1, Section 5.2.2.4.5.2 and SOW Exhibit 2.)

	Non-standard services required:
NSS 2.1.1	Replace a 10-ft PLF with a 10L PLF
NSS 3.2.1	6306 Payload Adapter (no price increase)
NSS 11.2	Enhanced Fairing Internal Surface Cleaning
NSS 27.1	Western Range (WR) Launch Incremental



Delta II 2920-10L

Mission Requirements:

Requirement	Solution
Payload Risk Category: 3.	Delta II 2925H-9.5 Launch Vehicle.
Launch Date: January 2004.	Delta On-Time Launch Service: Assurance in meeting planetary launch window periods is enhanced by building in contingency time including hardware scheduling, tracking, and early mission checkout. Instantaneous launch windows are met with multiple flight trajectories for launch windows and selective use of built-in holds for issue resolution during the day of launch countdown. (See Technical Acceptability Volume 1, Section 2.1.1, and SOW Exhibit 2 for an additional description.)
Launch Site: No mission requirement specified.	Delta II Eastern Range launch site (CCAFS SLC-17B).
Payload Mass: 1155 kg. Orbit: Escape; C_3 = 11.8 km^2/sec^2; DLA = 28.5 deg; RLA = 279.1 degrees	Delta II 2925H-9.5 with nine GEM-46 thrust augmentation solid motors and a 9.5-ft- (2.9-m)-dia payload fairing. Includes all the standard services associated with the 2925-9.5 basic vehicle. Delta II Non-Standard Service: Replace standard GEM-40 solid motors with higher performance GEM-46 solid motors (NSS 1.1). Delta II Non-Standard Service: Incremental one-time analysis is required. Revisions to account for the third stage will be made to the controls analysis that is planned for the upcoming 2920H-9.5 vehicle scheduled to be launched from the Eastern Range in Dec. 2001(NSS 26.2).
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in the Performance and Guidance Accuracy Analysis (CDRL C4-1).
Separation Attitude Accuracy and Rates: No mission requirements specified.	Delta II vehicle standard third-stage (despun) payload deployment: attitude <10.0 deg, rate <7.0-deg per sec (transverse), 0.0 ±5 rpm (roll). (See SOW Exhibit 1, Section 4,Table E1-28.)

Payload Accommodation Requirements:

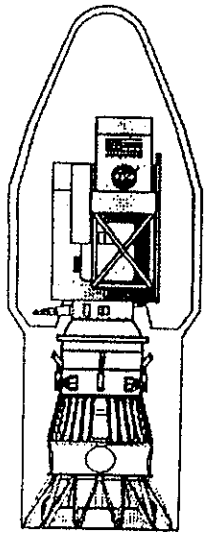
Requirement	Solution
Third-stage motor required to achieve hyperbolic orbit.	Star-48B motor, including spin table.
Payload interface: No mission requirements specified.	Delta II 3712C payload adapter, which includes a separation clampband sys-em, a yo-yo despin system, a nutation control system (NCS), and extended miss.on thermal modifications to accommodate mission lengths of up to 7,000 sec. (See SOW Exhibit 1, Section 6, Figure E1-19.) CG vertical limit (above separation plane) for payload mass based on generic load factors = 94 cm (37 in.). CG capability may be increased through the mission-specific coupled-loads process.
Spinup/Spindown: Separation spin rate is <3 rpm.	Delta II standard spinup of the third stage and payload to stabilize the Star-48B motor will be accomplished with the Delta II spin table and spin rocket motors. (See Technical Acceptability Volume 1, Section 2.1.6, and SOW Exhibit 2.) Yo-yo despin system includes a nutation control system to minimize velocity/attitude pointing errors and coning conditions during the time from third-stage ignition to yo-yo despin initiation.
Payload Envelope: Spacecraft Overall Dimensions in Launch Configuration: dia = 224 cm; height = 240 cm.	Delta II 9.5-ft- (2.9-m)-dia aluminum payload fairing with provision for a 0.64-cm (0.25-in.) GN_2 purge line.
Payload Access: No mission requirements specified.	Up to three Delta II standard service payload access doors are available for use by the payload. (See SOW Exhibit 2 for detailed information regarding availa>e standard service payload access doors.)
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 3 DC accelerometers, 1 pressure transducer, 1 temperature patch. (See Technical Acceptability Volume 1, Section 2.1.5, and SOW Exhibit 1, Section 9, Table E1-34, for a detailed description.)
Electrical Interface: No mission requirements specified.	Delta II Standard Service: Two 37-pin payload interface connectors 180 deg apart across the interface plane, disconnected upon separation; 61-pin connectors may be provided as an NSS. Payload wiring is routed to the GSE via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Section 7, Table E1-29, for a detailed description of available electrical interfaces.)

Exhibit 5
NLS MISSION SOLUTION
CLIN 2—DEEP IMPACT

SPACECRAFT AND MISSION DESCRIPTION

The objective of the Deep Impact mission is dramatically increase our understanding comets by sampling material deep below comet's surface. This will be accomplished precisely delivering a 500-kg impactor to t surface of comet Tempel 1 to produce a crater to 100 m deep. The mission will la approximately 2 years and supports the NAS Discovery Program.

The Boeing solution for this mission is a lo risk Delta II 2925H-9.5 vehicle with a 9.5- (2.9-m)-dia aluminum payload fairing and a Sta 48B third-stage motor. This mission will launched from the Delta II Eastern Range laun site. Specific details regarding the solution for currently identified mission requirement together with the corresponding rationale f technical acceptability, are described in t accompanying tables.

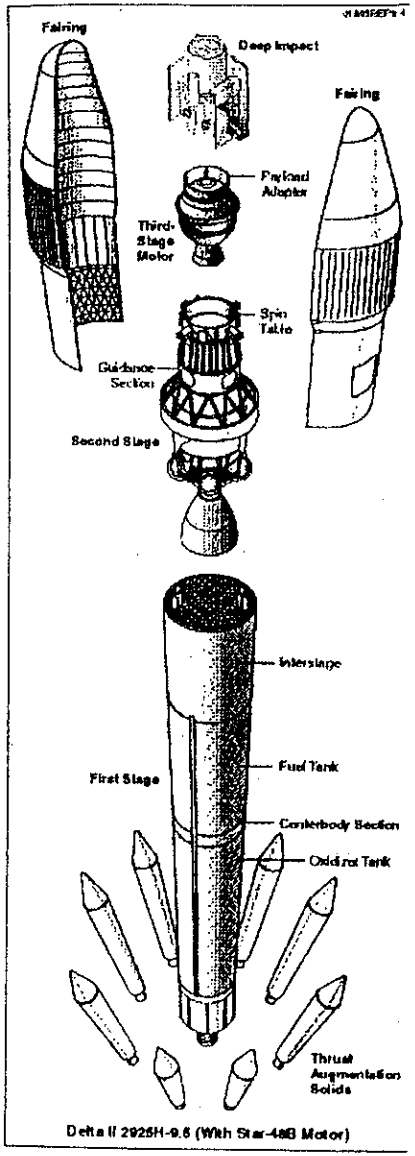


Deep Impact Spacecraft

Payload Environmental Requirements:

Requirement	Solution
Thermal: No mission requirements specified.	Delta II 9.5-ft (2.9-m) fairing and Star-48B third stage payload environments. (See SOW Exhibit 1, Section 8, Figures E1-43A and E1-43C and Exhibit 2 for established ranges and additional information.)
Dynamic Loads: No mission requirements specified.	Delta II 2925H environment: Payload design CG limit load factors based on a 1136-kg (2500-lb) spacecraft mass. (See SOW Exhibit 1, Section 8, Table E1-31.) Max axial (at MECO): Axial (g) 6.5 ± 0.6; Lateral (g) ±0.2 Max lateral: Axial (g) +2.8; Lateral (g) ±3.5 Max lateral: Axial (g) -0.2; Lateral (g) ±3.5 Maximum quasi-steady acceleration is a function of payload separated mass. (See SOW Exhibit 1, Section 8, Figures E1-37 and E1-43, for maximum values if mass changes.) Maximum expected sinusoidal vibration at the base of the PA: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz), 1.0 g zero to peak (6.2-100 Hz); lateral: 0.7 g zero to peak (5-100 Hz). (See SOW Exhibit 1, Section 8, Table E1-33, for additional information.) Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.
Dynamic Environments: No mission requirements specified.	Delta II 2925H-9.5 maximum flight level payload acoustic environment: OASPL = 141.8 dB. (See SOW Exhibit 1, Section 8, Figure E1-30, for maximum levels across the frequency spectrum; 2925H levels are 2 dB higher than on the 2925.) Delta II 3712 PA with 3300-lb preload maximum flight-level payload interface shock response spectrum: 40 g (100 Hz), +9.2 dB/octave (100-1500 Hz), 2500 g (1500-3000 Hz). (See SOW Exhibit 1, Section 8, Figure E1-35, for additional information.)
Radio Frequency: No mission requirements specified.	Delta II Standard Service: 20 V/m across the range of 14 KHz to 40 GHz with 40 V/m between 2.2 GHz and 2.3 GHz and between 5.762 and 5.768 GHz. RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section 8, Table E1-30, for additional information.)
Payload Compartment Venting: No mission requirements specified.	Delta II Standard Service: Pressure profiles and depressurization rates. (See SOW Exhibit 1, Section 8, Figure E1-22, for established maximum and minimum values.)
Launch Site Facility Environments: Spacecraft continuous instrument GN_2 purge through liftoff.	Delta II Standard Service: Spacecraft GN_2 purge is provided at the Eastern Range facility. (See Technical Acceptability Volume 1, Sections 5.2.3.1 and 5.2.3.2, and SOW Exhibit 2 for more information.)
Launch Site Facility Environments: Temperature, relative humidity, and filtration. No mission requirements specified.	Delta II Standard Service: Eastern Range facility environments: See Technical Acceptability Volume 1, Section 5.2.3, Table 5-9, and SOW Exhibit 2 for established ranges.)
Contamination Control: The internal payload fairing cleanliness level is required to meet visibly clean, highly sensitive, per JSC SN-C-0005D Table A.2, at a minimum.	Delta II Standard Service: Fairing will be cleaned and visually inspected per MDC STP0407-03 (VC-3). Generic Contamination Control Plan: (See Technical Acceptability Volume 1, Section 5.2.3, and SOW Exhibit 2 for established minimum requirements.)

Non-standard services required:	
NSS 1.1	Heavy Vehicle Upgrade
NSS 26.2	Category "2" Core Vehicle Analysis (Small)



Delta II 2925H-9.5 (With Star-48B Motor)

Mission Requirements:

Requirement	Solution
Payload Risk Category: 3.	Delta II 2925H-9.5 Launch Vehicle.
Launch Date: March 2004.	Delta On-Time Launch Service. Assurance of meeting planetary launch window periods is enhanced by building in contingency time including hardware scheduling, tracking, and early mission checkout. Instantaneous launch windows are met with multiple flight trajectories for two day-of-launch windows and selective use of built-in holds for issue resolution during the day of launch countdown. (See Technical Acceptability Volume 1, Section 2.1.1, and SOW Exhibit 2 for an additional description.)
Launch Site: No mission requirement specified.	Delta II Eastern Range launch site (CCAFS SLC-17B).
Payload Mass: 1066 kg. Orbit: Escape; C_3 = 16.0 km^2/sec^2; DLA < 28.5 deg.	Delta II 2925H-9.5 with nine GEM-46 thrust augmentation solid motors and a 9.5-ft- (2.9-m)-dia payload fairing. Includes all the standard services associated with the 2925-9.5 basic vehicle. Delta II Non-Standard Service: Replace standard GEM-40 solid motors with higher performance GEM-46 solid motors (NSS 1.1). Delta II Non-Standard Service: Incremental one-time analysis is required for this mission. Revisions to account for the third stage will be made to the controls analysis that is planned for the upcoming 2920H-9.5 vehicle scheduled to be launched from the Eastern Range in Dec. 2001(NSS 26.2).
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in the Performance and Guidance Accuracy Analysis (CDRL C4-1).
Separation Attitude Accuracy and Rates: No mission requirements specified.	Delta II vehicle standard third-stage (spinning) payload deployment: momentum vector < 10.0 deg, cone angle < 6.0 deg, spin rate error: < ± 15% from targeted rate. (See SOW Exhibit 1, Section 4, Table E1-28.)

Payload Accommodation Requirements:

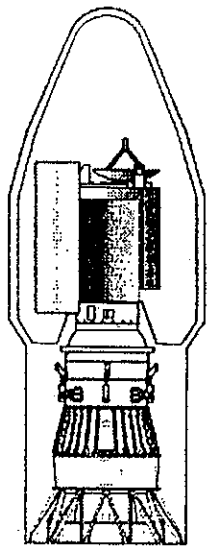
Requirement	Solution
Third-stage motor required to achieve hyperbolic orbit.	Star-48B motor, including spin table.
Payload Interface: A fixed ceramic shade on the spacecraft extends below the separation plane by 36 cm at a radius of 108 cm, and is an approximately 120-deg section of a cylinder.	Delta II 3712C payload adapter, which includes a separation clampband system, a yo-tumble system, a nutation control system, and extended mission thermal modifications to accommodate mission lengths of up to 7,000 sec. (See SOW Exhibit 1, Section 6, Figure E1-19.) Delta II Mission-Unique Service: A 12.7-cm- (5 in.)-high spacer will be added between the 3712C and Star-48B motor to accommodate the ceramic thermal shade below the separation plane. Payload orientation will be clocked so as to prevent any interference with the third-stage motor NCS thruster arm (MUS 3.1). CG vertical limit (above separation plane) for payload mass based on generic load factors = 99 cm (39 in.). CG capability may be increased through the mission specific coupled-loads process.
Spinup/Spindown: No mission requirements specified.	Delta II standard spinup of the third stage and payload to stabilize the Star-48B motor will be accomplished with the Delta II spin table and spin rocket motors. (See Technical Acceptability Volume 1, Section 2.1.6, and SOW Exhibit 2.) Delta II Non-Standard Service: Because no requirement to despin the payload was indicated for this mission, the standard yo-yo de-spin system will be replaced with a more cost-effective yo-tumble system. This non-standard service provides a cost credit to NASA (NSS 4.6).
Payload Envelope: Spacecraft Overall Dimensions in Launch Configuration: dia = 216 cm; height = 239 cm. A fixed ceramic thermal shade on the spacecraft extends below the separation plane by 36 cm at a radius of 108 cm, and is an approximately 120-deg section of a cylinder.	Delta II 9.5-ft-(2.9-m)-dia aluminum payload fairing.
Payload Access: No mission requirements specified.	Up to three Delta II standard service payload access doors are available for use by the payload. (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors.)
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 3 DC accelerometers, 1 pressure transducer, 1 temperature patch. (See Technical Acceptability Volume 1, Section 2.1.5, and SOW Exhibit 1, Section 9, Table E1-34, for a detailed description.)

Exhibit 5
NLS MISSION SOLUTION
CLIN 3—MESSENGER

SPACECRAFT AND MISSION DESCRIPTION

The MESSENGER mission will orbit Mercur to globally image and study this planet closest t the Sun. The mission will last approximatel 7 years and will be flown in support of the goal of the NASA Space Science enterprise.

The Boeing solution for this mission is a low risk Delta II 2925H-9.5 vehicle with a 9.5-ft (2.9-m)-dia aluminum payload fairing and a Star 48B third-stage motor. This mission will b launched from the Delta II Eastern Range launc site. Specific details regarding the solution for al currently identified mission requirements together with the corresponding rationale fo technical acceptability, are described in th accompanying tables.

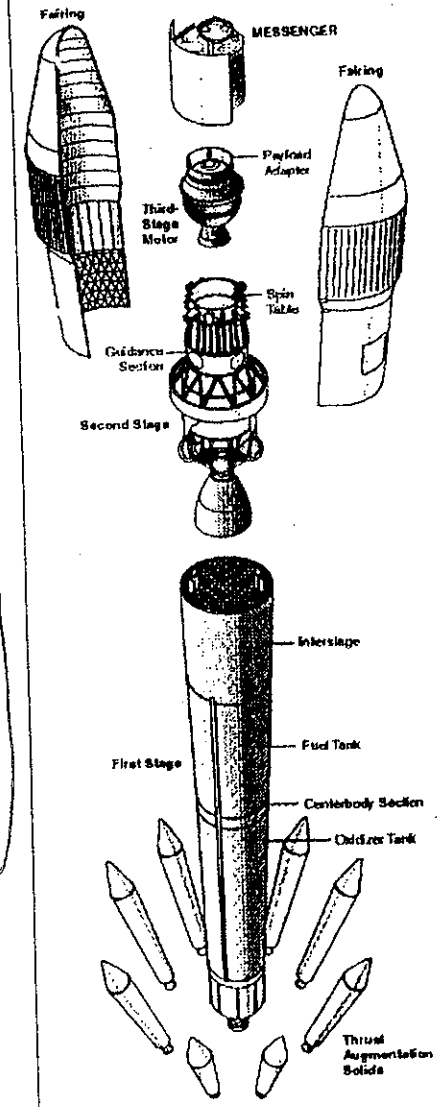


MESSENGER Spacecraft

Payload Accommodation Requirements (continued): Requirement	Solution
Electrical Interface: No mission requirements specified.	Delta II Standard Service: Two 37-pin payload interface connectors 180 deg apart across the interface plane, disconnected upon separation; 61-pin connectors may be provided as an NSS. Payload wiring is routed to GSE via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Section 7, Table E1-29, for a detailed description of available electrical interfaces.)

Payload Environmental Requirements: Requirement	Solution
Thermal: No mission requirements specified.	Delta II 9.5-ft (2.9-m) fairing and Star-48B third-stage payload environments. (See SOW Exhibit 1, Section 8, Figures E1-43A and E1-43C and Exhibit 2 for established ranges and additional information.)
Dynamic Loads: No mission requirements specified.	Delta II 2925H environment: Payload design CG limit load factors. (See SOW Exhibit 1 Section 8, Table E1-31.) Axial (g) / Lateral (g) Max axial (at MECO): 6.5 ± 0.6 / ±0.2 Max lateral: +2.8 / ±3.5 Max lateral: -0.2 / ±3.5 Maximum quasi-steady acceleration is a function of payload separated mass. (See SOW Exhibit 1, Section 8, Figures E1-37 and E1-43, for maximum values if mass changes.) Maximum expected sinusoidal vibration at the base of the PA: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz), 1.0 g zero to peak (6.2-100 Hz); lateral: 0.7 g zero to peak (5-100 Hz). (See SOW Exhibit 1, Section 8, Table E1-33, for additional information.) Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.
Dynamic Environments: No mission requirements specified.	Delta II 2925H-9.5 maximum flight level payload acoustic environment: OASPL = 141.8 dB. (See SOW Exhibit 1, Section 8, Figure E1-30, for maximum levels across the frequency spectrum.) 2925H levels are 2 dB higher than the 2925. Delta II 3712 PA with 3300-lb preload maximum flight-level payload interface shock response spectrum: 40 g (100 Hz), +9.2 dB/octave (100-1500 Hz), 2500 g (1500-3000 Hz). (See SOW Exhibit 1, Section 8, Figure E1-35, for additional information.)
Radio Frequency: No mission requirements specified.	Delta II Standard Service: 20 V/m across the range of 14 KHz to 40 GHz with 40 V/m between 2.2 GHz and 2.3 GHz and between 5.762 and 5.768 GHz. RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section 8, Table E1-30, for additional information.)
Payload Compartment Venting: No mission requirements specified.	Delta II Standard Service: Pressure profiles and depressurization rates. (See SOW Exhibit 1, Section 8, Figure E1-22, for established maximum and minimum values.)
Launch Site Facility Environments: Temperature, relative humidity, and filtration. No mission requirements specified.	Delta II Standard Service: Eastern Range facility environments. (See Technical Acceptability Volume 1, Section 5.2.3, Table 5-9, and SOW Exhibit 2 for established ranges.)
Contamination Control: No mission requirements specified.	Delta II Standard Service: Generic Contamination Control Plan. (See Technical Acceptability Volume 1, Section 5.2.3, and SOW Exhibit 2 for established minimum requirements.)

	Non-standard services required:
NSS 1.1	Heavy Vehicle Upgrade
NSS 4.6 Tumble	Exchange a Star-48B Despin System With a System
NSS 26.2	Category "2" Core Vehicle Analysis (Small)



Delta II 2925H-9.6 (With Star-48B Motor)

Mission Requirements:

Requirement	Solution
Payload Risk Category. 3.	Delta II 2320-10 Launch Vehicle.
Launch Date: September 2003.	Delta On-Time Launch Service.
Launch Site: No mission requirement specified.	Delta II Eastern Range launch site (CCAFS SLC-17).
Payload Mass: 1118 kg. Orbit: 600 km circular; inclination ≤ 19 deg.	Delta II 2320-10 with three GEM-40 thrust augmentation solid motors and a 10-ft-(3-m)-dia composite payload fairing. Includes all the standard services associated with the 2320-10 basic vehicle. Delta II Mission-Unique Service: A scope reduction credit for multiple trajectories/dual launch windows will be provided (MUS 4.1).
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in the Performance and Guidance Accuracy Analysis (CDRL C4-1).
Separation Attitude Accuracy and Rates: Low tip-off rates are required.	Delta II vehicle standard second-stage low tip-off payload deployment: attitude (deg): < 3.0 (per axis); rate (deg per sec), <0.25 (per axis) with 6306 payload adapter (See SOW Exhibit 1, Section 4, Table E1-28.)

Payload Accommodation Requirements:

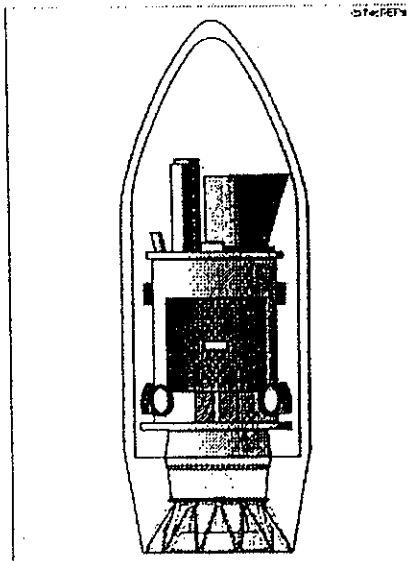
Requirement	Solution
Third-Stage Motor: No mission requirement specified.	Not required.
Payload Interface: Low tip-off rates are required.	Delta II 6306 payload adapter non-standard service, which includes a separation clampband, secondary latches, and second-stage retro system. This PA is selected for its low profile, providing the maximum payload envelope for the spacecraft. Note: No price increase or decrease is associated with this non-standard service (NSS 3.2.1). (See SOW Exhibit 1, Section 6, Figure E1-19.) CG vertical limit (above separation plane) for payload mass based on generic load factors = 254 cm (100 in.). CG capability may be increased through the mission-specific coupled-loads process.
Spinup/Spindown: No mission requirements specified.	N/A.
Payload Envelope: Spacecraft overall dimensions in launch configuration: dia = 270.5 cm, height = 451.5 cm.	Delta II 10-ft- (3-m)-dia composite payload fairing.
Payload Access: No mission requirements specified.	Up to three Delta II standard service payload access doors are available for use by the payload. (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors.)
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 1 DC accelerometer, 3 AC accelerometers, 1 pressure transducer, 1 temperature patch. (See Technical Acceptability Volume 1, Section 2.1.5, and SOW Exhibit 1, Section 9, Table E1-34, for a detailed description.)
Electrical Interface: No mission requirements specified.	Delta II Standard Service: Two 37-pin payload interface connectors at one location and disconnected by the fairing; 61-pin connectors may be provided as an NSS. Payload wiring is routed to GSE via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Section 7, Table E1-29, for a detailed description of available electrical interfaces.)

Exhibit 5
NLS MISSION SOLUTION
CLIN 4—OPTION 1

SPACECRAFT AND MISSION DESCRIPTION

The mission will fly an Earth-orbiting spacecraft designed to capture gamma-ray-burst transient astronomical observations. The mission will last approximately 3 years and will be flown in support of the goals of the NASA Space Science enterprise. The spacecraft will consist of a data bus system that has been demonstrated on the MISTI and DS-1 missions.

The Boeing solution for this mission is the low-risk Delta II 2320-10 vehicle with a 10-ft (3-m)-dia composite payload fairing. This mission will be launched from the Delta II Eastern Range launch site. Specific details regarding the solution for all currently identified mission requirements, together with the corresponding rationale for technical acceptability, are described in the accompanying tables.

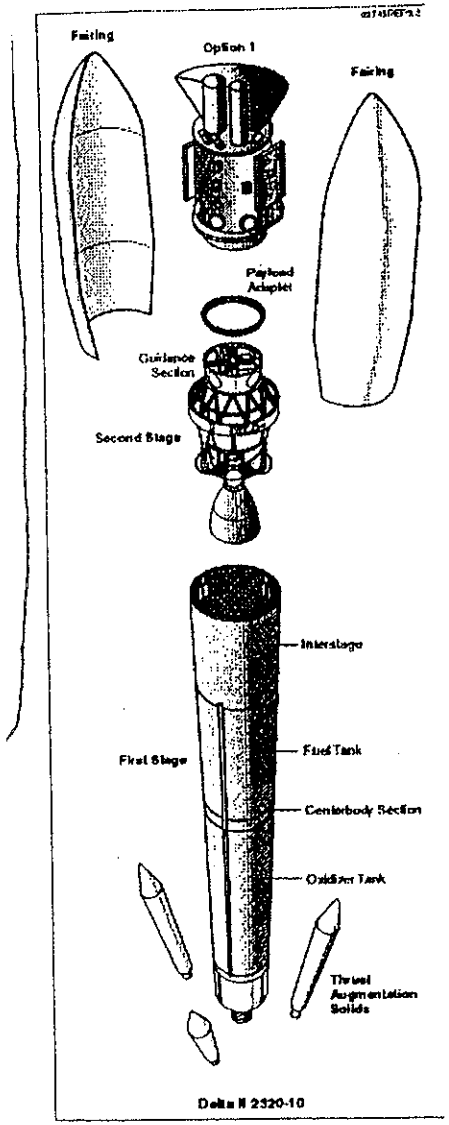


Option 1 Spacecraft

Payload Environmental Requirements:

Requirement	Solution
Thermal: No mission requirements specified.	Delta II 10-ft (3-m) fairing payload environment. (See SOW Exhibit 1, Section 8, Figure E1-43A and Exhibit 2 for established ranges and additional information.)
Dynamic Loads: No mission requirements specified.	Delta II 2320 environment: Payload design CG limit load factors. (See SOW Exhibit 1, Section 8, Table E1-31.) Axial (g) / Lateral (g) Max axial (at MECO): +7.4 ± 0.6 / ± 0.2 Max lateral: +2.8 / ± 3.5 Max lateral: -0.2 / ± 3.5 Maximum quasi-steady acceleration is a function of payload separated mass. (See SOW Exhibit 1, Section 8, Figure E1-37, for maximum values if mass changes.) Maximum expected sinusoidal vibration at the base of the PA: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz), 1.0 g zero to peak (6.2-100 Hz); lateral: 0.7 g zero to peak (5-100 Hz). (See SOW Exhibit 1, Section 8, Table E1-33, for additional information.) Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.
Dynamic Environments: No mission requirements specified.	Delta II 2320-10 maximum flight level payload acoustic environment: OASPL = 138.5 dB. (See SOW Exhibit 1, Section 8, Figure E1-29, for maximum levels across the frequency spectrum; 2320 levels are 0.5 dB lower than on the 2420.) Delta II 6306 PA maximum flight-level payload interface shock response spectrum: 100 g (100 Hz), +9.8 dB/octave (100-800 Hz), 3000 g (800-3000 Hz) complies with the specified requirement. (See SOW Exhibit 1, Section 8, Figure E1-35, for additional information.)
Radio Frequency: No mission requirements specified.	Delta II Standard Service: 20 V/m across the range of 14 KHz to 40 GHz with 40 V/m between 5.762 and 5.768 GHz. RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section 8, Table E1-30, for additional information.)
Payload Compartment Venting: No mission requirements specified.	Delta II Standard Service: Pressure profiles and depressurization rates: (See SOW Exhibit 1, Section 8, Figure E1-22, for established maximum and minimum values.)
Launch Site Facility Environments: Temperature, relative humidity, and filtration. No mission requirements specified.	Delta II Standard Service: Eastern Range facility environments (see Technical Acceptability Volume 1, Section 5.2.3, Table 5-9, and SOW Exhibit 2 for established ranges.)
Contamination Control: No mission requirements specified.	Delta II Standard Service: Generic contamination control plan. (See Technical Acceptability Volume 1, Section 5.2.3, and SOW Exhibit 2 for established minimum requirements.)

Non-standard services required:	
NSS 3.2.1	6306 Payload Adapter (no price increase)



Mission Requirements:

Requirement	Solution
Payload Risk Category: 3.	Delta II 2425-10 Launch Vehicle.
Launch Date: July 2004	Delta On-Time Launch Service.
Launch Site: No mission requirement specified.	Delta II Eastern Range launch site (CCAFS SLC-17).
Payload Mass: 1120 kg. Orbit: Geosynchronous transfer (185 km x 36,086 km), inclination = 28.7 deg.	Delta II 2425-10 with four GEM-40 thrust augmentation solid motors and a 10-ft- (3-m)-dia composite payload fairing. Includes all the standard services associated with the 2425-10 basic vehicle. Delta II Mission-Unique Service: An off-loaded Star-48B third-stage motor is required for this mission (MUS 5.1). Delta II Mission-Unique Service: A scope reduction credit for multiple trajectories/dual launch windows will be provided (MUS 5.2).
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in the Performance and Guidance Accuracy Analysis (CDRL C4-1).
Separation Attitude Accuracy and Rates: Zero spin rate at separation.	Delta II vehicle standard third-stage (despun) payload deployment: attitude <10.0 deg, rate < 7.0 deg per sec (transverse), 0.0± 5 rpm (roll). (See SOW Exhibit 1, Section 4, Table E1-28.)

Payload Accommodation Requirements:

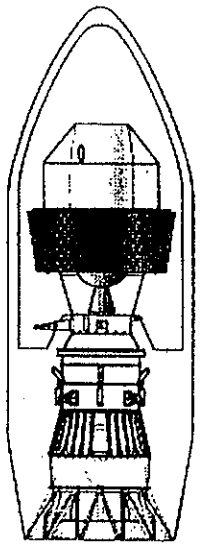
Requirement	Solution
Third-Stage Motor: No mission requirement specified.	Star-48B motor, including spin table. Delta II Mission-Unique Service: 241 kg (530 lb) of propellant will be off-loaded from the Star-48B motor used for this mission. This service is required for the spacecraft to achieve the prescribed orbit (MUS 5.1).
Payload Interface: No mission requirements specified.	Delta II 3712C payload adapter, which includes a separation clampband system, a yo-yo despin system, a nutation control system, and extended mission thermal modifications to accommodate mission lengths of up to 7,000 sec. (See SOW Exhibit 1, Section 6, Figure E1-19.) CG vertical limit (above separation plane) for payload mass based on generic load factors = 99 cm (39 in.). CG capability may be increased through the mission-specific coupled-loads process.
Spinup/Spindown: Separation spin rate is 0 rpm.	Delta II standard spinup of the third stage and payload to stabilize the Star-48B motor will be accomplished with the Delta II spin table and spin rocket motors. (See Technical Acceptability Volume 1, Section 2.1.6, and SOW Exhibit 2.) Yo-yo despin system includes a nutation control system to minimize velocity/attitude pointing errors and coning conditions during the time from third-stage ignition to yo-yo despin initiation.
Payload Envelope: Spacecraft overall dimensions in launch configuration: cylindrical dia = 251 cm and height = 200 cm with upper conic base dia = 251 cm, top dia = 102 cm, and height = 266 cm.	Delta II 10-ft- (3-m)-dia composite payload fairing with local nose cone blanket modifications (removal) to accommodate the payload envelope. Delta II Non-Standard Service: Replace the baseline Delta II 2425 9.5-ft (2.9-m) aluminum payload fairing with a 10-ft (3-m) composite payload fairing. Note: No price increase or decrease is associated with this non-standard service (NSS 2.1.2).
Payload access: No mission requirements specified.	Up to three Delta II standard service payload access doors are available for use by the payload. (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors.)
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 3 DC accelerometers, 1 pressure transducer, 1 temperature patch. (See Technical Acceptability Volume 1, Section 2.1.5, and SOW Exhibit 1, Section 9, Table E1-34, for a detailed description.)
Electrical Interface: No mission requirements specified.	Delta II Standard Service: Two 37-pin payload interface connectors 180 deg apart across the interface plane; disconnected upon separation; 61-pin connectors may be provided as an NSS. Payload wiring is routed to GSE via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Exhibit 7, Table E1-29, for a detailed description of available electrical interfaces.)

Exhibit 5
NLS MISSION SOLUTION
CLIN 5—OPTION 2

SPACECRAFT AND MISSION DESCRIPTION

The mission will fly an Earth-orbitin spacecraft designed to capture astronomical targ position data. The mission will la approximately 2-½ years and will be flown support of the goals of the NASA Space Scien enterprise.

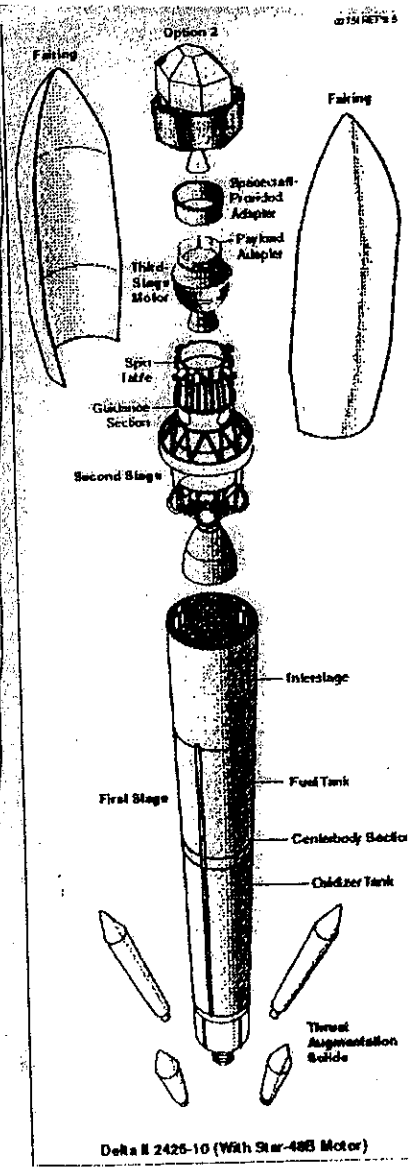
The Boeing solution for this mission is a lo risk Delta II 2425-10 vehicle with a 10-f (3-m)-dia composite payload fairing and a Sta 48B third-stage motor. This mission will l launched from the Delta II Eastern Range laun site. Specific details regarding the solution for currently identified mission requiremen together with the corresponding rationale f technical acceptability, are described in t accompanying tables.



Option 2 Spacecraft

Payload Environmental Requirements: Requirement	Solution
Thermal: No mission requirements specified.	Delta II 10-ft (3-m) fairing and Star-48B third stage payload environments. (See SOW Exhibit 1, Section 8, Figures E1-43A and E1-43C and Exhibit 2 for established ranges and additional information.)
Dynamic Loads: No mission requirements specified.	Delta II 2425 environment: Payload design CG limit load factors: (See SOW Exhibit 1 Section 8, Table E1-31.) Axial (g) / Lateral (g) Max axial (at MECO): 7.4 ± 0.6 / +0.2 Max lateral: +2.8 / ±3.5 Max lateral: 0.2 / +3.5 Maximum quasi-steady acceleration is a function of payload separated mass. (See SOW Exhibit 1, Section 8, Figures E1-37 and E1-43, for maximum values if mass changes.) Maximum expected sinusoidal vibration at the base of the PA: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz), 1.0 g zero to peak (6.2-100 Hz); lateral: 0.7 g zero to peak (5-100 Hz). (See SOW Exhibit 1, Section 8, Table E1-33, for additional information.) Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.
Dynamic Environments: No mission requirements specified.	Delta II 2425-10 maximum flight level payload acoustic environment: OASPL = 139.0 dB. (See SOW Exhibit 1, Section 8, Figure E1-29, for maximum levels across the frequency spectrum.) Delta II 3712 PA with 3300-lb preload maximum flight level payload interface shock response spectrum: 40 g (100 Hz), +9.2 dB/octave (100-1500 Hz), 2500 g (1500-3000 Hz). (See SOW Exhibit 1, Section 8, Figure E1-35, for additional information.)
Radio Frequency: No mission requirements specified.	Delta II Standard Service: 20 V/m across the range of 14 KHz to 40 GHz with 40 V/m between 2.2 GHz to 2.3 GHz and between 5.762 and 5.768 GHz. RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section 8, Table E1-30, for additional information.)
Payload Compartment Venting: No mission requirements specified.	Delta II Standard Service: Pressure profiles and depressurization rates. (See SOW Exhibit 1, Section 8, Figure E1-22, for established maximum and minimum values.)
Launch Site Facility Environments: Temperature, relative humidity, and filtration: No mission requirements specified.	Delta II Standard Service: Eastern Range facility environments. (See Technical Acceptability Volume 1, Section 5.2.3, Table 5-9, and SOW Exhibit 2 for established ranges.)
Contamination Control: No mission requirements specified.	Delta II Standard Service: Generic Contamination Control Plan. (See Technical Acceptability Volume 1, Section 5.2.3, and SOW Exhibit 2 for established minimum requirements.)
Safety: The on-board propulsion will consist of an apogee kick motor (AKM) and a hydrazine reaction control system (RCS) and will be used to go from geosynchronous transfer orbit (GTO) to geosynchronous orbit (GSO) and to maintain its orbit.	Space Wing Safety Regulations require that liquid propellants aboard spacecraft be removable from tanks, piping, or other components during any stage of prelaunch processing. (See Technical Acceptability Volume 1, Section 5.2.2.4.5.2, and SOW Exhibit 2.)

Non-standard services required:
NSS 2.1.2 - Replace a 9.5-ft PLF with a 10-ft PLF (no price increase)



Delta II 2425-10 (With Star-48B Motor)

Mission Requirements:

Requirement	Solution
Payload Risk Category: 2.	Delta II 2925-10L Launch Vehicle.
Launch Date: June 2004.	Delta On-Time Launch Service: Assurance in meeting planetary launch window periods is enhanced by building in contingency time including hardware scheduling, tracking, and early mission checkout. Instantaneous launch windows are met with multiple flight trajectories for two day-of-launch windows and selective use of built-in holds during the day-of-launch countdown for issue resolution. (See Technical Acceptability Volume 1, Section 2.1.1, and SOW Exhibit 2 for additional description.)
Launch Site: No mission requirement specified.	Delta II Eastern Range launch site (CCAFS SLC-17).
Payload Mass: 912.5 kg (440 kg per spacecraft plus separation system). Orbit: Heliocentric "Drift Away" orbit achieved using lunar gravity assist(s). The spacecraft are placed into an eccentric phasing orbit around the Earth. The common spacecraft phasing orbit characteristics are: Launch energy: C_3 = -2.0 to 0.0 km²/sec². Inclination: ≥ 28.7 deg. Right ascension of the ascending node: Selectable for each opportunity, 0 deg <RLA ≥ +360 deg. Argument of perigee: Selectable for each launch opportunity, 0 deg <RLA ≥ +360 deg. Perigee altitude: TBP.	Delta II 2925-10L with nine GEM-40 thrust augmentation solid motors and a 10L stretched length composite payload fairing (NSS 2.1.1). Includes all the standard services associated with the 2925-10 basic vehicle. Delta II Non-Standard Service: Incremental one-time analysis is required for this mission. Revisions to account for the first use of this vehicle configuration with a stretched fairing from the ER will be made to the range safety, controls, aerodynamics, loads, and strength analyses (NSS 26.1).
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in Performance and Guidance Accuracy Analysis (CDRL C4-1).
Separation Attitude Accuracy and Rates: Three axes stabilized (nonspinning) release, low tip-offs are preferred.	Delta II vehicle standard third-stage (despun) payload deployment: attitude < 10.0 deg, rate < 7.0 deg per sec (transverse), 0.0± 5 rpm (roll). (See SOW Exhibit 1, Section 4, Table E1-28.)

Payload Accommodation Requirements:

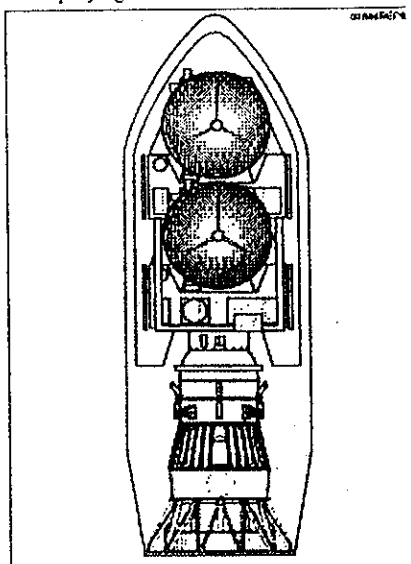
Requirement	Solution
Third-stage motor required to achieve hyperbolic orbit.	Star-48B motor, including spin table.
Payload Interface: No mission requirements specified.	Delta II Standard Service: 3712C payload attach fitting, which includes a separation clampband system, a yo-yo despin system, a nutation control system, and extended mission thermal modifications to accommodate mission lengths of up to 7,000 sec. (See SOW Exhibit 1, Section 6, Figure E1-19.) CG vertical limit (above separation plane) for payload mass based on generic load factors = 104.1 cm (41 in.). CG capability may be increased through the mission-specific coupled loads process.
Spinup/Spindown: Three axes stabilized (nonspinning) release, low tip-offs are preferred.	Delta II standard spinup of the third stage and payload to stabilize the Star-48B motor will be accomplished with the Delta II spin table and spin rocket motors. (See Technical Acceptability Volume 1, Section 2.1.6, and SOW Exhibit 2.) Spindown is accomplished with the yo-yo despin systems that includes a nutation control system to minimize velocity/attitude pointing errors and coning conditions during the time from third-stage ignition to despin initiation.
Payload Envelope: Spacecraft Overall Dimensions in Launch Configuration: depth = 175 cm; width = 226 cm; height = 320 cm. Spacecraft will stack vertically, one on top of the other. Dimensions include entire spacecraft stack.	Delta II 10L composite payload fairing (stretch length) with provision for 0.64 cm (0.25 in) GN_2 purge line. Local cylinder section blanket modifications (thickness reduction or removal) are required to accommodate the four corners of the payload envelope. Delta II Non-Standard Services: Replace the baseline Delta II 2925 9.5-ft (2.9-m) aluminum payload fairing with a 10-ft (3-m) stretched length (10L) composite payload fairing (NSS 2.1.1 and NSS 2.1.2). Delta II Mission-Unique Service: Minor modifications are required to the erection trolley and fairing storage position at the Eastern Range to accommodate the 10 fairing (MUS 8.1).

Exhibit 5
NLS MISSION SOLUTION
CLIN 8—OPTION 5

SPACECRAFT AND MISSION DESCRIPTION

This mission contains two spacecraft, one tha will lead the Earth in its orbit, and another tha will lag the Earth in its orbit.

The Boeing solution for this mission is a low risk Delta II 2925-10L vehicle with a stretche 10-ft (3-m) composite payload fairing and a Star 48B third-stage motor. This mission will b launched from the Delta II Eastern Range launc site. Specific details regarding the solution for a currently identified mission requirements together with the corresponding rationale fc technical acceptability, are described in th accompanying tables.



Option 5 Spacecraft

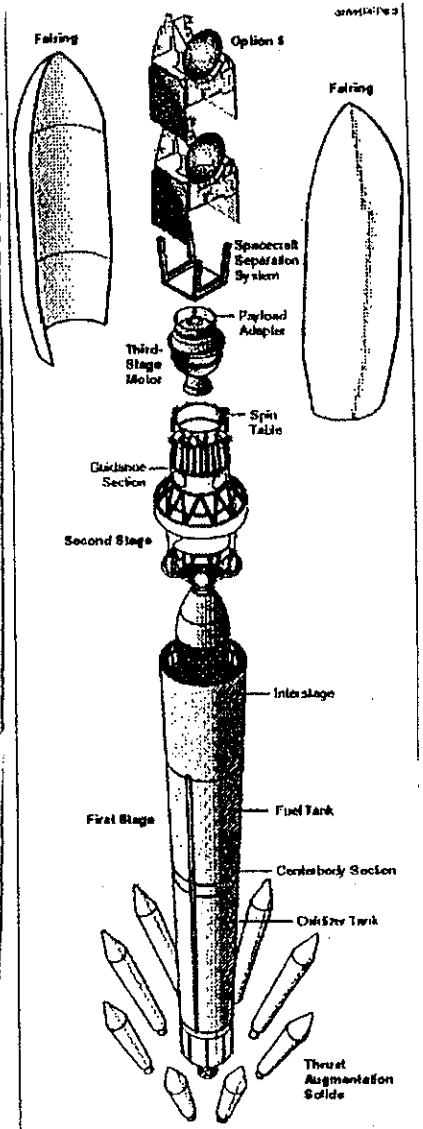
Payload Accommodation Requirements (continued):

Requirement	Solution
Payload Access: No mission requirements specified.	Up to three Delta II Standard Service payload access doors are available for use by the payload. (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors.)
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 3 DC accelerometers, 1 pressure transducer, 1 temperature patch. (See Technical Acceptability Volume 1, Section 2.1.5, and SOW Exhibit 1, Section 9, Table E1-34, for a detailed description.)
Electrical Interface: No mission requirements specified.	Delta II Standard Service: Two 37-pin payload interface connectors 180 deg apart across the interface plane, disconnected upon separation; 61-pin connectors may be provided as an NSS. Payload wiring is routed to GSE via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Section 7, Table E1-29, for a detailed description of available electrical interfaces.)

Payload Environmental Requirements:

Requirement	Solution
Thermal: No mission requirements specified.	Delta II 10-ft (3-m) fairing and Star-48B third-stage payload environments. (See SOW Exhibit 1, Section 8, Figures E1-43A and E1-43C and Exhibit 2 for established ranges and additional information.)
Dynamic Loads: No mission requirements specified.	Delta II 2925 environment: Payload design CG limit load factors. (See SOW Exhibit 1 Sect. 8, Table E1-31.) Axial (g) / Lateral (g) Max axial (at MECO): +6.5± 0.6 / ± 0.2 Max lateral: +2.8 / ± 4.0 Max lateral: -0.2 / ± 4.0 Maximum quasi-steady acceleration is a function of payload separated mass. (See Exhibit 1, Section 8, Figures E1-37 and E1-43, for maximum values if mass changes.) Maximum expected sinusoidal vibration at the base of the PA: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz), 1.0 g zero to peak (6.2-100 Hz); lateral: 0.7 g zero to peak (5-100 Hz). (See SOW Exhibit 1, Section 8, Table E1-33, for additional information.) Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.
Dynamic Environments: No mission requirements specified.	Delta II Mission-Unique Service: The maximum payload acoustic environment will be affected by the fairing blanket modifications that are required to accommodate the spacecraft in the fairing. (As a guide, refer to Delta II 2925-10L acoustic levels in SOW Exhibit 1, Section 8, Figure E1-31, for maximum flight acoustic levels across the frequency spectrum.) Preliminary impact of acoustic blanket modifications could increase fairing acoustic levels by 1 to 2 dB. A mission-specific acoustic analysis will be required to finalize the P/L acoustic environments (MUS 8.2). Delta II 3712 PA with 3300-lb preload maximum flight-level payload interface shock response spectrum: 40 g (100 Hz), +9.2 dB/octave (100-1500 Hz), 2500 g (1500-3000 Hz). (See SOW Exhibit 1, Section 8, Figure E1-35, for additional information.)
Radio Frequency: No mission requirements specified.	Delta II Standard Service: 20 V/m across the range of 14 KHz to 40 GHz with 40 V/m between 2.2 GHz and 2.3 GHz and between 5.782 and 5.768 GHz. RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section 8, Table E1-30, for additional information.)
Payload Compartment Venting: No mission requirements specified.	Delta II Standard Service: pressure profiles and depressurization rates. (See SOW Exhibit 1, Section 8, Figure E1-22, for established max. and min. values.)
Launch Site Facility Environments: Spacecraft GN_2 purge through liftoff.	Delta II Standard Service: Spacecraft GN_2 purge is provided at the Eastern Range facility. (See Technical Acceptability Volume 1, Sections 5.2.3.1 and 5.2.3.2, and SOW Exhibit 2.)
Launch Site Facility Environments: Temperature, relative humidity, and filtration. No mission requirements specified.	Delta II Standard Service: Eastern Range facility environments (See Technical Acceptability Volume 1, Section 5.2.3, Table 5-9, and SOW Exhibit 2.)
Contamination Control: Due to the sensitivity of the optical instruments, the spacecraft requires a 10,000 class environment per FED-STD-209E within the fairing and at the payload processing facility, at a minimum. The fairing internal surface cleanliness is required to meet level 500A per MIL-STD-1246C, at a minimum.	Non-Standard Services: Fairing and white room contamination shroud airflow is class ≤10,000 per FED-STD 209E (NSS 11.1). The fairing will be cleaned and visually inspected per MDC STP0407-06 (VC-6); incident light plus UV (NSS 11.2). White room cleanliness will be recertified following fairing storage position modifications.

Non-standard services required:	
NSS 2.1.1	Replace a 10-ft PLF with a 10L PLF
NSS 2.1.2	Replace a 9.5-ft PLF with a 10-ft PLF (no price increase)
NSS 11.1	Enhanced Fairing Environment
NSS 11.2	Enhanced Fairing Internal Surface Cleaning
NSS 26.1	Category "1" Core Vehicle Analysis (Medium)



Delta II 2925-10L (With Star-48B Motor)

Mission Requirements:

Requirement	Solution
Payload Risk Category: 3.	Delta II 2320-10 Launch Vehicle.
Launch Date: December 2004. Mission is to replenish existing on-orbit assets. Normal mission scheduling shall be attempted 12 to 18 months prior to launch; however, mission objectives may require a 120-day call up. NASA reserves the right to stand down at 120 days prior to launch for up to 48 months. During this stand-down period the LV shall be ready for launch within 120 days of launch call-up (conditional upon range scheduling constraints).	Delta On-Time Launch Service. Vehicle hardware production, assembly, and checkout will be scheduled to support the initial mission launch date. If NASA requires a launch delay and the related call-up capability for this mission, then NSS 25.0, 120-Day Mission Call-Up, must be exercised.
Launch Site: No mission requirement specified.	Delta II Western Range launch site (VAFB SLC-2). (NSS 27.1, Western Range [WR] Launch Incremental.)
Payload Mass: 1540 kg. Orbit: 871 km circular at 98.8 deg inclination (Sun synchronous).	Delta II 2320-10 with three GEM-40 thrust augmentation solid motors and a 10-ft- (3-m)-dia composite payload fairing. Includes all the standard services associated with the 2320-10 basic vehicle. Delta II Mission-Unique Service: A scope reduction credit for multiple trajectories/dual launch windows will be provided (MUS 9.1).
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in Performance and Guidance Accuracy Analysis (CDRL C4-1).
Separation Attitude Accuracy and Rates: No mission requirements specified.	Boeing will review a separation analysis performed for this mission by the spacecraft contractor. Delta II standard two-stage preseparation attitude (deg): <0.65 per axis, rate (deg/sec); <0.2 per axis assuming launch vehicle control system deactivated at initiation of separation. Attitude errors will increase proportionally with any increase in time between control system deactivation and the separation event.

Payload Accommodation Requirements:

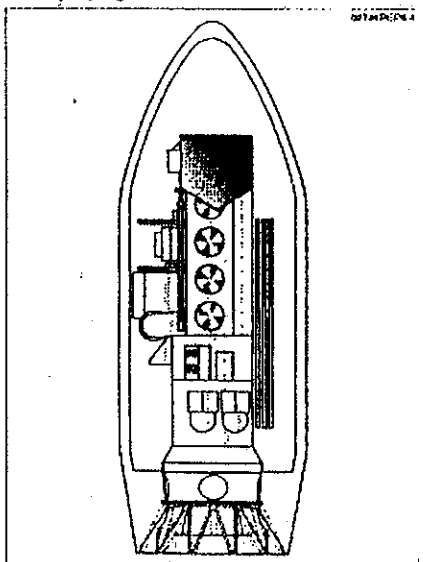
Requirement	Solution
Third-Stage Motor: No mission requirements specified.	Not required.
Payload Interface: Spacecraft configuration includes a payload adapter that was designed to mate to a fixed mating surface with a 58.63-in. dia (68 bolt) launch vehicle interface. The spacecraft will provide the spacecraft separation system and will provide a separation command signal to the launch vehicle.	Delta II Launch Vehicle Interface: The launch vehicle guidance section interface is 68 x 0.73/0.71 cm (0.288/0.279 in.) holes on a 148.9-cm- (58.63-in.)-dia bolt circle at Sta. 500.213. (See SOW Exhibit 1, Section 6, Figure E1-16.) Delta II Mission-Unique Service: With payload-provided adapter, a mission-unique credit for a baseline two-stage PA is reflected in the vehicle solution price (MUS 9.2). CG vertical limit (above the guidance section interface) for payload mass based on generic load factors = 254 cm (100.0 in.). CG capability may be increased through the mission-specific coupled-loads process.
Spinup/Spindown: No mission requirements specified.	N/A.
Payload envelope: Spacecraft Overall Dimensions in Launch Configuration: dia = 266.5 cm; height = 434 cm.	Delta II 10-ft- (3-m)-dia composite payload fairing with the provision for a 0.64-cm (0.25-in.) GN_2 purge line.
Payload Access: An RF transparent door in the payload fairing is required.	Up to three Delta II standard service payload access doors are available for use by the payload. RF transparency through one of the three standard service payload fairing doors is included as a non-standard service at no additional cost, as long as the location of the payload fairing door satisfies the RF transmission requirement (NSS 2.6). (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors.)
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 1 DC accelerometer, 3 AC accelerometers, 1 pressure transducer, 1 temperature patch. (See Technical Acceptability Volume 1, Section 2.1.5, and SOW Exhibit 1, Section 9, Table E1-34, for a detailed description.)

Exhibit 5
NLS MISSION SOLUTION
CLIN 9—OPTION 6

SPACECRAFT AND MISSION DESCRIPTION

The mission will fly an Earth orbiter designed to capture weather observation data. The mission will last approximately 2 years and will be flown in support of the goals of the NASA Earth Science enterprise. The spacecraft will consist of a data-bus system, which has been demonstrated on prior NOAA missions.

The Boeing solution for this mission is a low-risk Delta II 2320-10 vehicle with a 10-ft- (3-m)-dia composite payload fairing. This mission will launched from the Delta II Western Range launch site. Specific details regarding the solution for all currently identified mission requirements, together with the corresponding rationale for technical acceptability, are described in the accompanying tables.



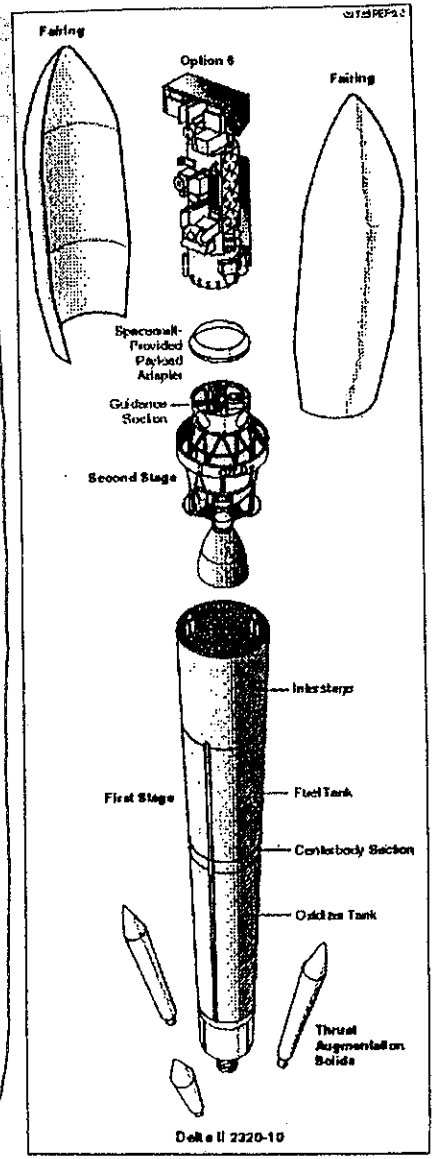
Option 6 Spacecraft

Payload Accommodation Requirements (continued):

Requirement	Solution
Electrical Interface: The spacecraft will provide the spacecraft separation system and will provide a separation command signal to the launch vehicle. The launch vehicle shall provide the power required to fire the spacecraft separation system upon receipt of the separation command signal.	Delta II Mission-Unique Service: Four payload separation command wire harnesses (two new wire harnesses external to the guidance section and two modified wire harnesses internal to the guidance section) will be required in addition to the payload separation wire harnesses normally provided (MUS 9.3). The Delta II/spacecraft separation system shall have the following characteristics: 1. Two simultaneous separation command signals shall be provided redundantly by the spacecraft. 2. Each separation command signal shall be 28+/- 4 Vdc referenced to the spacecraft/launch vehicle interface ground, activated for a minimum of 180 msec and capable of driving a 90-ohm relay coil. 3. Launch vehicle-provided ordnance-firing signals shall be redundant and capable of simultaneously firing a maximum of three NASA standard initiators (NSI) located on the spacecraft-provided payload adapter. 4. Spacecraft separation commands shall have a minimum of two independent inhibits before launch vehicle liftoff. 5. Spacecraft separation must occur within a predetermined period of flight time so that the launch vehicle may continue with mission events after that time of flight. 6. Spacecraft shall provide a positive means of confirming spacecraft separation. 7. Command signals shall be provided on a minimum of two connectors at the spacecraft-to-launch vehicle interface in a manner that will maintain system redundancy. 8. Ordnance firing signals shall be provided on a minimum of two connectors at the spacecraft-to-launch vehicle interface or separation ordnance devices in a manner that will maintain system redundancy. 9. All launch vehicle wiring will use 20 American wire gauge (AWG) twisted shielded pairs of wires with a 100% overbraid, with the shield and overbraid grounded at all connectors. All spacecraft ordnance wiring shall be similar in design. 10. Operation of the spacecraft separation system will be verified by an end-to-end vehicle test. Delta II Standard Service: Two 37-pin payload interface connectors at one location and disconnected by the fairing or 180 deg apart across the interface plane, disconnected at separation; 61-pin connectors may be provided as an NSS. Payload wiring is routed to GSE via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Section 7, Table E1-29, for a detailed description of available electrical interfaces.)

Payload Environmental Requirements:

Requirement	Solution
Thermal: See CLIN 9 DATA SHEET – Figure D1-12: Option 6 Payload Fairing Thermal Environment.	Delta II 10-ft (3-m) fairing payload environment complies with the specified requirement. (See SOW Exhibit 1, Section 8, Figure E1-43A and Exhibit 2 for established ranges and additional info.)
Dynamic Loads: See CLIN 9 DATA SHEET, Table D1-V, Option 6 Flight Loads; Table D1-W, Option 6 Maximum Sinusoidal Vibration Flight Levels at the LV/Spacecraft Interface.	Delta II 2320 environment: A preliminary coupled-loads analysis was prepared under separate task assignment from NASA (Contract NAS5-32933, Task No. 85) for a NOAA/2320-10 mission. This analysis yielded the following load factors, which include a load contribution due to dynamic effects. Because the maximum axial flight loads requirements for this mission are assumed to represent static load levels only, they are met with the Delta 2320-10 launch vehicle standard service. Axial (g) / Lateral (g) Max axial (at MECO): +7.2±0.6 / ±0.1 Max lateral: +2.5 / ±2.4 Max lateral: +0.3 / ±2.4 Maximum quasi-steady acceleration is a function of payload separated mass. (See SOW Exhibit 1, Section 8, Figure E1-37, for maximum values if mass changes.) Maximum expected sinusoidal vibration at the base of the PA: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz), 1.0 g zero to peak (6.2-100 Hz); lateral: 0.7 g zero to peak (5-100 Hz). (See SOW Exhibit 1, Section 8, Table E1-33, for additional information.) Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.



Payload Environmental Requirements (continued):

Requirement	Solution
Dynamic Environments: See CLIN 9 DATA SHEET – Table D1-X: Option 6 Maximum Expected Acoustic Environment Flight Levels within Payload Fairing, Figure D1-11: Option 6 Shock Response at LV/Spacecraft Interface.	The maximum expected acoustic environment requirements for this mission are met with the Delta 2320-10 vehicle. The launch-vehicle-produced shock response environment at the LV/spacecraft interface is consistent with Delta 2320 standard service, as documented in Exhibit 1, Section 8, Figure E1-36. The spacecraft-produced shock response environment at the LV/spacecraft interface is assumed to be the same as that previously encountered for the Delta II 2920-10/Landsat-7 mission.
Radio Frequency: No mission requirements specified.	Delta II Standard Service: 20 V/m across the range of 14 KHz to 40 GHz with 40 V/m between 5.762 and 5.768 GHz. RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section, 8, Table E1-30, for additional information.)
Payload Compartment Venting: See CLIN 9 DATA SHEET – Figure D1-13: Option 6 Ascent Pressure Profile.	Delta II Standard Service: Pressure profiles and depressurization rates comply with specified requirement. (See SOW Exhibit 1, Section 8, Figure E1-22, for established maximum and minimum values.)
Launch Site Facility Environments: Spacecraft GN_2 purge through liftoff.	Delta II Standard Service: Spacecraft GN_2 purge is provided at the Western Range facility. (See Technical Acceptability Volume 1, Sections 5.2.3.1 and 5.2.3.2, and SOW Exhibit 2 for more information.)
Launch Site Facility Environments: Temperature, relative humidity, and filtration. No mission requirements specified.	Delta II Standard Service: Western Range facility environments. (See Technical Acceptability Volume 1, Section 5.2.3, Table 5-9, and SOW Exhibit 2 for established ranges.)
Contamination Control: No mission requirements specified.	Delta II Standard Service: Generic Contamination Control Plan. (See Technical Acceptability Volume 1, Section 5.2.3, and SOW Exhibit 2 for established minimum requirements.)
Safety: The on-board propulsion system will contain hydrazine and will be used to maintain spacecraft orbit.	Space Wing Safety Regulations require that liquid propellants aboard spacecraft be removable from tanks, piping, or other components during any stage of prelaunch processing. (See Technical Acceptability Volume 1, Section 5.2.2.4.5.2, and SOW Exhibit 2.)

Non-standard services required:	
NSS 2.6	RF-Transparent doors (no price increase)
NSS 27.1	Western Range (WR) Launch Incremental

Mission-unique services required:	
MUS 9.1	One-Time Multiple Trajectory/Multiple Azimuth Scope Reduction Credit
MUS 9.2	Baseline 2 Stage PA Credit
MUS 9.3	Spacecraft Commanded S/C Separation

Mission Requirements:

Requirement	Solution
Payload Risk Category: 3.	Delta II 2920-10 Launch Vehicle.
Launch Date: March 2005.	Delta On-Time Launch Service.
Launch Site: No mission requirement specified.	Delta II Eastern Range launch site (CCAFS SLC-17).
Payload Mass: 600 kg; CG is approximately 100 cm above the separation plane. Orbit: Escape; C_3=0.3 km²/sec²; DLA< 28.5 deg; near-Earth (approximately 0.1 AU distant) solar orbit, slightly inclined to the ecliptic. This mission will consist of two separate spacecraft. The spacecraft will provide the separation/dispenser system but will require separation commanding from the launch vehicle. Each spacecraft will require independent placement by the launch vehicle.	Delta II 2920-10 with nine GEM-40 thrust augmentation solid motors and a 10-ft- (3-m)-dia composite payload faking. Includes all the standard services associated with the 2920-10 basic vehicle. Delta II Non-Standard Service: Incremental one-time analysis is required for this mission. Revisions to account for the first use of this vehicle con-figuration with a 10-ft- (3-m)-dia fairing from the ER will be made to the range safety, controls, aerodynamics, loads, and strength analyses (NSS 26.1). The mission scenario would be as follows. After the vehicle has achieved the required mission orbit, the stage/stack (two spacecraft plus dispenser) will be pointed in the desired attitude for the first spacecraft followed by first spacecraft separation. The second stage can then be restarted (if necessary) to change the orbit followed by an additional second stage pointing maneuver to the desired attitude for the second spacecraft deployment. The second spacecraft is then separated followed by a second stage collision/contamination avoidance maneuver (CCAM).
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in Performance and Guidance Accuracy Analysis (CDRL C4-1).
Separation Attitude Accuracy and Rates: The spacecraft will provide the spacecraft separation/dispenser system. No attitude or rate requirements specified.	Delta II standard two-stage preseparation attitude (deg): <0.65 per axis, rate (deg/sec): <0.2 per axis. Delta II Mission-Unique Service: To accommodate the independent placement of two separate spacecraft by the launch vehicle, a mission-unique spacecraft separation analysis will be performed (MUS 10.1).

Payload Accommodation Requirements:

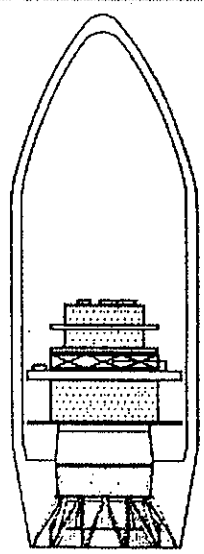
Requirement	Solution
Third-Stage Motor: No mission requirement specified.	Not required.
Payload Interface: This mission will consist of two separate spacecraft. The spacecraft will provide the separation/dispenser system but will require separation commanding from the launch vehicle. Each spacecraft will require independent placement by the launch vehicle.	Delta II Launch Vehicle Interface: The launch vehicle guidance section interface is 68 x 0.73/0.71-cm (0.288/0.279-in.) holes on a 148.9-m-(58.63-in.)-dia inner bolt circle or 154.6-m-(60.871-in.)-dia outer bolt circle at Sta. 500.213. (See SOW Exhibit 1, Section 6, Figure E1-18.) Delta II Mission-Unique Service: Modifications will be required (direct mate adapter interface angles) to accommodate the spacecraft-provided payload dispenser interface to the transportation GSE (MUS 10.2). With payload-provided dispenser a mission-unique credit for a baseline two-stage PA is reflected in the vehicle solution price (MUS 10.3). CG vertical limit (above the guidance section interface) for payload mass based on generic load factors = 254 cm (100.0 in.). CG capability may be increased through the mission-specific coupled loads process.
Spinup/Spindown: Separation spin rate is 0 rpm.	Standard payload deployment from the Delta II launch vehicle second stage is nonspinning, with the attitude accuracy levels indicated above.
Payload envelope: Spacecraft Overall Dimensions in Launch Configuration: dia = 272 cm; height = 200 cm.	Delta II 10-ft (3-m)-dia composite payload fairing.
Payload Access: No mission requirements specified.	Up to three Delta II standard service payload access doors are available for use by the payload. (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors.)
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 1 DC accelerometer, 3 AC accelerometers, 1 pressure transducer, 1 temperature patch. (See Technical Acceptability Volume 1, Section 2.1.5, and SOW Exhibit 1, Section 9, Table E1-34, for a detailed description.)

Exhibit 5
NLS MISSION SOLUTION
CLIN 10—OPTION 7

SPACECRAFT AND MISSION DESCRIPTION

This space technology mission will consist of two separate spacecraft that will be used to test the techniques of interferometry and formation flying in space. The revolutionary techniques demonstrated during this experimental flight will be used by such NASA missions planned for the next few decades as the Space Interferometer Mission, the Terrestrial Planet Finder, and the Terrestrial Planet Imager.

The Boeing solution for this mission is a low-risk Delta II 2920-10 vehicle with a 10-ft- (3-m)-dia composite payload fairing. This mission will be launched from the Delta II Eastern Range launch site. Specific details regarding the solution for all currently identified mission requirements together with the corresponding rationale for technical acceptability, are described in the accompanying tables.



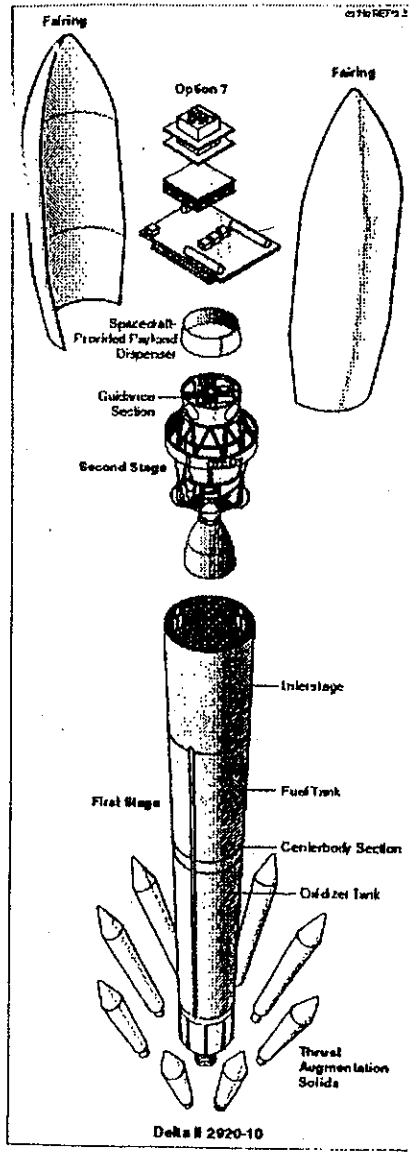
Option 7 Spacecraft

Payload Accommodation Requirements (continued):

Requirement	Solution
Electrical Interface: The spacecraft will provide the separation/ dispenser system but will require separation commanding from the launch vehicle. Each spacecraft will require independent placement by the launch vehicle.	Delta II Mission-Unique Service: The Delta vehicle will provide the power and separation signal required to activate the spacecraft-provided separation system for each spacecraft. Four payload separation wire harnesses (two wire harnesses external and two wire harnesses internal to the guidance section) will be required in addition to the four payload-separation wire harnesses normally provided for a single spacecraft (MUS 10.4). Each Delta II/spacecraft separation system shall have the following characteristics: 1. Launch vehicle-provided ordnance-firing signals shall be redundant and capable of simultaneously firing a maximum of three NASA standard initiators (NSI) located on the spacecraft-provided payload dispenser. 2. Spacecraft shall provide a positive means of confirming spacecraft separation. 3. Ordnance firing signals shall be provided on a minimum of two connectors at the spacecraft-to-launch vehicle interface or separation ordnance devices in a manner that will maintain system redundancy. 4. All launch vehicle wiring will use 20 AWG twisted shielded pairs of wires with a 100% overbraid, with the shield and overbraid grounded at all connectors. All spacecraft ordnance wiring shall be similar in design. 5. Verification of the separation circuitry for each spacecraft will be performed by an end-to-end vehicle test. Delta II Standard Service: Two 37-pin payload interface connectors at one location and disconnected by the fairing or 180 deg apart across the interface plane, disconnected at separation; 61-pin connectors may be provided as an NSS. Payload wiring is routed to GSE via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Section 7, E1-29, for a detailed description of available electrical interfaces.)

Payload Environmental Requirements:

Requirement	Solution
Thermal: No mission requirements specified.	Delta II 10-ft (3-m) fairing payload environment: (See SOW Exhibit 1, Section II, Figure E1-43A and Exhibit 2 for established ranges and additional information.)
Dynamic Loads: No mission requirements specified.	Delta II 2920-10 environment: payload design CG limit load factors: (See SOW Exhibit 1 Section 8, Table E1-31.) Axial (g) / Lateral (g) Max axial (at MECO): 7.7 ± 0.6 / ±0.2 Max lateral: +2.8 / ±4.5 Max lateral: -0.2 / ±4.5 Maximum quasi-steady acceleration is a function of payload separated mass. (See SOW Exhibit 1, Section 8, Figure E1-37, for maximum values if mass changes.) Maximum expected sinusoidal vibration at the base of the PA: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz), 1.0 g zero to peak (6.2-100 Hz); lateral: 0.7 g zero to peak (5-100 Hz). (See SOW Exhibit 1, Section 8, Table E1-33, for additional information.) Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.
Dynamic Environments: No mission requirements specified.	Delta II 2920-10 maximum flight level payload acoustic environment: OASPL = 140.8 dB. (See SOW Exhibit 1, Section 8, Figure E1-31, for maximum levels across the frequency spectrum.) The launch-vehicle-produced shock response environment at the LV/spacecraft interface is consistent with Delta 2320 standard service as documented in SOW Exhibit 1, Section 8, Figure E1-36.
Radio Frequency: No mission requirements specified.	Delta II Standard Service: 20 V/m across the range of 14 KHz to 40 GHz with 40 V/m between 5.752 and 5.768 GHz. RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section 8, Table E1-30, for additional information)



Delta II 2920-10

Payload Environmental Requirements (continued):

Requirement	Solution
Payload Compartment Venting: No mission requirements specified.	Delta II Standard Service: Pressure profiles and depressurization rates. (See SOW Exhibit 1, Section 8, Figure E1-22, for established maximum and minimum values.)
Launch Site Facility Environments: Temperature, relative humidity, and filtration. No mission requirements specified.	Delta II Standard Service: Eastern Range Facility Environments. (See Technical Acceptability Volume 1, Section 5.2.3, Table 5-9, and SOW Exhibit 2, for established ranges.)
Contamination Control: No mission requirements specified.	Delta II Standard Service: Generic Contamination Control Plan. (See Technical Acceptability Volume 1, Section 5.2.3, and SOW Exhibit 2 for established minimum requirements.)

Non-standard services required:	
NSS 26.1	Category "1" Core Vehicle Analysis (Medium)

Mission-unique services required:	
MUS 10.1	Spacecraft Separation Analysis
MUS 10.2	Direct Mate Adapter Angles Modification
MUS 10.3	Baseline 2 Stage PA Credit
MUS 10.4	Dual Payload Separation Command System

Mission Requirements

Requirement	Solution
Payload Risk Category: 3.	Delta II 2420-10 Launch Vehicle.
Launch Date: January 2006.	Delta On-Time Launch Service.
Launch Site: Vandenberg Air Force Base (VAFB). Payload Processing: Commercial.	Delta II Non-Standard Service: Delta II Western Range launch site: VAFB Space Launch Complex 2 (SLC-2). NSS 27.1 Western Range (WR) Launch Incremental. Delta II Non-Standard Service: Payload processing facility at Western Range. (NSS 19.2)
Payload Mass: 1650 kg (wet, estimate as of August 2001). Orbit: 824 km circular, sun synchronous. Descending Node Crossing Time = 10:30 am ±10 min.	Delta II 2420-10 with four GEM-40 thrust augmentation solid motors and a 10-ft (3-m)-dia aluminum payload fairing. Includes all the standard services associated with the 2420-10 basic vehicle.
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in Performance and Guidance Accuracy Analysis (CDRL C4-1).
Separation Attitude Accuracy and Rates: No mission requirements specified.	Delta II vehicle standard two-stage low-lip-off payload deployment for the 6915 or 6306 payload attach fitting: attitude (deg): < 3.0 (per axis), rate (deg/sec): < 0.25 (per axis). (See statement of work (SOW) Exhibit 1, Section 4, Table E1-28 and Exhibit 2).

Payload Accommodation Requirements

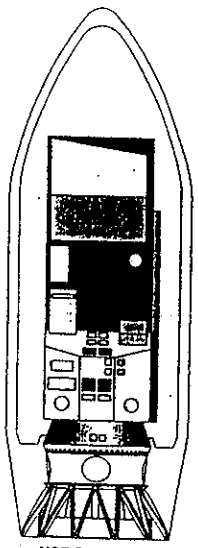
Requirement	Solution
Third-Stage Motor: No mission requirement specified.	Not required.
Payload Interface: No mission requirements specified.	One of two available two-stage Delta II PAFs: (See SOW, Exhibit 1, Section 6, Figure E1-19): 1. Delta II Standard Service: 6915 PAF, which includes separation nut system, secondary latch, and retro system, CG vertical limit (above separation plane) for payload mass based on generic load factors = 228.6 cm (90 in.). 2. Delta II Non-Standard Service: 6306 PAF, which includes separation clamp band, secondary latch, and retro system, CG vertical limit (above separation plane) for payload mass based on generic load factors = 251.5 cm (99 in.). (NSS 3.2.1) CG capability may be increased through the mission-specific coupled-loads process.
Spinup/Spindown: No mission requirements specified.	Not Required.
Payload Envelope: Spacecraft overall dimensions in launch configuration will fit in a 9.5-ft fairing envelope.	Delta II 10-ft (3-m)-dia composite payload fairing with provision for a 0.64-cm (0.25-in.) GN_2 purge line.
Payload Access: The launch vehicle shall have one or more access doors through the shroud for spacecraft launch closeout operations. No RF window required.	Up to three Delta II standard service payload access doors are available for use by the payload. (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors.)
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 1 DC accelerometer, 3 AC accelerometers 1 pressure transducer, 1 temperature patch. (See SOW Exhibit 1, Section 9, Table E1-34, for a detailed description.)

Exhibit 5
NLS MISSION SOLUTION
CLIN 14—NPP

SPACECRAFT AND MISSION DESCRIPTION

The NPP mission will provide NASA with continuation of global change observations after Earth Observing System (EOS) Terra and Aqua, including atmospheric temperature and humidity profiles, sea surface temperatures, land and ocean biological productivity, and cloud and aerosol properties. The mission lifetime is 5 years.

The Boeing solution for this mission is the Delta II 2420-10 launch vehicle. This mission will be launched from the Delta II Western Range launch site. Specific details regarding the solution for all currently identified mission requirements, together with the corresponding rationale for technical acceptability, are described in the accompanying tables.



NPP Spacecraft

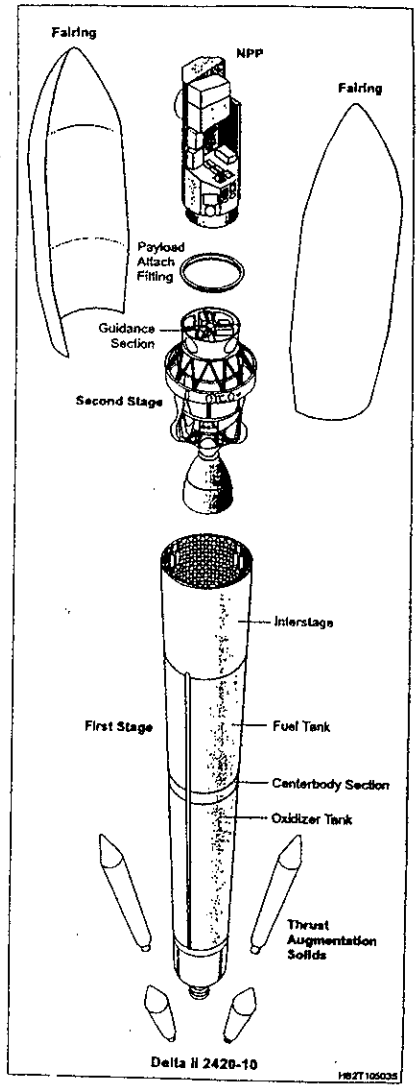
HBZT109034

Payload Accommodation Requirements (continued)

Requirement	Solution
Electrical Interfaces:	
Prior to launch and during ascent, the launch vehicle shall transmit satellite 1 Kbps health and safety S-band telemetry with ~5 watt transmitter via a launch vehicle provided re-rad system. The spacecraft data will be processed and distributed on the ground using standard launch vehicle ground stations.	Delta II Standard Service: Two 37-pin payload interface connectors at one location on the spacecraft and disconnected by fairing; 61-pin connectors may be provided as a non-standard service. Payload wiring is routed to the spacecraft GSE via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Section 7, Table E1-29, for a detailed description of available electrical interfaces).
While the satellite is on-stand, the launch site shall provide a capability for commanding the satellite and receiving telemetry from the satellite via a launch vehicle umbilical connection.	Delta II Mission-Unique Service: A re-rad system consisting of a fairing internal antenna and bracket, coaxial cable, and fairing re-radiating antenna will be provided by the launch vehicle to allow the spacecraft to re-radiate prior to launch and during launch vehicle ascent. (MUS 14.1) The spacecraft induced RF levels within the fairing will be evaluated during the integration process for acceptability. Modifications, if required to accommodate the SC-induced RF levels, are not bid in this mission unique service.
After fairing separation the satellite shall transmit telemetry via the same S-band telemetry transmitter(s) with no special launch vehicle pointing requirements.	Boeing's solution assumes the telemetry link from the MST is to Building 836 and KSC will provide and check out the DAS-6 repeater, MST antenna, and Building 836 telemetry support GSE. Boeing will support NASA on-pad end-to-end testing from the SC or SC simulator to Building 836 through the re-radiating system including the MST dish. Boeing will perform the end-to-end link analysis from the MST dish to Building 836. It is assumed that positive link margins will be attainable for the MST in place and rolled back. The ascent telemetry link margin will be optimized with a goal of positive link margin through payload fairing jettison. Boeing will perform a coupling loss test with a representative NASA-provided SC antenna and LV, assumed to validate the design concept. Dynamic environments analysis will be required to verify that selected antennas will be qualified to predicted environments. No antenna qualification or re-qualification effort is included. The telemetry downlink re-rad system will utilize two additional antennas: one internal to the PLF and one external to the PLF. Assumes station locations can be selected to prevent interference within the PLF with the PLF pickup antenna bracket that is mounted adjacent to the SC antenna and such that the PLF transmitting antenna is not directly in line with MST deck plates.
The launch vehicle shall supply redundant positive indication of satellite separation to the satellite.	Delta II Standard Service: To monitor the vehicle/payload separation for Delta II, a separation switch can be installed in the payload. This is based on the assumption that the spacecraft requires real-time indication, thus the switch must be installed in the spacecraft and the signal received by the spacecraft. The configuration must be coordinated with the Delta Program Office. (See SOW, Exhibit 1, Section 7.0.)
The launch vehicle shall be supplied with an onboard video camera and video transmission for ground recording of the launch vehicle exterior view during ascent.	Delta II Non-Standard Services: A single launch vehicle externally mounted camera and its near-real-time video will be provided in accordance with the non-standard service referenced. The mounting location of the camera can either be on the first-stage centerbody door (either Quad I/II or III/IV) and looking aft or the location can be on the second-stage miniskirt and looking aft. Note: this capability requires that the launch/observations be in daylight. (NSS 10.1)

Payload Environmental Requirements

Requirement	Solution
Thermal: No mission requirements specified.	Delta II 10-ft (3-m) fairing payload environment. (See SOW Exhibit 1, Section 8, Figure E1-43A and Exhibit 2 for established ranges and additional information.)
Dynamic Loads: No mission requirements specified.	Delta II 2420 environment: payload design CG limit load factors. Based on 6915 PAF. (See SOW Exhibit 1, Section 8, Table E1-31.) Axial (g) / Lateral (g) Max axial (at MECO): 7.2 ± 0.6 / ±0.2 Max lateral: +2.8 / ±3.0 Max lateral: -0.2 / ±3.0 Maximum quasi-steady acceleration is a function of payload separated mass. (See SOW Exhibit 1, Section 8, Figure E1-37, for maximum values if mass changes.) Maximum expected sinusoidal vibration at the base of the PAF: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz), 1.0 g zero to peak (6.2-100 Hz); lateral: 0.7 g zero to peak (5-100 Hz). (See SOW Exhibit 1, Section 8, Table E1-33, for additional information.) Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.



Payload Environmental Requirements (continued)	
Requirement	**Solution**
Dynamic Environments: No mission requirements specified.	Delta II 2420-10 maximum flight level payload acoustic environment: overall sound pressure level (OASPL) = 139.9 dB. (See SOW Exhibit 1, Section 8, Figure E1-29, for maximum levels across the frequency spectrum. Delta II 6915 PAF maximum flight-level payload interface shock response spectrum: 100 g (100-350 Hz), +12.3 dB/octave (350-1700 Hz), 2500 g (1700 Hz), +5.6 dB/octave (1700-4000 Hz), 5500g (4000-5000 Hz), -8.6 dB/ octave (5000-10000 Hz), 2000 g (10000 Hz). Delta II 6306 PAF maximum flight-level payload interface shock response spectrum: 100 g (100 Hz), +9.8 dB/octave (100-800 Hz), 3000 g (800-3000 Hz). (See SOW Exhibit 1, Section 8, Figure E1-35, for additional information.)
Radio Frequency: No mission requirements specified. After fairing separation the satellite shall transmit telemetry. See Electrical Interfaces, above.	Delta II Standard Service: 20 V/m across the range of 14 KHz to 40 GHz with 40 V/m between 5.762 and 5.768 GHz. RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section 8, Table E1-30, for additional information.)
Payload Compartment Venting: No mission requirements specified.	Delta II Standard Service: pressure profiles and depressurization rates. (See SOW Exhibit 1, Section 8, Figure E1-22, for established maximum and minimum values.)
Launch Site Facility Environments: A continuous clean and dry nitrogen purge (up to TBD cc/minute) shall be supplied to the satellite for instrument cleanliness via the launch vehicle while on stand up through liftoff.	Delta II Non-Standard Service: Spacecraft GN_2 purge is provided at the Western Range facility. (See SOW Exhibits 2 and 3 for more information.) (NSS 27.1, See Note 4)
Launch Site Facility Environments: Temperature, relative humidity, and filtration. HEPA-filtered, air-conditioned, Class 10,000 clean air to be verified at the duct outlet maintaining a positive pressure at all times. Air-conditioned class 10,000 clean air conditions shall be maintained at the satellite level work area while the satellite activities are conducted on stand. The launch site shall supply an uninterruptible power supply (UPS) to maintain electrical power and air conditioning to the satellite in the event of power outage.	Delta II Non-Standard Service: Western Range facility environments. (See SOW, Exhibits 2 and 3 for established ranges.) (NSS 27.1, See Note 4) Delta II Non-Standard Service: A mission-specific contamination control plan will be developed to implement a Class 10,000 payload environment, per FED STD 209E, from the beginning of payload integration processing at the pad until launch. (NSS: 11.1) The spacecraft customer should protect all sensitive spacecraft surfaces where possible prior to installation into the transportation canister through encapsulation in the payload fairing at the launch pad. A commercial Class 100,000 payload processing facility environment will be provided. The transportation canister will be continuously purged with Grade A GN_2 per MIL-P-24701C for transport to the pad. Purge during hoisting can be provided if required. Payload environment will be maintained by using the payload contamination shroud and Class 10,000 fairing air while the spacecraft is in the Mobile Service Tower white room except during spacecraft transportation can removal and fairing installation. During fairing installation, personnel limits will be imposed to minimize particulates utilizing Class 10,000 protocol. Particle counters in the payload fairing air-conditioning air stream and in the white room will be utilized to verify contamination levels are maintained. Fairing will be cleaned to Boeing level VC-3. VAFB has a UPS for electrical power for spacecraft GSE to the spacecraft in the Electrical Equipment Building (EEB). Backup power generators are also available to supply electrical power to other electrical equipment, including air conditioning (A/C) systems. A/C systems are not connected to the UPS system, but to the backup power generators that will re-establish power within 30 sec.
Contamination Control: See Launch Site Facility Environments, above.	See Launch Site Facility Environments, above.
Safety: A hydrazine leak alarm system will be supplied at the launch site. A low oxygen alarm system will be supplied at the launch site.	Delta II Standard Service: Boeing has an existing vapor detection alarm system at VAFB with a capability to detect 3 parts per million (ppm) gross leak. Also, a portable interscan is manually used prior to entering an area to detect lower concentrations for personnel limits. Delta II Standard Service: All confined spaces and areas have oxygen monitors with visual indicators and alarm sets.

Non-Standard Services Required
NSS 10.1 Launch Vehicle Mounted Cameras
NSS 11.1 Enhanced Fairing Environment
NSS 19.2 Ground Processing Facilities Payloads at Western Range.
NSS 27.1 Western Range (WR) Launch Incremental

Mission Requirements

Requirement	Solution
Payload Risk Category: 3.	Delta II 2925H-9.5 Launch Vehicle.
Launch Date: May 2006.	Delta On-Time Launch Service: Assurance in meeting planetary launch window periods is enhanced by building in contingency time including hardware scheduling, backing, and early mission checkout. Instantaneous launch windows are met with multiple flight trajectories for launch windows and selective use of built-in holds for issue resolution during the day of launch countdown. (See SOW Exhibit 2 for an additional description.)
Launch Site: Cape Canaveral Air Force Station (CCAFS). Payload Processing: Commercial.	Delta II Eastern Range launch site: CCAFS, Space Launch Complex 17 (SLC-17). Delta II Non-Standard Service: Astrotech Payload Processing Facility. (NSS 19.1)
Payload Mass: 1105 kg. Orbit: Escape; C_3 = 9.6 km^2/sec^2, declination = -24.5.	Delta II 2925H-9.5 with nine GEM-46 thrust augmentation solid motors and a 9.5-ft (2.9-m)-dia payload fairing. Includes all the standard services associated with the 2925-9.5 basic vehicle. Delta II Non-Standard Service: Replace standard GEM-40 solid motors with higher performance GEM-46 solid motors (NSS 1.1)
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in the Performance and Guidance Accuracy Analysis (CDRL C4-1).
Separation Attitude Accuracy and Rates: 0.0 ± 2 rpm spin rate at separation.	Delta II vehicle standard third-stage (despun) payload deployment: attitude <10.0 deg, rate <7.0-deg/sec (transverse), 0.0 ±5 rpm (roll). (See SOW Exhibit 1, Section 4, Table E1-28, and Exhibit 2.) The 0.0±2 rpm spin rate uncertainty requirement can be satisfied assuming spacecraft "measured" roll moment of inertia with a 1% or better 3-sigma accuracy is provided.

Payload Accommodation Requirements

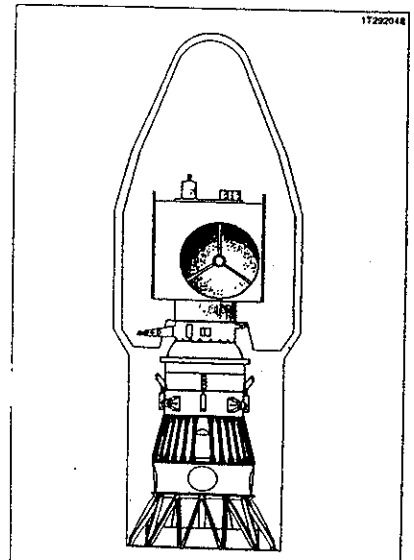
Requirement	Solution
Third-Stage Motor required to achieve the escape orbit for this mission.	STAR™48B motor, including spin table.
Payload Interface: No mission requirements specified.	Delta II 3712C payload attach fitting (PAF), which includes a separation clamp band system, a yo-yo despin system, a nutation control system (NCS), and extended mission thermal modifications to accommodate mission lengths of up to 7,000 sec. (See SOW Exhibit 1, Section 6, Figure E1-19.) CG vertical limit (above separation plane) for payload mass based on generic load factors = 94 cm (37 in.). CG capability may be increased through the mission-specific coupled-loads process.
Spinup/Spindown: Third-stage burn spin rate = 60 rpm, yo-yo de-spin to 0.0 ±2 rpm.	Delta II standard spinup of the third stage and payload to stabilize the STAR™48B motor will be accomplished with the Delta II spin table and spin rocket motors. Delta II vehicle standard third-stage (despun) payload deployment: 0.0 ±5 rpm (roll). (See SOW Exhibit 1, Section 4, Table E1-28 and Exhibit 2). Yo-yo despin system includes a nutation control system to minimize velocity/attitude pointing errors and coning conditions during the time from third-stage ignition to yo-yo despin initiation. The 0.0±2 rpm spin rate uncertainty requirement can be satisfied assuming spacecraft "measured" roll moment of inertia with a 1% or better 3-sigma accuracy is provided.
Payload Envelope: The spacecraft fits inside the static envelope of a 9.5-ft fairing.	Delta II 9.5-ft (2.9-m)-dia aluminum payload fairing.
Payload Access: No mission requirements specified.	Up to three Delta II standard service payload access doors are available for use by the payload. (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors.)
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 3 DC accelerometers, 1 pressure transducer, 1 temperature patch. (See SOW Exhibit 1, Section 9, Table E1-34, for a detailed description.)
Electrical Interface: Two standard launch vehicle-provided 37-pin connectors to provide real-time telemetry through RS-422 interfaces with the CEU uplink and downlink cards.	Delta II Standard Service: Two 37-pin payload interface connectors 180 deg apart across the interface plane, disconnected upon separation; 61-pin connectors may be provided as an non-standard service. Payload wiring is routed to the GSE via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Section 7, Table E1-29, for a detailed description of available electrical interfaces.)

Exhibit 5
NLS MISSION SOLUTION
CLIN 15—Dawn

SPACECRAFT AND MISSION DESCRIPTION

The Dawn mission will make a 9-year journey to orbit the two most massive asteroids known, Vesta and Ceres, both located in the main asteroid belt between Mars and Jupiter. Dawn will improve our understanding of how planets formed during the earliest epoch of the solar system. The mission will determine these pre-planets' physical attributes, such as shape, size, mass, craters, and internal structure, and study more complex properties such as composition, density, and magnetism.

The Boeing solution for these missions is a Delta II 2925H-9.5 launch vehicle. This mission will be launched from the Delta II Eastern Range launch site. Specific details regarding the solution for all currently identified mission requirements, together with the corresponding rationale for technical acceptability, are described in the accompanying tables.

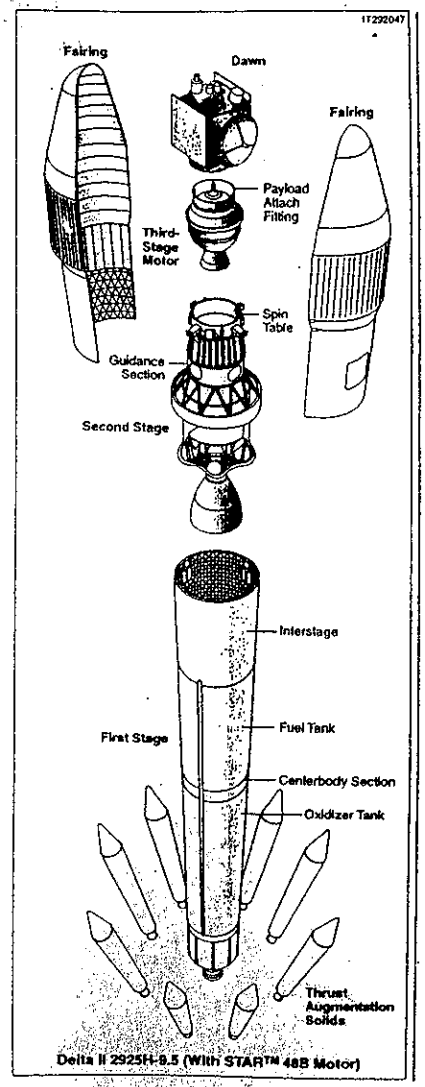


Dawn Spacecraft

Payload Environmental Requirements

Requirement	Solution
Thermal: No mission requirements specified.	Delta II 9.5-ft (2.9-m) fairing and STAR™48B third-stage payload environments. (See SOW Exhibit 1, Section 8, Figures E1-43A and E1-43C and Exhibit 2 for established ranges and additional information.)
Dynamic Loads: No mission requirements specified.	Delta II 2925H environment: Payload design CG limit load factors. (See SOW Exhibit 1, Section 8, Table E1-31.) Axial (g) / Lateral (g) Max axial (at MECO) 6.4 ± 0.6 / ±0.2 Max lateral +2.8 / ±3.5 Max lateral -0.2 / ±3.5 Maximum quasi-steady acceleration is a function of payload separated mass. (See SOW Exhibit 1, Section 8, Figures E1-37 and E1-43, for maximum values if mass changes.) Maximum expected sinusoidal vibration at the base of the PAF: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz), 1.0 g zero to peak (6.2-100 Hz); lateral: 0.7 g zero to peak (5-100 Hz). (See SOW Exhibit 1, Section 8, Table E1-33, for additional information.) Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.
Dynamic Environments: No mission requirements specified.	Delta II 2925H-9.5 maximum flight level payload acoustic environment: OASPL = 141.8 dB. (See SOW Exhibit 1, Section 8, Figure E1-30, for maximum levels across the frequency spectrum. Delta II 3712 PAF with 3300-lb preload maximum flight-level payload interface shock response spectrum: 40 g (100 Hz), +9.2 dB/octave (100-1500 Hz), 2500 g (1500-3000 Hz). (See SOW Exhibit 1, Section 8, Figure E1-35, for additional information.)
Radio Frequency: No mission requirements specified.	Delta II Standard Service: 20 V/m across the range of 14 KHz to 40 GHz with 40 V/m between 2.2 GHz and 2.3 GHz and between 5.762 and 5.768 GHz. RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section 8, Table E1-30, for additional information.)
Payload Compartment Venting: No mission requirements specified.	Delta II Standard Service: Pressure profiles and depressurization rates. (See SOW Exhibit 1, Section 8, Figure E1-22, for established maximum and minimum values.)
Launch Site Facility Environments: Temperature, relative humidity, and filtration. Class 10,000 clean or better.	Delta II Standard Service: Eastern Range facility environments: (See SOW Exhibit 2 for established ranges.) Delta II Non-Standard Service: Provide a Class 10,000 payload environment at the commercial payload processing facility. (NSS 19.1.1) Delta II Non-Standard Service: A mission-specific contamination control plan will be developed to implement a Class 10,000 payload environment, per FED STD 209E, from the beginning of payload integration processing at the pad until launch. (NSS 11.11) The spacecraft customer should protect all sensitive spacecraft surfaces where possible prior to installation into the transportation canister through encapsulation in the payload fairing at the launch pad. A commercial Class 10,000 payload processing facility environment will be provided. The transportation canister will be continuously purged with Grade A GN2 per MIL-P-24701C for transport to the pad. Purge during hoisting can be provided if required. Payload environment will be maintained by using the payload contamination shroud and Class 10,000 fairing air while the spacecraft is in the Mobile Service Tower white room except during spacecraft transportation can removal and fairing installation. During fairing installation personnel limits will be imposed to minimize particulates utilizing Class 10,000 protocol. Particle counters in the payload fairing air-conditioning air stream and in the white room will be utilized to verify contamination levels are maintained. Fairing will be cleaned to Boeing level JC-3.
Contamination Control: See Launch Site Facility Environments, above.	See Launch Site Facility Environments, above.

Non-Standard Services Required
NSS 1.1 Heavy vehicle upgrade
NSS 11.1: Enhanced Fairing Environment
NSS 19.1: Ground Processing Facilities Payloads at Eastern Range
NSS 19.1.1 Enhanced Payload Processing Environment Increment (ER)



Delta II 2925H-9.5 (With STAR™ 48B Motor)

Mission Requirements	
Requirement	**Solution**
Payload Risk Category: 3.	Delta II 2320-10 Launch Vehicle.
Launch Date: July 2006.	Delta On-Time Launch Service.
Launch Site: Vandenberg Air Force Base (VAFB).	Delta II Non-Standard Service: Delta II Western Range launch site: VAFB Space Launch Complex 2 (SLC-2). NSS 27.1, Western Range (WR) Launch Incremental.
Payload Processing: Commercial.	Delta II Non-Standard Service: Payload processing facility at Western Range. (NSS 19.2)
Payload Mass: The approximate spacecraft mass is 1050 kg. Orbit: 1350 km circular; inclination 60 deg.	Delta II 2320-10 with three GEM-40 thrust augmentation solid motors and a 10-ft-(3-m)-dia composite payload fairing. Includes all the standard services associated with the 2320-10 basic vehicle.
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in the Performance and Guidance Accuracy Analysis (CDRL C4-1).
Separation Attitude Accuracy and Rates: No mission requirements specified.	Delta II vehicle standard two-stage low tip-off payload deployment for the 6915, 6306, or 6019 payload attach fitting: attitude (deg): < 3.0 (per axis); rate (deg/sec), <0.25 (per axis). (See SOW Exhibit 1, Section 4, Table E1-28 and Exhibit 2.)
Parts of the spacecraft will be classified in nature and clearances may be required by key players on the team to attend design/other technical reviews.	Key members of our mission integration team will obtain or already have clearances necessary to attend design/other technical reviews as appropriate. No effort for document control, classified engineering analysis, or special facilities is included as part of the solution to this mission. Any effort beyond attendance at a few design/other technical reviews would be out of scope and may result in additional cost to NASA.

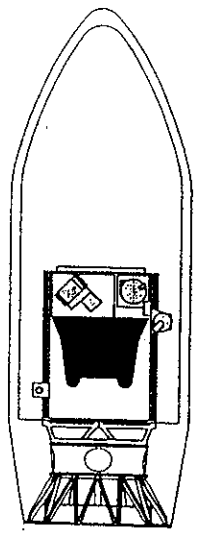
Payload Accommodation Requirements	
Requirement	**Solution**
Third-Stage Motor: No mission requirements specified.	Not required.
Payload Interface: No mission requirements specified.	One of three available two-stage Delta II payload attach fittings (PAF). (See SOW Exhibit 1, Section 6, Figure E1-19.) 1) Delta II Standard Service: 6915 PAF, which includes separation nut system, a secondary latch, and retro system. CG vertical limit (above separation plane) for payload mass based on generic load factors > 254 cm (100.0 in.). 2) Delta II Non-Standard Service: 6306 PAF, which includes separation clampband, a secondary latch, and retro system. CG vertical limit (above separation plane) for payload mass based on generic load factors > 254 cm (100.0 in.). (NSS 3.2.1) 3) Delta II Non-Standard Service: 6019 PAF, which includes separation nut system, secondary latch, and retro system. CG vertical limit (above separation plane), for payload mass based on generic load factors > 254 cm (100.0 in.). (NSS 3.2.2) Generic CG capability of available PAFs exceeds overall height of spacecraft provided.
Spinup/Spindown: No mission requirements specified.	Not required.
Payload Envelope: Approximately 89 in. (X) x 59 in. (Y) x 59 in. (Z).	Delta II 10-ft- (3-m)-dia composite payload fairing.
Payload Access: No mission requirements specified.	Up to three Delta II standard service payload access doors are available for use by the payload. (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors.)

Exhibit 5
NLS MISSION SOLUTION
CLIN 16–SBIRS Low 1

SPACECRAFT AND MISSION DESCRIPTION

The Space Based Infrared System (SBIRS) Low mission is a technology demonstration mission in support of the new National Missile Defense strategy. This mission will demonstrate the new technology that is targeted for use on the low Earth-orbiting component of the SBIRS overall architecture. The purpose of the SBIRS Low satellites will be to augment global missile defense missions by observing and reporting ballistic missiles in all phases of their flight.

The Boeing solution for this mission is the Delta II 2320-10 vehicle. This mission will be launched from the Delta II Western Range launch site. Specific details regarding the solution for all currently identified mission requirements, together with the corresponding rationale for technical acceptability, are described in the accompanying tables.



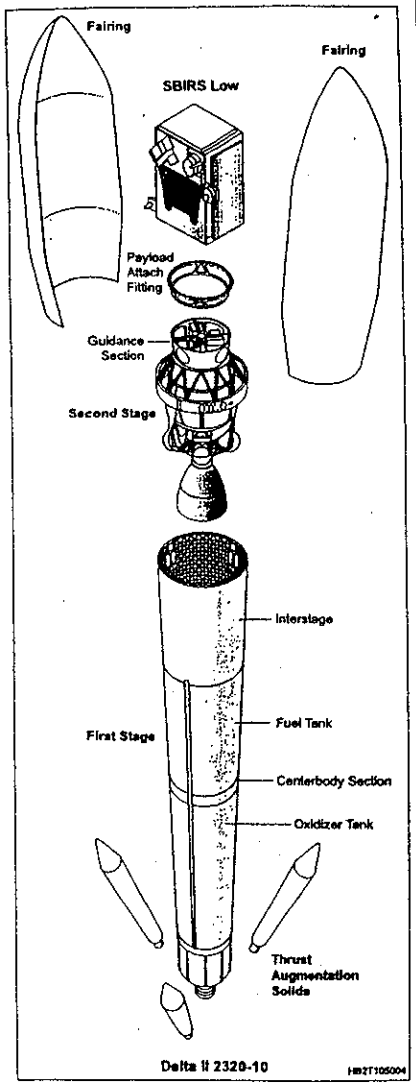
SBIRS Low Spacecraft

H82T100003

Payload Accommodation Requirements (continued)	
Requirement	**Solution**
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 1 DC accelerometer, 3 AC accelerometers, 1 pressure transducer, 1 temperature patch. (See SOW Exhibit 1, Section 9, Table E1-34, for a detailed description.)
Electrical Interface: No mission requirements specified.	Delta II Standard Service: Two 37-pin payload interface connectors at one location and disconnected by the fairing; 61-pin connectors may be provided as a non-standard service. Payload wiring is routed to GSE via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Section 7, Table E1-29, for a detailed description of available electrical interfaces.)

Payload Environmental Requirements	
Requirement	**Solution**
Thermal: No mission requirements specified.	Delta II 10-ft (3-m) fairing payload environment: (See SOW Exhibit 1, Section 8, Figure E1-43A and Exhibit 2 for established ranges and additional information.)
Dynamic Loads: No mission requirements specified.	Delta II 2320 environment: Payload design CG limit load factors. Based on 6915 PAF. (See SOW Exhibit 1, Section 8, Table E1-31.) Axial (g) / Lateral (g) Max axial (at MECO) 7.3 ± 0.6 / ± 0.2 Max lateral +2.8 / ± 3.5 Max lateral -0.2 / ± 3.5 Maximum quasi-steady acceleration is a function of payload separated mass. (See SOW Exhibit 1, Section 8, Figure E1-37, for maximum values if mass changes.) Maximum expected sinusoidal vibration at the base of the PAF: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz), 1.0 g zero to peak (6.2-100 Hz); lateral 0.7 g zero to peak (5-100 Hz). (See SOW Exhibit 1, Section 8, Table E1-33, for additional information.) Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.
Dynamic Environments: No mission requirements specified.	Delta II 2320-10 maximum flight level payload acoustic environment: OASPL = 139.4 dB. (See SOW Exhibit 1, Section 8, Figure E1-29, for maximum levels across the frequency spectrum.) Delta II 6915 and 6019 PAF maximum flight-level payload interface shock response spectrum: 100 g (100-350 Hz), +12.3 dB/octave (350-1700 Hz), 1500 g (1700 Hz), +5.6 dB/octave (1700-4000 Hz), 5500g (4000-5000 Hz), -8.8 dB/octave (5000-10000 Hz), 2000 g (10000 Hz). Delta II 6306 PAF maximum flight-level payload interface shock response spectrum: 100 g (100 Hz), +9.8 dB/octave (100-800 Hz), 3000 g (800-3000 Hz). (See SOW Exhibit 1, Section 8, Figure E1-35, for additional information.)
Radio Frequency: No mission requirements specified.	Delta II Standard Service: 20 V/m across the range of 14 KHz to 40 GHz with 40 V/m between 5.752 and 5.768 GHz. RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section 8, Table E1-30, for additional information.)
Payload Compartment Venting: No mission requirements specified.	Delta II Standard Service: Pressure profiles and depressurization rates: (See SOW Exhibit 1, Section 8, Figure E1-22, for established maximum and minimum values.)
Launch Site Facility Environments: No mission requirements specified.	Delta II Non-Standard Service: Western Range facility environments. (See SOW Exhibits 2 and 3 for established ranges.) (NSS 27.1, see Note 4.)
Launch Site Facility Environments: Temperature, relative humidity, and filtration. No mission requirements specified.	Delta II Non-Standard Service: Western Range facility environments. (See SOW Exhibits 2 and 3 for established ranges.) (NSS 27.1, see Note 4.)
Contamination Control: No mission requirements specified.	Delta II Standard Service: Generic contamination-control plan. (See SOW Exhibit 2 for established minimum requirements.)

Non-Standard Services Required
NSS 19.2 Ground Processing Facilities Payloads at Western Range
NSS 27.1 Western Range (WR) Launch Incremental



Mission Requirements	
Requirement	**Solution**
Payload Risk Category: 3.	Delta II 2920H-10 Launch Vehicle.
Launch Date: September 2006.	Delta On-Time Launch Service.
Launch Site: Cape Canaveral Air Force Station (CCAFS). Payload Processing Facility: Commercial.	Delta II Eastern Range (ER) launch site: CCAFS, Space Launch Complex (SLC-17). Delta II Non-Standard Service: Astrotech Payload Processing Facility. (NSS 19.1)
Payload Mass: 4460 kg. Orbit: 550 km circular; inclination 28.5 deg.	Delta II 2920H-10 with nine GEM-46 thrust augmentation solid motors and a 10-ft (3-m)-dia composite payload fairing. Includes all the standard services associated with the 2920-10 basic vehicle. Delta II Non-Standard Service: Replace standard GEM-40 solid motors with higher performance GEM-46 solid motors. (NSS 1.1) Delta II-Non-Standard Service: Because this mission is the first use of the 2920H-10 vehicle configuration from the Eastern Range (ER), NSS 26.1, Category "1" core vehicle analysis (Medium), is required. Revisions to account for the first use of this "Group H" two-stage Heavy vehicle configuration with a 10-ft fairing from the ER will be made to the range safety, controls, aerodynamics, loads, and strength analyses.
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in the Performance and Guidance Accuracy Analysis (CDRL C4-1).
Separation Attitude Accuracy and Rates: Low tip-off of less than 0.25 deg/sec per axis	Delta II vehicle standard two-stage low-tip-off payload deployment for the 6915, 6306, or 6019 payload attach fitting: attitude (deg): < 3.0 (per axis); rate (deg/sec): < 0.25 (per axis). (See SOW Exhibit 1, Section 4, Table E1-28 and Exhibit 2.)

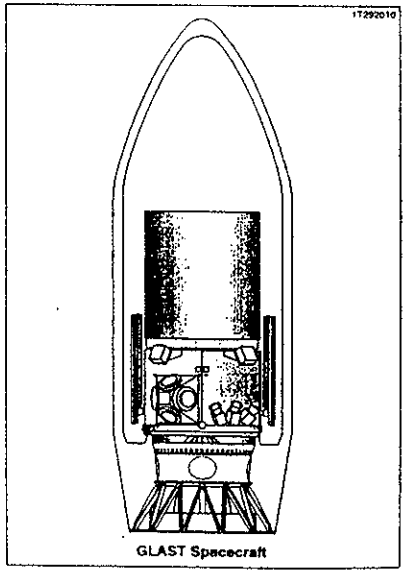
Payload Accommodation Requirements	
Requirement	**Solution**
Third-Stage Motor: No mission requirements specified.	Not required.
Payload Interface: No mission requirements specified.	One of three available two-stage Delta II PAFs) (see SOW Exhibit 1, Section 6, Figure E1-19): 1. Delta II Standard Service: 6915 PAF, which includes separation nut system, secondary latch, and retro system. CG vertical limit (above separation plane) for payload mass based on generic load factors = 86.4 cm (34.0 in.). 2. Delta II Non-Standard Service: 6306 PAF, which includes separation clampband, secondary latch, and retro system. CG vertical limit (above separation plane) for payload mass based on generic load factors = 109.2 cm (43.0 in.). (NSS 3.2.1) 3. Delta II Non-Standard Service: 6019 PAF, which includes separation nut system, secondary latch, and retro system. CG vertical limit (above separation plane) for payload mass based on generic load factors = 76.2 cm (30.0 in.). NSS 3.2.2) CG capability may be increased through the mission-specific coupled-load process.
Spinup/Spindown: No mission requirements specified.	Not required.
Payload Envelope: Spacecraft overall dimensions in launch configuration: 140 cm (55.1 in.) height with maximum possible diameter.	Delta II 10-ft (3-m)-dia composite payload fairing. Static payload envelope = 274 cm (108.0 in.) dia maximum and 416 cm (163.91 in.) long above the spacecraft separation plane with 6915 PAF.

Exhibit 5
NLS MISSION SOLUTION
CLIN 17—GLAST

SPACECRAFT AND MISSION DESCRIPTION

GLAST is an observatory that will measure the direction, energy, and arrival time of celestial gamma rays. The mission has a design lifetime of 5 years (10-year goal for operations). The payload will consist of two instruments: the Large Area Telescope (LAT) and the GLAST Burst Monitor (GBM). The spacecraft will be procured through the GSFC Rapid Spacecraft Development Office (RSDO) in the spring of 2002.

The Boeing solution for this mission is a Delta II 2920H-10 launch vehicle. This mission will be launched from the Delta II Eastern Range launch site. Specific details regarding the solution for all currently identified mission requirements, together with the corresponding rationale for technical acceptability, are described in the accompanying tables.

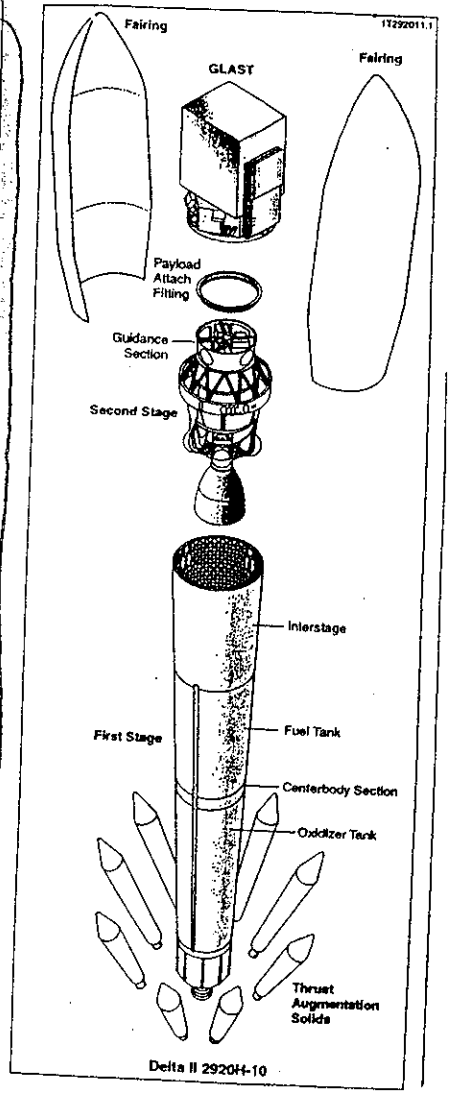


GLAST Spacecraft

Payload Accommodation Requirements (continued)	
Requirement	**Solution**
Payload Access: No mission requirements specified.	Up to three Delta II standard service payload access doors are available for use by the payload. (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors.)
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 1 DC accelerometer, 3 AC accelerometers, 1 pressure transducer, 1 temperature patch. (See SOW Exhibit 1, Section 9, Table E1-34 for a detailed description.)
Electrical Interface: No mission requirements specified.	Delta II Standard Service: Two 37-pin payload interface connectors at one location and disconnected by the fairing; 61-pin connectors may be provided as a non-standard service. Payload wiring is routed to GSE via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Section 7, Table E1-29, for a detailed description of available electrical interfaces.)

Payload Environmental Requirements	
Requirement	**Solution**
Thermal: No mission requirements specified.	Delta II 10-ft (3-m) fairing payload environment. (See SOW, Exhibit 1, Section 8, Figure E1-43A, and Exhibit 2 for established ranges and additional information.)
Dynamic Loads: No mission requirements specified.	Delta II 2920H environment: payload design CG limit load factors. Based on 6915 PAF. (See SOW Exhibit 1, Section 8, Table E1-31). Max axial (at MECO): Axial (g) 5.9 ± 0.6; Lateral (g) ±0.2 Max lateral: Axial (g) +2.8; Lateral (g) ±2.0 Max lateral: Axial (g) -0.2; Lateral (g) ±2.0 Maximum quasi-steady acceleration is a function of payload separated mass. (See SOW Exhibit 1, Section 8, Figures E1-37, for maximum values if mass changes.) Maximum expected sinusoidal vibration at the base of the PAF: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz), 1.0 g zero to peak (6.2-100 Hz); lateral: 0.7 g zero to peak (5-100 Hz). (See SOW Exhibit 1, Section 8, Table E1-33, for additional information.) Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.
Dynamic Environments: No mission requirements specified.	Delta II 2920H-10 maximum flight level payload acoustic environment: OASPL = 142.8 dB. (See SOW Exhibit 1, Section 8, Figure E1-31, for maximum levels across the frequency spectrum; 2920H levels are 2 dB higher than on the 2920.) Delta II 6915 and 6019 PAF maximum flight-level payload interface shock response spectrum: 100 g (100-350 Hz), +12.3 dB/octave (350-1700 Hz), 2500 g (1700 Hz), +5.6 dB/octave (1700-4000 Hz), 5500g (4000-5000 Hz), -8.8 dB/ octave (5000-10000 Hz), 2000 g (10000 Hz). Delta II 6306 PAF maximum flight-level payload interface shock response spectrum: 100 g (100 Hz), +9.8 dB/octave (100-800 Hz), 3000 g (800-3000 Hz). (See SOW Exhibit 1, Section 8, Figure E1-35, for additional information.)
Radio Frequency: No mission requirements specified.	Delta II Standard Service: 20 V/m across the range of 14 KHz to 40 GHz with 40 V/m between 5.762 GHz and 5.768 GHz. RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section 8, Table E1-18, for additional information.)
Payload Compartment Venting: No mission requirements specified.	Delta II Standard Service: pressure profiles and depressurization rates. (See SOW Exhibit 1, Section 8, Figure E1-22, for established maximum and minimum values.)
Launch Site Facility Environments: temperature, relative humidity, and filtration. No mission requirements specified.	Delta II Standard Service: Eastern Range facility environments. (See SOW Exhibit 2 for established ranges.)
Contamination Control: No mission requirements specified.	Delta II Standard Service: Generic Contamination Control Plan (See SOW Exhibit 2 for established minimum requirements.)

Non-Standard Services Required
NSS 1.1 Heavy vehicle upgrade
NSS 19.1 Ground Processing Facilities Payloads at Eastern Range
NSS 26.1 Category "1" Core Vehicle Analysis (Medium)



Delta II 2920H-10

Mission Requirements	
Requirement	**Solution**
Payload Risk Category: 3.	Delta II 2320-9.5 Launch Vehicle.
Launch Date: December 2006.	Delta On-Time Launch Service.
Launch Site: Vandenberg Air Force Base (VAFB). Payload Processing: Commercial.	Delta II Non-Standard Service: Delta II Western Range launch site: VAFB Space Launch Complex 2 (SLC-2). NSS 27.1, Western Range (WR) Launch Incremental. Delta II Non-Standard Service: Payload processing facility at WR. (NSS 19.2)
Payload Mass: 600 kg. Orbit: 720 nmi (1335 km) circular; inclination 66 deg.	Delta II 2320-9.5 with three GEM-40 thrust augmentation solid motors and a 9.5-ft (2.9-m)-dia payload fairing. Includes all the standard services associated with the 2320-9.5 basic launch vehicle. Delta II Non-Standard Service: Because this mission is the first use of the 2320-9.5 vehicle configuration from the Western Range (WR), NSS 26.2, Category "2" core vehicle analysis (Small) is required. Revisions to account for the first use of this "Group L" two-stage vehicle configuration with a 9.5-ft fairing from the WR will be made to controls and strength analyses.
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in Performance and Guidance Accuracy Analysis (CORL C4-1).
Separation Attitude Accuracy and Rates: No mission requirements specified.	Delta II vehicle standard two-stage low-tip-off payload deployment for the 6915, 6306 or 6019 payload attach fitting: attitude (deg): < 3.0 (per axis), rate (deg/sec): < 0.25 (per axis). (See SOW Exhibit 1, Section 4, Table E1-28 and Exhibit 2.)

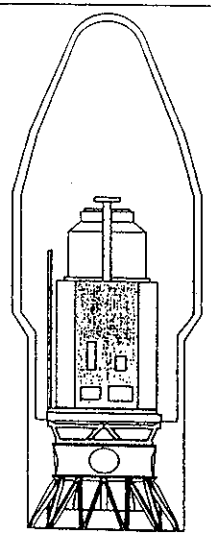
Payload Accommodation Requirements	
Requirement	**Solution**
Third-Stage Motor: No mission requirement specified.	Not required.
Payload Interface: No mission requirements specified.	One of three available two-stage Delta II PAFs (see SOW Exhibit 1, Section 5, Figure E1-19): 1. Delta II Standard Service: 6915 PAF, which includes separation nut system, secondary latch, and retro system. CG vertical limit (above separation plane) for payload mass based on generic load factors = 304.8 cm (120.0 in.). 2. Delta II Non-Standard Service: 6306 PAF, which includes separation clampband, secondary latch, and retro system. CG vertical limit (above separation plane) for payload mass based on generic load factors = 304.8 cm (120.0 in.). (NSS 3.2.1) 3. Delta II Non-Standard Service: 6019 PAF, which includes separation nut system, secondary latch, and retro system. CG vertical limit (above separation plane), for payload mass based on generic load factors = 304.8 cm (120.0 in.). (NSS 3.2.2) CG capability may be increased through the mission-specific coupled-loads process.
Spinup/Spindown: No mission requirements specified.	N/A.
Payload Envelope: Spacecraft overall dimensions in launch configuration: approximately dia = 177.8 cm (70 in.); approximately height = 342.9 cm (135 in).	Delta II 9.5-ft (2.9-m)-dia aluminum payload fairing. Delta II Non-Standard Service: Replace the baseline Delta II 2320 10-ft (3-m) composite payload fairing with a 9.5-ft (2.9 m) aluminum payload fairing. (NSS 2.1.3)
Payload Access: No mission requirements specified.	Up to three Delta II standard service payload access doors are available for use by the payload. (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors.)

Exhibit 5
NLS MISSION SOLUTION
CLIN 18— Ocean Surface Topography Mission

SPACECRAFT AND MISSION DESCRIPTION

The Ocean Surface Topography Mission (OSTM) is a follow-on to the Jason-1 mission. The mission will further extend ocean surface topography into the 21st century, provide a multi-year view of global ocean surface topography, increase understanding of ocean circulation, improve forecasting of climate events, and measure global sea level change.

The Boeing solution for this mission is a Delta II 2320-9.5 launch vehicle. This mission will be launched from the Delta II Western Range launch site. Specific details regarding the solution for all currently identified mission requirements, together with the corresponding rationale for technical acceptability, are described in the accompanying tables.



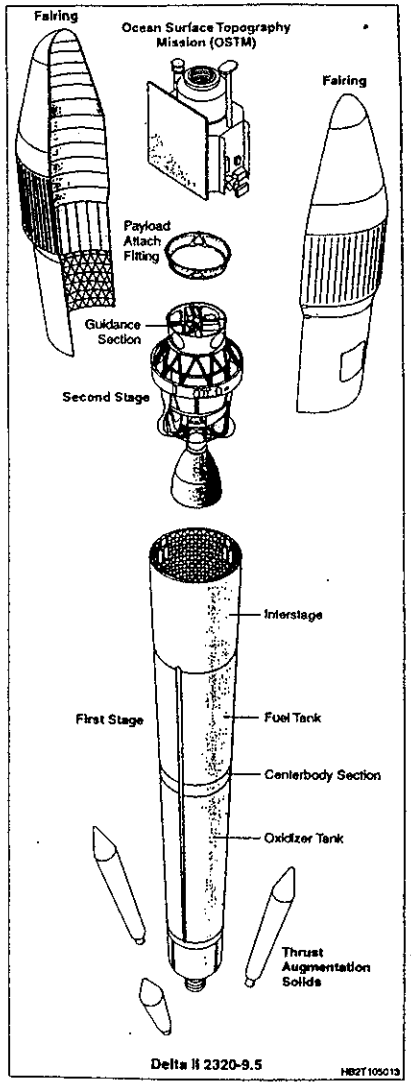
Ocean Surface Topography Mission (OSTM) Spacecraft

H82T105011

Payload Accommodation Requirements (continued)	
Requirement	**Solution**
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 1 DC accelerometer, 3 AC accelerometers, 1 pressure transducer, 1 temperature patch. (See SOW Exhibit 1, Section 9, Table E1-34 for a detailed description.)
Electrical Interface: No mission requirements specified.	Delta II Standard Service: Two 37-pin payload interface connectors at one location and disconnected by the fairing; 61-pin connectors may be provided as a non-standard service. Payload wiring is routed to GSE via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Section 7, Table E1-29, for a detailed description of available electrical interfaces.)

Payload Environmental Requirements	
Thermal: No mission requirements specified.	Delta II 9.5-ft (2.9-m) fairing payload environment. (See SOW Exhibit 1, Section 8, Figure E1-43A and Exhibit 2 for established ranges and additional information.)
Dynamic Loads: No mission requirements specified.	Delta II 2320-9.5 environment: payload design CG limit load factors. Based on 6915 PAF. (See SOW Exhibit 1, Section 8, Table E1-31). Axial (g) / Lateral (g) Max axial (at MECO) 7.6 ± 0.6 / ±0.2 Max lateral +2.8 / ±4.5 Max lateral -0.2 / ±4.5 Maximum quasi-steady acceleration is a function of payload separated mass. (See SOW Exhibit 1, Section 8, Figure E1-37, for maximum values if mass changes.) Maximum expected sinusoidal vibration at the base of the PAF: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz), 1.0 g zero to peak (6.2-100 Hz); lateral: 0.7 g zero to peak (5-100 Hz). (See SOW Exhibit 1, Section 8, Table E1-33, for additional information.) Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.
Dynamic Environments: No mission requirements specified.	Delta II 2320-9.5 environment maximum flight level payload acoustic environment: OASPL = 145.7 dB. (See SOW Exhibit 1, Section 8, Figure E1-28, for maximum levels by frequency. 2320 levels are 0.5 dB lower than the 2420.) Delta II 6915 PAF or 6019 PAF maximum flight-level payload interface shock response spectrum: 100 g (100-350 Hz), +12.3 dB/octave (350-1700 Hz), 2500 g (1700 Hz), +5.6 dB/octave (1700-4000 Hz), 5500g (4000-5000 Hz), -8.8 dB/ octave (5000-10000 Hz), 2000 g (10000 Hz). Delta II 6306 PAF maximum flight-level payload interface shock response spectrum: 100 g (100 Hz), +9.8 dB/octave (100-800 Hz), 3000 g (800-3000 Hz). (See SOW Exhibit 1, Section 8, Figure E1-35, for additional information.)
Radio Frequency: No mission requirements specified.	Delta II Standard Service: 20 V/m across the range of (14 KHz to 40 GHz) with 40 V/m between (5.762 GHz – 5.768 GHz). RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section 8, Table E1-30, for additional information.)
Payload Compartment Venting: No mission requirements specified.	Delta II Standard Service: pressure profiles and depressurization rates. (See SOW Exhibit 1, Section 8, Figure E1-22, for established maximum and minimum values.)
Launch Site Facility Environments: temperature, relative humidity and filtration. No mission requirements specified.	Delta II Non-Standard Service: Western Range facility environments. (See SOW Exhibits 2 and 3 for established ranges.) (NSS 27.1, See Note 4)
Contamination Control: No mission requirements specified.	Delta II Non-Standard Service: Generic Contamination Control Plan. (See SOW Exhibits 2 and 3 for established minimum requirements.) (NSS 27.1, See Note 4)

Non-Standard Services Required
NSS 2.1.3 Replace a 10-ft PLF with a 9.5-ft PLF
NSS 19.2 Ground Processing Facilities at Western Range
NSS 26.2 Category "2" Core Vehicle Analysis (Small)
NSS 27.1 Western Range (WR) Launch Incremental



Delta II 2320-9.5

Mission Requirements	
Requirement	**Solution**
Payload Risk Category: 3.	Delta II 2420-10 Launch Vehicle.
Launch Date: March 2007.	Delta On-Time Launch Service.
Launch Site: Cape Canaveral Air Force Station (CCAFS).	Delta II Eastern Range launch site: CCAFS, Space Launch Complex 17 (SLC-17).
Payload Processing: Commercial.	Delta II Non-Standard Service: Astrotech Payload Processing facility (NSS 13.1).
Payload Mass: 2400 kg. Orbit: 1000 km circular; inclination 28.7 deg.	Delta II 2420-10 with four GEM-40 thrust augmentation solid motors and a 10-ft- (3-m)-dia composite payload fairing. Includes all the standard services associated with the 2420-10 basic vehicle.
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in the Performance and Guidance Accuracy Analysis (CDRL C4-1).
Separation Attitude Accuracy and Rates: No mission requirements specified.	Delta II vehicle standard two-stage low-tip-off payload deployment for the 6915, 6306, or 6019 payload attach fitting: attitude (deg): < 3.0 (per axis); rate (deg/ sec), <0.25 (per axis). (See SOW Exhibit 1, Section 4, Table E1-28 and Exhibit 2.)

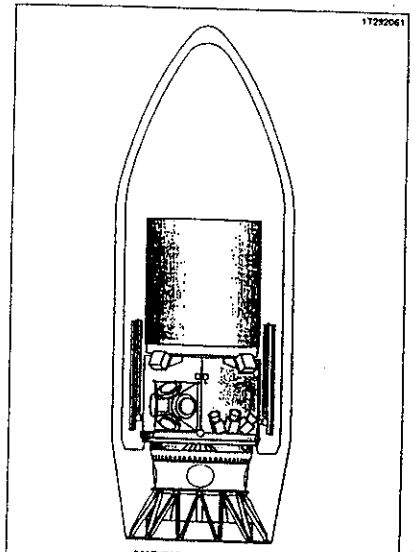
Payload Accommodation Requirements	
Requirement	**Solution**
Third-Stage Motor: No mission requirement specified.	Not required.
Payload Interface: No mission requirements specified.	One of three available two-stage Delta II PAFs (see SOW Exhibit 1, Section 6, Figure E1-19): 1. Delta II Standard Service: 6915 PAF, which includes separation nut system, secondary latch, and retro system. CG vertical limit (above separation plane) for payload mass based on generic load factors = 190.5 cm (75.0 in.). 2. Delta II Non-Standard Service: 6306 PAF, which includes a separation clampband, secondary latch, and retro system. (NSS 3.2.1) (See SOW Exhibit 1, Section 6, Figure E1-19.). CG vertical limit (above separation plane) for payload mass based on generic load factors = 213.4 cm (84.0 in.). 3. Delta II Non-Standard Service: 6019 PAF, which includes separation nut system, secondary latch, and retro system. CG vertical limit (above separation plane) for payload mass based on generic load factors = 162.6 cm (64.0 in.). (NSS 3.2.2) CG capability may be increased through the mission-specific coupled-loads process.
Spinup/Spindown: No mission requirements specified.	Not required
Payload Envelope: Spacecraft overall dimensions in launch configuration: No mission requirements specified.	Delta II 10-ft- (3-m)-dia composite payload fairing per NASA vehicle recommendation
Payload Access: No mission requirements specified.	Up to three Delta II standard service payload access doors are available for use by the payload. (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors.)
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 1 DC accelerometer, 3 AC accelerometers, 1 pressure transducer, 1 temperature patch. (See SOW Exhibit 1, Section 9, Table E1-34, for a detailed description.)
Electrical Interface: No mission requirements specified.	Delta II Standard Service: Two 37-pin payload interface connectors at one location and disconnected by the fairing; 61-pin connectors may be provided as a non-standard service. Payload wiring is routed to GSE via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Section 7, Table E1-29, for a detailed description of available electrical interfaces.)

Exhibit 5
NLS MISSION SOLUTION
CLIN 19—MIDEX 5

SPACECRAFT AND MISSION DESCRIPTION

The MIDEX 5 mission is a space physics and astronomy mission intended to study the sun, to examine the space environment of the Earth and other planets, and to observe the universe beyond our solar system.

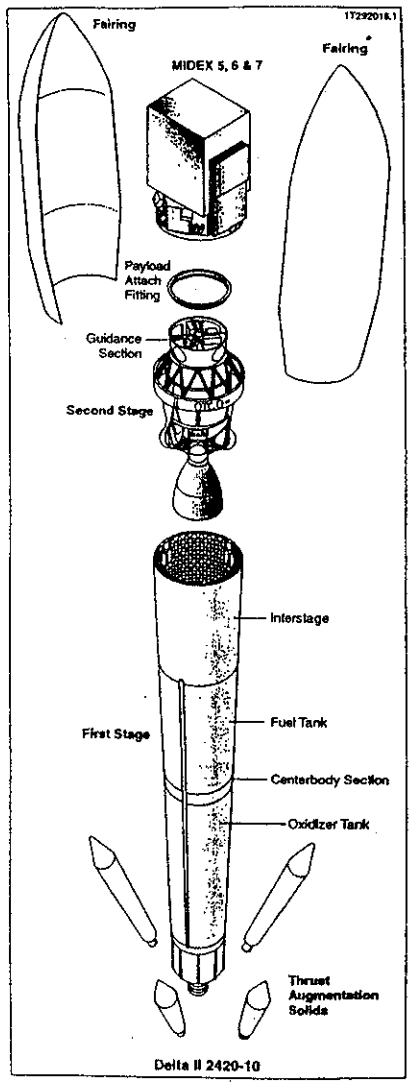
The Boeing solution for this mission is the Delta II 2420-10 vehicle. This mission will be launched from the Delta II Eastern Range launch site. Specific details regarding the solution for all currently identified mission requirements, together with the corresponding rationale for technical acceptability, are described in the accompanying tables.



MIDEX 5 Spacecraft

Payload Environmental Requirements	
Requirement	**Solution**
Thermal: No mission requirements specified.	Delta II 10-ft (3-m) fairing payload environment: (See SOW Exhibit 1, Section 8, Figure E1-43A and Exhibit 2 for established ranges and additional information.)
Dynamic Loads: No mission requirements specified.	Delta II 2420 environment: Payload design CG limit load factors. Based on 6915 PAF. (See SOW Exhibit 1, Section 8, Table E1-31.) Axial (g) / Lateral (g) Max axial (at MECO) +6.7 ± 0.6 / ± 0.2 Max lateral +2.8 / ± 2.5 Max lateral -0.2 / ± 2.5 Maximum quasi-steady acceleration is a function of payload separated mass. (See SOW Exhibit 1, Section 8, Figure E1-37, for maximum values if mass changes.) Maximum expected sinusoidal vibration at the base of the PAF: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz), 1.0 g zero to peak (6.2-100 Hz); lateral: 0.7 g zero to peak (5-100 Hz). (See SOW Exhibit 1, Section 8, Table E1-33, for additional information.) Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.
Dynamic Environments: No mission requirements specified.	Delta II 2420-10 maximum flight level payload acoustic environment: OASPL = 139.9 dB. (See SOW Exhibit 1, Section 8, Figure E1-29, for maximum levels across the frequency spectrum.) Delta II 6915 or 6019 PAF maximum flight-level payload interface shock response spectrum: 100 g (100-350 Hz), +12.3 dB/octave (350-1700 Hz); 2500 g (1700 Hz), +5.6 dB/octave (1700-4000 Hz); 5500 g (4000-5000 Hz), -8.8 dB/octave (5000-10,000 Hz); 2000 g (10,000 Hz). Delta II 6306 PAF maximum flight-level payload interface shock response spectrum: 100 g (100 Hz), +9.8 dB/octave (100-800 Hz), 3000 g (800-3000 Hz). (See SOW Exhibit 1, Section 8, Figure E1-35, for additional information.)
Radio Frequency: No mission requirements specified.	Delta II Standard Service: 20 V/m across the range of 14 KHz to 40 GHz with 40 V/m between 5.762 and 5.768 GHz. RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section 8, Table E1-30, for additional information.)
Payload Compartment Venting: No mission requirements specified.	Delta II Standard Service: Pressure profiles and depressurization rates: (See SOW Exhibit 1, Section 8, Figure E1-22, for established maximum and minimum values.)
Launch Site Facility Environments: Temperature, relative humidity, and filtration. No mission requirements specified.	Delta II Standard Service: Eastern Range facility environments (See SOW Exhibits 2 for established ranges.)
Contamination Control: No mission requirements specified.	Delta II Standard Service: Generic contamination control plan. (See SOW Exhibit 2 for established minimum requirements.)

Non-Standard Services Required
NSS 19.1 Ground Processing Facilities Payloads at Eastern Range



Delta II 2420-10

Mission Requirements	
Requirement	**Solution**
Payload Risk Category: 3.	Delta II 2320-10 Launch Vehicle.
Launch Date: July 2007.	Delta On-Time Launch Service.
Launch Site: Vandenberg Air Force Base (VAFB). Payload Processing: Commercial.	Delta II Non-Standard Service: Delta II Western Range launch site: VAFB Space Launch Complex 2 (SLC-2). NSS 27.1, Western Range (WR) Launch Incremental. Delta II Non-Standard Service: Payload processing facility at Western Range. (NSS 19.2)
Payload Mass: The approximate spacecraft mass is 1050 kg Orbit: 1350 km circular: Inclination 60 deg.	Delta II 2320-10 with three GEM-40 thrust augmentation solid motors and a 10-ft-(3-m)-dia composite payload fairing. Includes all the standard services associated with the 2320-10 basic vehicle.
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in the Performance and Guidance Accuracy Analysis (CDRL C4-1).
Separation Attitude Accuracy and Rates: No mission requirements specified.	Delta II vehicle standard two-stage low tip-off payload deployment for the 6915, 6306, or 6019 payload attach fitting: attitude (deg): < 3.0 (per axis); rate (deg/sec), <0.25 (per axis). (See SOW Exhibit 1, Section 4, Table E1-28 and Exhibit 2.)
Parts of the spacecraft will be classified in nature and clearances may be required by key players on the team to attend design/other technical reviews.	Key members of our mission integration team will obtain or already have clearances necessary to attend design/other technical reviews as appropriate. No effort for document control, classified engineering analysis, or special facilities is included as part of the solution to this mission. Any effort beyond attendance at a few design/other technical reviews would be out of scope and may result in additional cost to NASA.

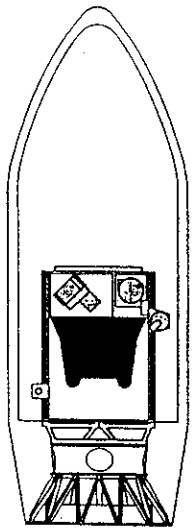
Payload Accommodation Requirements	
Requirement	**Solution**
Third-Stage Motor: No mission requirements specified.	Not required.
Payload Interface: No mission requirements specified.	One of three available two-stage Delta II payload attach fittings (PAF). (See SOW Exhibit 1, Section 6, Figure E1-19.) 1) Delta II Standard Service: 6915 PAF, which includes separation nut system, a secondary latch, and retro system. CG vertical limit (above separation plane) for payload mass based on generic load factors > 254 cm (100.0 in.). 2) Delta II Non-Standard Service: 6306 PAF, which includes separation clampband, a secondary latch, and retro system. CG vertical limit (above separation plane) for payload mass based on generic load factors > 254 cm (100.0 in.). (NSS 3.2.1) 3) Delta II Non-Standard Service: 6019 PAF, which includes separation nut system, secondary latch, and retro system. CG vertical limit (above separation plane), for payload mass based on generic load factors > 254 cm (100.0 in.). (NSS 3.2.2) Generic CG capability of available PAFs exceeds overall height of spacecraft provided.
Spinup/Spindown: No mission requirements specified.	Not required.
Payload Envelope: Approximately 89 in. (X) x 59 in. (Y) x 69 in. (Z)	Delta II 10-ft- (3-m)-dia composite payload fairing.
Payload Access: No mission requirements specified.	Up to three Delta II standard service payload access doors are available for use by the payload. (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors.)

Exhibit 5
NLS MISSION SOLUTION
CLIN 20—SBIRS Low 2

SPACECRAFT AND MISSION DESCRIPTION

The Space Based Infrared System (SBIRS) Low mission is a technology demonstration mission in support of the new National Missile Defense strategy. This mission will demonstrate the new technology that is targeted for use on the low Earth-orbiting component of the SBIRS overall architecture. The purpose of the SBIRS Low satellites will be to augment global missile defense missions by observing and reporting ballistic missiles in all phases of their flight.

The Boeing solution for this mission is the Delta II 2320-10 vehicle. This mission will be launched from the Delta II Western Range launch site. Specific details regarding the solution for all currently identified mission requirements, together with the corresponding rationale for technical acceptability, are described in the accompanying tables:



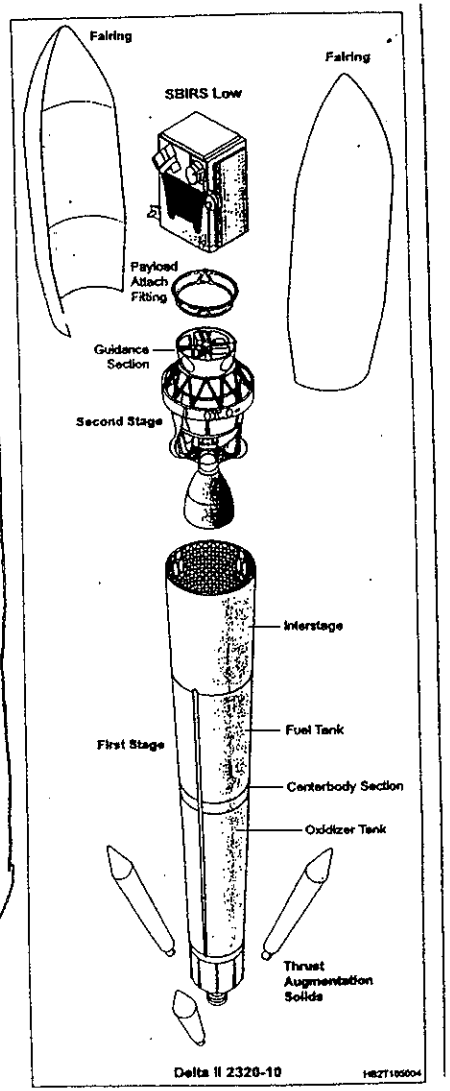
SBIRS Low Spacecraft

H82T105003

Payload Accommodation Requirements (continued)	
Requirement	**Solution**
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 1 DC accelerometer, 3 AC accelerometers, 1 pressure transducer, 1 temperature patch. (See SOW Exhibit 1, Section 9, Table E1-34, for a detailed description.)
Electrical Interface: No mission requirements specified.	Delta II Standard Service: Two 37-pin payload interface connectors at one location and disconnected by the fairing; 61-pin connectors may be provided as a non-standard service. Payload wiring is routed to GSE via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Section 7, Table E1-29, for a detailed description of available electrical interfaces.)

Payload Environmental Requirements	
Requirement	**Solution**
Thermal: No mission requirements specified.	Delta II 10-ft (3-m) fairing payload environment: (See SOW Exhibit 1, Section 8, Figure E1-43A and Exhibit 2 for established ranges and additional information.)
Dynamic Loads: No mission requirements specified.	Delta II 2320 environment: Payload design CG limit load factors. Based on 6915 PAF. (See SOW Exhibit 1, Section 8, Table E1-31.) Axial (g) / Lateral (g) Max axial (at MECO): 7.3 ± 0.6 / ± 0.2 Max lateral: +2.8 / ± 3.5 Max lateral: -0.2 / ± 3.5 Maximum quasi-steady acceleration is a function of payload separated mass. (See SOW Exhibit 1, Section 8, Figure E1-37, for maximum values if mass changes.) Maximum expected sinusoidal vibration at the base of the PAF: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz), 1.0 g zero to peak (6.2-100 Hz); lateral: 0.7 g zero to peak (5-100 Hz). (See SOW Exhibit 1, Section 8, Table E1-33, for additional information.) Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.
Dynamic Environments: No mission requirements specified.	Delta II 2320-10 maximum flight level payload acoustic environment: OASPL = 139.4 dB. (See SOW Exhibit 1, Section 8, Figure E1-29, for maximum levels across the frequency spectrum.) Delta II 6915 and 6019 PAF maximum flight-level payload interface shock response spectrum: 100 g (100-350 Hz), +12.3 dB/octave (350-1700 Hz), 2500 g (1700 Hz), +5.6 dB/octave (1700-4000 Hz), 5500g (4000-5000 Hz), -8.8 dB/octave (5000-10000 Hz), 2000 g (10000 Hz). Delta II 6306 PAF maximum flight-level payload interface shock response spectrum: 100 g (100 Hz), +9.8 dB/octave (100-800 Hz), 3000 g (800-3000 Hz). (See SOW Exhibit 1, Section 8, Figure E1-35, for additional information.)
Radio Frequency: No mission requirements specified.	Delta II Standard Service: 20 V/m across the range of 14 KHz to 40 GHz with 40 V/m between 5.762 and 5.768 GHz. RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section 8, Table E1-30, for additional information.)
Payload Compartment Venting: No mission requirements specified.	Delta II Standard Service: Pressure profiles and depressurization rates: (See SOW Exhibit 1, Section 8, Figure E1-22, for established maximum and minimum values.)
Launch Site Facility Environments: No mission requirements specified.	Delta II Non-Standard Service: Western Range facility environments. (See SOW Exhibits 2 and 3 for established ranges.) (NSS 27.1, see Note 4.)
Launch Site Facility Environments: Temperature, relative humidity, and filtration. No mission requirements specified.	Delta II Non-Standard Service: Western Range facility environments. (See SOW Exhibits 2 and 3 for established ranges.) (NSS 27.1, see Note 4.)
Contamination Control: No mission requirements specified.	Delta II Standard Service: Generic contamination-control plan. (See SOW Exhibit 2 for established minimum requirements.)

Non-Standard Services Required
NSS 19.2 Ground Processing Facilities Payloads at Western Range
NSS 27.1 Western Range (WR) Launch Incremental



Delta II 2320-10

Mission Requirements

Requirement	Solution
Payload Risk Category: 3.	Delta II 2925-10L Launch Vehicle.
Launch Date: July 2007.	Delta On-Time Launch Service: Assurance in meeting planetary launch window periods is enhanced by building in contingency time including hardware scheduling, tracking, and early mission checkout. Instantaneous launch windows are met with multiple flight trajectories for launch windows and selective use of built-in holds for issue resolution during the day of launch countdown. (See SOW Exhibit 2 for an additional description.)
Launch Site: Cape Canaveral Air Force Station (CCAFS). Payload Processing: Commercial.	Delta II Eastern Range launch site: CCAFS, Space Launch Complex 17 (SLC-17). Delta II Non-Standard Service: Astrotech Payload Processing Facility. (NSS 19.1)
Payload Mass: 903 kg. Orbit: Escape; $C_3 \approx 0.4$ km^2/sec^2, Earth-trailing heliocentric orbit.	Delta II 2925-10L with nine GEM-40 thrust augmentation solid motors and a 10L-ft- (3.0-m)-dia payload fairing. Includes all the standard services associated with the 2925-10 basic vehicle. Incremental one-time analysis (NSS 26.1) is not required for this mission based upon the assumption that the CLIN 8-Option 5, Stereo I/II mission (from the original, January 2000, NLS proposal and contract) is launched by Boeing from CCAFS prior to launch of this mission.
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in the Performance and Guidance Accuracy Analysis (CDRL C4-1).
Separation Attitude Accuracy and Rates: Despin required (rates TBD).	Delta II vehicle standard third-stage (despun) payload deployment: attitude <10.0 deg, rate <7.0-deg/sec (transverse), 0.0 ±5 rpm (roll). (See SOW Exhibit 1, Section 4,Table E1-28, and Exhibit 2.)

Payload Accommodation Requirements

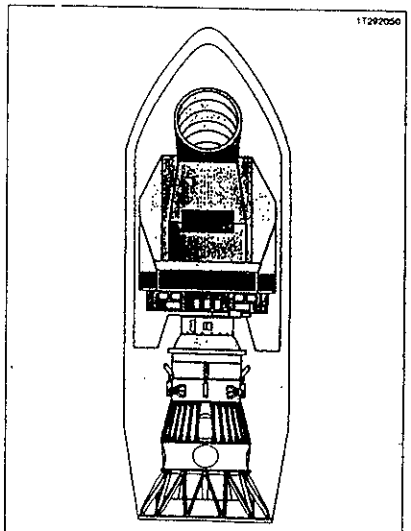
Requirement	Solution
Third-stage motor required to achieve the escape orbit for this mission.	STAR™48B motor, including spin table.
Payload Interface: 3712A PAF.	Delta II 3712A payload attach fitting (PAF), which includes a separation clampband system, a yo-yo despin system, a nutation control system (NCS), and extended mission thermal modifications to accommodate mission lengths of up to 7,000 sec. (See SOW Exhibit 1, Section 6, Figure E1-19.) CG vertical limit (above separation plane) for payload mass based on generic load factors = 152.4 cm (60 in.) for the 3712A PAF. Note capability with a 3712C PAF is 101.6 cm (40 in.). CG capability may be increased through the mission-specific coupled-loads process.
Spinup/Spindown: Spin/despin third stage required (rates TBD).	Delta II standard spinup of the third stage and payload to stabilize the STAR™48B motor will be accomplished with the Delta II spin table and spin rocket motors. (See SOW Exhibit 2.) Yo-yo despin system includes a nutation control system to minimize velocity/attitude pointing errors and coning conditions during the time from third-stage ignition to yo-yo despin initiation.
Payload Envelope: Satisfies 10L launch envelope.	Delta II 10L-ft- (3.0-m)-dia stretched composite payload fairing. Delta II Non-Standard Service: Replace the baseline Delta II 2925-9.5-ft (2.9-m) aluminum payload fairing with a 10-ft (3.0-m) stretched length (10L) composite payload fairing. (NSS 2.1.1 and NSS 2.1.2) Delta II Mission-Unique Service: For the first use of the 10L payload fairing from the Eastern Range, a one-time effort is required to coordinate and define the handling operations. Additionally, preparation, review, and release of the Launch Preparation Documents to implement this change will be completed (MUS 21.1). Should another mission (i.e., CLIN 8 STEREO) with a 10L fairing be exercised prior to this mission, MUS 21.1 will be credited and no mission unique service will be required.
Payload Access: No mission requirements specified.	Up to three Delta II standard service payload access doors are available for use by the payload. (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors. See SOW Exhibit 3, Note 1 for locations.

Exhibit 5
NLS MISSION SOLUTION
CLIN 21—KEPLER

SPACECRAFT AND MISSION DESCRIPTION

Kepler, a spaceborne telescope, will search for Earth-like planets around stars beyond the solar system. Kepler will look for the 'transit' signature of planets that occurs each time a planet crosses the line-of-sight between the planet's parent star and the observer. This periodic dimming signature is used to detect the planet and to determine its size and orbit. Kepler will be able to determine if Earth-sized planets make a transit across any of the 100,000 stars in the region of space it will be gazing at.

The Boeing solution for this mission is a Delta II 2925-10L vehicle. This mission will be launched from the Delta II Eastern Range launch site. Specific details regarding the solution for all currently identified mission requirements, together with the corresponding rationale for technical acceptability, are described in the accompanying tables.

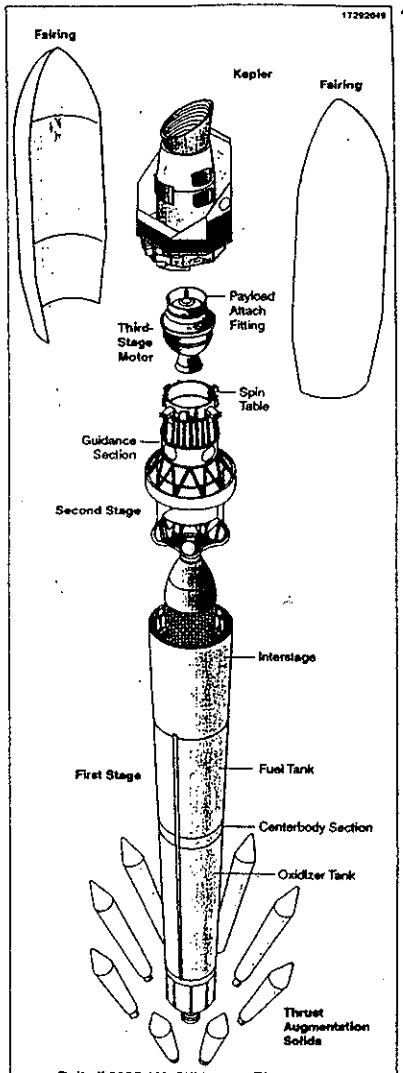


Kepler Spacecraft

Payload Environmental Requirements

Requirement	Solution
Payload Access: No mission requirements specified.	Up to three Delta II standard service payload access doors are available for use by the payload. (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors. See SOW Exhibit 3, Note 1 for locations.
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 3 DC accelerometers, 1 pressure transducer, 1 temperature patch. (See SOW Exhibit 1, Section 9, Table E1-34, for a detailed description.)
Electrical Interface: 2- to 37-pin connectors	Delta II Standard Service: Two 37-pin payload interface connectors 180 deg apart across the interface plane, disconnected upon separation; 61-pin connectors may be provided as an non-standard service. Payload wiring is routed to the GSE via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Section 7, Table E1-29, for a detailed description of available electrical interfaces.)
Thermal: No mission requirements specified.	Delta II 10-ft (3.0-m) fairing and STAR™48B third-stage payload environments. (See SOW Exhibit 1, Section 8, Figures E1-43A and E1-43C and Exhibit 2 for established ranges and additional information.)
Dynamic Loads: No mission requirements specified.	Delta II 2925 environment: Payload design CG limit load factors. (See SOW Exhibit 1, Section 8, Table E1-31.) Axial (g) / Lateral (g) Max axial (at MECO): 6.3 ± 0.6 / ±0.2 Max lateral: +2.8 / ±4.0 Max lateral: -0.2 / ±4.0 Maximum quasi-steady acceleration is a function of payload separated mass. (See SOW Exhibit 1, Section 8, Figures E1-37 and E1-43, for maximum values if mass changes.) Maximum expected sinusoidal vibration at the base of the PAF: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz), 1.0 g zero to peak (6.2-100 Hz); lateral: 0.7 g zero to peak (5-100 Hz). (See SOW Exhibit 1, Section 8, Table E1-33, for additional information.) Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.
Dynamic Environments: No mission requirements specified.	Delta II 2925-10L maximum flight level payload acoustic environment: OASPL = 140.8 dB. (See SOW Exhibit 1, Section 8, Figure E1-31, for maximum levels across the frequency spectrum.) Delta II 3712 PAF with 3300-lb preload maximum flight-level payload interface shock response spectrum: 40 g (100 Hz), +9.2 dB/octave (100-1500 Hz), 2500 g (1500-3000 Hz). (See SOW Exhibit 1, Section 8, Figure E1-35, for additional information.)
Radio Frequency: No mission requirements specified.	Delta II Standard Service: 20 V/m across the range of 14 KHz to 40 GHz with 40 V/m between 2.2 GHz and 2.3 GHz and between 5.762 and 5.768 GHz. RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section 8, Table E1-30, for additional information.)
Payload Compartment Venting: No mission requirements specified.	Delta II Standard Service: Pressure profiles and depressurization rates. (See SOW Exhibit 1, Section 8, Figure E1-22, for established maximum and minimum values.)
Launch Site Facility Environments: Temperature, relative humidity, and filtration. No mission requirements specified.	Delta II Standard Service: Eastern Range facility environments: (See SOW Exhibit 2 for established ranges.)
Contamination Control: 100,000 clean.	Delta II Standard Service: Generic Contamination Control Plan: (See SOW Exhibit 2 for established minimum requirements.)

Non-Standard Services Required:
NSS 2.1.1: Replace a 10-ft PLF with a 10L PLF
NSS 2.1.2: Replace a 9.5-ft PLF with a 10-ft PLF
NSS 19.1: Ground Processing Facilities Payloads at Eastern Range.



Delta II 2925-10L (With STAR™ 48B Motor)

CLIN 22 - PHOENIX

Mission Requirements

Requirement	Solution
Payload Risk Category: 3.	Delta II 2925-9.5 Launch Vehicle.
Launch Date: August 2007.	Delta On-Time Launch Service.
Launch Site: Cape Canaveral Air Force Station (CCAFS). Payload Processing: Commercial. Requires Hazardous Payload Processing Facility capable of servicing a large spacecraft bipropellant (anhydrous hydrazine and nitrogen tetroxide) propulsion system.	Delta II Eastern Range launch site: CCAFS, Space Launch Complex 17 (SLC-17). Delta II Non-Standard Service: Astrotech Payload Processing facility has the capability to handle spacecraft propellant quantities identified. (NSS 19.1)
Payload Mass: 1833 kg (or maximum vehicle capability, whichever is greater). . Orbit: 185 km x 35788 km (GTO); Inclination 28.7 deg. SDO requires the launch vehicle to insert it into a GTO orbit. Trade studies will be performed to determine the optimum separation apogee altitude. It has not yet been determined whether a Minimum Residual Shutdown or a Guidance Control Shutdown is preferable for this mission. Launch vehicle vendor to provide data for orbit-debris assessment.	Delta II 2925-9.5 with nine GEM-40 thrust augmentation solid motors and a 9.5-ft (2.9-m)-dia composite payload fairing. Includes all the standard services associated with the 2925-9.5 basic vehicle. Trade studies will be conducted during the integration process as mutually agreed upon and funded by NASA outside the scope of this mission solution. Minimum Probability of Command Shutdown previously flown has been approximately 95%. Delta II Standard Service: Provides launch vehicle data for orbital-debris assessment.
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in Performance and Guidance Accuracy Analysis (CDRL C4-1).
Separation Attitude Accuracy and Rates: No mission requirements specified. The spacecraft's 860 kg of on-board propellant will comprise approximately 47% of the observatory's 1833-kg mass. Launching a payload containing such a large amount of liquid fuel on a spinning third stage presents significant energy dissipation challenges. The spacecraft team will make every effort to design the propulsion system to meet the nutation time constant requirements outlined in the Delta Payload Planners Guide. However, the possibility exists that these requirements will not be met; possible fallback options may involve launch vehicle modifications, including a reduction of third-stage spin rate and/or increased capability of the Delta II nutation control system.	Delta II vehicle standard third-stage (despun) payload deployment: attitude <10.0 deg, rate < 7.0-deg/sec (transverse), 0.0± 5 rpm (roll). (See SOW Exhibit 1, Section 4, Table E1-28 and Exhibit 2.) Trade studies will be conducted during the integration process to assess the impact of the spacecraft nutation time constant if outside Delta II minimum requirements, as mutually agreed upon and funded by NASA outside the scope of this mission solution. Any modifications and analyses required to accommodate the spacecraft nutation time constant will be the subject of a mission unique proposal.

Payload Accommodation Requirements

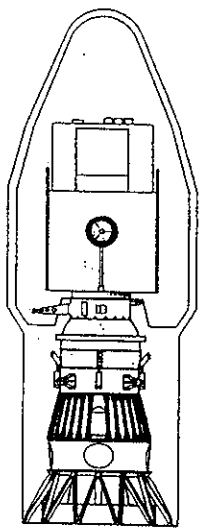
Requirement	Solution
Third-stage motor required to achieve GTO orbit.	STAR™ 48B motor, including spin table.
Payload Interface: Payload adapter type is the Delta 3712 Boeing third-stage adapter.	Delta II 3712C payload attach fitting (PAF), which includes a separation clampband system, a yo-yo despin system, a nutation control system, and extended mission thermal modifications to accommodate mission lengths of up to 7000 sec. (See SOW Exhibit 1, Section 6, Figure E1-19.) CG vertical limit (above separation plane) for payload mass based on genetic load factors = 63.5 cm (25 in.). CG capability may be increased through the mission-specific coupled loads process.

Exhibit 5
NLS MISSION SOLUTION
CLIN 22—SDO

SPACECRAFT AND MISSION DESCRIPTION

The Solar Dynamics Observatory's 5-year mission is to understand the nature and source of the solar variability that affects life and society. It must make accurate measurements of solar parameters to provide a deeper physical understanding of the mechanisms that underlie the sun's variability on timescales from seconds to centuries. It must monitor and record the sun's variable radiative, particulate, and magnetic plasma outputs.

The Boeing solution for this mission is a Delta II 2925-9.5 vehicle. This mission will be launched from the Delta II Eastern Range launch site. Specific details regarding the solution for all currently identified mission requirements, together with the corresponding rationale for technical acceptability, are described in the accompanying tables.



SDO Spacecraft

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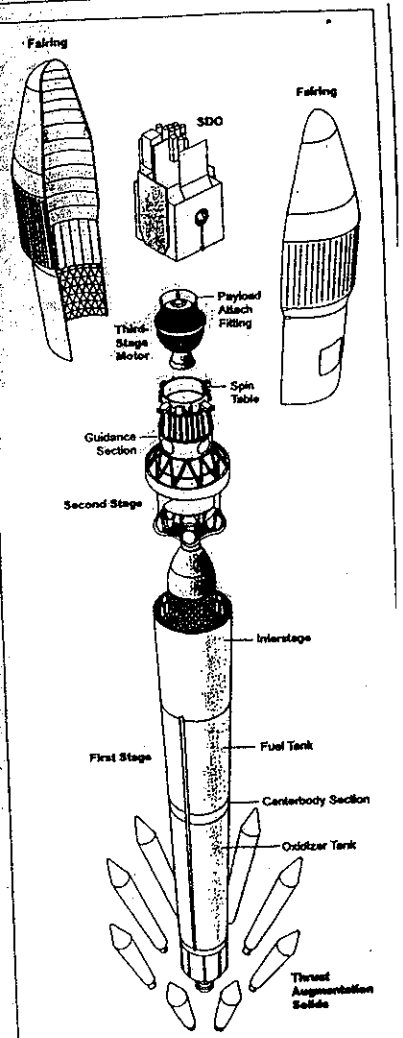
Section D
Attachment D1, Exhibit 5: Firms/Options Mission Solutions

Payload Accommodation Requirements (continued) Requirement	Solution
Spinup/Spindown: No mission requirements specified.	Delta II standard spinup of the third stage and payload to stabilize the STAR™ 48B motor will be accomplished with the Delta II spin table and spin rocket motors. (See SOW Exhibit 2.) Yo-yo despin system includes a nutation control system to minimize velocity/attitude pointing errors and coning conditions during the time from third-stage ignition to yo-yo despin initiation.
Payload Envelope: Spacecraft Overall Dimensions in Launch Configuration: 299-cm diameter (maximum vehicle capability) X 390-cm height. As the spacecraft concept matures, the spacecraft team will continue performing analyses/trades so that the spacecraft will fit/meet all the 9.5-ft fairing requirements. Instruments may require continuous GN_2 purge, possibly through liftoff (T-0 purge).	Delta II 9.5-ft (2.9-m) aluminum payload fairing with provision for a 0.64-cm (0.25-in.) GN_2 purge line.
Payload Access: Access to spacecraft on pad is required for contingency propellant unloading and TBD other activities.	Up to three Delta II Standard Service payload access doors are available for use by the payload. (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors.)
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 3 DC accelerometers, 1 pressure transducer, 1 temperature patch. (See SOW Exhibit 1, Section 9, Table E1-34, for a detailed description.)
Electrical Interface: Electrical interface with the encapsulated spacecraft for the purposes of battery charging and vehicle state-of-health checks will be needed.	Delta II Standard Service: Capability for spacecraft battery charging and state-of-health checks on the launch pad provided via two 37-pin payload interface connectors 180 deg apart across the interface plane; disconnected upon separation; 61-pin connectors may be provided as a non-standard service. Payload wiring is routed to GSE via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Section 7, Table E1-29, for a detailed description of available electrical interfaces.)
Spacecraft telemetry (TM) is desired during ascent. Method of transmitting telemetry is TBD. Options include (1) direct RF link from spacecraft to ground and (2) interleaving spacecraft TM with launch vehicle TM.	Trade studies will be conducted during the integration process to determine the method for transmitting spacecraft telemetry during ascent and the acceptability of the spacecraft-induced RF environment on the launch vehicle, as mutually agreed upon and funded by NASA outside the scope of this mission solution. Any modifications and analyses required to accommodate the telemetry downlink will be the subject of a mission unique proposal.

Payload Environmental Requirements Requirement	Solution
Thermal: No mission requirements specified.	Delta II 9.5-ft (2.9-m) fairing and STAR™ 48B third-stage payload environments. (See SOW Exhibit 1, Section 8, Figures E1-43A and E1-43C and Exhibit 2 for established ranges and additional information.)
Dynamic Loads: No mission requirements specified.	Delta II 2925 environment: Payload design CG limit load factors. (See SOW Exhibit 1 Section 8, Table E1-31.) Axial (g) / Lateral (g) Max axial (at MECO) -6.2 ± 0.6 / ± 0.2 Max lateral +2.8 / ± 3.0 Max lateral -0.2 / ± 3.0 Maximum quasi-steady acceleration is a function of payload separated mass. (See Exhibit 1, Section 8, Figures E1-37 and E1-43, for maximum values if mass changes.) Maximum expected sinusoidal vibration at the base of the PAF: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz); 1.0 g zero to peak (6.2-100 Hz); lateral: 0.7 g zero-to peak (5-100 Hz). (See SOW Exhibit 1, Section 8, Table E1-33, for additional information.) Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.
Dynamic Environments: No mission requirements specified.	Delta II 2925-9.5 maximum flight level payload acoustic environment: OASPL = 139.8 dB. (See SOW Exhibit 1, Section 8, Figure E1-30, for maximum levels across the frequency spectrum.) Delta II 3712 PAF with 3300-lb preload maximum flight-level payload interface shock response spectrum: 40 g (100 Hz), +9.2 dB/octave (100-1500 Hz); 2500 g (1500-3000 Hz). (See SOW Exhibit 1, Section 8, Figure E1-35, for additional information.)
Radio Frequency: No mission requirements specified.	Delta II Standard Service: 20 V/m across the range of 14 KHz to 40 GHz with 40 V/m between 2.2 GHz and 2.3 GHz and between 5.762 and 5.768 GHz. RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section 8, Table E1-30, for additional information.)
Payload Compartment Venting: No mission requirements specified.	Delta II Standard Service: pressure profiles and depressurization rates. (See SOW Exhibit 1, Section 8, Figure E1-22, for established maximum and minimum values.)
Launch Site Facility Environments: Instruments may require continuous GN_2 purge, possibly through liftoff (T-0 purge).	Delta II Standard Service: Spacecraft GN_2 purge is provided at the Eastern Range facility. (See SOW Exhibit 2 for more information.)



Delta II 2925-9.5 (With STAR™ 48B Motor)

Payload Environmental Requirements (continued)	
Requirement	**Solution**
Contamination Control: Launch vehicle hardware that comes in contact with the spacecraft environment will be cleaned to visibly clean level 2 with a black light inspection. GSE that comes into direct contact with the spacecraft will be cleaned to visibly clean level 0. The level of contaminants that the launch vehicle contributes to the spacecraft from the point of encapsulation through launch shall not exceed molecular 1.0 mg/ft² on critical surfaces and particulate Level 300 per MIL-STD 1246 for critical surfaces. The spacecraft shall be maintained at Class 100,000 environment from arrival at the payload processing facility, through spacecraft processing, and up to payload fairing closeout. The spacecraft may need a " shower curtain" over the stacked observatory so that positive pressure is maintained inside the shower curtain using the Class 1000 fairing air supply. The curtain would remain over the observatory until fairing encapsulation.	Delta II Non-Standard Service: A mission-specific contamination-control plan will be developed to maintain a Class 10,000 payload environment, per FED-STD-209E including Class 1000 payload fairing positive pressure air flow to the spacecraft while inside the "shower curtain" enclosure. (NSS: 11.1) Delta II Non-Standard Service: Provide payload fairing cleaning to Level 500A per MIL-STD-1246C to comply with visibly clean level 2 with black light inspection, which is assumed to be equivalent to Boeing level VC-6 per MDC STP0407. (NSS: 11.2) Cleaning of other launch vehicle flight hardware (upper stage and second stage) will be Boeing standard level VC-3. Boeing-provided GSE (transportation can and work stands) will be cleaned to level VC-2, which is assumed to comply with stated level VC-0 of which Boeing has no such level designation. The spacecraft customer should protect all sensitive spacecraft surfaces where possible prior to installation into the transportation canister through encapsulation into the payload fairing at the launch pad. Molecular levels on critical surfaces specified (not to exceed 1.0 mg/ft²) from the point of encapsulation (fairing installation) will be maintained. Meeting the critical surfaces % obscuration requirement (Level 300 per MIL-STD-1246C) is dependent upon location of the surfaces in question. Additional information is required to scope the effort required to analyze this condition or provide any non-standard monitoring. These will be addressed during the integration process and will be the subject of a mission unique proposal. This analysis may require expansion to the entire payload processing flow and flight environments.

Non-Standard Services Required
NSS 11.1 Enhanced Fairing Environment
NSS 11.2 Enhanced Fairing Internal Surface Cleanliness
NSS 19.1 Ground Processing Facilities Payloads at Eastern Range

Mission-Unique Services Required:
MUS: None (to be defined during integration process)

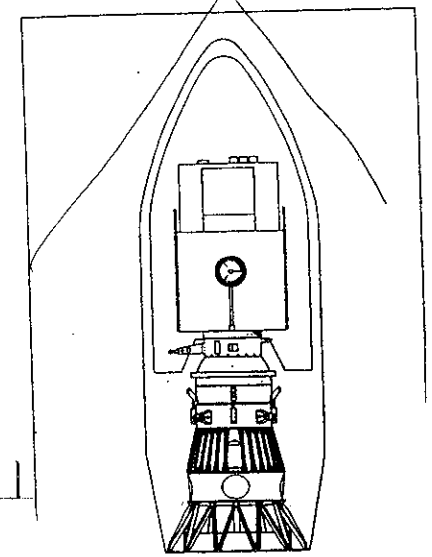
Mission Requirements	
Requirement	**Solution**
Payload Risk Category: 3.	Delta II 2925H-10 Launch Vehicle.
Launch Date: August 2007.	Delta On-Time Launch Service: Assurance in meeting planetary launch window periods is enhanced by building in contingency time including hardware scheduling, tracking, and early mission checkout. Instantaneous launch windows are met with multiple flight trajectories for launch windows and selective use of built-in holds for issue resolution during the day of launch countdown. (See SOW Exhibit 2 for an additional description.)
Launch Site: Cape Canaveral Air Force Station (CCAFS). Payload Processing: Commercial.	Delta II Eastern Range launch site: CCAFS, Space Launch Complex 17 (SLC-17). Delta II Non-Standard Service: Astrotech Payload Processing facility. (NSS 19.1)
Payload Mass: Approximately 1,000 kg. Orbit: Escape: C3 = 15 km^2/s^2.	Delta II 2925H-10 with nine GEM-46 thrust augmentation solid motors and a 10-ft (3-m)-dia composite payload fairing. Includes all the standard services associated with the 2925-10 basic vehicle. Delta II Non-Standard Service: Replace standard GEM-46 solid motors with higher performance GEM-46 solid motors. (NSS 1.1) Delta II Non-Standard Service: Because this mission is the first 2925H-10 vehicle configuration from the Eastern Range (ER), NSS 26.2, Category "2" core vehicle analysis (Small), is required. Revisions to account for the first use of this "Group H" three-stage heavy vehicle configuration with a 10-ft fairing from the ER will be made to the controls and strength analyses.
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in Performance and Guidance Accuracy Analysis (CDRL C4-1).
Separation Attitude Accuracy and Rates: No mission requirements specified.	Delta II vehicle standard third-stage (despun) payload deployment: attitude <10.0 deg, rate < 7.0-deg/sec (transverse), 0.0± 5 rpm (roll). (See SOW Exhibit 1, Section 4, Table E1-28 and Exhibit 2.)

Payload Accommodation Requirements	
Requirement	**Solution**
Third-stage motor: No mission requirements specified.	STAR™48B motor, including spin table.
Payload Interface: No mission requirements specified.	Delta II 3712C payload attach fitting (PAF), which includes a separation clampband system, a yo-yo despin system, a nutation control system, and extended mission thermal modifications to accommodate mission lengths of up to 7000 sec. (See SOW Exhibit 1, Section 6, Figure E1-19.) CG vertical limit (above separation plane) for payload mass based on generic load factors = 101.6 cm (40 in.). CG capability may be increased through the mission-specific coupled loads process.
Spinup/Spindown: No mission requirements specified.	Delta II standard spinup of the third stage and payload to stabilize the STAR™48B motor will be accomplished with the Delta II spin table and spin rocket motors. (See SOW Exhibit 2.) Y. yo despin system includes a nutation control system to minimize velocity/attitude pointing errors and coning conditions during the time from third-stage ignition to yo-yo despin initiation
Payload Envelope: No mission requirements specified.	Delta II 10-ft-(3m) composite payload fairing. Delta II Non-Standard Service: Replace the baseline Delta II 2925H -9.5-ft (2.9-m) aluminum payload fairing with a 10-ft (3-m) composite payload fairing. (NSS 2.1.2)
Payload Access: No mission requirements specified.	Up to three Delta II standard service payload access doors are available for use by the payload. (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors.)

Exhibit 5
NLS MISSION SOLUTION
CLIN 23—Space Science 1

SPACECRAFT AND MISSION DESCRIPTION

The Boeing solution for this mission is a Delta II 2925H-10 vehicle. This mission will be launched from the Delta II Eastern Range launch site. Specific details regarding the solution for all currently identified mission requirements, together with the corresponding rationale for technical acceptability, are described in the accompanying tables.



Space Science 1 Spacecraft

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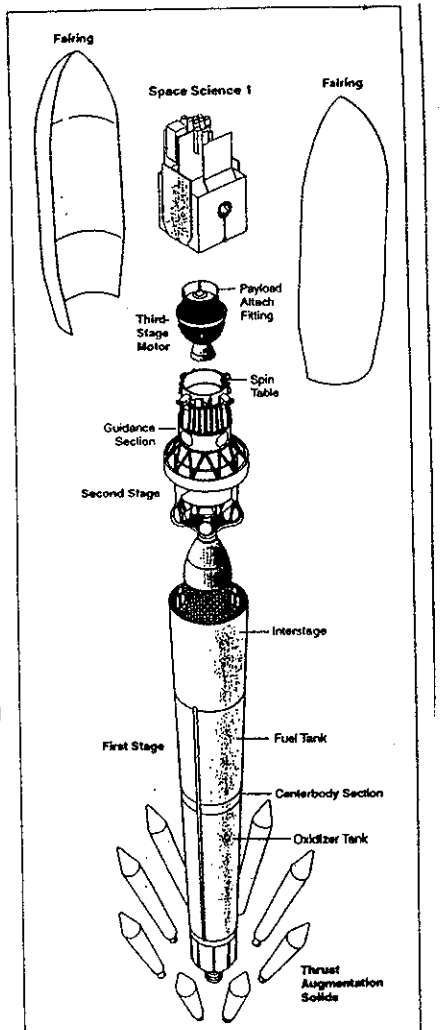
NOW CLIN 22
PHOENIX

Payload Accommodation Requirements (continued)	
Requirement	**Solution**
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 3 DC accelerometers, 1 pressure transducer, 1 temperature patch. (See SOW Exhibit 1, Section 9, Table E1-34, for a detailed description.)
Electrical Interface: No mission requirements specified.	Delta II Standard Service: Two 37-pin payload interface connectors 180 deg apart across the interface plane, disconnected upon separation; 61-pin connectors may be provided as a non-standard service. Payload wiring is routed to GSE via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Section 7, Table E1-29, for a detailed description of available electrical interfaces.)

Payload Environmental Requirements	
Requirement	**Solution**
Thermal: No mission requirements specified.	Delta II 10-ft (3-m) fairing and STAR™48B third-stage payload environments. (See SOW Exhibit 1, Section 8, Figures E1-43A and E1-43C and Exhibit 2 for established ranges and additional information.)
Dynamic Loads: No mission requirements specified.	Delta II 2925H environment: Payload design CG limit load factors. (See SOW Exhibit 1 Section 8, Table E1-31.) To be determined upon definition of payload mass. Axial (g) / Lateral (g) Max axial (at MECO) 6.3 ± 0.6 / ± 0.2 Max lateral +2.8 / ± 3.5 Max lateral - 0.2 / ± 3.5 Maximum quasi-steady acceleration is a function of payload separated mass (See Exhibit 1, Section 8, Figures E1-37 and E1-43, for maximum values if mass changes.) Maximum expected sinusoidal vibration at the base of the PAF: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz), 1.0 g zero to peak (6.2-100 Hz); lateral: 0.7 g zero to peak (5-100 Hz). (See SOW Exhibit 1, Section 8, Table E1-33, for additional information.) Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.
Dynamic Environments: No mission requirements specified.	Delta II 2925H-10 maximum flight level payload acoustic environment: OASPL = 142.8 dB. (See SOW Exhibit 1, Section 8, Figure E1-31, for maximum levels across the frequency spectrum.) Delta II 3712 PAF with 3300-lb preload maximum flight-level payload interface shock response spectrum: 40 g (100 Hz), +9.2 dB/octave (100-1500 Hz), 2500 g (1500-3000 Hz). (See SOW Exhibit 1, Section 8, Figure E1-35, for additional information.)
Radio Frequency: No mission requirements specified.	Delta II Standard Service: 20 V/m across the range of 14 KHz to 40 GHz with 40 V/m between 2.2 GHz and 2.3 GHz and between 5.762 and 5.768 GHz. RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section 8, Table E1-30, for additional information.)
Payload Compartment Venting: No mission requirements specified.	Delta II Standard Service: Pressure profiles and depressurization rates. (See SOW Exhibit 1, Section 8, Figure E1-22, for established maximum and minimum values.)
Launch Site Facility Environments: Temperature, relative humidity, and filtration. No mission requirements specified.	Delta II Standard Service: Eastern Range facility environments. (See SOW Exhibit 2.)
Contamination Control: No mission requirements specified.	Delta II Standard Service: Generic contamination-control plan. (See SOW Exhibit 2 for established minimum requirements.)

Non-Standard Services Required
NSS 1.1 Heavy vehicle upgrade
NSS 2.1.2 Replace a 9.5-ft PLF with a 10-ft PLF
NSS 19.1 Ground Processing Facilities Payloads at Eastern Range
NSS 26.2 Category "2" core vehicle analysis (Small)



Delta II 2925H-10 (With STAR™ 48B Motor)

Mission Requirements	
Requirement	**Solution**
Payload Risk Category: 3.	Delta II 2320-10 Launch Vehicle.
Launch Date: September 2007.	Delta On-Time Launch Service.
Launch Site: Vandenberg Air Force Base (VAFB). Payload Processing: Commercial.	Delta II Non-Standard Service: Delta II Western Range launch site: VAFB Space Launch Complex 2 (SLC-2). NSS 27.1. Western Range (WR) Launch Incremental. Delta II Non-Standard Service: Payload processing facility at Western Range. (NSS 19.2)
Payload Mass: 894 kg. Orbit: 6AM Sun Synchronous at 600 km.	Delta II 2320-10 with three GEM-40 thrust augmentation solid motors and a 10-ft (3-m)-dia payload fairing. Includes all the standard services associated with the 2320-10 basic launch vehicle.
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in Performance and Guidance Accuracy Analysis (CDRL C4-1).
Separation Attitude Accuracy and Rates: No mission requirements specified.	Delta II vehicle standard two-stage low-tip-off payload deployment for the 6915, 6306 or 6019 payload attach fitting: attitude (deg): < 3.0 (per axis), rate (deg/sec): < 0.25 (per axis). (See SOW Exhibit 1, Section 4, Table E1-28 and Exhibit 2.)

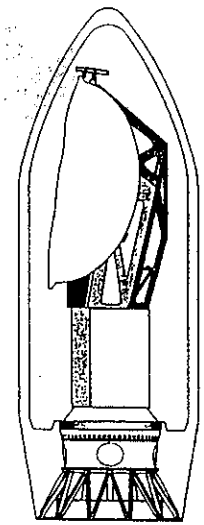
Payload Accommodation Requirements	
Requirement	**Solution**
Third-Stage Motor: No mission requiremens specified.	Not required.
Payload Interface: No mission requirements specified.	One of three available two-stage Delta II PAFs (see SOW Exhibit 1, Section 3, Figure E1-19): 1. Delta II Standard Service: 6915 PAF, which includes separation nut system, secondary latch, and retro system. CG vertical limit (above separation plane) for payload mass based on generic load factors =304.8 cm (120 in.). 2. Delta II Non-Standard Service: 6306 PAF, which includes separation clamp band, secondary latch, and retro system. CG vertical limit (above separation plane) for payload mass based on generic load factors =304.8 cm (120 in.). (NSS 3.2.1) 3. Delta II Non-Standard Service: 6019 PAF, which includes separation nut system, secondary latch, and retro system. CG vertical limit (above separation plane) for payload mass based on generic load factors =279.4 cm (110 in.). (NSS 3.2.2) Due to the Aquarius stack height inside the fairing provided, the 6306 is the preferred option. If during the integration process the other PAFs become viable solutions they may be swapped per NSS above. For consistency, performance values will continue to be quoted based upon use of the baseline 6915 PAF. CG capability may be increased through the mission-specific coupled-loads process.
Spinup/Spindown: No mission requirements specified.	N/A.
Payload Envelope: 2.0 X 6.1 m.	Delta II 10-ft (3-m)-dia composite payload fairing.

Exhibit 5
NLS MISSION SOLUTION
CLIN 24—Aquarius

SPACECRAFT AND MISSION DESCRIPTION

The new NASA Aquarius mission will utilize an accurate radiometer system to make the first global measurements of salt concentration at the ocean surface. This unique mission, developed in partnership with CONAE, NOAA, and ESR, will make discoveries about the ocean circulation, the global cycling of fresh water, and climate.

The Boeing solution for this mission is a Delta II 2320-10 launch vehicle. This mission will be launched from the Delta II Western Range launch site. Specific details regarding the solution for all currently identified mission requirements, together with the corresponding rationale for technical acceptability, are described in the accompanying tables.



Aquarius Spacecraft

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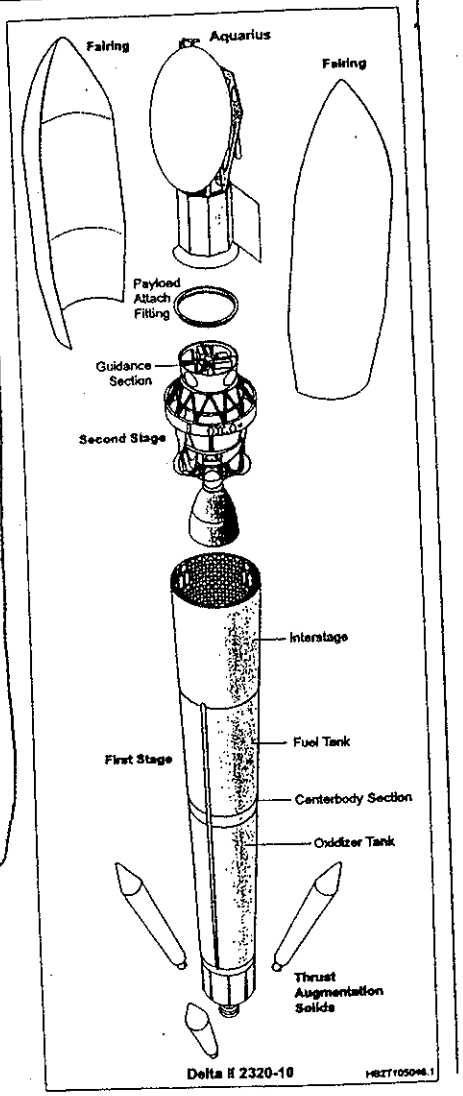
Payload Accommodation Requirements (continued)	
Requirement	**Solution**
Payload Access: No mission requirements specified.	Up to three Delta II standard service payload access doors are available for use by the payload. (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors.)
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 1 DC accelerometer, 3 AC accelerometers, 1 pressure transducer, 1 temperature patch. (See SOW Exhibit 1, Section 9, Table E1-34 for a detailed description.)
Electrical Interface: No mission requirements specified.	Delta II Standard Service: Two 37-pin payload interface connectors at one location and disconnected by the fairing; 61-pin connectors may be provided as a non-standard service. Payload wiring is routed to GSE via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Section 7, Table E1-29, for a detailed description of available electrical interfaces.)

Payload Environmental Requirements	
Requirement	**Solution**
Thermal: No mission requirements specified.	Delta II 10-ft (3-m) fairing payload environment. (See SOW Exhibit 1, Section 8, Figure E1-43A and Exhibit 2 for established ranges and additional information.)
Dynamic Loads: No mission requirements specified.	Delta II 2320-10 environment: payload design CG limit load factors. Based on 6915 PAF. (See SOW Exhibit 1, Section 8, Table E1-31). Axial (g) / Lateral (g) Max axial (at MECO): 7.5 ± 0.6 / ±0.2 Max lateral: + 2.8 / ± 4.0 Max lateral: - 0.2 / ± 4.0 Maximum quasi-steady acceleration is a function of payload separated mass. (See SOW Exhibit 1, Section 8, Figure E1-37, for maximum values if mass changes.) Maximum expected sinusoidal vibration at the base of the PAF: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz), 1.0 g zero to peak (6.2-100 Hz); lateral: 0.7 g zero to peak (5-100 Hz). (See SOW Exhibit 1, Section 8, Table E1-33, for additional information.) Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.
Dynamic Environments: No mission requirements specified.	Delta II 2320-10 environment maximum flight level payload acoustic environment: OASPL = 139.4 dB. (See SOW Exhibit 1, Section 8, Figure E1-29, for maximum levels by frequency. 2320 levels are 0.5 dB lower than the 2420.) Delta II 6915 PAF or 6019 PAF maximum flight-level payload interface shock response spectrum: 100 g (100-350 Hz), +12.3 dB/octave (350-1700 Hz), 2500 g (1700 Hz), +5.6 dB/octave (1700-4000 Hz), 5500g (4000-5000 Hz), -8.8 dB/ octave (5000-10000 Hz), 2000 g (10000 Hz). Delta II 6306 PAF maximum flight-level payload interface shock response spectrum: 100 g (100 Hz), +9.8 dB/octave (100-800 Hz), 3000 g (800-3000 Hz). (See SOW Exhibit 1, Section 8, Figure E1-35, for additional information.)
Radio Frequency: No mission requirements specified.	Delta II Standard Service: 20 V/m across the range of (14 KHz to 40 GHz) with 40 V/m between (5.762 GHz – 5.768 GHz). RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section 8, Table E1-30, for additional information.)
Payload Compartment Venting: No mission requirements specified.	Delta II Standard Service: Pressure profiles and depressurization rates. (See SOW Exhibit 1, Section 8, Figure E1-22, for established maximum and minimum values.)
Launch Site Facility Environments: temperature, relative humidity, and filtration. No mission requirements specified.	Delta II Non-Standard Service: Western Range facility environments. (See SOW Exhibits 2 and 3 for established ranges.) (NSS 27.1, see Note 4.)
Contamination Control: No mission requirements specified.	Delta II Non-Standard Service: Generic contamination-control plan. (See SOW Exhibits 2 and 3 for established minimum requirements.) (NSS 27.1, see Note 4.)

Non-Standard Services Required
NSS 19.2 Ground Processing Facilities Payloads at Western Range
NSS 27.1 Western Range (WR) Launch Incremental



Mission Requirements	
Requirement	**Solution**
Payload Risk Category: 3.	Delta II 2420-10 Launch Vehicle.
Launch Date: March 2008.	Delta On-Time Launch Service.
Launch Site: Cape Canaveral Air Force Station (CCAFS). Payload Processing: Commercial.	Delta II Eastern Range launch site: CCAFS, Space Launch Complex 17 (SLC-17). Delta II Non-Standard Service: Astrotech Payload Processing facility (NSS 13.1).
Payload Mass: 2400 kg. Orbit: 1000 km circular; inclination 28.7 deg.	Delta II 2420-10 with four GEM-40 thrust augmentation solid motors and a 10-ft- (3-m)-dia composite payload fairing. Includes all the standard services associated with the 2420-10 basic vehicle.
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in the Performance and Guidance Accuracy Analysis (CDRL C4-1).
Separation Attitude Accuracy and Rates: No mission requirements specified.	Delta II vehicle standard two-stage low-tip-off payload deployment for the 6915, 6306, or 6019 payload attach fitting: attitude (deg): < 3.0 (per axis); rate (deg/ sec), <0.25 (per axis). (See SOW Exhibit 1, Section 4, Table E1-28 and Exhibit 2.)

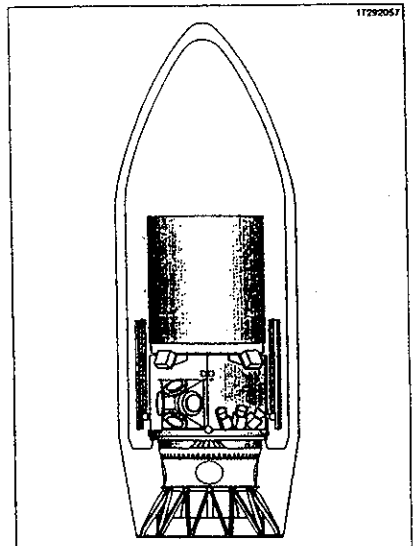
Payload Accommodation Requirements	
Requirement	**Solution**
Third-Stage Motor: No mission requirement specified.	Not required.
Payload Interface: No mission requirements specified.	One of three available two-stage Delta II PAFs (see SOW Exhibit 1, Section 6, Figure E1-19): 1. Delta II Standard Service: 6915 PAF, which includes separation nut system, secondary latch, and retro system. CG vertical limit (above separation plane) for payload mass based on generic load factors = 190.5 cm (75.0 in.). 2. Delta II Non-Standard Service: 6306 PAF, which includes a separation clampband, secondary latch, and retro system. (NSS 3.2.1) (See SOW Exhibit 1, Section 6, Figure E1-19.). CG vertical limit (above separation plane) for payload mass based on generic load factors = 213.4 cm (84.0 in.). 3. Delta II Non-Standard Service: 6019 PAF, which includes separation nut system, secondary latch, and retro system. CG vertical limit (above separation plane) for payload mass based on generic load factors = 162.6 cm (64.0 in.) (NSS 3.2.2). CG capability may be increased through the mission-specific coupled-loads process.
Spinup/Spindown: No mission requirements specified.	Not required
Payload Envelope: Spacecraft overall dimensions in launch configuration: No mission requirements specified.	Delta II 10-ft- (3-m)-dia composite payload fairing per NASA vehicle recommendation
Payload Access: No mission requirements specified.	Up to three Delta II standard service payload access doors are available for use by the payload. (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors.)
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 1 DC accelerometer, 3 AC accelerometers, 1 pressure transducer, 1 temperature patch. (See SOW Exhibit 1, Section 9, Table E1-34, for a detailed description.)
Electrical Interface: No mission requirements specified.	Delta II Standard Service: Two 37-pin payload interface connectors at one location and disconnected by the fairing; 61-pin connectors may be provided as a non-standard service. Payload wiring is routed to GSE via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Section 7, Table E1-29, for a detailed description of available electrical interfaces.)

Exhibit 5
NLS MISSION SOLUTION
CLIN 25—MIDEX 6

SPACECRAFT AND MISSION DESCRIPTION

The MIDEX 6 mission is a space physics and astronomy mission intended to study the sun, to examine the space environment of the Earth and other planets, and to observe the universe beyond our solar system.

The Boeing solution for this mission is the Delta II 2420-10 vehicle. This mission will be launched from the Delta II Eastern Range launch site. Specific details regarding the solution for all currently identified mission requirements, together with the corresponding rationale for technical acceptability, are described in the accompanying tables.

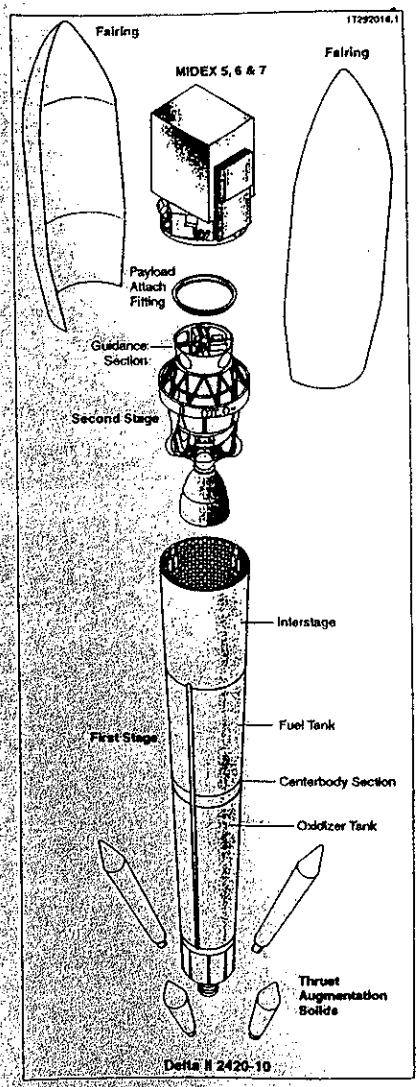


MIDEX 6 Spacecraft

Payload Environmental Requirements

Requirement	Solution
Thermal: No mission requirements specified.	Delta II 10-ft (3-m) fairing payload environment: (See SOW Exhibit 1, Section 8, Figure E1-43A and Exhibit 2 for established ranges and additional information.)
Dynamic Loads: No mission requirements specified.	Delta II 2420 environment: Payload design CG limit load factors. Based on 6915 PAF. (See SOW Exhibit 1, Section 8, Table E1-31.) Axial (g) / Lateral (g) Max axial (at MECO) +6.7 ± 0.6 / ± 0.2 Max lateral +2.8 / ± 2.5 Max lateral -0.2 / ± 2.5 Maximum quasi-steady acceleration is a function of payload separated mass. (See SOW Exhibit 1, Section 8, Figure E1-37, for maximum values if mass changes.) Maximum expected sinusoidal vibration at the base of the PAF: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz), 1.0 g zero to peak (6.2-100 Hz); lateral: 0.7 g zero to peak (5-100 Hz). (See SOW Exhibit 1, Section 8, Table E1-33, for additional information.) Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.
Dynamic Environments: No mission requirements specified.	Delta II 2420-10 maximum flight level payload acoustic environment: OASPL = 139.9 dB. (See SOW Exhibit 1, Section 8, Figure E1-29, for maximum levels across the frequency spectrum.) Delta II 6915 or 6019 PAF maximum flight-level payload interface shock response spectrum: 100 g (100-350 Hz), +12.3 dB/octave (350-1700 Hz); 2500 g (1700 Hz), +5.6 dB/octave (1700-4000 Hz); 5500 g (4000-5000 Hz), -8.8 dB/octave (5000-10,000 Hz); 2000 g (10,000 Hz). Delta II 6306 PAF maximum flight-level payload interface shock response spectrum: 100 g (100 Hz), +9.8 dB/octave (100-800 Hz), 3000 g (800-3000 Hz). (See SOW Exhibit 1, Section 8, Figure E1-35, for additional information.)
Radio Frequency: No mission requirements specified.	Delta II Standard Service: 20 V/m across the range of 14 KHz to 40 GHz with 40 V/m between 5.752 and 5.768 GHz. RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section 8, Table E1-30, for additional information.)
Payload Compartment Venting: No mission requirements specified.	Delta II Standard Service: Pressure profiles and depressurization rates: (See SOW Exhibit 1, Section 8, Figure E1-22, for established maximum and minimum values.)
Launch Site Facility Environments: Temperature, relative humidity, and filtration. No mission requirements specified.	Delta II Standard Service: Eastern Range facility environments (See SOW Exhibits 2 for established ranges.)
Contamination Control: No mission requirements specified.	Delta II Standard Service: Generic contamination control plan. (See SOW Exhibit 2 for established minimum requirements.)

Non-Standard Services Required
NSS 19.1 Ground Processing Facilities Payloads at Eastern Range



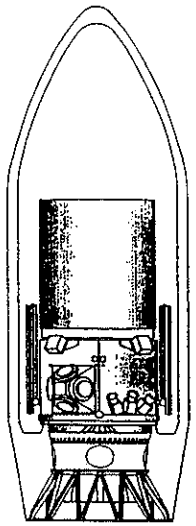
Mission Requirements	
Requirement	**Solution**
Payload Risk Category: 3.	Delta II 2920-10 Launch Vehicle.
Launch Date: April 2006.	Delta On-Time Launch Service.
Launch Site: Cape Canaveral Air Force Station (CCAFS). Payload Processing: Commercial.	Delta II Eastern Range (ER) launch site: CCAFS, Space Launch Complex (SLC-17). Delta II Non-Standard Service: Astrotech Payload Processing Facility. (NSS 3.1)
Payload Mass: No mission requirements specified. Orbit: No mission requirements specified.	Delta II 2920-10 with nine GEM-40 thrust augmentation solid motors and a 10-ft (3-m)-dia payload fairing. Includes all the standard services associated with the 2920-10 basic launch vehicle. Delta II Non-Standard Service: Because this mission is the first use of the 2920-10 vehicle configuration from the Eastern Range (ER), NSS 26.1, Category "1" core vehicle analysis (Medium), will be required. Revisions to account for the first use of this "Group E" two-stage vehicle configuration with a 10-ft fairing from the ER will be made to the range safety, controls, aerodynamics, loads and strength analyses.
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in Performance and Guidance Accuracy Analysis (CDRL C4-1).
Separation Attitude Accuracy and Rates: No mission requirements specified.	Delta II vehicle standard two-stage low-tip-off payload deployment for the 6315, 6306, or 6019 payload attach fitting: attitude (deg): < 3.0 (per axis), rate (deg/sec): < 0.25 (per axis). (See SOW Exhibit 1, Section 4, Table E1-28 and Exhibit 2.)

Payload Accommodation Requirements	
Requirement	**Solution**
Third-Stage Motor: No mission requirements specified.	Not required.
Payload Interface: No mission requirements specified.	One of three available two-stage Delta II PAFs (see SOW Exhibit 1, Section 6, Figure E1-19): 1. Delta II Standard Service: 6315 PAF, which includes separation nut system, secondary latch, and retro system. CG vertical limit (above separation plane) for payload mass based on generic load factors will be determined upon definition of payload mass. 2. Delta II Non-Standard Service: 6306 PAF, which includes separation clampband, secondary latch, and retro system. CG vertical limit (above separation plane) for payload mass based on generic load factors will be determined upon definition of payload mass. (NSS 3.2.1) 3. Delta II Non-Standard Service: 6019 PAF, which includes separation nut system, secondary latch, and retro system. CG vertical limit (above separation plane), for payload mass based on generic load factors will be determined upon definition of payload mass. (NSS 3.2.2) CG capability may be increased through the mission-specific coupled-loads process.
Spinup/Spindown: No mission requirements specified.	N/A.
Payload Envelope: No mission requirements specified.	Delta II 10-ft (3-m)-dia composite payload fairing.
Payload Access: No mission requirements specified.	Up to three Delta II standard service payload access doors are available for use by the payload. (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors.)

Exhibit 5
NLS MISSION SOLUTION
CLIN 26—SLI/AAS Demo

SPACECRAFT AND MISSION DESCRIPTION

The Boeing solution for this mission is a Delta II 2920-10 launch vehicle. This mission will be launched from the Delta II Eastern Range launch site. Specific details regarding the solution for all currently identified mission requirements, together with the corresponding rationale for technical acceptability, are described in the accompanying tables.

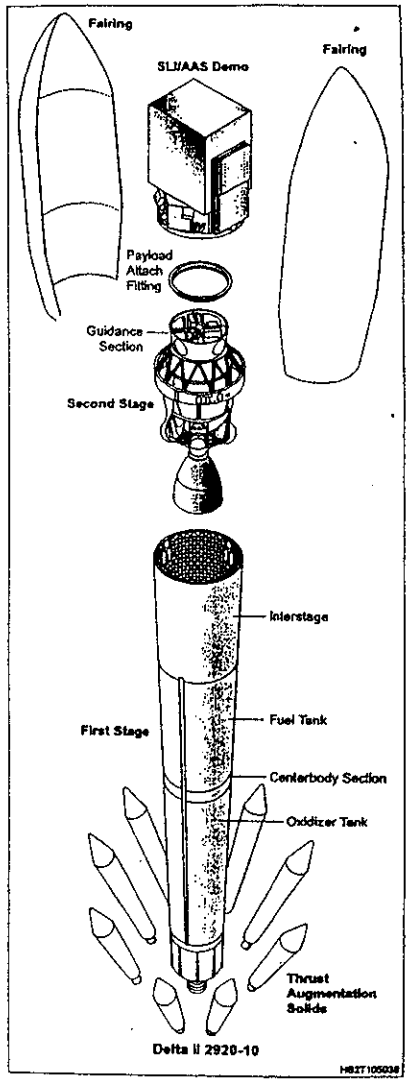


SLI/AAS Demo Spacecraft

Payload Accommodation Requirements (continued)	
Requirement	**Solution**
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 1 DC accelerometer, 3 AC accelerometers, 1 pressure transducer, 1 temperature patch. (See SOW Exhibit 1, Section 9, Table E1-34 for a detailed description.)
Electrical Interface: No mission requirements specified.	Delta II Standard Service: Two 37-pin payload interface connectors at one location and disconnected by the fairing; 61-pin connectors may be provided as a non-standard service. Payload wiring is routed to GSE via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Section 7, Table E1-29, for a detailed description of available electrical interfaces.)

Payload Environmental Requirements	
Thermal: No mission requirements specified.	Delta II 10-ft (3-m) fairing payload environment. (See SOW Exhibit 1, Section 8, Figure E1-43A and Exhibit 2 for established ranges and additional information.)
Dynamic Loads: No mission requirements specified.	Delta II 2920-10 environment: payload design CG limit load factors. (See SOW Exhibit 1, Section 8, Table E1-31.) To be determined upon definition of payload mass. Axial (g) / Lateral (g) Max axial (at MECO): TBD ± 0.6 / ± TBD Max lateral: + TBD / ± TBD Max lateral: - TBD / ± TBD Maximum quasi-steady acceleration is a function of payload separated mass. (See SOW Exhibit 1, Section 8, Figure E1-37, for maximum values.) Maximum expected sinusoidal vibration at the base of the PAF: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz), 1.0 g zero to peak (6.2-100 Hz); lateral: 0.7 g zero to peak (5-100 Hz). (See SOW Exhibit 1, Section 8, Table E1-33, for additional information.) Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.
Dynamic Environments: No mission requirements specified.	Delta II 2920-10 environment maximum flight level payload acoustic environment: OASPL = 140.8 dB. (See SOW Exhibit 1, Section 8, Figure E1-31, for maximum levels across frequency spectrum.) Delta II 6915 PAF or 6019 PAF maximum flight-level payload interface shock response spectrum: 100 g (100-350 Hz), +12.3 dB/octave (350-1700 Hz), 2500 g (1700 Hz), +5.6 dB/octave (1700-4000 Hz), 5500g (4000-5000 Hz), -8.8 dB/ octave (5000-10000 Hz), 2000 g (10000 Hz). Delta II 6306 PAF maximum flight-level payload interface shock response spectrum: 100 g (100 Hz), +9.8 dB/octave (100-800 Hz), 3000 g (800-3000 Hz). (See SOW Exhibit 1, Section 8, Figure E1-35, for additional information.)
Radio Frequency: No mission requirements specified.	Delta II Standard Service: 20 V/m across the range of (14 KHz to 40 GHz) with 40 V/m between (5.762 GHz – 5.768 GHz). RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section 8, Table E1-30, for additional information.)
Payload Compartment Venting: No mission requirements specified.	Delta II Standard Service: Pressure profiles and depressurization rates. (See SOW Exhibit 1, Section 8, Figure E1-22, for established maximum and minimum values.)
Launch Site Facility Environments: temperature, relative humidity, and filtration. No mission requirements specified.	Delta II Non-Standard Service: Western Range facility environments. (See SOW Exhibits 2 and 3 for established ranges.) (NSS 27.1, see Note 4.)
Contamination Control: No mission requirements specified.	Delta II Non-Standard Service: Generic contamination-control plan. (See SOW Exhibits 2 and 3 for established minimum requirements.) (NSS 27.1, see Note 4.)

Non-Standard Services Required
NSS 19.1 Ground Processing Facilities Payloads at Eastern Range
NSS 26.1 Category "1" Core Vehicle Analysis (Medium)



Mission Requirements

Requirement	Solution
Payload Risk Category: 3.	Delta II 2920H-10 Launch Vehicle. The Boeing solution is a standard vehicle. Mission unique services to develop and fly an unshrouded winged vehicle will be proposed and price provided following completion of the feasibility study being conducted outside the NLS contract.
Launch Date: July 2006.	Delta On-Time Launch Service.
Launch Site: Cape Canaveral Air Force Station (CCAFS). Payload Processing Facility: Commercial.	Delta II Eastern Range (ER) launch site: CCAFS, Space Launch Complex (SLC-17). Delta II Non-Standard Service: Astrotech Payload Processing Facility. (NSS 19.1)
Payload Mass: 5400 kg. Orbit: 85–160 nmi circular; inclination 28.5 deg.	Delta II 2920H-10 with nine GEM-46 thrust augmentation solid motors and a 10-ft (3-m)-dia composite payload fairing. Includes all the standard services associated with the 2920-10 basic vehicle. Delta II Non-Standard Service: Replace standard GEM-40 solid motors with higher performance GEM-46 solid motors. (NSS 1.1)
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in the Performance and Guidance Accuracy Analysis (CDRL C4-1).
Separation Attitude Accuracy and Rates: No mission requirements specified.	Delta II vehicle standard two-stage low-tip-off payload deployment for the 6915, 6306, or 6019 payload attach fitting: attitude (deg): < 3.0 (per axis); rate (deg/sec): < 0.25 (per axis). (See SOW Exhibit 1, Section 4, Table E1-28 and Exhibit 2.)

Payload Accommodation Requirements

Requirement	Solution
Third-Stage Motor: No mission requirements specified.	Not required.
Payload Interface: No mission requirements specified.	One of three available two-stage Delta II PAFs (see SOW Exhibit 1, Section 6, Figure E1-19): 1. Delta II Standard Service: 6915 PAF, which includes separation nut system, secondary latch, and retro system. CG vertical limit (above separation plane) for payload mass based on generic load factors = 88.9 cm (35 in.). 2. Delta II Non-Standard Service: 6306 PAF, which includes separation clampband, secondary latch, and retro system. CG vertical limit (above separation plane) for payload mass based on generic load factors = 111.8 cm (44 in.). (NSS 3.2.1) 3. Delta II Non-Standard Service: 6019 PAF, which includes separation nut system, secondary latch, and retro system. CG vertical limit (above separation plane) for payload mass based on generic load factors = 78.7 cm (31 in.). (NSS 3.2.2) CG capability may be increased through the mission-specific coupled-loads process.
Spinup/Spindown: No mission requirements specified.	Not required.
Payload Envelope: Unshrouded test vehicle, 28 ft tall, 15 ft in diameter, likely a winged vehicle.	Delta II 10-ft (3-m)-dia composite payload fairing. A credit for the 10-ft (3-m) composite payload fairing will be provided as part of the mission unique defined for the winged vehicle.
Payload Access: No mission requirements specified.	Up to three Delta II standard service payload access doors are available for use by the payload. (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors.)
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 1 DC accelerometer, 3 AC accelerometers, 1 pressure transducer, 1 temperature patch. (See SOW Exhibit 1, Section 9, Table E1-34 for a detailed description.)
Electrical Interface: No mission requirements specified.	Delta II Standard Service: Two 37-pin payload interface connectors at one location and disconnected by the fairing; 61-pin connectors may be provided as a non-standard service. Payload wiring is routed to GSE via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Section 7, Table E1-22, for a detailed description of available electrical interfaces.)

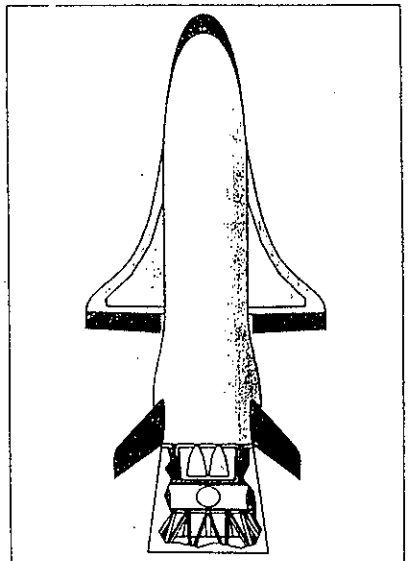
Exhibit 5
NLS MISSION SOLUTION
CLIN 27—SLI Demo

SPACECRAFT AND MISSION DESCRIPTION

This mission will be a demonstration of an unshrouded Reusable Launch Vehicle Flight for Space Launch Initiative.

The Boeing solution for this mission is a Delta II 2920H-10 launch vehicle. This mission will be launched from the Delta II Eastern Range launch site. Specific details regarding the solution for all currently identified mission requirements, together with the corresponding rationale for technical acceptability, are described in the accompanying tables.

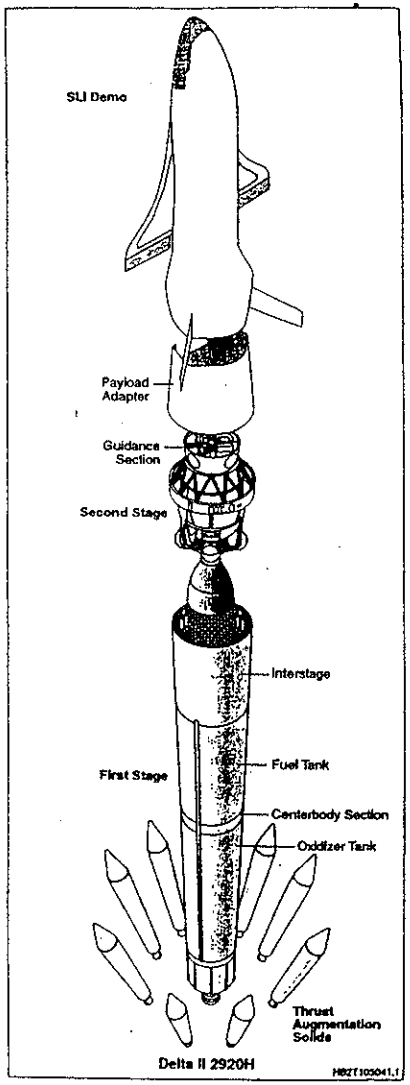
It is recognized an ongoing feasibility study is being conducted outside the NLS contract. For purposes of this LSTO a baseline vehicle configuration is proposed with the definition of mission uniques to be addressed upon feasibility study completion.



SLI Demo Spacecraft

Payload Environmental Requirements	
Requirement	**Solution**
Thermal: No mission requirements specified.	Delta II 10-ft (3-m) fairing payload environment. (See SOW, Exhibit 1, Section 8, Figure E1-43A, and Exhibit 2 for established ranges and additional information.)
Dynamic Loads: No mission requirements specified.	Delta II 2920H environment: payload design CG limit load factors. Based on 5915 PAF and standard vehicle configuration. (See SOW Exhibit 1, Section 8, Table E1-31). To be evaluated upon completion of feasibility study. Axial (g) / Lateral (g) Max axial (at MECO) 5.7 ± 0.6 / ± 0.2 Max lateral + 2.8 / ± 2.0 Max lateral - 0.2 / ± 2.0 Maximum quasi-steady acceleration is a function of payload separated mass. (See SOW Exhibit 1, Section 8, Figure E1-37, for maximum values if mass changes. Maximum expected sinusoidal vibration at the base of the PAF: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz), 1.0 g zero to peak (6.2-100 Hz); lateral: 0.7 g zero to peak (5-100 Hz). (See SOW Exhibit 1, Section 8, Table E1-33, for additional information.) Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.
Dynamic Environments: No mission requirements specified.	Delta II 2920H-10 maximum flight level payload acoustic environment: OASPL = 142.8 dB based upon standard vehicle configuration. (See SOW Exhibit 1, Section 8, Figure E1-31, for maximum levels across the frequency spectrum; 2920H levels are 2 dB higher than on the 2920.) Delta II 6915 and 6019 PAF maximum flight-level payload interface shock response spectrum: 100 g (100-350 Hz), +12.3 dB/octave (350-1700 Hz), 2500 g (1700 Hz), +5.6 dB/octave (1700-4000 Hz), 5500g (4000-5000 Hz), -6.8 dB/ octave (5000-10000 Hz), 2000 g (10000 Hz). Delta II 6306 PAF maximum flight-level payload interface shock response spectrum: 100 g (100 Hz), +9.8 dB/octave (100-800 Hz), 3000 g (800-3000 Hz). (See SOW Exhibit 1, Section 8, Figure E1-35, for additional information.)
Radio Frequency: No mission requirements specified.	Delta II Standard Service: 20 V/m across the range of 14 KHz to 40 GHz with 40 V/m between 5.762 GHz and 5.768 GHz. RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section 8, Table E1-3X, for additional information.)
Payload Compartment Venting: No mission requirements specified.	Delta II Standard Service: Pressure profiles and depressurization rates. (See SOW Exhibit 1, Section 8, Figure E1-22, for established maximum and minimum values.)
Launch Site Facility Environments: temperature, relative humidity, and filtration. No mission requirements specified.	Delta II Standard Service: Eastern Range facility environments. (See SOW Exhibit 2 for established ranges.)
Contamination Control: No mission requirements specified.	Delta II Standard Service: Generic contamination-control plan. (See SOW Exhibit 2 for established minimum requirements.)

Non-Standard Services Required
NSS 1.1 Heavy vehicle upgrade
NSS 19.1 Ground Processing Facilities Payloads at Eastern Range



Mission Requirements	
Requirement	**Solution**
Payload Risk Category: 3.	Delta II 2925-9.5 Launch Vehicle.
Launch Date: May 2008.	Delta On-Time Launch Service: Assurance in meeting planetary launch window periods is enhanced by building in contingency time including hardware scheduling, tracking, and early mission checkout. Instantaneous launch windows are met with multiple flight trajectories for launch windows and selective use of built-in holds for issue resolution during the day of launch countdown. (See SOW Exhibit 2 for an additional description.)
Launch Site: Cape Canaveral Air Force Station (CCAFS).	Delta II Eastern Range launch site: CCAFS, Space Launch Complex 17 (SLC-17).
Payload Processing: Commercial.	Delta II Non-Standard Service: Astrotech Payload Processing Facility. (NSS 19.1)
Payload Mass: approximately 900 kg.	Delta II 2925-9.5 with nine GEM-40 thrust augmentation solid motors and a 9.5-ft (2.9-m)-dia payload fairing. Includes all the standard services associated with the 2925-9.5 basic vehicle.
Orbit: Escape: $C_3 = 15\ km^2/sec^2$	
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in the Performance and Guidance Accuracy Analysis (CDRL C4-1).
Separation Attitude Accuracy and Rates: No mission requirements specified.	Delta II vehicle standard third-stage (despun) payload deployment: attitude <10.0 deg, rate <7.0-deg/sec (transverse), 0.0 ±5 rpm (roll). (See SOW Exhibit 1, Section 6, Table E1-28, and Exhibit 2.)

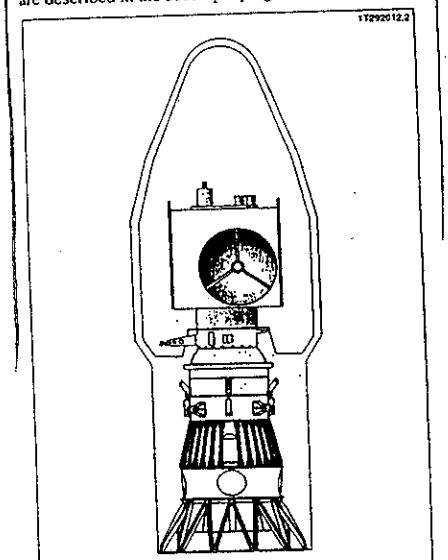
Payload Accommodation Requirements	
Requirement	**Solution**
Third-Stage Motor required to achieve the escape orbit for this mission.	STAR™48B motor, including spin table.
Payload Interface: No mission requirements specified.	Delta II 3712C payload attach fitting (PAF), which includes a separation clampband system, a yo-yo despin system, a nutation control system (NCS), and extended mission thermal modifications to accommodate mission lengths of up to 7,000 sec. (See SOW Exhibit 1, Section 6, Figure E1-19.) CG vertical limit (above separation plane) for payload mass based on generic load factors = 106.7 cm (42 in.). CG capability may be increased through the mission-specific coupled-loads process.
Spinup/Spindown: No mission requirements specified.	Delta II standard spinup of the third stage and payload to stabilize the STAR™48B motor will be accomplished with the Delta II spin table and spin rocket motors. (See SOW Exhibit 2.) Yo-yo despin system includes a nutation control system to minimize velocity/attitude pointing errors and coning conditions during the time from third-stage ignition to yo-yo despin initiation.
Payload Envelope: TBD.	Delta II 9.5-ft (2.9-m)-dia aluminum payload fairing per NASA vehicle recommendation.
Payload Access: No mission requirements specified.	Up to three Delta II standard service payload access doors are available for use by the payload. (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors.)
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 3 DC accelerometers, 1 pressure transducer, 1 temperature patch. (See SOW Exhibit 1, Section 9, Table E1-34, for a detailed description.)
Electrical Interface: No mission requirements specified.	Delta II Standard Service: Two 37-pin payload interface connectors 180 deg apart across the interface plane, disconnected upon separation; 61-pin connectors may be provided as an non-standard service. Payload wiring is routed to the GSE via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Section 7, Table E1-29, for a detailed description of available electrical interfaces.)

Exhibit 5
NLS MISSION SOLUTION
CLIN 28—Discovery 11

SPACECRAFT AND MISSION DESCRIPTION

The Discovery 11 mission is a solar system science mission intended for travel to and exploration of solar system bodies and/or for remote examination of the solar system and extra-solar planetary system environments.

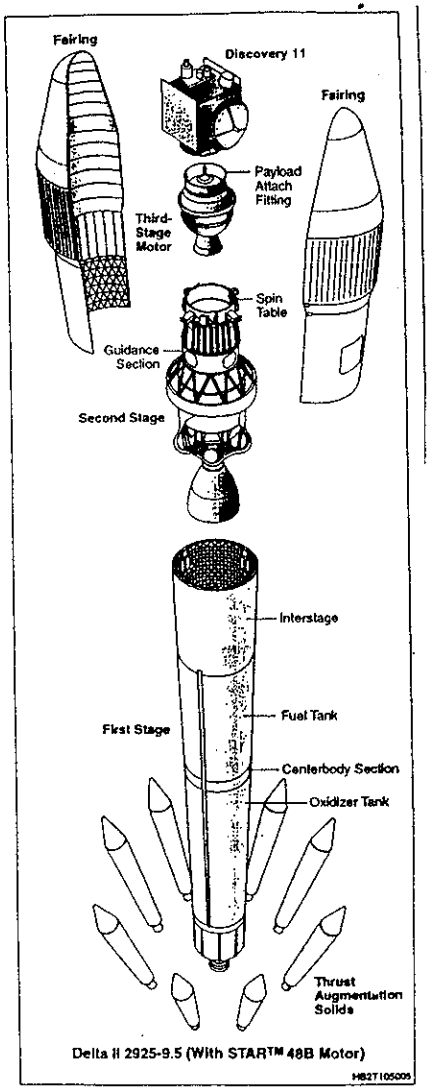
The Boeing solution for this mission is a Delta II 2925-9.5 vehicle. This mission will be launched from the Delta II Eastern Range launch site. Specific details regarding the solution for all currently identified mission requirements, together with the corresponding rationale for technical acceptability, are described in the accompanying tables.



Discovery 11 Spacecraft

Payload Environmental Requirements	
Requirement	**Solution**
Thermal: No mission requirements specified.	Delta II 9.5-ft (2.9-m) fairing and STAR™ 48B third-stage payload environments. (See SOW Exhibit 1, Section 8, Figures E1-43A and E1-43C and Exhibit 2 for established ranges and additional information.)
Dynamic Loads: No mission requirements specified.	Delta II 2925 environment: Payload design CG limit load factors. (See SOW Exhibit 1, Section 8, Table E1-31.) Axial (g) / Lateral (g) Max axial (at MECO): 6.5 ± 0.6 / ±0.2 Max lateral: +2.8 / ±4.0 Max lateral: -0.2 / ±4.0 Maximum quasi-steady acceleration is a function of payload separated mass. (See SOW Exhibit 1, Section 8, Figures E1-37 and E1-43, for maximum values if mass changes.) Maximum expected sinusoidal vibration at the base of the PAF: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz), 1.0 g zero to peak (6.2-100 Hz); lateral: 0.7 g zero to peak (5-100 Hz). (See SOW Exhibit 1, Section 8, Table E1-33, for additional information.) Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.
Dynamic Environments: No mission requirements specified.	Delta II 2925-9.5 maximum flight level payload acoustic environment: OASPL = 139.8 dB. (See SOW Exhibit 1, Section 8, Figure E1-30, for maximum levels across the frequency spectrum. Delta II 3712 PAF with 3300-lb preload maximum flight-level payload interface shock response spectrum: 40 g (100 Hz), +9.2 dB/octave (100-1500 Hz), 2500 g (1500-3000 Hz). (See SOW Exhibit 1, Section 8, Figure E1-35, for additional information.)
Radio Frequency: No mission requirements specified.	Delta II Standard Service: 20 V/m across the range of 14 KHz to 40 GHz with 40 V/m between 2.2 GHz and 2.3 GHz and between 5.762 and 5.768 GHz. RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section 8, Table E1-30, for additional information.)
Payload Compartment Venting: No mission requirements specified.	Delta II Standard Service: Pressure profiles and depressurization rates. (See SOW Exhibit 1, Section 8, Figure E1-22, for established maximum and minimum values.)
Launch Site Facility Environments: Temperature, relative humidity, and filtration. No mission requirements specified.	Delta II Standard Service: Eastern Range facility environments: (See SOW Exhibit 2 for established ranges.)
Contamination Control: No mission requirements specified.	Delta II Standard Service: Generic Contamination Control Plan: (See SOW Exhibit 2 for established minimum requirements.)

Non-Standard Services Required
NSS 19.1: Ground Processing Facilities Payloads at Eastern Range.



Delta II 2925-9.5 (With STAR™ 48B Motor)

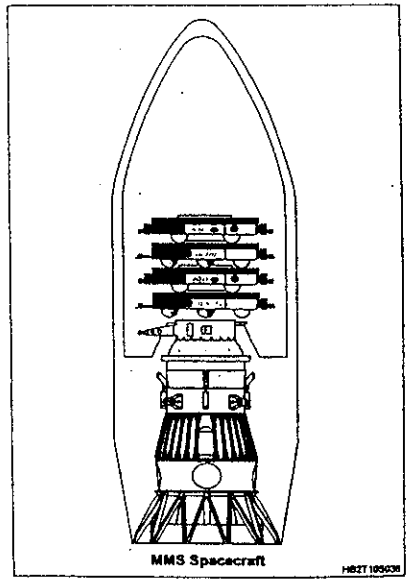
Mission Requirements	
Requirement	**Solution**
Payload Risk Category: 3.	Delta II 2925H-10 Launch Vehicle.
Launch Date: January 2009.	Delta On-Time Launch Service.
Launch Site: Cape Canaveral Air Force Station (CCAFS). Payload Processing: Commercial.	Delta II Eastern Range launch site: CCAFS, Space Launch Complex 17 (SLC-17). Delta II Non-Standard Service: Astrotech Payload Processing facility. (NSS 19.1)
Payload Mass: 1522 kg (total stack without PAF) Orbit: Insertion into an elliptical orbit 1.2 Earth radii by 12 Earth radii (at 28.7-deg inclination).	Delta II 2925H-10 with nine GEM-46 thrust augmentation solid motors and a 10-ft (3-m)-dia payload fairing. Includes all the standard services associated with the 2925-10 basic vehicle. Delta II Non-Standard Service: Replace standard GEM-40 solid motors with higher performance GEM-46 solid motors. (NSS 1.1) Incremental one-time analysis (NSS 26.2) is not required for this mission based upon the assumption that CLIN 23, Space Science 1, is launched by Boeing from CCAFS prior to launch of this mission.
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in the Performance and Guidance Accuracy Analysis (CDRL C4-1).
Separation Attitude Accuracy and Rates: No mission requirements specified.	Delta II vehicle standard third-stage (despun) payload deployment: attitude <10.0 deg, rate < 7.0 deg per sec (transverse), 0.0± 5 rpm (roll). (See SOW Exhibit 1, Section 4, Table E1-26 and Exhibit 2.)
Payload Accommodation Requirements	
Requirement	**Solution**
Third-stage motor required to achieve elliptical orbit.	STAR™48B motor, including spin table.
Payload Interface: No mission requirements specified. Launch vehicle will separate the integrated stack as a single unit. The spacecraft is responsible for separation between satellites.	Delta II 3712C payload attach fitting (PAF), which includes a separation clampband system, a yo-yo despin system, a nutation control system, and extended mission thermal modifications to accommodate mission lengths of up to 7,000 sec. (See SOW Exhibit 1, Section 6; Figure E1-19.) CG vertical limit (above separation plane) for payload mass based on generic load factors = 78.7cm (31 in.). CG capability may be increased through the mission-specific coupled-loads process.
Spinup/Spindown: No mission requirements specified.	Delta II standard spinup of the third stage and payload to stabilize the STAR™48B motor will be accomplished with the Delta II spin table and spin rocket motors. (See SOW Exhibit 2.) Yo-yo despin system includes a nutation control system to minimize velocity/attitude pointing errors and coning conditions during the time from third-stage ignition to yo-yo despin initiation.
Payload Envelope: Spacecraft Overall Dimensions in Launch Configuration: Stack of 4 satellites from where it bolts to the adapter cone will fit in a 10-ft fairing envelope (stack height of approximately 85 in. and a stacked diameter of just under 108 in. It is recognized that the 10-ft fairing starts to taper to a smaller diameter after 76.6 in. and the top of the MMS spacecraft would be configured to fit in the available space).	Delta II 10-ft (3-m) composite payload fairing with provision for a 0.64-cm (0.25 in. GN_2 purge line. Delta II Non-Standard Service: Replace baseline Delta II 2925H-9.5 ft (2.9-m) aluminum payload fairing with a 10-ft (3-m) composite payload fairing. (NSS 2.1.2)
Payload Access: No mission requirements specified.	Up to three Delta II standard service payload access doors are available for use by the payload. (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors.)
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 3 DC accelerometers, 1 pressure transducer, 1 temperature patch. (See SOW Exhibit 1, Section 9, Table E1-34, for a detailed description.)
Electrical Interface: No mission requirements specified.	Delta II Standard Service: Two 37-pin payload interface connectors 180 deg apart across the interface plane, disconnected upon separation; 61-pin connectors may be provided as a non-standard service. Payload wiring is routed to the GSE via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Section 7, Table E1-29, for a detailed description of available electrical interfaces.)

Exhibit 5
NLS MISSION SOLUTION
CLIN 29—MMS

SPACECRAFT AND MISSION DESCRIPTION

The MMS 2-year mission is a constellation of four satellites launching together that will study the magnetosphere and its tail. Each satellite will carry identical instrumentation consisting of hot plasma, energetic particle, electric field, and magnetic field instrumentation. There will be four phases of the mission in which three fundamental processes will be studied: reconnection, particle acceleration, and turbulence.

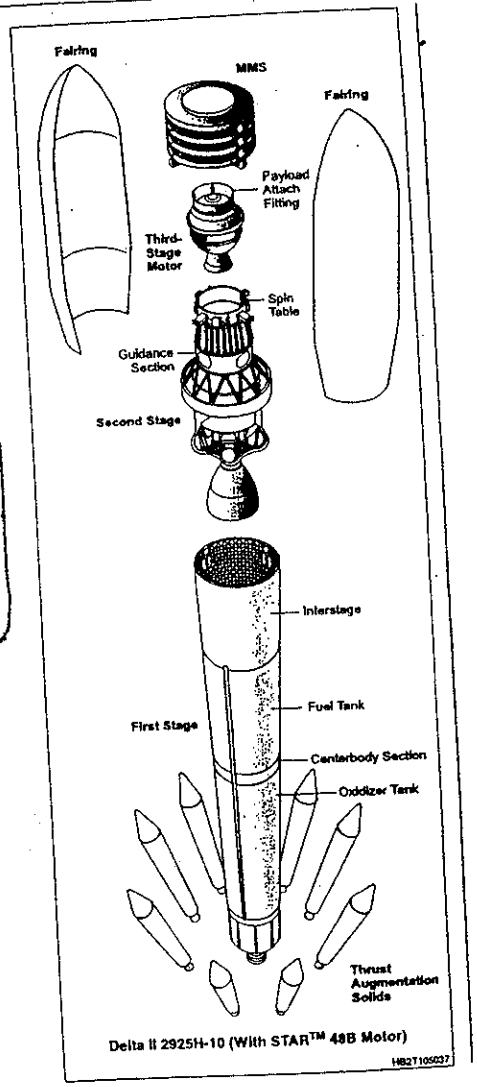
The Boeing solution for this mission is a Delta II 2925H-10 vehicle. This mission will be launched from the Delta II Eastern Range launch site. Specific details regarding the solution for all currently identified mission requirements, together with the corresponding rationale for technical acceptability, are described in the accompanying tables.



Section D
Attachment D1, Exhibit 5: Firms/Options Mission Solutions

Payload Environmental Requirements: Requirement	Solution
Thermal: No mission requirements specified.	Delta II 10-ft (3-m) fairing and STAR™ 48B third-stage payload environments. (See SOW Exhibit 1, Section 8, Figures E1-43A and E1-43C and Exhibit 2 for established ranges and additional information.)
Dynamic Loads: No mission requirements specified.	Delta II 2925H environment: Payload design CG limit load factors. (See SOW Exhibit 1, Section 8, Table E1-31.) Axial (g) / Lateral (g) Max axial (at MECO): 6.2 ± 0.6 / ±0.2 Max lateral: +2.8 / ±3.0 Max lateral: -0.2 / ±3.0 Maximum quasi-steady acceleration is a function of payload separated mass. (See SOW Exhibit 1, Section 8, Figures E1-37 and E1-43, for maximum values if mass changes.) Maximum expected sinusoidal vibration at the base of the PAF: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz), 1.0 g zero to peak (6.2-100 Hz); lateral: 0.7 g zero to peak (5-100 Hz). (See SOW Exhibit 1, Section 8, Table E1-33, for additional information.) Nothing of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.
Dynamic Environments: No mission requirements specified.	Delta II 2925H-10 maximum flight level payload acoustic environment: OASPL = 142.8 dB. (See SOW Exhibit 1, Section 8, Figure E1-31, for maximum levels across the frequency spectrum; 2925H levels are 2 dB higher than on the 2925.) Delta II 3712 PAF with 3300-lb preload maximum flight-level payload interface shock response spectrum: 40 g (100 Hz), +9.2 dB/octave (100-1500 Hz), 2500 g (1500-3000 Hz). (See SOW Exhibit 1, Section 8, Figure E1-35, for additional information.)
Radio Frequency: No mission requirements specified.	Delta II Standard Service: 20 V/m across the range of 14 KHz to 40 GHz with 40 V/m between 2.2 GHz and 2.3 GHz and between 5.752 and 5.768 GHz. RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section 8, Table E1-30, for additional information.)
Payload Compartment Venting: No mission requirements specified.	Delta II Standard Service: Pressure profiles and depressurization rates. (See SOW Exhibit 1, Section 8, Figure E1-22, for established maximum and minimum values.)
Launch Site Facility Environments: Spacecraft instrument ground GN_2 purge may be required.	Delta II Standard Service: Spacecraft GN_2 purge is provided at the Eastern Range facility. (See SOW Exhibit 2 for more information.)
Launch Site Facility Environments: Temperature, relative humidity, and filtration. No mission requirements specified.	Delta II Standard Service: Eastern Range facility environments: (See SOW Exhibit 2 for established ranges.)
Contamination Control: No mission requirements specified	Delta II Standard Service: Generic Contamination Control Plan: (See SOW Exhibit 2 for established minimum requirements.)

Non-Standard Services Required:	
NSS 1.1	Heavy Vehicle Upgrade
NSS 2.1.2	Replace a 9.5-ft PLF with a 10-ft PLF
NSS 19.1	Ground Processing Facilities Payloads at Eastern Range



Delta II 2925H-10 (With STAR™ 48B Motor)
HB2T105037

Mission Requirements

Requirement	Solution
Payload Risk Category: 3.	Delta II 2420-10 Launch Vehicle.
Launch Date: March 2009.	Delta On-Time Launch Service.
Launch Site: Vandenberg Air Force Station (VAFB). Payload Processing: Commercial.	Delta II Non-Standard Service: Delta II Western Range launch site: VAFB Space Launch Complex 2 (SLC-2). NSS 27.1, Western Range (WR) Launch Incremental. Delta II Non-Standard Service: Payload processing facility at Western Range (NSS 19.2)
Payload Mass: 1600 kg. Orbit: 1000 km circular; polar orbit (Inclination 90 deg).	Delta II 2420-10 with four GEM-40 thrust augmentation solid motors and a 10-ft (3-m)-dia composite payload fairing. Includes all the standard services associated with the 2420-10 basic vehicle.
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in the Performance and Guidance Accuracy Analysis (CDRL C4-1).
Separation Attitude Accuracy and Rates: No mission requirements specified.	Delta II vehicle standard two-stage low tip-off payload deployment for the 6915, 6306, or 6019 payload attach fitting: attitude (deg): < 3.0 (per axis); rate (deg /sec): <0.25 (per axis). (See SOW Exhibit 1, Section 4, Table E1-28 and Exhibit 2.)

Payload Accommodation Requirements

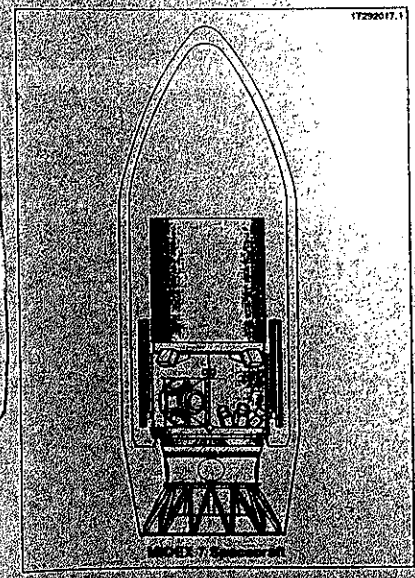
Requirement	Solution
Third-Stage Motor: No mission requirement specified.	Not required.
Payload Interface: No mission requirements specified.	One of three available two-stage Delta II PAFs (see SOW Exhibit 1, Section 6, Figure E1-19): 1. Delta II Standard Service: 6915 PAF, which includes separation nut system, secondary latch, and retro system. CG vertical limit (above separation plane) for payload mass based on generic load factors = 205.7 cm (81.0 in.). 2. Delta II Non-Standard Service: 6306 PAF, which includes a separation clamp band, secondary latch, and retro system. (NSS 3.2.1) (See SOW Exhibit 1, Section 6, Figure E1-19.). CG vertical limit (above separation plane) for payload mass based on generic load factors = 228.6 cm (90 in.). 3. Delta II Non-Standard Service: 6019 PAF, which includes separation nut system, secondary latch, and retro system. CG vertical limit (above separation plane) for payload mass based on generic load factors = 182.9 cm (72.0 in.) (NSS 3.2.2). CG capability may be increased through the mission-specific coupled load process.
Spinup/Spindown: No mission requirements specified.	Not required
Payload Envelope: Spacecraft overall dimensions in launch configuration: No mission requirements specified.	Delta II 10-ft- (3-m)-dia composite payload fairing per NASA vehicle recommendation.
Payload Access: No mission requirements specified.	Up to three Delta II standard service payload access doors are available for use by the payload. (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors.)
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 1 DC accelerometer, 3 AC accelerometers, 1 pressure transducer, 1 temperature patch. (See SOW Exhibit 1, Section 7, Table E1-34, for a detailed description.)
Electrical Interface: No mission requirements specified.	Delta II Standard Service: Two 37-pin payload interface connectors are provided and disconnected by the fairing; 61-pin connectors may be provided as a non-standard service. Payload wiring is routed to GSE via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Section 7, Table E1-29, for a detailed description of available standard interfaces.)

Exhibit 5
NLS MISSION SOLUTION
CLIN 30—MIDEX 7

SPACECRAFT AND MISSION DESCRIPTION

The MIDEX 7 mission is a space physics and astronomy missions intended to study the sun, to examine the space environment of the Earth and other planets, and to observe the universe beyond our solar system.

The Boeing solution for this mission is the Delta II 2420-10 vehicle. This mission will be launched from the Delta II Western Range launch site. Specific details regarding the solution for all currently identified mission requirements, together with the corresponding rationale for technical acceptability, are described in the accompanying tables.

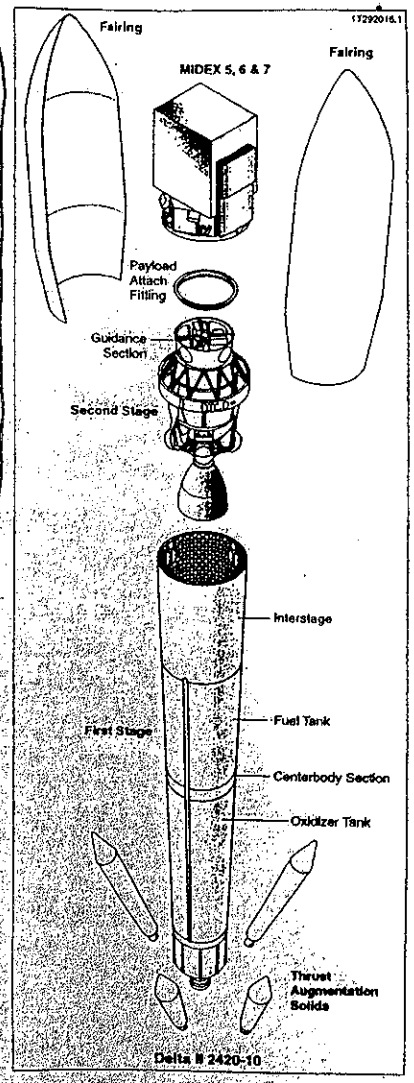


MIDEX 7 Spacecraft

Payload Environmental Requirements

Requirement	Solution
Thermal: No mission requirements specified.	Delta II 10-ft (3-m) fairing payload environment: (See SOW Exhibit 1, Section 8, Figure E1-43A and Exhibit 2 for established ranges and additional information.)
Dynamic Loads: No mission requirements specified.	Delta II 2420 environment: Payload design CG limit load factors. Based on E915 PAF. (See SOW Exhibit 1, Section 8, Table E1-31.) Axial (g) / Lateral (g) Max axial (at MECO) +7.0 ± 0.6 / ± 0.2 Max lateral +2.8 / ± 3.0 Max lateral -0.2 / ± 3.0 Maximum quasi-steady acceleration is a function of payload separated mass. (See SOW Exhibit 1, Section 8, Figure E1-37, for maximum values if mass changes.) Maximum expected sinusoidal vibration at the base of the PAF: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz), 1.0 g zero to peak (6.2-100 Hz); lateral: 0.7 g zero to peak (5-100 Hz). (See SOW Exhibit 1, Section 8, Table E1-33, for additional information.) Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.
Dynamic Environments: No mission requirements specified.	Delta II 2420-10 maximum flight level payload acoustic environment: OASPL = 139.9 dB. (See SOW Exhibit 1, Section 8, Figure E1-29, for maximum levels across the frequency spectrum.) Delta II 6915 or 6019 PAF maximum flight-level payload interface shock response spectrum: 100 g (100-350 Hz), +12.3 dB/octave (350-1700 Hz); 2500 g (1700 Hz), +5.6 dB/octave (1700-4000 Hz); 5500 g (4000-5000 Hz), -8.8 dB/octave (5000-10,000 Hz); 2000 g (10,000 Hz). Delta II 6306 PAF maximum flight-level payload interface shock response spectrum: 100 g (100 Hz), +9.8 dB/octave (100-800 Hz), 3000 g (800-3000 Hz). (See SOW Exhibit 1, Section 8, Figure E1-35, for additional information.)
Radio Frequency: No mission requirements specified.	Delta II Standard Service: 20 V/m across the range of 14 KHz to 40 GHz, 40 V/m between 5.762 and 5.768 GHz. RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section 8, Table E1-30, for additional information.)
Payload Compartment Venting: No mission requirements specified.	Delta II Standard Service: Pressure profiles and depressurization rates. (See SOW Exhibit 1, Section 8, Figure E1-22, for established maximum and minimum values.)
Launch Site Facility Environments: Temperature, relative humidity, and filtration. No mission requirements specified.	Delta II Non-Standard Service: Western Range facility environments. (See SOW Exhibit 2 and 3 for established ranges.) (NSS 27.1, see note 4)
Contamination Control: No mission requirements specified.	Delta II Standard Service: Generic contamination control plan. (See SOW Exhibit 2 for established minimum requirements.)

Non-Standard Services Required
NSS 19.2 Ground Processing Facilities Payloads at Western Range
NSS 27.1 Western Range (WR) Launch Incremental



Mission Requirements	
Requirement	**Solution**
Payload Risk Category: 3.	Delta II 2925H-9.5 Launch Vehicle.
Launch Date: May 2009.	Delta On-Time Launch Service: Assurance in meeting planetary launch window periods is enhanced by building in contingency time including hardware scheduling, tracking, and early mission checkout. Instantaneous launch windows are met with multiple flight trajectories for launch windows and selective use of built-in holds for issue resolution during the day of launch countdown. (See SOW Exhibit 2 for an additional description.)
Launch Site: Cape Canaveral Air Force Station (CCAFS). Payload Processing: Commercial.	Delta II Eastern Range launch site: CCAFS, Space Launch Complex 17 (SLC-17). Delta II Non-Standard Service: Astrotech Payload Processing Facility. (NSS 19.1)
Payload Mass: 1000 kg. Orbit: Escape; $C_3 = 15\ km^2/sec^2$.	Delta II 2925H-9.5 with nine GEM-46 thrust augmentation solid motors and a 9.5-ft (2.9-m)-dia payload fairing. Includes all the standard services associated with the 2925-9.5 basic vehicle. Delta II Non-Standard Service: Replace standard GEM-40 solid motors with higher performance GEM-46 solid motors. (NSS 1.1)
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in the Performance and Guidance Accuracy Analysis (CDRL C4-1).
Separation Attitude Accuracy and Rates: No mission requirements specified.	Delta II vehicle standard third-stage (despun) payload deployment: attitude <10.0 deg, rate <7.0-deg/sec (transverse), 0.0 ±5 rpm (roll). (See SOW Exhibit 1, Section 4, Table E1-28, and Exhibit 2.)

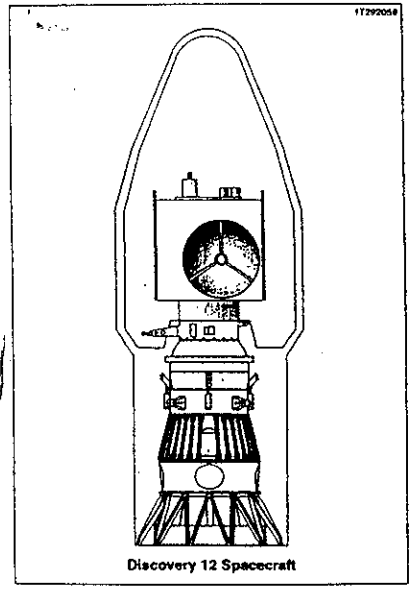
Payload Accommodation Requirements	
Requirement	**Solution**
Third-Stage Motor required to achieve the escape orbit for this mission.	STAR™48B motor, including spin table.
Payload Interface: No mission requirements specified.	Delta II 3712C payload attach fitting (PAF), which includes a separation clampband system, a yo-yo despin system, a nutation control system (NCS), and extended mission thermal modifications to accommodate mission lengths of up to 7,000 sec. (See SOW Exhibit 1, Section 6, Figure E1-19.) CG vertical limit (above separation plane) for payload mass based on generic load factors = 101.6 cm (40 in.). CG capability may be increased through the mission-specific coupled-loads process.
Spinup/Spindown: No mission requirements specified.	Delta II standard spinup of the third stage and payload to stabilize the STAR™48B motor will be accomplished with the Delta II spin table and spin rocket motors. (See SOW Exhibit 2.) Yo-yo despin system includes a nutation control system to minimize velocity/attitude pointing errors and coning conditions during the time from third-stage ignition to yo-yo despin initiation.
Payload Envelope: TBD.	Delta II 9.5-ft (2.9-m)-dia aluminum payload fairing per NASA vehicle recommendation.
Payload Access: No mission requirements specified.	Up to three Delta II standard service payload access doors are available for use by the payload. (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors.)
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 3 DC accelerometers, 1 pressure transducer, 1 temperature patch. (See SOW Exhibit 1, Section 9, Table E1-34, for a detailed description.)
Electrical Interface: No mission requirements specified.	Delta II Standard Service: Two 37-pin payload interface connectors 180 deg apart across the interface plane, disconnected upon separation; 61-pin connectors may be provided as an non-standard service. Payload wiring is routed to the GSE via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Section 7, Table E1-29, for a detailed description of available electrical interfaces.)

Exhibit 5
NLS MISSION SOLUTION
CLIN 31—Discovery 12

SPACECRAFT AND MISSION DESCRIPTION

The Discovery 12 mission is a solar system science mission intended for travel to and exploration of solar system bodies and/or for remote examination of the solar system and extra-solar planetary system environments.

The Boeing solution for this mission is a Delta II 2925H-9.5 vehicle. This mission will be launched from the Delta II Eastern Range launch site. Specific details regarding the solution for all currently identified mission requirements, together with the corresponding rationale for technical acceptability, are described in the accompanying tables.

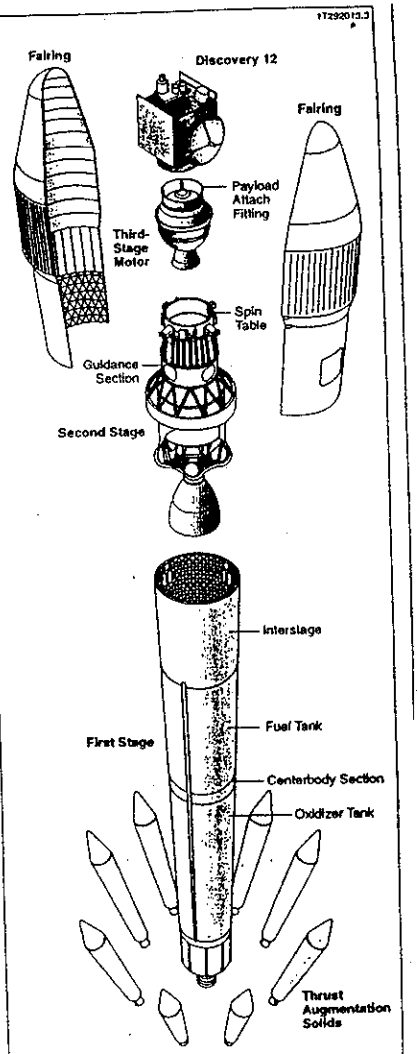


Discovery 12 Spacecraft

Section D
Attachment D1, Exhibit 5: Firms/Options Mission Solutions

Payload Environmental Requirements	
Requirement	**Solution**
Thermal: No mission requirements specified.	Delta II 9.5-ft (2.9-m) fairing and STAR™ 48B third-stage payload environments. (See SOW Exhibit 1, Section 8, Figures E1-43A and E1-43C and Exhibit 2 for established ranges and additional information.)
Dynamic Loads: No mission requirements specified.	Delta II 2925H environment: Payload design CG limit load factors. (See SOW Exhibit 1, Section 8, Table E1-31.) Axial (g) / Lateral (g) Max axial (at MECO): 6.4 ± 0.6 / ±0.2 Max lateral: +2.8 / ±3.5 Max lateral: -0.2 / ±3.5 Maximum quasi-steady acceleration is a function of payload separated mass. (See SOW Exhibit 1, Section 8, Figures E1-37 and E1-43, for maximum values if mass changes.) Maximum expected sinusoidal vibration at the base of the PAF: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz), 1.0 g zero to peak (6.2-100 Hz); lateral: 0.7 g zero to peak (5-100 Hz). (See SOW Exhibit 1, Section 8, Table E1-33, for additional information.) Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.
Dynamic Environments: No mission requirements specified.	Delta II 2925H-9.5 maximum flight level payload acoustic environment: OASPL = 141.8 dB. (See SOW Exhibit 1, Section 8, Figure E1-30, for maximum levels across the frequency spectrum. Delta II 3712 PAF with 3300-lb preload maximum flight-level payload interface shock response spectrum: 40 g (100 Hz), +9.2 dB/octave (100-1500 Hz), 2500 g (1500-3000 Hz). (See SOW Exhibit 1, Section 8, Figure E1-35, for additional information.)
Radio Frequency: No mission requirements specified.	Delta II Standard Service: 20 V/m across the range of 14 KHz to 40 GHz with 40 V/m between 2.2 GHz and 2.3 GHz and between 5.762 and 5.768 GHz. RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section 8, Table E1-30, for additional information.)
Payload Compartment Venting: No mission requirements specified.	Delta II Standard Service: Pressure profiles and depressurization rates. (See SOW Exhibit 1, Section 8, Figure E1-22, for established maximum and minimum values.)
Launch Site Facility Environments: Temperature, relative humidity, and filtration. No mission requirements specified.	Delta II Standard Service: Eastern Range facility environments: (See SOW Exhibit 2 for established ranges.)
Contamination Control: No mission requirements specified.	Delta II Standard Service: Generic Contamination Control Plan: (See SOW Exhibit 2 for established minimum requirements.)

Non-Standard Services Required
NSS 1.1: Heavy Vehicle Upgrade
NSS 19.1: Ground Processing Facilities Payloads at Eastern Range.



Delta II 2925H-9.5 (With STAR™ 48B Motor)

Mission Requirements

Requirement	Solution
Payload Risk Category: 3.	Delta II 2920-10 Launch Vehicle.
Launch Date: September 2009.	Delta On-Time Launch Service.
Launch Site: Vandenberg Air Force Base (VAFB). Payload Processing: Commercial. Hazardous Payload Processing Facility capable of servicing a large spacecraft fuel load (~ 1200 kg).	Delta II Non-Standard Service: Delta II Western Range launch site: VAFB Space Launch Complex 2 (SLC-2). NSS 27.1, Western Range (WR) Launch Incremental. Delta II Non-Standard Service: Payload processing facility at Western Range. (NSS 19.2)
Payload Mass: The estimated spacecraft masses (dry + wet) plus Multi-Spacecraft Launch System (MSLS) is 2500 kg. Orbit: 185 km perigee, 2000 km apogee; inclination 83 deg. Altitude is referenced above the equator.	Delta II 2920-10 with nine GEM-40 thrust augmentation solid motors and a 10-ft-(3-m)-dia composite payload fairing. Includes all the standard services associated with the 2920-10 basic vehicle.
Insertion Accuracy: No mission requirements specified.	Delta II launch vehicle insertion accuracy is established in the Performance and Guidance Accuracy Analysis (CDRL C4-1).
Separation Attitude Accuracy and Rates: The spacecraft will provide the spacecraft separation/dispenser system (MSLS). No attitude or rate requirements specified. The spacecraft will be sequentially deployed to within 10's of km from each other.	The mission scenario would be as follows. After the vehicle has achieved the required mission orbit, the stage/stack (four spacecraft plus dispenser) will be pointed in the desired attitude for the first spacecraft. Following separation of the first spacecraft, the second stage can then maneuver to the desired attitude for the second spacecraft deployment. The scenario will be repeated for the third and fourth spacecraft separations followed by a second-stage collision/contamination avoidance maneuver (CCAM). The spacecraft contractor is providing the separation system and will be responsible for the spacecraft separation analysis and spacecraft-to-spacecraft relative motion assessment. Spacecraft contractor will provide the inertial pointing requirements and MSLS/spacecraft mass properties for each separation event. Boeing will provide the second-stage mass properties and pre-separation states to the spacecraft contractor for its separation analysis. Following review of the spacecraft separation analysis, Boeing will determine minimum allowable time between each separation event, which allows for post-separation rate capture and attitude maneuvers. Boeing will perform a relative motion assessment between each spacecraft and the Delta second stage based upon the required CCAM. This will require the spacecraft contractor to provide state vectors for each spacecraft and the second stage after separation. Delta II standard two-stage pre-separation attitude (deg): <0.65 per axis, rate (deg/sec): <0.2 per axis. Boeing recommends separation of the four spacecraft in opposite pairs instead of sequentially one at a time. This will minimize moments applied to the second stage, which will affect spacecraft separation clearances. This scenario will reduce launch vehicle control gas usage. Gas that would have been used to recover from the induced rates can be used to perform a cold gas settling maneuver to gain margin on deployment distances. This method has flight experience on seven Globalstar missions, each deploying four spacecraft in a 2+2 sequence. The mission scenario would be as follows. After the vehicle has achieved the required mission orbit, the stage/stack (four spacecraft plus dispenser) will be pointed in the desired attitude for the simultaneous separation of the first and second spacecraft (located 180° apart). The second stage can then maneuver to the desired attitude for the third and fourth spacecraft (located 180° apart) simultaneous deployment. The third and fourth spacecraft are then separated followed by a second-stage collision/contamination avoidance maneuver (CCAM).

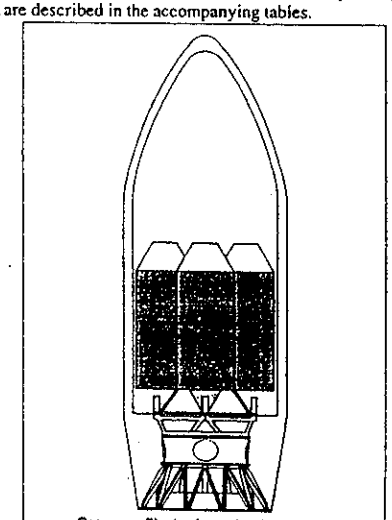
Exhibit 5
NLS MISSION SOLUTION
CLIN 32 Geospace Electrodynamics Connection (GEC)

SPACECRAFT AND MISSION DESCRIPTION

The GEC mission will consist of a constellation of four spacecraft capable of making the required in-situ plasma/neutral atmosphere measurements needed to understand the temporal and spatial scales that underlie the coupling between the Earth's ionosphere, thermosphere, and magnetosphere. This knowledge is key to predicting how solar activity affects the near-Earth environment.

The mission is managed by the Solar Terrestrial Probes (STP) program at Goddard Space Flight Center (GSFC) and is flown in support of the goals of the NASA Sun Earth Connection Program; a component of the Space Science Enterprise.

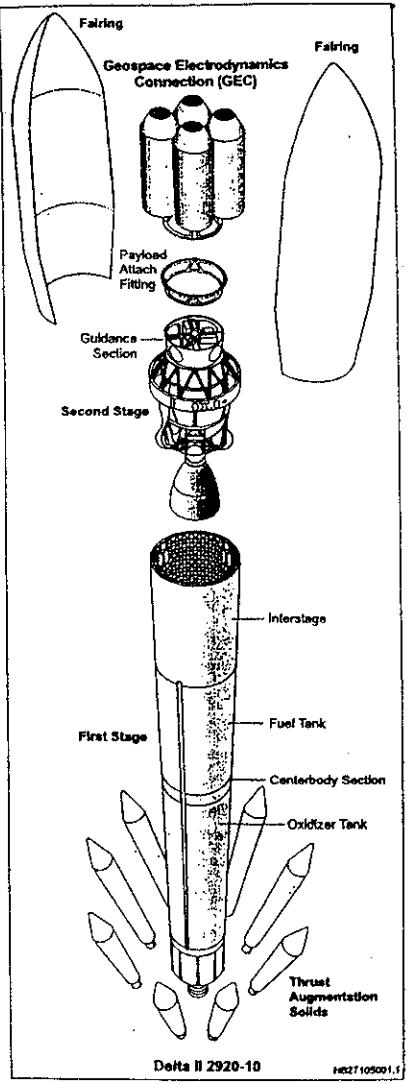
The Boeing solution for this mission is the Delta II 2920-10 vehicle. This mission will be launched from the Delta II Western Range launch site. Specific details regarding the solution for all currently identified mission requirements, together with the corresponding rationale for technical acceptability, are described in the accompanying tables.



Geospace Electrodynamics Connection (GEC) Spacecraft

Payload Accommodation Requirements

Requirement	Solution
Third-Stage Motor: No mission requirements specified.	Not required.
Payload Interface: The constellation of four spacecraft and the MSLS has an estimated center of gravity (CG) of 1.32 m above the base of the MSLS.	It is assumed the MSLS will interface to the launch vehicle (LV) via a LV-provided PAF but will not separate from the LV PAF. Deployment of the four spacecraft will occur with the MSLS attached to the LV. One of three available two-stage Delta II payload attach fittings (PAF). (See SOW Exhibit 1, Section 6, Figure E1-19.) 1) Delta II Standard Service: 6915 PAF with a four-hard-point interface system and a CG vertical limit (above separation plane) for payload mass based on generic load factors = 172.7 cm (68.0 in.). 3) Delta II Non-Standard Service: 6306 with a clampband and a CG vertical limit (above separation plane) for payload mass based on generic load factors = 195.6 cm (77.0 in.). (NSS 3.2.1) This is not a recommended PAF as its height is less than that required to locate the provided MSLS and spacecraft envelope out of the payload fairing aft conic tapered envelope. As additional envelope definition becomes available during the integration process, it will be evaluated to determine if the 6306 PAF would be a viable solution. 3) Delta II Non-Standard Service: 6019 PAF with a three-hard-point interface system and a CG vertical limit (above separation plane), for payload mass based on generic load factors = 154.9 cm (61.0 in.). (NSS 3.2.2) CG capability may be increased through the mission-specific coupled-loads process.
Spinup/Spindown: No mission requirements specified.	Not required.
Payload Envelope: The four spacecraft and Multi-Spacecraft Launch System (MSLS) are within diameter of 2.7 m. The estimated stack height from the base of MSLS is 3.1 m. T-0 nitrogen purge for science instruments.	Delta II 10-ft- (3-m)-dia composite payload fairing with provision for a 0.64-cm (0.25-in.) GN_2 purge line. Assumes manifold to individual spacecraft will be provided by the MSLS.
Payload Access: At least four access doors on the launch vehicle fairing (e.g., safe/arm connectors, emergency fuel servicing).	Up to three Delta II standard service payload access doors are available for use by the payload. Delta II Non-Standard Service: Additional 24-in.-diameter access door. (NSS 2.2.3) (See SOW Exhibit 2 for detailed information regarding available standard service payload access doors.)
Payload Environment Instrumentation: No mission requirements specified.	Delta II Standard Service: 1 microphone, 1 DC accelerometer, 3 AC accelerometers, 1 pressure transducer, 1 temperature patch. (See SOW Exhibit 1, Section 9, Table E1-34, for a detailed description.)
Electrical Interface: The spacecraft will provide the separation/dispenser system (Multi-Spacecraft Launch System (MSLS)) and will require separation commanding from the launch vehicle.	Delta II Mission-Unique Service: The Delta vehicle will provide the power and separation signal required to activate the spacecraft-provided separation system for each spacecraft. Six additional payload separation wire harnesses (two wire harnesses internal to the guidance section per additional spacecraft) will be integrated into the payload-separation wire harnesses normally provided for a single spacecraft (MUS 32.1). Each Delta II/spacecraft separation system shall have the following characteristics: 1. Launch vehicle-provided ordnance-firing signals shall be redundant and capable of simultaneously firing a maximum of three NASA standard initiators (NSI) located on the spacecraft-provided payload dispenser (MSLS). 2. Spacecraft shall provide a positive means of confirming spacecraft separation. 3. Ordnance firing signals shall be provided on two connectors per spacecraft at the MSLS-to-launch vehicle interface in a manner that will maintain system redundancy. Spacecraft will provide wire harnesses from MSLS-to-launch vehicle interface to each spacecraft separation system. Interface brackets to the LV wire harnesses will be provided by the MSLS. 4. All launch vehicle wiring will use 20 AWG twisted shielded pairs of wires with a 100% overbraid, with the shield and overbraid grounded at all connectors. All spacecraft ordnance wiring shall be similar in design. 5. Verification of the separation circuitry for each spacecraft will be performed by an end-to-end vehicle test. Delta II Standard Service: Two 37-pin payload interface connectors at one location and disconnected by the fairing or fixed at the MSLS-to-launch vehicle interface plane. Spacecraft will provide wire harnesses from MSLS-to-launch vehicle interface to each spacecraft. Interface brackets to the LV wire harnesses and across the spacecraft separation interface will be provided by the MSLS; 61-pin connectors may be provided as an NSS. Payload wiring is routed to GSE via the launch vehicle T-0 umbilical connector. (See SOW Exhibit 1, Section 7, Table E1-29, for a detailed description of available electrical interfaces.)



Payload Environmental Requirements

Requirement	Solution
Thermal: No mission requirements specified.	Delta II 10-ft (3-m) fairing payload environment: (See SOW Exhibit 1, Section 8, Figure E1-43A and Exhibit 2 for established ranges and additional information.)
Dynamic Loads: No mission requirements specified.	Delta II 2920 environment: Payload design CG limit load factors. Based on 6015 PAF. (See SOW Exhibit 1, Section 8, Table E1-31.) Axial (g) / Lateral (g) Max axial (at MECO) +6.7 ± 0.6 / ± 0.2 Max lateral +2.8 / ± 2.5 Max lateral -0.2 / ± 2.5 Maximum quasi-steady acceleration is a function of payload separated mass. (See SOW Exhibit 1, Section 8, Figure E1-37, for maximum values if mass changes.) Maximum expected sinusoidal vibration at the base of the PAF: axial: 1.27 cm (0.5 in.) double amplitude (5-6.2 Hz), 1.0 g zero to peak (6.2-100 Hz); lateral: 0.7 g zero to peak (5-100 Hz). (See SOW Exhibit 1, Section 8, Table E1-33, for additional information.) Notching of the sinusoidal vibration input levels at spacecraft fundamental frequencies may be required during testing and should be based on the results of the vehicle coupled dynamic loads analysis.
Dynamic Environments: No mission requirements specified.	Delta II 2920-10 maximum flight level payload acoustic environment: OASPL = 140.8 dB. (See SOW Exhibit 1, Section 8, Figure E1-31, for maximum levels across the frequency spectrum. The launch-vehicle-induced shock response environment to the payload-provided PA interface is consistent with Delta 2920 standard service as documented in SOW Exhibit 1, Section 8, Figure E1-36.
Radio Frequency: No mission requirements specified.	Delta II Standard Service: 20 V/m across the range of 14 KHz to 40 GHz with 40 V/m between 5.762 and 5.768 GHz. RF requirement contains margin; a lower RF environment can be negotiated. (See SOW Exhibit 1, Section 8, Table E1-30, for additional information.)
Payload Compartment Venting: No mission requirements specified.	Delta II Standard Service: Pressure profiles and depressurization rates: (See SOW Exhibit 1, Section 8, Figure E1-22, for established maximum and minimum values.)
Launch Site Facility Environments: T-0 nitrogen purge for science instruments required.	Delta II Standard Service: Spacecraft GN_2 purge is provided at the Western Range facility. (See SOW Exhibit 2 for more information.)
Launch Site Facility Environments: Temperature, relative humidity, and filtration. Nickel-hydrogen battery cooling on the launch pad.	Delta II Non-Standard Service: Western Range facility environments. (See SOW Exhibits 2 and 3 for established ranges.) (NSS 27.1, see Note 4.) Delta II Mission-Unique Service: Battery cooling can be provided utilizing the existing secondary air-conditioning system previously used on multiple commercial and DPAF missions (MUS 32.2). This system is capable of delivering 50 – 60 °F air at a flow rate of 200 cubic feet per minute with no humidity control. With no definitive requirements specified, this is assumed to be acceptable. The system will interface with spacecraft-provided ducting to route the conditioned air to the individual battery cooling interfaces through the mission specific fairing access doors. Ducting will be removed 10-12 hr before launch at fairing closeout. Our assumption is that this system will be identified on the NASA 5-year maintenance program at SLC-2 and be refurbished for availability in the 2009 launch year.
Contamination Control: No mission requirements specified.	Delta II Standard Service: Generic contamination-control plan. (See SOW Exhibit 2 for established minimum requirements.)

Non-Standard Services Required
NSS 2.2.3 24-in.-dia Door
NSS 19.2 Ground Processing Facilities Payloads at Western Range
NSS 27.1 Western Range (WR) Launch Incremental

Mission-Unique Services Required
MUS 32.1 Multi-Spacecraft Launch System Separation Commands
MUS 32.2 Prelaunch Spacecraft Battery Cooling

EXHIBIT 6

AWARDED LSTO MISSIONS

Mission	Proposed Launch Vehicle	Risk Cat.	Launch Date	Mass (kg)	Orbit (km x km)	Inclination/ Declination (Degrees)	C3 (km^2/sec^2)
TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Table E6-1: Awarded LSTO Missions

Exhibit 7 – Launch Vehicle Data and Qualification Plan

(redacted in its entirety)

ATTACHMENT D2

CONTRACT DATA REQUIREMENTS LIST (CDRL)

The Contract Data Requirements List (CDRL) identifies critical elements of the contracted effort where NASA requires aspects of mission integration insight and approval. The following CDRL defines the scope of documentation required; however, NASA will utilize the Contractor's existing documentation to the extent practicable. Where there is not a direct match between a CDRL item and the Contractor's standard documentation, the Contractor's documentation will be acceptable provided it contains equivalent data requirements. CDRL approval may be assumed unless the Contractor is notified by NASA of disapproval within thirty (30) days. Under certain circumstances, NASA may elect to eliminate certain submittal cycles.

The number of copies listed in Table D2-A represents the number of hard copies to be delivered to NASA only if the CDRL data is not available electronically, except CDRLs C1-1, C1-2, C1-3, C5-4, and C5-5 which must also be delivered in hard copy. All data requirements shall be delivered to the KSC ELV Library. The Contractor shall notify the Contracting Officer in writing of CDRL delivery.

Item	Document	Approval/ Review	Initial Submittal Date	Subsequent Submittal Date	No. of Copies
	C1: Documentation				
C1-1	Formal Review Documentation	Review	(A) At Review; (B,C,D,E) Review + 1W	A/R	A/R
C1-2*	Countdown Documentation	Approval (A,B); Review (C)	L-1W	As Changed	5
C1-3*	Mission Console Notebook	Review	At Launch Dress Rehearsal	As Changed	50
C1-4	Program Master Schedule and Launch Vehicle Planning Manifest	Review	As Released	A/R	10

* Required per mission

TABLE D2-A: CDRL INDEX

Item	Document	Approval/ Review	Initial Submittal Date	Subsequent Submittal Date	No. of Copies
	C2: Mission Integration				
C2-1*	ICD/Verification Matrix	Approval	Input + 6M	As Changed	10
C2-2*	Mission Specific Program Requirements Document/ Operational Requirements (PRD/OR)	Approval	A/R	As Changed	3
C2-3*	LV Detailed Mission Requirements (DMR)	Approval	A/R	As Changed	3
C2-4*	Detailed Mission Requirements (DMR) Annex	Approval	A/R	Not Required	3
C2-5*	Mission Success Determination Methodology	Approval	NLT L-4M	As Changed	5
	C3: Mission Assurance				
C3-1	Alert System Documentation	Review	Dispo + 1M		2
C3-2	Mishap Reporting and Investigation	Review	Initial Incident Notification = Mishap + 4hrs; Initial Incident Rpt = Mishap + 24 hrs; Assessment Rpt = Mishap + 5D; Mishap Report = Mishap + 30D; Corrective Action Plan = Mishap + 45D		2
C3-3	ISO 9001 Certification Certificate	Review	RFP Response	Upon Recertification	1
	C4: Analysis				
C4-1*	Performance and Guidance Accuracy Analysis (PGAA)	Initial Submittal = Review, Subsequent Submittals = Approval	Input + 4M	Input +12W, except for DPAF missions Input +14W nominal targets L-12M & L-6M	3
C4-2*	Final Mission Analysis (FMA)	Approval	Receipt of P/L Data + 3W	A/R	3

* Required per mission

TABLE D2-A: CDRL INDEX

Item	Document	Approval/ Review	Initial Submittal Date	Subsequent Submittal Date	No. of Copies
	C4: Analysis (Continued)				
C4-3*	Payload/Expended Stage Separation Analysis	Approval	**Initial (if req'd) – 2nd PGAA Mass Properties Input + 6W (Prelim)**	**Subsequent – 3-Stage Mission: S/C Final Mass Properties (Post Spin Balance & Weighing) Input + 2W NET L-2W NLT L-1W 2-Stage Mission: S/C Final Mass Properties Input + 6W NET L-2W NLT L-1W**	3
C4-4*	Payload Fairing Venting Analysis	Approval	Receipt of P/L Data + **6W**	A/R	3
C4-5*	Payload Fairing Clearance Analysis	Approval	**CDRL C4-7 (1ST) Input +15W**	**CDRL C4-7 (2ND) Input + 15W, CDRL C4-7 (3RD) Input + 17W, nominal target L-22W**	3
C4-6*	Pre-Flight Controls and Stability Analysis	Approval	**CDRL C4-7 (3rd) Input +33W, nominal target L-6W**	A/R	3
C4-7*	Coupled Dynamic Loads Analysis	Approval	Receipt of P/L Model + 3M	Receipt of P/L model +3M, nominal targets L-15M and L-26W	3
C4-8*	Integrated Thermal Analysis	Approval	**CDRL C4-1 (3rd) Input + 20W, nominal target L-18W**	A/R	3
C4-9*	RF Link Analysis	Approval	**Prelim = CDRL C4-1 (3rd) Input +16W Final = L-4W**	A/R	3
C4-10*	Payload/Launch Vehicle EMI/EMC and RF Compatibility Analysis	Approval	A/R	A/R	3

* Required per mission

TABLE D2-A: CDRL INDEX

Item	Document	Approval/ Review	Initial Submittal Date	Subsequent Submittal Date	No. of Copies
	C4: Analysis (Continued)				
C4-11*	Mission Unique Software	Approval	**Prelim = L-8W Final = Part 1– Section released Mission Constants Drawing L-2W Part 2–Released Mission Constants Drawing and Guidance, Targeting and Performance Memo L-5D**	A/R	3
C4-12*	Quick Look Flight Report	Review	L+2W		3
C4-13*	Final Flight Report	Review	L+9W	A/R	3

	C5: Engineering				
C5-1*	Vehicle Data Package	Review	L-4W	As Changed	4
C5-2*	Mission Unique Hardware Test Plan	Approval	**ATP of Mission unique + 12M**	As Changed	4
C5-3*	Mission Unique Hardware Test Report	Review	Test Completion + 6W	As Changed	4
C5-4*	Mission Unique Drawings	Review	As Generated	As Changed	4
C5-5*	Integrated Procedures	Approval	**Input +4W, NET** 1W Prior to Use	A/R	5

	C6: Telemetry and Communications				
C6-1	Vehicle Telemetry Formats	Review	**L-12W**	As Changed with Configuration	2
C6-2*	Vehicle Telemetry (Test, Pre-Launch, and Launch)	Review	Test + 1D; Pre-Launch + 1D; Launch + 1W		1

* Required per mission

TABLE D2-A: CDRL INDEX

DATA ITEM DESCRIPTION **Number: C1-1**

FORMAL REVIEW DOCUMENTATION

DESCRIPTION/PURPOSE:

To provide presentation and handout material, minutes, and accompanying action item lists from each formal review.

DATA REQUIREMENTS:

Formal review documentation shall include:

(A) Presentation packages and hand-out materials provided at the review for NASA attendees

(B) Minutes from each formal review

(C) List of attendees

(D) Agreements from each formal review

(E) An action item list maintained and updated by the Contractor. The list shall include:

(i) Due Date

(ii) Subject

(iii) Assigned tracking number for each action item

(iv) Person or organization responsible for completing the action

(v) Status of action (i.e., open, closed, or deleted)

DATA DESCRIPTION

Boeing will provide data and documentation formatted to satisfy the above-noted Data Requirements specified.

DATA ITEM DESCRIPTION

Number: C1-2

COUNTDOWN DOCUMENTATION

DESCRIPTION/PURPOSE:

To provide the documents necessary to launch the vehicle and also assist NASA management in determination of a GO or NO-GO.

DATA REQUIREMENTS:

Appendices for the documents listed below shall be provided when necessary to present supplemental or incidental information, detailed tabulations or deviations, or graphic representations.

(A) Countdown

The Countdown document shall provide:

(i) All necessary steps and built-in holds required to successfully launch the vehicle and its payload during the launch window

(ii) Procedures required to safe the vehicle after a launch attempt

(iii) Procedures required to recycle the countdown for another launch attempt

The necessary steps shall be listed as a sequence of events with each entry including a T-time. T-time is defined as the time before launch, not including planned holds, and with T-0 being the time of launch vehicle lift-off from the launch pad. T+ time is any event after T-0. Each member of the launch team shall be identified by call sign and communication channel. All mission constraints to launch shall also be identified.

(B) Mission Constraints Document

This document is a summary of all the launch vehicle, payload and range mission constraints to launch. The launch vehicle constraints shall include, but not be limited to:

(i) Weather

(ii) Communication

C1-2 (Continued)

(iii) Range requirements

(iv) Collision avoidance (COLA)

(v) Tracking and telemetry

The document shall also identify critical measurements during the launch countdown. Not to exceed values shall be identified for all critical measurements.

(C) Redline Document

A document that identifies all the measurements on the vehicle and each measurement's minimum and maximum values during launch.

DATA DESCRIPTION

The requirements of this CDRL will be fulfilled by the publication of the Countdown Document, the Redline Document, and the Launch Operations Plan (LOP).

The Countdown Document will provide all items identified in item (A).

The Launch Operations Plan (LOP) summarizes the launch vehicle, payload, and Range mission constraints leading to a Go or No-Go decision identified in item (B).

The Redline Document satisfies the requirements in item (C).

DATA ITEM DESCRIPTION **Number: C1-3**

MISSION CONSOLE NOTEBOOK

DESCRIPTION/PURPOSE:

A mission console notebook to assist on-console users during pre-count, terminal count, and plus count operations.

DATA REQUIREMENTS:

As a minimum, the notebook shall include:

(A) Terminal or abbreviated countdown procedure

(B) Flight sequence of events

(C) Range, payload, launch vehicle mandatory items

(D) Communication channel matrix

(E) Down-range telemetry coverage plan

(F) Launch window for all possible attempts

(G) Launch decision flowchart

(H) Control center seating

(I) Call sign matrix

(J) Protocol for calling holds

(K) Day of launch winds plan

DATA DESCRIPTION

The Boeing mission console notebook will contain the data specified above.

DATA ITEM DESCRIPTION **Number: C1-4**

PROGRAM MASTER SCHEDULE AND LAUNCH VEHICLE PLANNING MANIFEST

DESCRIPTION/PURPOSE:

The contractor shall develop and provide a Program Master Schedule including sub-tier schedules, production schedules, and launch operations schedules for each launch service. In addition, a Launch Vehicle Planning Manifest shall be provided which forecast launch services for a period of no less than five (5) years.

DATA REQUIREMENTS:

Contractor formats acceptable.

DATA DESCRIPTION

Boeing will provide data and documentation formatted to satisfy the above-noted Data Requirements specified.

DATA ITEM DESCRIPTION **Number: C2-1**

INTERFACE CONTROL DOCUMENT (ICD)/VERIFICATION MATRIX

DESCRIPTION/PURPOSE:

The ICD identifies and defines the functional and environmental interfaces, and performance requirements of the payload with the launch vehicle and associated payload/launch processing facilities. The ICD shall contain a verification matrix that documents all requirements and methods by which they will be verified and responsible organization.

DATA REQUIREMENTS:

As a minimum, the ICD shall include:
(1) Payload description
(2) Mission requirements
(3) Launch vehicle modification description
(4) Launch vehicle induced environments
(5) Ground handling requirements
(6) Payload-to-blockhouse wiring diagram
(7) Payload compatibility drawing
(8) Verification matrix

DATA DESCRIPTION

Boeing will provide data and documentation formatted to satisfy the above-noted Data Requirements specified.

INPUT REQUIREMENTS

A payload questionnaire is provided to the contractor for initial definition of payload requirements, interface details, launch site facilities, and preliminary safety data. It contains a set of questions whose answers define the requirements and interfaces as they are known at the time of preparation. Normally this document would not be kept current; it will evolve into the mission interface control document. For ease of conversion to the interface control document (ICD), the questionnaire content and format are essentially the same as those of the ICD.

Additional inputs required are an 8.5 by 11-in. color transparency of the spacecraft insignia for the mission-specific decal definition and the electrical wiring requirements, both flight and ground segments.

DATA ITEM DESCRIPTION **Number: C2-2**

MISSION SPECIFIC PROGRAM REQUIREMENTS DOCUMENT OPERATIONAL REQUIREMENTS (PRD/OR)

DESCRIPTION/PURPOSE:

The Mission Specific Program Requirements Document (PRD) and Operational Requirements (OR) identifies specific support services provided by the Range. Range support services required by NASA and the Contractor are submitted to the Range through the PRD and OR.

DATA REQUIREMENTS:

The Mission Specific PRD/OR, or equivalent mission specific Range support request documentation for the proposed launch site(s), shall be submitted to obtain Range support. The Contractor, with support from NASA/KSC, completes all forms appropriate to the mission in the format required by the Range and submits them to the appropriate Range for formal acceptance.

DATA DESCRIPTION

The Boeing mission-specific PRD/OR prepared per the Universal Documentation System Handbook, Volume 2 Requirements, Formats and Instructions, Program Introduction, Program Requirements Documentation/Operations Requirements (UDS) satisfies the data requirements specified above.

INPUT REQUIREMENTS

Mission-specific payload requests for range support from the Eastern Range, Western Range, or others for integrated payload/launch vehicle operations. This information is incorporated by the contractor into the PRD/OR, or the equivalent mission-specific range support request documentation, and submitted to the appropriate range for formal acceptance.

DATA ITEM DESCRIPTION **Number: C2-3**

LAUNCH VEHICLE DETAILED MISSION REQUIREMENTS (DMR)

DESCRIPTION/PURPOSE:

The Launch Vehicle DMR documents formal requests for tracking, communications, and data system services that are either managed by or negotiated through the Networks and Mission Services Project (Code 450) at Goddard Space Flight Center (GSFC).

DATA REQUIREMENTS:

The DMR, consisting of sets of Universal Documentation System (UDS) standard forms (with associated instructions), shall be completed to obtain network support from NASA for the baseline launch vehicle. The Contractor, with the support of NASA/KSC, completes all forms appropriate to the vehicle and submits them to NASA/KSC for review and GSFC Code 450 for formal acceptance. The DMR shall follow the format provided in the NASA/GSFC Instruction Manual for the NASA DMR document.

DATA DESCRIPTION

The Boeing DMR prepared per the Universal Documentation System Handbook, Volume 2 Requirements, Formats and Instructions, Program Introduction, Program Requirements Documentation/Operations Requirements (UDS) and following format provided in the NASA/GSFC instruction manual satisfies the data requirements specified above.

DATA ITEM DESCRIPTION **Number: C2-4**

DETAILED MISSION REQUIREMENTS (DMR) ANNEX

DESCRIPTION/PURPOSE:

The DMR Annex documents formal requests for tracking, communications, and data system services that are either managed by or negotiated through the Networks and Mission Services Project (Code 450) at GSFC.

DATA REQUIREMENTS:

The DMR Annex consisting of sets of UDS standard forms (with associated instructions), shall be completed to obtain network support from NASA for the vehicle integration, test, and launch phase of each mission. The Contractor, with support from NASA/KSC completes all appropriate forms and submits them to NASA/KSC for review and GSFC Code 450 for formal acceptance.

DATA DESCRIPTION

The Boeing DMR Annex prepared per the Universal Documentation System Handbook, Volume 2 Requirements, Formats and Instructions, Program Introduction, Program Requirements Documentation/Operations Requirements (UDS) and following format provided in the NASA/GSFC instruction manual satisfies the data requirements specified above.

INPUT REQUIREMENTS

Mission-specific payload requirements for tracking, communications, and data system services that are either managed by or negotiated through the NASA Office of Space Communications Lead Center. This information is incorporated by the contractor into the DMR Annex for each mission.

DATA ITEM DESCRIPTION

Number: C2-5

MISSION SUCCESS DETERMINATION METHODOLOGY

DESCRIPTION/PURPOSE:

This data item proposes methodology to support the Contracting Officer's determination of mission success.

DATA REQUIREMENTS:

The Contractor's proposed method, including required vehicle telemetry measurements and ground observation, for verifying that each proposed mission success criterion is satisfied. Allowances for sensor measurement accuracy shall be explicitly identified and justified.

DATA DESCRIPTION

Boeing will provide NASA a detailed description and mission success determination requirement matrix that will clearly identify mission success determination methodology for each criterion specific to a NASA mission.

The criterion description shall include a narrative explaining criteria, ICD predicted values or tolerances, measurement accuracy allowances and appropriate justification, vehicle telemetry measurement and/or ground observation determination method.

The matrix will be tailored to each NASA mission and reflect that mission's success requirements. The matrix will include a description of criteria (such as target orbits, Interface Control Document (ICD) environments and parameters, no damage from LV during or after deployment), predicted values and tolerances, sensor measurement accuracy and determination method. The actual flight value or measurement will be used to determine mission success and the same matrix reported in the post-flight report (CDRL C-13). The NASA-provided Payload Evaluation Criteria will determine partial mission success methodology.

The following table is an example template of what is to be provided. Note: Mission Success Criteria items will vary based on the specific NASA mission and the items listed below are for reference only.

C2-5 (Continued)

Mission Success Criteria	ICD Predicted Values and Tolerances	Sensor Measurement Accuracy	Determination (Verification) Method Ground Observation or LV telemetry	Actual Flight Value
Target Orbit				
ICD environments or parameters e.g., Acoustic Environment				
Shock Environments				
Structural Loads				
Thermal Environment				
Spin rates				
No LV re-contact with payload				

DATA ITEM DESCRIPTION **Number: C3-1**

ALERT SYSTEM DOCUMENTATION

DESCRIPTION/PURPOSE:

A Government Industries Data Exchange Program (GIDEP) Alert Report will be generated for matches of all hardware covered by this contract.

DATA REQUIREMENTS:

(A) This report will identify all matches of hardware provided under this contract.

(B) The report shall identify the GIDEP Alert number, flight hardware impacted, analysis of the problem, and any corrective action required.

(C) The report shall include results from any subcontractor GIDEP Alert reviews.

DATA DESCRIPTION

Boeing will provide data and documentation formatted to satisfy the above-noted Data Requirements specified.

DATA ITEM DESCRIPTION **Number: C3-2**

MISHAP REPORTING AND INVESTIGATION

DESCRIPTION/PURPOSE:

All Type A, B, and C mishaps as defined in KHB 1710.2D mishap notification shall be written and immediately provided to the Government Safety Representative Office as outlined in KHB 1710.2 when the contractor is in a NASA-owned or controlled facility or is using NASA assets located elsewhere.

DATA REQUIREMENT:

(A) Initial Incident Notification: An informal notification of the incident shall be reported to the designated NASA Safety Representative.

(B) Initial Incident Report: An initial incident report shall be provided to the designated Government Safety Representative. The following information, as a minimum, shall be included: organization, facility, specific location, date and time of incident, date and time the Safety Office was notified, and description of incident.

(C) Assessment Report: A written assessment shall be prepared, providing supporting justification, if it is determined that the incident is not a mishap. The assessment shall be provided to the designated Government Safety Representative. A mishap report shall be submitted if no assessment is performed.

(D) Mishap Report: If the incident is a reportable mishap, the Contractor shall submit a written mishap report to the designated Government Safety Representative.

(E) Corrective Action Plan: A Corrective Action Plan submitted to the designated Government Safety Representative. The submitting organization shall update changes to the completion dates for the submitted corrective actions.

DATA DESCRIPTION

Boeing will provide data and documentation formatted to satisfy the above-noted Data Requirements specified.

DATA ITEM DESCRIPTION

Number: C3-3

ISO 9001 CERTIFICATION CERTIFICATE

DESCRIPTION/PURPOSE:

The certificate that is provided by the Registrar upon successful completion of ISO 9001 certification.

DATA REQUIREMENTS:

After completion of ISO 9001 3rd party certification, a copy of the certificate shall be provided to NASA. Upon loss of certification, NASA shall be notified within 5 business days.

DATA DESCRIPTION

Boeing will provide data and documentation formatted to satisfy the above-noted Data Requirements specified.

DATA ITEM DESCRIPTION **Number: C4-1**

PERFORMANCE AND GUIDANCE ACCURACY ANALYSIS (PGAA)

DESCRIPTION/PURPOSE:

This analysis is prepared using the best available mission requirements (payload mass properties, insertion state vector requirements, tracking requirements, etc.) to identify any potential problems inherent in accomplishing the mission objectives. This analysis shall include parametric trade studies.

DATA REQUIREMENTS:

The preliminary mission analysis shall include, as a minimum:

(A) The nominal and 3-sigma limits for orbit elements and associated covariance matrix

(B) Performance impacts as a function of launch date and time.

(C) Performance capability, margins and reserves

(D) Sequence of events and tracking coverage

(E) Time history of trajectory from launch to targeted condition

(F) Launch vehicle summary weight statement

(G) Sources and magnitude for all dispersions used. If statistical dispersions are used, then the distribution method (e.g., normal, gaussian) shall be specified for each parameter

(H) Definition of all coordinate systems used

(I) Reference to the source(s) for all payload inputs to this analysis (e.g., requirements, mass properties)

DATA DESCRIPTION

The Performance and Guidance Accuracy Analysis (PGAA) is used to provide mission planners with launch vehicle trajectories along with associated vehicle performance and orbit dispersion data to meet spacecraft mission requirements. The following are included as part of the PGAA:

C4-1 (Continued)

1. Description of all phases of vehicle trajectory from liftoff to the target interface point describing key points about the trajectory design. References for all vehicle performance models, weights, and associated data used in the trajectory design are included.
2. Geodetic parameters and atmospheric data used in the trajectory calculations are presented.
3. List of mission sequence of events including all engine ignition and cutoff times, stage separation times, vehicle control program rate start and stop times, flight environmental times such as Mach 1 and maximum dynamic pressure, and any other mission event times of significance.
4. List of all vehicle control program rates defined for both powered flight and coast phases of mission.
5. Vehicle weight summary providing listing of total vehicle weight at key vehicle events such as stage ignition and cutoff times and separation times. Also provided in the weight summary are individual stage hardware weights and propellant consumption history for the mission.
6. Vehicle performance capability data are presented in tabular and/or graphic form. Included in the data are vehicle available and required velocity reserves, and margins above the mission performance requirements. Vehicle parametric performance capability data can also be presented in the PGAA.
7. Tabular and graphic presentation of the time history of the vehicle instantaneous impact (IIP) which can be used to verify compliance of the nominal mission trajectory with range safety requirements.
8. Tabular presentation of time history of tracking data for all stations used for launch vehicle tracking purposes and for spacecraft-requested stations. Data provided include slant range, slant range rate of change, line-of-sight azimuth and elevation angles, and line-of-sight look angles. Also provided are tables of acquisition and loss time for each station based on various vehicle elevation angles. Definitions of the tracking parameters are provided.
9. Tabular presentation of time history of vehicle sun-angle data for various launch dates and times. Also included is a listing of the corresponding sun/shadow entry/exit times. Definitions of the sun angles are provided. (Note: Only applicable when launch window can be defined.)
10. Orbit error analysis – Includes a description of the method used to define the orbit errors and a listing of all error sources used in the analysis. Also included are sensitivities of various trajectory and orbit parameters to the +/-3-sigma error sources, a covariance matrix of injection conditions based on 3-sigma sensitivities, a table of velocity deficit versus probability and sensitivities, and a listing of the expected 3-sigma errors for various trajectory and orbit errors.
11. Tabular presentation of the time history of various trajectory parameters. Blocks of 200 parameters are presented at each time point. Data presented include basic trajectory parameters defining vehicle position, velocity, and attitude, environmental parameters, vehicle engine performance data, and orbit parameters. Data are presented for various coordinate systems such as Earth Centered Inertial (ECI) and J2000. Definitions of all parameters and coordinate systems are presented.

C4-1 (Continued)

INPUT REQUIREMENTS

Provide the best available mission-specific payload characteristics, orbit requirements, spin-rate requirements, tracking requirements, nutation time constant, etc. required by the contractor to perform the performance and guidance accuracy analysis.

DATA ITEM DESCRIPTION **Number: C4-2**

FINAL MISSION ANALYSIS (FMA)

DESCRIPTION/PURPOSE:

This analysis is prepared based on payload requirements resulting from NASA review of the PGAA and contains information similar to that in the PGAA. This analysis supports pre-flight verification of compliance with mission requirements.

DATA REQUIREMENTS:

The FMA shall include, as a minimum:

(A) The nominal 5 or 6 Degree of Freedom (DOF) trajectory simulation for each targeted insertion condition utilizing actual weights and propulsion models (electronic format is preferred).

(B) All Data Requirements identified in PGAA Data Item Description.

DATA DESCRIPTION

The Final Mission Analysis (FMA) is the last launch vehicle trajectory analysis performed prior to launch. The FMA is a guided trajectory using a 5-degrees-of-freedom (5-DOF) trajectory simulation through the first-stage portion of flight. Use of the 5-DOF simulation results in a trajectory that incorporates the effects of vehicle rotational dynamics and control system response during the high aerodynamic loading portion of flight. A 3-degrees-of-freedom (3-DOF) simulation is used after first-stage flight. Actual vehicle and spacecraft weights and propulsion models are used in the FMA. The following are included as part of the FMA:

1. Description of all phases of vehicle trajectory from liftoff to the target interface point. References for all vehicle performance models, weights, guidance targeting data, and vehicle control system data used in the trajectory analysis are included.
2. List of trajectory and orbit parameters at significant trajectory events such as stage engine cutoff times and at the target interface point. The FMA trajectory and orbit parameter values are compared to those from the final submittal of the Performance and Guidance Accuracy Analysis (PGAA).
3. List of mission sequence of events including all engine ignition and cutoff times, stage separation times, vehicle control program rate start and stop times, flight environmental times such as Mach 1 and maximum dynamic pressure, and any other mission event times of significance. The FMA sequence of events times are compared to those from the final submittal of the PGAA. Also presented is a list of estimated 3-sigma deviations in significant event times based on 3-sigma perturbations in vehicle performance parameters.

C4-2 (Continued)

4. Vehicle weight summary providing listing of total vehicle weight at key vehicle events such as stage ignition and cutoff times and separation times. Also provided in the weight summary are individual stage hardware weights and propellant consumption history for the mission. The weights used in the FMA are compared to the weights used in the final submittal of the PGAA.
5. Vehicle performance capability data are presented and compared to the corresponding data from the final submittal of the PGAA. Included in the data are vehicle available and required velocity reserves, and margins above mission performance requirements.
6. A comparison is made of the actual vehicle engine performance parameters from the FMA to the nominal engine performance parameters from the final submittal of the PGAA.
7. A listing is presented of the guidance targeting parameters used in the FMA.
8. Tabular presentation of the time history of various trajectory parameters. Blocks of 200 parameters are presented at each time point. Data presented include basic trajectory parameters defining vehicle position, velocity, and attitude, environmental parameters, vehicle engine performance data, and orbit parameters. Data are presented for various coordinate systems such as Earth Centered Inertial (ECI) and J2000. Definitions of all parameters and coordinate systems are presented.
9. For multiple targeted missions, the FMA will be delivered so as to stagger the output in targeting blocks of 10 days at a time with subsequent targeting blocks published only when it becomes necessary to do so (because of launch delay and/or output preparation time).

INPUT REQUIREMENTS

Provide a review of the PGAA and update the specific payload characteristics, orbit requirements, spin-rate requirements, tracking requirements, and similar data required by the contractor to perform the final mission analysis.

DATA ITEM DESCRIPTION **Number: C4-3**

PAYLOAD/EXPENDED STAGE SEPARATION ANALYSIS

DESCRIPTION/PURPOSE:

The Payload/Expended Stage Separation Analysis is required to demonstrate that adequate separation distance exists between the payload and the upper stage during the relative motion predicted following payload deployment. The analysis is also required to demonstrate that payload tip-off rates satisfy requirements. This analysis supports pre-flight verification of compliance with mission requirements.

DATA REQUIREMENTS:

(A) Provide nominal, 3-sigma, or worst-case payload tip-off rates and cone angles (cone angles if deployed while spinning) at deployment.

(B) The analysis shall include the effects of residual thrust, vehicle and payload mass properties uncertainties, and separation mechanism uncertainties. Additionally, include any methods utilized to ensure contamination upon separation is prevented.

(C) The report documenting this analysis shall list and describe all dispersion sources used for the analysis, mass properties data sources, and all coordinate systems used.

(D) Expended stage/payload relative motion analysis following payload deployment

DATA DESCRIPTION

The Payload/Expended Stage Separation Analysis serves as a pre-flight verification of acceptable performance of the launch vehicle/spacecraft separation system. The analysis results will demonstrate compliance with all separation requirements (i.e. separation clearances, tip-off rates, attitude pointing, cone angle, separation velocity, long-term separation clearance, and contamination) at or above the 3-sigma probability level. The analysis utilizes Monte Carlo computer simulations to predict mean and 3-sigma performance of key parameters during the separation event. The analysis documentation provides a detailed description of the computer simulation, coordinate systems, and all simulation input data (i.e. mass properties, residual thrust, initial attitude and angular rates, and separation system components) used in the analysis.

INPUT REQUIREMENTS

The separation analyses require that a complete set of spacecraft mass properties be provided. This consists of mean values and 3-sigma uncertainties for the spacecraft mass, three components of center of gravity, three moments of inertia, and three products of inertia. The sign convention (i.e., positive or negative) summations of the products of inertia must be specified. In addition, for three-stage missions (i.e., spinning

C4-3 (Continued)

upper stage) the energy dissipative nutation time constants at upper-stage ignition and burnout shall be provided as well as the spacecraft propellant minimum slosh frequencies and associated slosh masses.

These data shall be provided with the second PGAA mass properties input to support the initial separation analysis and updated after final spacecraft weighing and spin balance for the final analysis delivery.

DATA ITEM DESCRIPTION

Number: C4-4

PAYLOAD FAIRING VENTING ANALYSIS

DESCRIPTION/PURPOSE:

This analysis shall evaluate and verify that the payload depressurization rate requirements are satisfied.

DATA REQUIREMENTS:

The Payload Fairing Venting Analysis shall be based on the mission trajectory and payload geometry and volume.

DATA DESCRIPTION

This analysis shall evaluate and verify that the payload compartment depressurization rate requirements are satisfied. The maximum payload fairing pressure decay rate is derived from the overall launch vehicle compartment venting analysis that models the venting of gases between internal compartments as well as between internal compartments and the external atmosphere as a function of time of flight.
The analysis shall be based on the mission trajectory and payload geometry and volume. It utilizes both the ventable and non-ventable payload volumes.

INPUT REQUIREMENTS

Provide spacecraft ventable and nonventable volumes.

DATA ITEM DESCRIPTION **Number: C4-5**

PAYLOAD FAIRING CLEARANCE ANALYSIS

DESCRIPTION/PURPOSE:

This analysis documents/demonstrates that sufficient clearance exists under dynamic conditions is available to prevent payload damage from lift-off through payload fairing jettison.

DATA REQUIREMENTS:

The Payload Fairing Clearance Analysis shall include, as a minimum, the effects of:

(A) Thermal pre-load

(B) Disconnect forces

(C) Actuator forces

(D) Dynamic response

DATA DESCRIPTION

Compliance with this CDRL will be accomplished with two documents, the Payload Fairing Separation Analysis and the Payload Fairing Clearance Study Drawing

The Payload Fairing Separation Analysis serves as a pre-flight verification of acceptable clearance between the fairing and the launch vehicle/payload envelope during the fairing separation event. The analysis utilizes computer models calibrated to match full-scale separation test data to predict fairing clearances, separation velocities, and angular rates. The analysis includes effects of uncertainties in mass properties, separation joint energy, connector disconnect forces, actuator forces, rivet strength, and thermal loading.

The Payload Fairing Clearance Study Drawing calculates/documents that sufficient clearances exist between payload and fairing/PA under dynamic conditions to prevent payload damage from lift-off through payload fairing jettison. This drawing also provides verification that the pull-off angles of the fairing/payload and fairing/launch vehicle electrical connectors and/or purge lines are within qualified values. The analysis includes the effects of dynamic deflections of the payload fairing as predicted in the payload fairing separation analysis. See CDRL C4-7 for description of deflection data input to CDRL C4-5.

C4-5 (Continued)

INPUT REQUIREMENTS

Payload interface compatibility drawings are required as early as possible. The drawings should show nominal and worst-case (maximum tolerance) dimensions for the contractor-prepared compatibility drawing, clearance analysis, fairing compatibility, and other interface details. Preliminary drawings are desired with the payload questionnaire, if possible. The contractor will issue a compatibility drawing that combines the payload and fairing and shows all pertinent mechanical interfaces. The compatibility drawing is formally accepted as a controlled interface between the contractor and NASA, is included in the ICD, and is the basis for the worst-case payload-fairing clearance drawing.

DATA ITEM DESCRIPTION **Number: C4-6**

PRE-FLIGHT CONTROLS AND STABILITY ANALYSIS

DESCRIPTION/PURPOSE:

This report describes analyses conducted to ensure an acceptable vehicle mission unique autopilot design.

DATA REQUIREMENTS:

(A) List all flight conditions analyzed. Reference source for flight condition data (e.g., nominal mission trajectory).

(B) Provide tabular-format gain and filter histories for all times during the course of the mission and provide detailed descriptions of all filters used (by reference, if previously supplied). Mission unique software electronic-format files are acceptable.

(C) List all vehicle models used including, but not limited to: aerodynamics, mass properties, structural frequencies, thrust profiles, and liquid slosh representations. Reference the source for each vehicle model.

(D) List all dispersions used and describe (or reference) how they were defined.

(E) List all software tools used to develop the analyses documented in this report.

(F) Provide detailed descriptions of all linear analysis results, to include rigid body and flexible mode gain and phase margins at all flight conditions analyzed.

(G) Provide vehicle structural mode frequency histories in graphical or tabular format.

(H) Describe the results of any and all time-domain controllability analyses either generally applicable to the design or unique to design of the autopilot in the mission unique software.

DATA DESCRIPTION

Boeing will provide data and documentation formatted to satisfy the above-noted Data Requirements specified.

DATA ITEM DESCRIPTION **Number: C4-7**

COUPLED DYNAMIC LOADS ANALYSIS

DESCRIPTION/PURPOSE:

This analysis defines flight loads to major vehicle and payload structure. This analysis also supports pre-flight verification of compliance with mission requirements.

DATA REQUIREMENTS:

(A) Describe the model and forcing functions used.

(B) The flight events and conditions that cause the greatest loads on the payload shall be identified and included in the analysis. The flight events and conditions that cause the greatest deflections in the fairing and payload (including instances of minimum clearance) shall be identified and included in the analysis.

(C) Output from each flight event shall include maximum/minimum tables of payload selected Acceleration Transformation Matrices (ATM), interface forces, and internal Load Transformation Matrices (LTM).

(D) Worst-case payload fairing dynamic relative deflections shall be identified and included.

(E) Typically three load cycles will be required per mission: A preliminary loads cycle, intermediate loads cycle, and a verification loads cycle.

DATA DESCRIPTION

A report will be provided that contains a description of the vehicle model configuration, events analyzed, and corresponding forcing functions used. Also included will be a description of the spacecraft utilized including any dynamic uncertainty factor imposed for recovery of spacecraft responses. Tables of results will be provided as appendices to the report, which include requested spacecraft responses, launch vehicle responses, and spacecraft-to-launch-vehicle dynamic relative deflections. The spacecraft-to-launch-vehicle dynamic relative deflections will also be used in the payload fairing clearance study drawing (CDRL C4-5).
Model description will include a discussion of coupling techniques, damping, and modal frequency content. Spacecraft and spacecraft-to-launch-vehicle coupled system frequencies and damping will be provided in tables for all events analyzed.
Discussion of events analyzed will include flight times and description of the corresponding forcing functions. Specific events analyzed will include liftoff, transonic (Mach 1.2 for the 9.5-ft fairing and Mach 0.86 and Mach 1.2 for the 10-ft fairing) and maximum q. In the case of transonic and maximum q, an equation will be provided for combining the responses from the various force contributions (static-elastic, quasi-static axial, gust, and buffet).

C4-7 (Continued)

Tables of results will be provided for each event as well as for an envelope of all events. Liftoff tables provided will be an envelope of all cases (32 for ETR and 16 for WTR). Transonic and maximum q tables will include tables which define responses due to static-elastic, quasi-static axial, gust, and buffet. Transonic and maximum q tables will also include the combined total response. Overall summary tables will include the maximum response for each item and define the corresponding event at which the maximum occurred.

All results tables (including the individual liftoff cases) will be electronically transferred, if an FTP site is provided. If requested, spacecraft generalized coordinate acceleration and displacement time histories (liftoff, gust) and mean-squared responses (buffet) will be electronically transferred, if an FTP site is provided. The format of the time history and mean-squared data will be NASTRAN OP4 BCD.

INPUT REQUIREMENTS

A payload mathematical model must be provided for use in the coupled-loads analyses. Acceptable forms include a discrete mass model with associated mass and stiffness matrices or a constrained normal mode model with the appropriate transformation matrices to recover internal responses. Required model information such as specific format, degree-of-freedom requirements, and other necessary information shall be supplied.

DATA ITEM DESCRIPTION **Number: C4-8**

INTEGRATED THERMAL ANALYSIS

DESCRIPTION/PURPOSE:

The purpose of this CDRL is to quantify payload thermal environments in various operational configurations (pre-launch and in-flight). The scope of this analysis may vary depending on the complexity of the payload and upper stage thermal interfaces.

DATA REQUIREMENTS:

The integrated thermal analysis shall include, to the fidelity required by the thermal interfaces:

(A) Temperature time histories at selected locations (identified by the payload) in the payload thermal model

(B) Description of all inputs, assumptions, boundary conditions, and analytical methods used to perform the analysis

(C) Summary of results identifying maxima and minima (for the selected locations of interest, identified by the payload) and the times and flight events at which they occur

DATA DESCRIPTION

Boeing shall provide a prelaunch thermal analysis memorandum that details the prelaunch environment. It will integrate the spacecraft on the upper stage and list boundary conditions and assumptions. The memorandum will also include a nodal map and show a maximum/minimum temperature-prediction table along with temperature histories of launch vehicle nodes and spacecraft nodes that have been determined by the spacecraft to be of importance.

An ascent thermal analysis memorandum will be provided that details the ascent thermal environment. The memorandum will contain all vehicle predicted temperatures influenced by aerodynamic heating. This memorandum verifies overall acceptability of the vehicle for the given mission trajectory and verifies that the payload fairing interior environment is within the environment specified in the ICD.

A transfer orbit thermal analysis memorandum will be provided that details the transfer orbit environment. It will integrate the spacecraft on the upper stage and list boundary conditions, assumptions, sun angles and sun and umbra exposure times, and show the upper-stage thermal control system. The memorandum will also include a nodal map and show a maximum/minimum temperature-prediction table along with temperature histories of the launch vehicle nodes and spacecraft nodes that have been determined by the spacecraft to be of importance.

C4-8 (Continued)

The three memoranda satisfy the prelaunch and in-flight thermal spacecraft environment requirement. All three memoranda present details that satisfy the requirements of the analysis, temperature histories of nodes, and tables of maximum and minimum temperatures. The memoranda also provide confidence in the launch vehicle's thermal control system and the margins that are maintained for each specific mission.

INPUT REQUIREMENTS

Simplified payload geometric and thermal mathematical models in TRASYS and SINDA85/Fluint formats, respectively, shall be provided for use in the integrated thermal analysis. These models shall be limited to 500 payload nodes.

DATA ITEM DESCRIPTION

Number: C4-9

RF LINK ANALYSIS

DESCRIPTION/PURPOSE:

This analysis is performed for each nominal mission trajectory and is required to ensure sufficient RF Link margins exist for both the telemetry and flight termination systems during all phases of powered flight through payload separation. This analysis also supports pre-flight verification of compliance with mission requirements.

DATA REQUIREMENTS:

(A) RF Link analysis using antenna pattern test data for antenna gain, and maximum insertion loss data for cables and dividers/combiners.

(B) Identify, by reference, the mission trajectory used as an input to this analysis.

(C) Identify and describe all coordinate systems used.

(D) Recommend and list ground (and airborne, if applicable) station location assumed and applicable data source references.

(E) Provide the link data specified below (in the preferred format given) for each configuration of Mission, Vehicle System, Launch Date, Ground Station, and Antenna (see Figure D2-1).

DATA DESCRIPTION

The RF Link Analysis verifies that adequate RF Link margins exist for telemetry and flight termination systems throughout all powered phases of the mission trajectory to ensure vehicle tracking, command capability, and telemetry data will be available during all significant flight events through payload separation and to the final vehicle operation.

The preliminary analysis is performed using the third Performance and Guidance accuracy analysis (PGAA) trajectory to review and possibly adjust the RF coverage. The final analysis is performed using the Final Mission Analysis (FMA) trajectory.Using the trajectory information, appropriate ground stations are selected and coordinated. For the selected ground stations, data on the slant range from the ground station to the vehicle are determined and azimuth and elevation information to the vehicle is calculated. The azimuth and elevation data are presented in vehicle coordinate system and must be converted to the coordinate system used for vehicle antenna patterns (IRIG STANDARD 253-93) to produce vehicle look angles. The analysis uses the trajectory data along with the transmitter/receiver characteristics, vehicle RF system insertion losses, vehicle antenna patterns that were determined by test, and ground station RF characteristics to calculate the received signal strength. The RF level is displayed on a chart of the format indicated along with the required and desired margins

C4-9 (Continued)

and provides the RF Link margin above the receiver threshold for all times of flight when the vehicle is in sight of the selected ground station. The RF link margin is calculated for Telemetry, Range Safety Flight Termination, and Tracking RF Links. In addition, 95% spherical coverage required by Range Safety Flight Termination and Tracking RF Links is also provided.

[MISSION] [VEHICLE SYSTEM] LINK ANALYSIS
[LAUNCH DATE] [GROUND STATION] [ANTENNA]

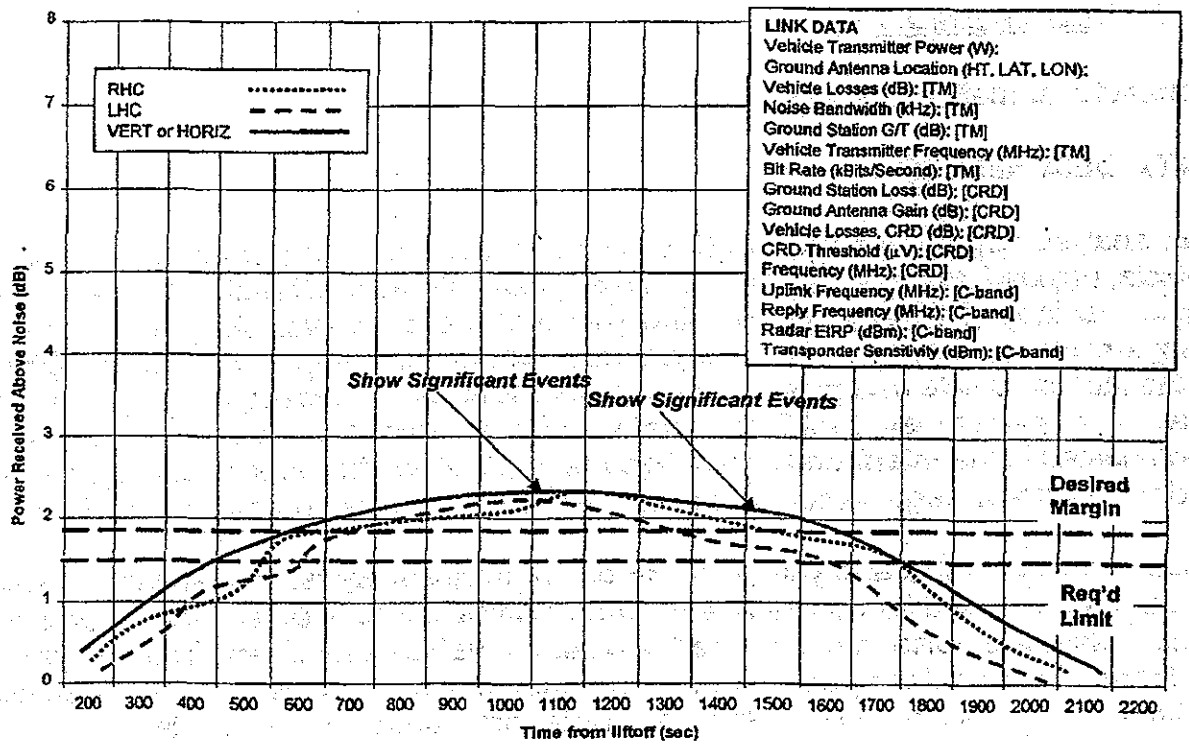


Figure D2-1: Power -Vs- Plus Count Time

DATA ITEM DESCRIPTION

Number: C4-10

PAYLOAD/LAUNCH VEHICLE EMI/EMC AND RF COMPATIBILITY ANALYSIS

DESCRIPTION/PURPOSE:

This EMI/EMC and RF analysis documents the results of EMI/EMC and RF acceptance tests and demonstrates that design requirements in the ICD are satisfied. This is to ensure payload, LV, and Range are compatible and that payload RF and EMI/EMC energy exposure requirements will not be exceeded.

DATA REQUIREMENTS:

Contractor formats acceptable.

DATA DESCRIPTION

This analysis establishes an EMI/EMC environment that is compatible to the launch vehicle, payload, and Range. This analysis considers the qualification status of the launch vehicle, and the available output power of the launch vehicle, payload, and Range-controlled emitters. The analysis documents the energy exposure acceptability of the launch vehicle and provides the environment for the subsequent payload evaluation against their qualification limits. Once established, this environment is documented in the Interface Control Document (ICD) for the launch vehicle and payload and the Program Requirements Document (PRD) to provide this data to the Range.

Another aspect of this analysis is the RF compatibility analysis. This analysis verifies that the payload and launch vehicle RF transmitters will not interfere with each other or cause excessive noise in the payload and launch vehicles receivers. The analysis is performed by considering all interfering intermodulation products and image rejection of all known or expected payload, launch vehicle, and range RF frequencies.

INPUT REQUIREMENTS

The following information is required to perform these analyses:

- Number of transmitters and receivers
- Transmitter/receiver frequency and bandwidth
- Number and location of antennas
- Transmitter type, power, maximum effective isotropic radiated power (EIRP), and modulation
- Antenna/transmitter configuration (block diagram)
- Antenna type and gain
- Plan for transmitting on the pad and during flight
- Number of independent inhibits
- Inhibit configuration (block diagram)

DATA ITEM DESCRIPTION **Number: C4-11**

MISSION UNIQUE SOFTWARE

DESCRIPTION/PURPOSE:

Ensure the mission unique software is consistent with the analyses and data products delivered under CDRLs C4-2, C4-3, C4-6, C4-7, and C4-9.

DATA REQUIREMENTS:

(A) Provide a report describing the methods used to check validity of the mission unique software (by reference if previously supplied).

(B) Provide a memorandum or report documenting the results of mission unique software validation tests. At a minimum, this report shall include comparison of hardware-in-the-loop flight simulation test results with all required event sequences and the target insertion state.

(C) Copy, in electronic format (ASCII test), of all mission constants, data loads, or I-loads for the mission. This data shall match the flight values used in the vehicle flight program.

DATA DESCRIPTION

The Mission Constants (MC) are the database that, together with the flight program operating in the RIFCA guidance computer, command the launch vehicle to fly the third Performance and Guidance Accuracy Analyses (PGAA) trajectory.

The guidance group receives documents from various technologies identifying inputs to the mission constants. These documents, along with the responsible technologies, are listed below:

- Mission Analysis
  PGAA memoranda; C4-2, C4-7 and C4-9 (Inputs to the PGAA)

- Controls
  Control System Mission Constants; C4-3, C4-6

All technologies participate in reviewing the sequence of events to verify correct sequencing and proper integration of all inputs. The Mission Constants assembly is checked by using several engineering development and analysis tools and then by a series of simulations. The simflight uses the MC with the actual flight code to fly a nominal trajectory and provides data for analysis via telemetry. The results are evaluated against the third PGAA for acceptable performance. The final simulation is a verification of the final software using a functional RIFCA with supporting hardware and/or simulators. The validation process is documented in Boeing company procedures.

C4-11 (Continued)

The Sequence of Events, Mission Constants source compilation listing, controls inputs, and plots from the simulated flights are included in the design specification provided for this CDRL. The results of the simulated flight tests are evaluated and compared to the "System/Subsystem Test Requirements Document" (SSTRD) requirements, the third PGAA, electronics, propulsion, controls and guidance inputs. These test results are published in a result's memorandum.

The Sequence of events and source compilation output of the Mission Constants will be available for electronic transfer. Both are in ASCII text format.

DATA ITEM DESCRIPTION **Number: C4-12**

QUICK LOOK FLIGHT REPORT

DESCRIPTION/PURPOSE:

After each launch, a quick look post-flight analysis shall be performed using preliminary evaluations of all available vehicle telemetry and insertion performance. A briefing may satisfy the intent of this report.

DATA REQUIREMENTS:

The data report shall include:

(A) Preliminary trajectory and performance data

(B) Orbital accuracy estimates

(C) Preliminary vehicle subsystem system performance

(D) Preliminary evaluations

DATA DESCRIPTION

Boeing will provide data and documentation formatted to satisfy the above-noted Data Requirements specified.

DATA ITEM DESCRIPTION

Number: C4-13

FINAL FLIGHT REPORT

DESCRIPTION/PURPOSE:

After each launch, a final post-flight report shall be provided. This report will support the NASA Contracting Officer's mission success determination.

DATA REQUIREMENTS:

(A) This report shall include, in its entirety, the Contractor's internal post-flight report produced for each mission.

This report shall also include:

(i) Orbit elements determined from vehicle guidance data

(ii) Vehicle data indicating payload separation

(iii) Pre-flight prediction of expected flight environments (i.e., acoustic/vibration, quasi-static acceleration, thermal, and pressure). Generic vehicle environmental data may be submitted unless mission unique environmental requirements are identified in the ICD

(iv) Post flight determination of actual flight environments

(v) Explanation of significant differences between the predicted and actual flight environments

(vi) Vehicle sequence and attitudes data

(vii) Payload tracking and telemetry data that is interleaved in the launch vehicle data stream

(B) This report shall also specifically address each ICD orbital parameter and environmental condition using flight data, ground observations, or other data sources in accordance with the determination methods proposed by the Contractor under CDRL C2-5.

DATA DESCRIPTION

Boeing will provide data and documentation formatted to satisfy the above-noted Data Requirements specified.

DATA ITEM DESCRIPTION **Number: C5-1**

VEHICLE DATA PACKAGE

DESCRIPTION/PURPOSE:

This item is a data package of vehicle hardware and software changes that are neither dictated by payload requirements nor represent fleet-wide changes.

DATA REQUIREMENTS:

Package shall include, as a minimum:

(A) A description of the item, the modification, and the purpose of the modification

(B) For all hardware changes, an indentured part list of the item, which shall define the difference between the assigned configuration and the as-built configuration and supporting rationale for differences. For purposes of this requirement, the as-built configuration excludes standard usage hardware (e.g., nuts, bolts, washers, shims, and pins). The as-built configuration list shall contain:

(i) Deliverable equipment part name, number, and serial number

(ii) Quantity

(iii) Drawing number or traceability code

(iv) Drawing dash number, change letter and unincorporated Engineering Orders (EOs)

(v) For EEE parts: circuit reference designators, part numbers, part manufacturers, and part lot data codes/serial numbers

(C) For software changes, a copy of all change documentation shall be provided, along with a laboratory and field testing plan

(D) Test Report/Data/Conclusions - A copy of the test procedures, a description of all changes since item qualification, a description of major fabrication anomalies and their disposition, a copy of the test data, a copy of any test failure reports and their disposition, and final approval signatures. For ordnance, inspection data records and a copy of the lot test data shall also be submitted.

C5-1 (Continued)

(E) Operating Time/Cycle - Status at the time of delivery of accumulated operating time and/or critical cycles history of parts designated as time/cycle critical

(F) Allowable (specification requirement) and remaining operating time and/or cycles from point of delivery

DATA DESCRIPTION

Boeing will provide data and documentation formatted to satisfy the above-noted Data Requirements specified.

DATA ITEM DESCRIPTION **Number: C5-2**

MISSION UNIQUE HARDWARE TEST PLAN

DESCRIPTION/PURPOSE:

This plan describes the qualification, test and analysis effort for mission unique hardware.

DATA REQUIREMENTS:

The mission unique hardware test plan shall include, as a minimum:

(A) Description, sequence, configuration, factors of safety, and success criteria for all tests and analyses that support qualification of mission unique hardware

(B) A verification matrix of requirements versus tests/analyses

(C) Reference to or description of any applicable industry standards used to support testing

DATA DESCRIPTION

Boeing will provide data and documentation formatted to satisfy the above-noted Data Requirements specified.

DATA ITEM DESCRIPTION **Number: C5-3**

MISSION UNIQUE HARDWARE TEST REPORT

DESCRIPTION/PURPOSE:

This plan describes the qualification and acceptance test results for mission unique hardware.

DATA REQUIREMENTS:

The mission unique hardware test report shall include, as a minimum:

(A) Sequence, configuration, setup, and results for all tests described in the mission unique hardware test plan (CDRL C5-2)

(B) A compliance matrix of test requirements versus tests successfully completed

(C) Reference to or description of any applicable industry standards used to support testing

(D) Detailed description of any test failures, anomalies, open items, and closure plan

DATA DESCRIPTION

Boeing will provide data and documentation formatted to satisfy the above-noted Data Requirements specified.

DATA ITEM DESCRIPTION **Number: C5-4**

MISSION UNIQUE DRAWINGS

DESCRIPTION/PURPOSE:

This data item identifies the mission unique configuration.

DATA REQUIREMENTS:

(A) Upper stage and PA mission unique drawings showing all sub-tier mission unique installations, including all payload mechanical interfaces.

(B) Fairing mission unique drawings showing all sub-tier mission unique installations.

(C) Top-level vehicle system specification drawings showing all sub-tier mission unique installations.

(D) All schematics harness drawings, and assembly drawings for mission unique electrical hardware.

DATA DESCRIPTION

Boeing will provide data and documentation formatted to satisfy the above-noted Data Requirements specified.

DATA ITEM DESCRIPTION **Number: C5-5**

INTEGRATED PROCEDURES

DESCRIPTION/PURPOSE:

Site procedures for various operations that involve the payload and/or the LV/payload interfaces.

DATA REQUIREMENTS:

Provide as a minimum, the following integrated procedures (If applicable):

(A) Payload/LV electrical interface verification test

(B) Payload encapsulation and transport

(C) Payload/LV mate

(D) LV electrical readiness/flight simulation

(E) Fairing installation

(F) Combined system test/final readiness test

DATA DESCRIPTION

The primary work control document used at our launch sites is the Launch Preparation Document (LPD). This set of integrated documents incorporates all Boeing and NASA operational requirements into a single modular procedure. The LPDs incorporate all customer requirements related to technical content, desired insight and oversight, and safety comments.

The LPDs identify all personnel, test equipment, and other resources required to meet task timelines. They control all hazardous operations and identify all safety equipment. Preplanned options and emergency sections provide contingency procedures to accommodate emergencies and unusual conditions in support of safety and mission success.

All LPDs involving joint operations between the payload and the launch vehicle will be coordinated with and provided to NASA.

INPUT REQUIREMENTS

On each mission, the contractor will prepare, in a format and in detail satisfactory to NASA and the range, launch site procedures for various operations that involve the

C5-5 (Continued)

payload after it is mated with the launch vehicle. The contractor requires inputs to these operations in the form of payload handling constraints, environmental constraints, personnel requirements, and equipment requirements. Of particular interest are payload tasks/requirements during the final few days before launch.

In addition, the payload agency will prepare a launch site test plan to provide all agencies with a detailed understanding of all launch site activities and operations planned for a particular mission. Operating procedures must be prepared for all payload operations accomplished at the launch site. For hazardous operations, special instructions must be followed for preparation.

DATA ITEM DESCRIPTION **Number: C6-1**

VEHICLE TELEMETRY FORMATS

DESCRIPTION/PURPOSE:

To provide all telemetry (RF and hardwire) formats for vehicle system and sub-systems testing, including detailed description of formats that will allow NASA to process, display and verify all launch vehicle telemetry (RF and hardwire).

DATA REQUIREMENTS:

The raw vehicle telemetry (RF and hardwire) formats shall include as a minimum:

(A) PCM Data Stream Description: this file will describe the format of the Pulse Code Modulation (PCM) telemetry data stream. A new file must be delivered if the formatting of the PCM data stream is modified. It must include:

(i) Bit rate in bits per second

(ii) Location and description of sync word

(iii) Number of minor frames in major frame

(iv) Size of minor frame

(v) Number of bits per word or syllable

(B) Measurement Description File: this must be standard ASCII text or another format easily read with a personal computer using commercially available software. A new file must be delivered if any measurement or calibration changes are made to the telemetry stream. It must include:

(i) Measurement ID

(ii) Measurement description

(iii) Engineering units of measurement

(iv) Location of measurement in minor frame

(v) Word step rate of measurement if supercommutated

C6-1 (Continued)

(vi) Size of measurement in bits or bytes

(vii) Type of measurement

(viii) Initial minor frame number where measurement is found

(ix) Frame step rate of measurement if found in more than 1 minor frame

(x) Special conversion algorithm from raw to engineering units if not standard polynomial

(xi) Calibration coefficients for conversion from raw to engineering units

(xii) Bit number in word if measurement is a discrete

(xiii) List of guidance modes that measurement is valid

(xiv) Method of determining guidance modes

(xv) Measurement mask if required

(C) Description of rules used to format measurement description file including:

(i) Description of each field in file

(ii) Description of all codes or abbreviations

(iii) Method of determining revision level or revision date

(D) Non-PCM Data Stream Description: This file will describe the format of the data stream location and description of all measurements, and the calibration data required to convert from raw to engineering units

(E) A list of flight events which will occur for each mission and the nominal time for event occurrence. If event can occur at variable times, this must include a description for determining event time during flight. This list must be delivered for every mission

(F) A list of predicted position and velocity state vectors for significant events during flight. This list must include, at a minimum, the end of all powered flight phases and payload separation. A description of the coordinate system used to provide the state vectors must also be included. This list must be delivered for every mission

C6-1 (Continued)

(G) A list of vehicle attitude measurements and description of format used

All files must be delivered using an electronic medium.

DATA DESCRIPTION

Boeing will provide data and documentation formatted to satisfy the above-noted Data Requirements specified.

DATA ITEM DESCRIPTION

Number: C6-2

VEHICLE TELEMETRY (TEST, PRELAUNCH, LAUNCH)

DESCRIPTION/PURPOSE:

To provide real time telemetry (RF and Hardwire) to the NASA ground telemetry station which will allow NASA to perform independent data processing and analysis.

DATA REQUIREMENTS:

Provide as a minimum:

(A) All real time telemetry (RF and hardwire) test data to the NASA ground telemetry station for all system and sub-system testing upon request. This data must be able to be time correlated in a manner that enables time synchronization and must conform to the standards defined in IRIG Standard 106-99.

(B) All real time telemetry (RF and Hardwire) to the NASA ground telemetry station from the start of Launch Countdown through all phases of powered flight up to Range LOS. This data must be able to be time correlated in a manner that enables time synchronization and must conform to the standards defined in IRIG Standard 106-99.

DATA DESCRIPTION

Boeing will provide data and documentation formatted to satisfy the above-noted Data Requirements specified.

ATTACHMENT D3

SUPPLEMENTAL DATA LIST (SDL)

The SDL identifies the non-CDRL documents generated in the course of production, integration, test, pre-launch, and launch activities that shall be provided to NASA. These items shall be delivered to NASA upon request within ten (10) days. Where there is not a direct match between an SDL item and the Contractor's standard documentation, the Contractor's documentation will be acceptable provided it contains equivalent data requirements.

ITEM	DESCRIPTION
	S1: Documentation
S1-1	Launch Service User's Guide

	S3: Mission Assurance
S3-1	QA Audit Plan/Schedule
S3-2	QA Audit Report
S3-3	As-Built Configuration List

	S4: Analysis
S4-1	Mission Battery Budget Analysis
S4-2	EED's Compatibility Analysis

	S5: Engineering
S5-1	Vehicle Test Procedures

	S6: Telemetry and Communications
S6-1	Telemetry Test Tape
S6-2	End to End Link Test Tape
S6-3	Recorded Vehicle Telemetry (Test, Pre-Launch, Launch)

Table D3-A: SDL Index

DATA ITEM DESCRIPTION

Number: S1-1

LAUNCH SERVICE USER'S GUIDE

DESCRIPTION/PURPOSE:

The Launch Service User's Guide provides customers with information and capabilities regarding launch services.

DATA REQUIREMENTS:

Provide the commercially available Launch Service User's Guide.

DATA ITEM DESCRIPTION **Number: S3-1**

QA AUDIT PLAN/SCHEDULE

DESCRIPTION/PURPOSE:

A QA Audit Plan and/or Schedule that lists all planned assessments and visits to various vendors, suppliers, and subcontractors.

DATA REQUIREMENTS:

This list shall include the subject of the audit/assessment, a QA tracking number or identifier, the assigned assessors, and a schedule by month indicating the planned event.

DATA ITEM DESCRIPTION **Number: S3-2**

QA AUDIT REPORT

DESCRIPTION/PURPOSE:

A Quality Assurance Audit Report documenting the results and actions of audits conducted.

DATA REQUIREMENTS:

(A) The report shall include the date/time and location of the audit, participating individuals, purpose of the audit/assessment, assessment duration, method of assessment, objective, discussion/comments, and conclusion.

(B) Supporting documentation shall be included when appropriate, such as QA assessment checklists, drawings, QA policies and procedures, organization charts, transmittal letters, etc.

DATA ITEM DESCRIPTION **Number: S3-3**

AS BUILT CONFIGURATION LIST

DESCRIPTION/PURPOSE:

A document describing the as-built configuration of each LV.

DATA REQUIREMENTS:

Contractor format acceptable

DATA ITEM DESCRIPTION **Number: S4-1**

MISSION BATTERY BUDGET ANALYSIS

DESCRIPTION/PURPOSE:

This analysis verifies sufficient energy and peak load margin exists to satisfy both vehicle and payload requirements.

DATA REQUIREMENTS:

Contractor formats acceptable.

DATA ITEM DESCRIPTION **Number: S4-2**

EED's COMPATIBILITY ANALYSIS

DESCRIPTION/PURPOSE:

This analysis verifies the payload and LV ordnance will not be unintentionally triggered by the electromagnetic environment around and generated by the integrated payload/LV.

DATA REQUIREMENTS:

Contractor formats acceptable.

DATA ITEM DESCRIPTION **Number: S5-1**

VEHICLE TEST PROCEDURES

DESCRIPTION/PURPOSE:

Procedures for various operations involving LV processing, testing, and checkout.

DATA REQUIREMENTS:

Provide upon request the following vehicle processing procedures:

Receiving Inspection
- First Stage
- Second Stage
- Third Stage
- Fairing
- Interstage
- Solid Motors

Horizontal Testing
- First Stage
- Second Stage
- Interface Test

Pad Testing
- Propulsion Testing
- Electrical Testing
- Cryogenic Leak
- Checks or Crew Certification
- Simulated Flight

DATA ITEM DESCRIPTION **Number: S6-1**

TELEMETRY TEST TAPE

DESCRIPTION/PURPOSE:

To provide raw telemetry signals, on magnetic tape or electronic medium, that are representative of the LV's telemetry allowing NASA to process, display and verify LV telemetry prior to LV testing.

DATA REQUIREMENTS:

Provide as a minimum:

(A) Magnetic test tape and/or electronic copy representative of the telemetry signals of the launch vehicle.

(B) Data on the magnetic tape and/or electronic copy shall be time correlated in a manner that enables time synchronization of all telemetry data and must conform to IRIG Standard 106-99.

DATA ITEM DESCRIPTION **Number: S6-2**

END TO END LINK TEST PLAN

DESCRIPTION/PURPOSE:

To provide a test plan that verifies the telemetry (RF and hardwire), voice communication channels and video links from the Contractor's site to NASA's ground telemetry station. The plan will test NASA's ability to receive, process, display and verify telemetry, voice communication channels and video from the Contractor's site prior to launch vehicle testing.

DATA REQUIREMENTS:

The end-to-end link test plan shall address how the Contractor will test all links from the Contractor's site to NASA's ground telemetry station. The plan shall address scope; organizations involved and points of contact for each; facilities used and/or involved; detailed information on telemetry signals, voice communication channels and video sources and transmission rates.

DATA ITEM DESCRIPTION

Number: S6-3

RECORDED VEHICLE TELEMETRY (TEST, PRE-LAUNCH, LAUNCH)

DESCRIPTION/PURPOSE:

To provide a copy of all telemetry (RF and Hardwire) allowing NASA to perform independent data processing and analysis.

DATA REQUIREMENTS:

To provide:

(A) A copy of all system and sub-system test telemetry (RF and hardwire) data on magnetic tape or electronic copy and corresponding processing software, if an electronic copy is provided. Telemetry data must be time correlated in a manner enabling time synchronization of all telemetry and conforming to the standards defined in IRIG Standard 106-99.

(B) Magnetic tape or electronic copy of the raw telemetry (RF and hardwire) data recorded from all phases of powered flight from two (2) minutes prior to stage ignition through 60 seconds after shutdown. The payload separation event from 120 seconds prior to and 60 seconds after separation shall also be included.

(C) All RF signal strengths as a function of time from launch until completion of vehicle safing.

Attachment D4 - Small Business Plan

(redacted in its entirety)

Attachment D5 – Safety and Health Plan

(redacted in its entirety)

Attachment D6 – Reliability Plan

(redacted in its entirety)

Attachment D7 – Quality Management Plan

(redacted in its entirety)

Attachment D8
NLS PAYMENT SCHEDULE WORK PLAN FOR DELTA II AND III*

Applies to all Launch Service CLINs with L-30 and L-27 Launch Service Payment Schedules (except CLIN 1)

Milestone Event No.	Milestone Event	Estimated Date of Completion	Accomplishment Criteria Narration
1A	Authorization To Proceed	N/A	Authority to proceed received from Contracting Officer
1B	Mission integration activities initiated	L-27	Mission configuration defined Launch Vehicle Qualification activities on or ahead of schedule (if applicable for CLIN)
2	Common hardware material, fabrication, and assembly authorized for production Kickoff meeting held	L-24	First-stage and second-stage configuration defined First-stage manufacturing bill of material released to production Second-stage manufacturing bill of material released to production Planning for first-stage and second-stage configuration long-lead items (structural, mechanical, and electrical) complete Mission Integration Kickoff Meeting complete
3	Propulsion subcontractors authorized Preliminary ICD complete	L-21	First-stage engine on order from subcontractor Second-stage engine on order from subcontractor Strap-on solid rocket motors on order from subcontractor Preliminary ICD complete[1]
4	PAF and fairing material, fabrication, and assembly authorized for production	L-18	PAF manufacturing bill of material released to production Fairing manufacturing bill of material released to production LV assigned
5	Avionics subcontractors authorized	L-15	PCM on order from subcontractor CRD on order from subcontractor RIFCA on order from subcontractor
6	Mission-peculiar hardware authorized for production	L-12	Performance of mission-peculiar tasks authorized List of mission-peculiar drawings (CRS) is issued with scheduled engineering release dates on each drawing Final ICD complete[2] Launch Vehicle Qualification activities complete or on schedule, if applicable
7	Critical subassemblies complete	L-9	First-stage tanks through final assembly in HB
8	Completion of selective mission-peculiar hardware.	L-6	PAF ready for payload fit check Payload Fit Check complete—The mechanical/electrical interface checks between the payload attach fitting and payload is complete First-stage engines received
9	First and second stages complete	L-3	Second-stage engines received First-stage assembly, production checkout, and pre-ship review complete Second stage assembly, production checkout, and pre-ship review complete Launch vehicle on schedule for shipment to launch site at L-6 weeks
10	Launch	L + 9W	Successful Launch and Final Flight Report submitted (CDRL C4-13).

Acronyms

CDRL	Contract data requirements list	NLS	NASA Launch Services
CLIN	Contract line item number	PAF	Payload attach fitting
CRD	Command receiver decoder	PCM	Pulse code modulation
CRS	Change request sheet	RIFCA	Redundant inertial flight control assembly
HB	Huntington Beach		

In the event that the above milestones are delayed, e.g., payload flight hardware not available, CDRLs, program or mission integration kickoff meetings are delayed, for reasons beyond the control or not attributable to the fault or negligence of the Contractor, an invoice may be submitted for payment after the scheduled milestone date. The payment invoice shall contain the required certification that progress towards accomplishment of the specific milestone is substantially complete with an accompanying descriptive narrative and/or a detailed explanation of the circumstances surrounding the Contractor's claim that the specific milestone was delayed for reasons beyond the control of or not attributable to the fault or negligence of the Contractor.

*Work plan will be updated for Delta IV under an LSP

[1]ICD sent out to NASA for comment

[2]All comments to preliminary ICD incorporated and ICD signed

Attachment D8
NLS PAYMENT SCHEDULE WORK PLAN FOR DELTA II AND III continued
CLIN 1 - AURA

Milestone Event No.	Milestone Event	Estimated Date of Completion	Accomplishment Criteria Narration
1	Mission integration activities initiated	L-27	Authority to proceed received from Contracting Officer Mission configuration defined Launch Vehicle Qualification activities on or ahead of schedule (if applicable for CLIN)
2	Common hardware material, fabrication, and assembly authorized for production	L-24	First-stage and second-stage configuration defined First-stage manufacturing bill of material released to production Second-stage manufacturing bill of material released to production Planning for first-stage and second-stage configuration long-lead items (structural, mechanical, and electrical) complete
3	Kickoff meeting held Propulsion subcontractors authorized	L-21	Mission Integration Kickoff Meeting complete First-stage engine on order from subcontractor Second-stage engine on order from subcontractor Strap-on solid rocket motors on order from subcontractor
4	Preliminary ICD complete PAF and fairing material, fabrication, and assembly authorized for production	L-18	Preliminary ICD complete[1] PAF manufacturing bill of material released to production Fairing manufacturing bill of material released to production LV assigned
5	Avionics subcontractors authorized	L-15	PCM on order from subcontractor CRD on order from subcontractor RIFCA on order from subcontractor
6	Mission-peculiar hardware authorized for production	L-12	Performance of mission-peculiar tasks authorized List of mission-peculiar drawings (CRS) is issued with scheduled engineering release dates on each drawing Launch Vehicle Qualification activities complete or on schedule, if applicable
7	Critical subassemblies complete	L-9	Final ICD complete[2] First-stage tanks through final assembly in HB
8	Completion of selective mission-peculiar hardware.	L-6	PAF ready for payload fit check Payload Fit Check complete—The mechanical/electrical interface checks between the payload attach fitting and payload is complete First-stage engines received
9	First and second stages complete	L-3	Second-stage engines received First-stage assembly, production checkout, and pre-ship review complete Second stage assembly, production checkout, and pre-ship review complete Launch vehicle on schedule for shipment to launch site at L-6 weeks
10	Launch	L + 9W	Successful Launch and Final Flight Report submitted (CDRL C4-13).

Acronyms

CDRL	Contract data requirements list	NLS	NASA Launch Services
CLIN	Contract line item number	PAF	Payload attach fitting
CRD	Command receiver decoder	PCM	Pulse code modulation
CRS	Change request sheet	RIFCA	Redundant inertial flight control assembly
HB	Huntington Beach		

In the event that the above milestones are delayed, e.g., payload flight hardware not available, CDRLs, program or mission integration kickoff meetings are delayed, for reasons beyond the control or not attributable to the fault or negligence of the Contractor, an invoice may be submitted for payment after the scheduled milestone date. The payment invoice shall contain the required certification that progress towards accomplishment of the specific milestone is substantially complete with an accompanying descriptive narrative and/or a detailed explanation of the circumstances surrounding the Contractor's claim that the specific milestone was delayed for reasons beyond the control of or not attributable to the fault or negligence of the Contractor.

[1]ICD sent out to NASA for comment

[2]All comments to preliminary ICD incorporated and ICD signed

Attachment D8
NLS PAYMENT SCHEDULE WORK PLAN FOR DELTA II AND III continued
CLIN 9 – NOAA-N'

Milestone Event No.	Milestone Event	Estimated Date of Completion	Accomplishment Criteria Narration
1	Authorization To Proceed Mission integration activities initiated	L-24	Authority to proceed received from Contracting Officer Mission configuration defined Launch Vehicle Qualification activities on or ahead of schedule (if applicable for CLIN)
2	Common hardware material, fabrication, and assembly authorized for production Kickoff meeting held Propulsion subcontractors Authorized	L-21	First-stage and second-stage configuration defined First-stage manufacturing bill of material released to production Second-stage manufacturing bill of material released to production Planning for first-stage and second-stage configuration long-lead items (structural, mechanical, and electrical) complete Mission Integration Kickoff Meeting complete First-stage engine on order from subcontractor Second-stage engine on order from subcontractor Strap-on solid rocket motors on order from subcontractor
3	Launch Vehicle Assigned	Mission Call-Up Readiness Date (MCRD)-18	Launch Vehicle assigned
4	Avionics subcontractors authorized; Fairing material, fabrication, and assembly authorized for production	MCRD-15	PCM on order from subcontractor CRD on order from subcontractor RIFCA on order from subcontractor Fairing manufacturing bill of material released to production
5	Mission-peculiar hardware authorized for production Preliminary ICD Complete	MCRD-12	Performance of mission-peculiar tasks authorized List of mission-peculiar drawings (CRS) is issued with scheduled engineering release dates on each drawing Peliminary ICD complete[1] Launch Vehicle Qualification activities complete or on schedule, if applicable
6	Critical subassemblies complete	MCRD-8	First-stage tanks through final assembly in HB
7	Completion of selective mission-peculiar hardware Final ICD Complete	MCRD-4	Second Stage ready for Fit check with Spacecraft PAF First-stage engines received Final ICD complete[2]
8	First and second stages complete	MCRD	Second-stage engines received First-stage assembly, production checkout, and pre-ship review complete Second stage assembly, production checkout, and pre-ship review complete Launch vehicle on schedule for shipment to launch site at L-6 weeks
9	Launch	L + 9W	Successful Launch and Final Flight Report submitted (CDRL C4-13).

Acronyms

CDRL	Contract data requirements list	NLS	NASA Launch Services
CLIN	Contract line item number	PAF	Payload attach fitting
CRD	Command receiver decoder	PCM	Pulse code modulation
CRS	Change request sheet	RIFCA	Redundant inertial flight control assembly
HB	Huntington Beach		

In the event that the above milestones are delayed, e.g., payload flight hardware not available, CDRLs, program or mission integration kickoff meetings are delayed, for reasons beyond the control or not attributable to the fault or negligence of the Contractor, an invoice may be submitted for payment after the scheduled milestone date. The payment invoice shall contain the required certification that progress towards accomplishment of the specific milestone is substantially complete with an accompanying descriptive narrative and/or a detailed explanation of the circumstances surrounding the Contractor's claim that the specific milestone was delayed for reasons beyond the control of or not attributable to the fault or negligence of the Contractor.

[1]ICD sent out to NASA for comment

[2]All comments to preliminary ICD incorporated and ICD signed

Attachment D8
NLS PAYMENT SCHEDULE WORK PLAN FOR CLIN 8 STEREO

Milestone Event No.	Milestone Event	Estimated Date of Completion	Accomplishment Criteria Narration
1	Authorization to Proceed Mission integration activities initiated Common hardware material, fabrication, and assembly authorized for production	L-24	Authority to proceed received from Contracting Officer Mission configuration defined Launch Vehicle Qualification activities on or ahead of schedule (if applicable) First-stage and second-stage configuration defined First-stage manufacturing bill of material released to production Second-stage manufacturing bill of material released to production Planning for first-stage and second-stage configuration long-lead items (structural, mechanical, and electrical) complete
2	Kickoff meeting held Propulsion subcontractors authorized	L-21	Mission Integration Kickoff Meeting complete First-stage engine on order from subcontractor Second-stage engine on order from subcontractor Strap-on solid rocket motors on order from subcontractor
3	Preliminary ICD complete PAF and fairing material, fabrication, and assembly authorized for production	L-18	Preliminary ICD complete[1] PAF manufacturing bill of material released to production Fairing manufacturing bill of material released to production LV assigned
4	Avionics subcontractors authorized	L-15	PCM on order from subcontractor CRD on order from subcontractor RIFCA on order from subcontractor
5	Mission-peculiar hardware authorized for production	L-12	Performance of mission-peculiar tasks authorized List of mission-peculiar drawings (CRS) is issued with scheduled engineering release dates on each drawing Final ICD complete[2] Launch Vehicle Qualification activities complete or on schedule, if applicable
6	Critical subassemblies complete	L-9	First-stage tanks through final assembly in HB
7	Completion of selective mission-peculiar hardware.	L-6	PAF ready for payload fit check Payload Fit Check complete—The mechanical/electrical interface checks between the payload attach fitting and payload is complete First-stage engines received
8	First and second stages complete	L-3	Second-stage engines received First-stage assembly, production checkout, and pre-ship review complete Second stage assembly, production checkout, and pre-ship review complete Launch vehicle on schedule for shipment to launch site at L-6 weeks
9	Launch	L + 9W	Successful Launch and Final Flight Report submitted (CDRL C4-13).

Acronyms

CDRL	Contract data requirements list	NLS	NASA Launch Services
CLIN	Contract line item number	PAF	Payload attach fitting
CRD	Command receiver decoder	PCM	Pulse code modulation
CRS	Change request sheet	RIFCA	Redundant inertial flight control assembly
HB	Huntington Beach		

In the event that the above milestones are delayed, e.g., payload flight hardware not available, CDRLs, program or mission integration kickoff meetings are delayed, for reasons beyond the control or not attributable to the fault or negligence of the Contractor, an invoice may be submitted for payment after the scheduled milestone date. The payment invoice shall contain the required certification that progress towards accomplishment of the specific milestone is substantially complete with an accompanying descriptive narrative and/or a detailed explanation of the circumstances surrounding the Contractor's claim that the specific milestone was delayed for reasons beyond the control of or not attributable to the fault or negligence of the Contractor.

*Work plan will be updated for Delta IV under an LSP

[1]ICD sent out to NASA for comment

[2]All comments to preliminary ICD incorporated and ICD signed

Attachment D9 – Most Favored Customer Certification Plan

(redacted in its entirety)

ATTACHMENT D10

ACRONYMS AND ABBREVIATIONS

A/R	As Required
ACS	Attitude Control System
AFSPCI	Air Force Space Command Instruction
AKM	Apogee Kick Motor
Alt.	Alternate
Amps	Amperes
ANSI	American National Standards Institute
AO	Announcement of Opportunity
ASCII	American Standard Code for Information Interchange
ASQC	American Society for Quality Control
ATM	Acceleration Transformation Matrix
ATP	Authority to Proceed
Attn.	Attention
AU	Astronomical Unit
BVS	Best Value Solicitation
C	Centigrade
C_3	Earth escape energy expressed in km^2/sec^2
CAGE	Commercial and Government Entity
CBA	Collective Bargaining Agreement
CCAM	Collision/Contamination Avoidance Maneuver
CCAS	Cape Canaveral Air Station
CDRL	Contract Data Requirements List
CFR	Code of Federal Regulations
CG	Center of Gravity
CLIN	Contract Line Item Number
CLSRB	Current Launch Schedule Review Board
cm	Centimeter
COB	Close Of Business
COLA	Collision Avoidance
COTR	Contracting Officer's Technical Representative
CRD	Command Receive Decoder
CVCM	Collected Volatile Condensable Materials

FMA	Final Mission Analysis
FPMR	Federal Procurement Material Record
FRB	Failure Review Board
FRR	Flight Readiness Review
g	Acceleration of Gravity
G&A	General and Administrative
GAO	General Accounting Office
G/T	Gain-to-Noise Temperature
GFP	Government-Furnished Property
GHe	Gaseous Helium
GIDEP	Government/ Industries Data Exchange Program
GN&C	Guidance Navigation and Control
GN_2	Gaseous Nitrogen
Govt.	Government
GSA	General Services Administration
GSE	Ground Support Equipment
GSFC	Goddard Space Flight Center
GSO	GeoSyncronous Orbit
GTO	Geosynchronous Transfer Orbit
Horiz	Horizontal
hrs	Hours
HT	Height
Hz	Hertz
I	Inertial
ICD	Interface Control Document
ID	Identification
IDIQ	Indefinite Delivery/Indefinite Quantity
IFB	Invitation For Bid
IR	Infrared
IRCA	International Registrar of Certified Auditors
IRIG	Inter-Range Instrumentation Group
IRS	Internal Revenue Service
ISO	International Organizations for Standardization
ITAR	International Traffic in Arms Regulations

MUPDR	Mission Unique Preliminary Design Review
MURR	Mission Unique Requirements Review
N/A	Not Applicable
NAFTA	North American Free Trade Agreement
NASA	National Aeronautics and Space Administration
NFS	NASA FAR Supplement
NLS	NASA Launch Services
NLT	No Later Than
NNC	NASA and NASA Customer(s)
No.	Number
NOAA	National Oceanic and Atmospheric Administration
NPD	NASA Policy Directive
NSP	Not Separately Priced
NSS/GO	NASA Safety Standard/Ground Operations
NTE	Not To Exceed
OASPL	Over-All Sound Pressure Level
OFCCP	Office of Federal Contract Compliance Programs
OMB	Office of Management and Budget
OR	Operational Requirements
P/FR	Problem/Failure Reporting
PA	Payload Adapter
PCM	Pulse Code Modulation
PD	Policy Directive
PGAA	Performance and Guidance Accuracy Analysis
PHSF	Payload Handling and Storage Facility
PLF	Payload Fairing
PMI	Program Management Instruction
POCC	Payload Operation Control Center
PP	Postponement
PPC	Procurement Placement Code
PPF	Payload Processing Facility
PRD	Program Requirements Data
psi	Pounds per Square Inch
Pub. L.	Public Law

TBP	To Be Proposed
TDRSS	Tracking and Data Relay Satellite System
TIC	Target Industry Categories
TIN	Taxpayer Identification Number
TM	Telemetry
TML	Total Mass Loss
Tot.	Total
TPA	Test Payload Adapter
UDS	Universal Documentation System
U.S.	United States
U.S.C.	United States Code
UV	Ultraviolet
V	Volt
VAFB	Vandenberg Air Force Base
VDC	Voltage Direct Current
VETS	Veterans
Vert	Vertical
W	Watt
W	Week
WOB	Woman-Owned Business
WTR	Western Test Range
YY	Year