Proton Launch System Mission Planner's Guide

APPENDIX C

Requirements for Customer-Supplied Data

C. REQUIREMENTS FOR CUSTOMER-SUPPLIED DATA

This section describes the data required from the SC Customer to determine the compatibility of the SC with the Proton integrated LV. Providing this data in full constitutes providing an IRD, which is a contractual document provided by the Customer at the beginning of a mission integration cycle.

The requested information is provided in the sequence the data appears in the ICD, in order to simplify the creation of this document once a contract is signed.

C.1 GENERAL INFORMATION

Item	Parameter	Units
Spacecraft	Name	
	Manufacturer	
	SC Platform	
	Isometric view, launch configuration	
	Isometric view, on-orbit configuration	
	Estimated launch date	

C.2 INPUT DOCUMENTS

Item	Parameter	Units
SC Dynamic Model	Per ILS SC Dynamic Model specification	
SC Thermal Model	Per ILS SC Thermal Model specification	
SC Computer-Aided Design (CAD) Model	Per ILS SC Computer-Aided Design (CAD) Model specification	
Launch Operations Plan	Reference Section 5.3.5 of this Mission Planner's Guide	
Acoustic and Sine Vibration Test Plans	Reference Section 5.3.3 of this Mission Planner's Guide	
SC Interface Control Drawing	Drawing which shows:	
	- SC critical point data listed in Section C.3.1	mm
	- Major SC dimensions while in launch configuration.	mm
	- SC bottom panel data listed in Section C.3.1	
	- SC mating interface ring data listed in Section C.3.1	
	- SC umbilical connector data, listed in Section C.3.1	
	- SC pneumatic connector data listed in Section C.3.1	
	- SC access data listed in Section C.3.1	
	- Drawing to show handling fixtures and how attached to SC (hoists, slings, crossbars).	

C.3 INTERFACES

C.3.1 Mechanical Interfaces

Item	Parameter	Units
SC Critical Points	Critical point data shall be presented in the form of Table C.3.1-3. A SC critical point is a point on the SC structure located less than 100 mm from the payload envelope.	
SC Bottom Panel	The nominal dimension from the SC bottom panel exterior surface to the separation plane. The manufacturing tolerance for this dimension. Thermal insulation thickness on the bottom panel exterior surface.	
SC Umbilical Connectors	Dimensions defining the position of umbilical electrical connectors relative to the SC coordinate system. The dimension between the SC umbilical electrical connector bracket and the separation plane. The dimension between the SC umbilical electrical connector bracket and the AS umbilical electrical connector bracket. The dimensions of the bracket openings for the part of the electrical connector on the LV side. Tolerances for all listed dimensions. Orientation of electrical connector alignment keys.	
SC Purge System Pneumatic Connector (if present)	Dimensions defining the position of the pneumatic connector relative to the SC coordinate system. Connector dimensions required to install its part on the LV side and to connect piping from the LV. Tolerances for all listed dimensions.	
Adapter System	Specify which standard adapter system. Reference Appendix D of this Mission Planner's Guide.	
	Number of push off springs (if known). Reference Appendix D of this Mission Planner's Guide.	
	Specific requirements for mechanical interfaces not provided by above standard adapter system.	
	Umbilical connector brackets need to have stiffness no lower than 1000 N/mm.	
Coordinate System	Drawing showing SC coordinate system.	
	Drawing showing desired orientation of SC coordinate system relative to Launch Vehicle coordinate system.	
	Description of constraints on SC orientation.	
SC Logo	Provide design.	
SC Telemetry and Command Antennae used for RF Link Through PLF	SC telemetry and command antenna phase center location according to Table C.3.2-1a.	

Item	Parameter	Units
SC Interface Flange	Dimensions that completely define the SC interface ring cross section at a distance 200 mm above the separation plane. Cross section properties: I_{XX} I_{YY} $L_s = 25$ S	mm mm^4 mm^4 mm mm^2
	Scribe mark location	
SC Stiffness	Minimum fundamental lateral and axial mode frequencies (must be greater than 8.5 and 25 Hz, respectively.	Hz
SC Interface Loads	Confirm SC lifting device and structure can lift SC + adapter mass = 200 kg.	Yes or no
SC Mass Properties	Fill in tables in attached Tables C.3.1-1 and C.3.1-2.	
Fairing Access Doors	Location required for access	SC coordinates
	Method of access required	
	Time when access required	
Fitcheck/Shock Test	Confirm fitcheck and shock test requirements.	
SC Pendulum Model	Provide pendulum model of SC during powered flight per Figure C.3.1-1.	
SC Slosh Model	Provide slosh model of SC during ballistic flight and at separation by providing parameters in Figure C.3.1-2.	
Propellant Tank	Provide general propellant tank geometry per Figure C.3.1-3.	

Table C.3.1-1: SC Mass Properties

SC mass properties are shown with a normal distribution. Dry SC mass properties, provided in c), are to be used for analysis of separation dynamics taking into account fluid sloshing effects.

Approximately ___ kg of helium gas (GHe) pressurant is included in the full-up SC mass.

a) Near 0g

	Mass (kg)	Center of Gravity Location (SC Coordinates, mm)			Moments of Inertia Relative to SC CG ($kg\text{-}m^2$)					
		CG_X	CG_Y	CG_Z	I_{XX}	I_{YY}	I_{ZZ}	I_{XY}	I_{XZ}	I_{YZ}
Nominal	___	___	___	___	___	___	___	___	___	___
±	± ___	± ___	± ___	± ___	___%	___%	___%	___%	___%	___%

b) Near 1g

	Mass (kg)	Center of Gravity Location (SC Coordinates, mm)			Moments of Inertia Relative to SC CG ($kg\text{-}m^2$)					
		CG_X	CG_Y	CG_Z	I_{XX}	I_{YY}	I_{ZZ}	I_{XY}	I_{XZ}	I_{YZ}
Nominal	___	___	___	___	___	___	___	___	___	___
±	± ___	± ___	± ___	± ___	___%	___%	___%	___%	___%	___%

Notes:

a) Maximum to minimum inertia ratio is greater than or equal to 1.02.
b) Z coordinate relative to separation plane.
c) Maximum required tolerance on the final weight before launch = +0/-___ kg, and will be based on the SC manufacturers final mass properties report.
d) Above data based on the SC manufacturers mass properties report dated ___.

c) Dry SC

	Mass (kg)	Center of Gravity Location (SC Coordinates, mm)			Moments of Inertia Relative to SC CG ($kg\text{-}m^2$)					
		CG_X	CG_Y	CG_Z	I_{XX}	I_{YY}	I_{ZZ}	I_{XY}	I_{XZ}	I_{YZ}
Nominal	___	___	___	___	___	___	___	___	___	___
±	± ___	± ___	± ___	± ___	___%	___%	___%	___%	___%	___%

Notes:

a) Z coordinate relative to separation plane.
b) Above data based on the SC manufacturers mass properties report dated ___.

Table C.3.1-2: Description of Liquid Masses

These tables provide the mass properties for the individual tanks for the nominal propellant load of ___% fill fraction (full tanks) being assumed, in a near 0 g field, in a 1 g field and during transportation.

The associated tank geometry is shown in Figure C.3.1-3.

a) Near 0 g (0.125 g)

	Mass (kg)	Center of Gravity Location (SC Coordinates, mm)			Moments of Inertia Relative to Propellant CG (kg-m^2)					
		CG_X	CG_Y	CG_Z	I_{XX}	I_{YY}	I_{ZZ}	I_{XY}	I_{XZ}	I_{YZ}
Ox	___	___	___	___	___	___	___	___	___	___
±	___	___	___	___	___%	___%	___%	___%	___%	___%
Fuel	___	___	___	___	___	___	___	___	___	___
±	___	___	___	___	___%	___%	___%	___%	___%	___%

b) 1 g

	Mass (kg)	Center of Gravity Location (SC Coordinates, mm)			Moments of Inertia Relative to Propellant CG (kg-m^2)					
		CG_X	CG_Y	CG_Z	I_{XX}	I_{YY}	I_{ZZ}	I_{XY}	I_{XZ}	I_{YZ}
Ox	___	___	___	___	___	___	___	___	___	___
±	___	___	___	___	___%	___%	___%	___%	___%	___%
Fuel	___	___	___	___	___	___	___	___	___	___
±	___	___	___	___	___%	___%	___%	___%	___%	___%

Note: Z coordinate relative to separation plane

c) 1 g (During Transportation)

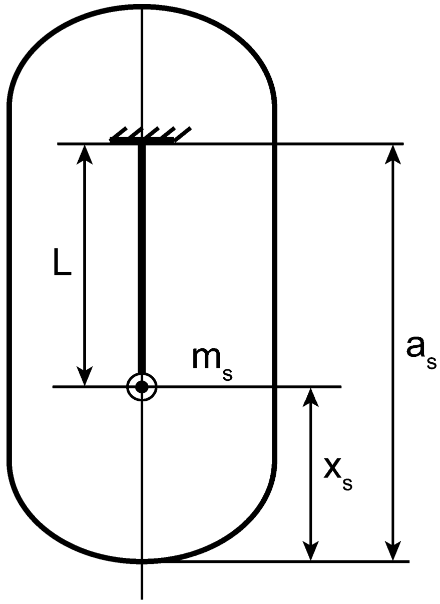
	Mass (kg)	Center of Gravity Location (SC Coordinates, mm)			Moments of Inertia Relative to Propellant CG (kg-m^2)					
		CG_X	CG_Y	CG_Z	I_{XX}	I_{YY}	I_{ZZ}	I_{XY}	I_{XZ}	I_{YZ}
Ox	___	___	___	___	___	___	___	___	___	___
±	___	___	___	___	___%	___%	___%	___%	___%	___%
Fuel	___	___	___	___	___	___	___	___	___	___
±	___	___	___	___	___%	___%	___%	___%	___%	___%

Note: Z coordinate relative to separation plane

Table C.3.1-3: SC Critical Points

SC Critical Points						
SC Critical Point Number	SC Critical Point Coordinates (mm)			SC Manufacturing Tolerance (mm)	SC Thermal Isolation Thickness (mm)	Displacement Transformation Matrix (DTM) Row Number Corresponding to SC Critical Points
	Xsc	Ysc	Zsc			

Figure C.3.1-1: SC Pendulum Model



Pendulum Model Parameters:

1. 0 g

Tank	m_s (kg)	L (m)	x_s (m)	a_s (m)	δ (%)	M_o (kg)	X_o (m)
F							
O							

2. 1 g

Tank	m_s (kg)	L (m)	x_s (m)	a_s (m)	δ (%)	M_o (kg)	X_o (m)
F							
O							

3. Filling Parameters: (t = 20°C)

Tank	Mass (kg)	Level (m)	Filling (%)	Density (kg/m^3)	Kinematic Viscosity (m^2/s)
F					
O					

a_s - Suspension point of the pendulum from the tank bottom (m)
L - Length of the pendulum (m)
x_s - Slosh mass location from the tank bottom (m)
m_s - Mass of the pendulum (kg)
δ - Damping (%)
M_o - Mass of fixed liquid (kg)
X_o - Coordinate of mass m_0 from the tank bottom (m)

Figure C.3.1-2: Sample SC Slosh Properties During Ballistic Flight and at Separation

$$I_g \frac{d\overline{\omega}}{dt} + M_g \overline{C} \times \frac{d^2\overline{l}}{dt^2} = \overline{T} - \overline{\omega} \times (I_g \cdot \overline{\omega}) - \sum_i (\overline{R}_{0i} \times \overline{F}_{CT.i});$$

$$-M_g \overline{C} \times \frac{d\overline{\omega}}{dt} + M_g \frac{d^2\overline{l}}{dt^2} = \overline{F} - \overline{\omega} \times (\overline{\omega} \times M_g \overline{C}) - \sum_i \overline{F}_{CT.i}$$

$$\frac{d^2\overline{a}_i}{dt^2} = -\frac{d\overline{\omega}}{dt} \times \overline{a}_i - 2\overline{\omega} \times \frac{d\overline{a}_i}{dt} - \overline{\omega} \times (\overline{\omega} \times \overline{a}_i) - G_i \overline{A}_i + \overline{F}_{CT.i} / m_i;$$

$$\overline{A}_i = \frac{d^2\overline{l}}{dt^2} + \frac{d\overline{\omega}}{dt} \times \overline{r}_{0i} + \overline{\omega} \times (\overline{\omega} \times \overline{r}_{0i})$$

$$M_g = M_s + \sum_i m_i (1 - G_i);$$

$$M_g \overline{C} = M_s \overline{r}_s + \sum_i m_i (1 - G_i) \overline{R}_{0i};$$

$$I_g = I_s - \sum_i m_i (1 - G_i) S(\overline{R}_{0i}) S(\overline{R}_{0i});$$

$$S(\overline{R}_{0i}) = S\begin{bmatrix} x_i \\ y_i \\ z_i \end{bmatrix} = \begin{bmatrix} 0 & z_i & -y_i \\ -z_i & 0 & x_i \\ y_i & -x_i & 0 \end{bmatrix} \qquad \overline{R}_{0i} = \overline{r}_{0i} + \overline{a}_i;$$

$$G_i = \frac{2(1 - K_i)}{1 + 2(1 - K_i)}; \qquad \overline{F}_{CT.i} = \begin{cases} 0 & r_i < R_i \\ -k_{pr}\overline{d}_i - k_{dem}\overline{V}_{pi} - k_{shear}\overline{V}_{ti} & r_i \geq R_i \end{cases}$$ (see Note 1)

$$r_i = \frac{1}{1 - \sqrt[3]{(1 - K_i)(1 + \frac{3H_i}{4R_i})}} \cdot \underset{\alpha \in [-0,5; +0,5]}{\text{minimum}} \left|\overline{\beta}_i(\alpha)\right|; \qquad \overline{\beta}_i(\alpha) = -\frac{\overline{a}_i K_i}{1 - K_i} + \alpha H_i \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix};$$ (see Note 2)

$$\overline{d}_i = -d_{0i} \frac{\overline{\beta}_i(\alpha)}{\left|\overline{\beta}_i(\alpha)\right|}; \qquad d_{0i} = (R_i - r_i) \frac{1 - K_i}{K_i} \left[1 - \sqrt[3]{(1 - K_i)(1 + \frac{3H_i}{4R_i})} \right];$$

$$\overline{V}_{p_i} = \frac{\overline{d}_i \cdot \frac{d\overline{a}_i}{dt}}{\overline{d}_i \cdot \overline{d}_i} \cdot \overline{d}_i; \qquad \overline{V}_{t_i} = \frac{d\overline{a}_i}{dt} - \overline{V}_{p_i}$$

Notes:

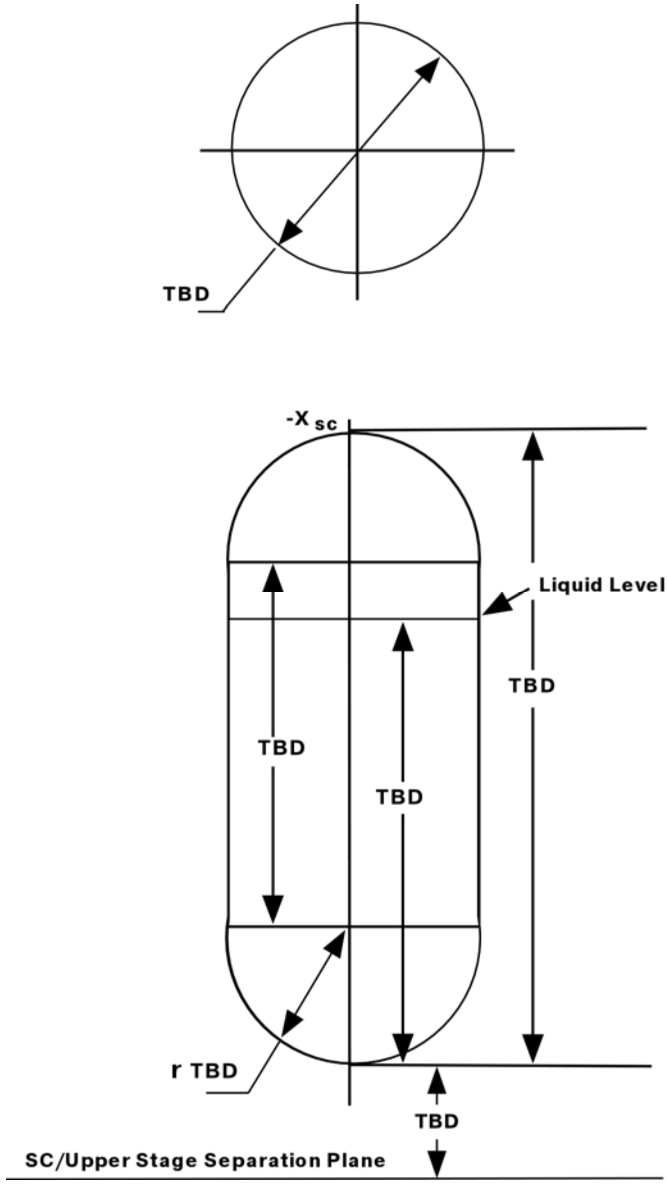
1. k_{pr} = 170229 N/m ; k_{dem} = 16256 N/m/s ; k_{shear} = 354,3 N/m/s

2. The binary operator $\begin{bmatrix}1\\0\\0\end{bmatrix}$ is a matrix that identifies the SC longitudinal axis, that is X_{SC} = 1,0,0, Y_{SC} = 0,1,0 and Z_{SC} = 0,0,1.

Conventional Notations:

$\overline{\omega}$	- SC angular rate vector
$\bar{l}$	- Vector representing position of origin of SC axes in an inertial frame
$\overline{C}$	- Vector representing SC CG position relative to SC axes
$\overline{T}$	- Sum of moments of external forces about origin of SC axes
$\overline{F}$	- Sum of external forces acting on the SC
$\overline{a}_i$	- Vector representing propellant CG position in *i*th tank relative to tank center
$\overline{V}_{pi}, \overline{V}_{ti}$	- Radial component and tangential component, respectively, of $\frac{d\overline{a}_i}{dt}$, velocity of *i*th tank's propellant CG
M_s, I_s	- Mass and moment of inertias, respectively, of a dry SC
R_i	- Radius of *i*th tank
$\bar{r}_s$	- Vector representing dry-SC CG position relative to origin of SC axes
$\boldsymbol{m_i}$	- *i*th tank's propellant mass
$\bar{r}_{0i}$	- Vector drawn from axes origin to *i*th tank's center
$\overline{R}_{0i}$	- Vector representing *i*th tank's propellant CG position relative to axes origin
$\overline{\grave{A}}_i$	- *i*th tank's inertial acceleration vector
K_i	- *i*th tank's filling factor (ullage): $K_I = V_{filling} / V_{total}$
$V_{filling}$	- *i*th tank's propellant volume
V_{total}	- Total *i*th tank's volume
H_i	- *i*th tank's cylinder length (H_i = 0 corresponds to spherical tank).

Figure C.3.1-3: Propellant Tank Geometry Required Data



Note: TBD data to be supplied by the Customer.

C.3.2 Electrical Interfaces

Item	Parameter	Units
Electrical Connector	Confirm type of connectors from SC side J1 J2	
	Confirm type of connectors from LV side P1 P2	
	Confirm location and keying P1 P2	
	Confirm quantities to be supplied J1 J2 P1 P2	
	Provide pin locations of SC separation jumper loops P1 pins: P2 pins:	
	Current flow 20 seconds or less prior to separation	milliampere (must be less than 100)
Dry Loop Commands	Dry loop commands required?	Yes/no
	Characteristics if yes: # commands Desired pin locations P1 pins: P2 pins: Current Voltage Pulse duration Time during flight	 milliampere V ms sec prior to separation
SC Telemetry Processing	LV processing of SC telemetry required?	Yes/no
	Characteristics of if yes: Desired pin locations P1 pins: P2 pins: Voltage Current Data rate	 V milliampere Hz
Current Through Umbilicals at Lift-off	Current flow 5 at lift-off.	milliampere (must be 0, except jumper circuits)
SC RF Characteristics	Fill in table in attached Table C.3.2-1.	
SC Telemetry and Command Antennae used for RF Link Through PLF	Antenna pattern showing antenna origin in SC coordinates, -3 dB bandwidth	
Umbilical Wiring	Fill out Table C.3.2-2 with pin assignments and desired line characteristics	
Mobile Service Tower	Can MST be used?	Yes/No

Table C.3.2-1: SC RF Characteristics

Description	Transmitter	Receiver
Carrier Frequency (MHz)	___	___
Bandwidth at 3 dB (MHz)	___	___
Bandwidth at 20 dB (MHz)	___	___
Bandwidth at 60 dB (MHz)	___	___
Transmission antenna output power (dBW):		
max.	___	N/A
nom.	___	N/A
min.	___	N/A
Field flux density on receiving antenna (dBW/m^2):		
max.	N/A	___
nom.	N/A	___
min.	N/A	___
Polarization	___	___
Antenna description	___	___
Antenna location	___	___
Antenna coverage zone	___	___
Operating on launch pad?	___	___
Operating in flight?	___	___
Ground equipment reception power (dBW):		
Destruction limit	___	
max.	___	N/A
nom.	___	N/A
min.	___	N/A
Ground equipment output power (dBW):		
max.	N/A	___
nom.	N/A	___
min.	N/A	___

Notes:

a) The number of table columns should correspond to the number of on-board receivers/transmitters.

b) TBD number of command signal transmission channels and TBD number of telemetry signal transmission channels are required. Two physical interfaces are required: one for commands and the other telemetry. STE has connectors of the type TBD plug and receptacle (TBD).

c) Telemetry and command frequencies at STE correspond to those presented in the table above (TBD).

d) V: vertical polarization (electrical field intensity vector is parallel to TBD SC axis); H: horizontal polarization (electrical field intensity vector is parallel to TBD SC axis): RHCP: right-hand circular polarization (electromagnetic field pointing vector is parallel to TBD SC axis); LHCP: left-hand circular polarization (electromagnetic field pointing vector parallel to TBD SC axis).

e) SC TLM amplifiers TBD.

f) During all launch pad operations, SC antenna interfaces given in the table should correspond to the prior-to-flight SC radio equipment configuration.

g) STE interface wave resistance is 50 Ohm.

h) The SC Customer should provide KhSC with command and telemetry signal degradation values for signals passing through a radio transparent window; these values should be obtained while checking the channel after the SC is encapsulated in the integration facility.

i) Prior to LV+AU placement on the launch pad and after delivering STE to the Bunker, the Customer should check the mating of the KhSC radio channel with STE and will give KhSC a Certificate Of Launch Pad Readiness for accepting the LV+AU assembly. The spectrum analyzer supplied by the Customer should be set to 220 V, 50 Hz.

j) After LV+AU placement on the launch pad and prior to the MST roll-up, the Customer, with the assistance of KhSC, will check the radio link between SC and STE. This check will take place 20 minutes after the LV bottom plate is mated. The Customer should confirm the functioning of the radio channel within 45 minutes.

Minimum signal-to-noise ratio:

	On SC Antenna	**On STE**
Telemetry Channel	N/A	___
Command Channel	___	N/A

Table C.3.2-1a: Phase Center Location of SC T&C Antennas

Phase Center Location of SC T&C Antennas		
	Telemetry Antenna	**Command Antenna**
X (mm)		
Y (mm)		
Z (mm)		

Table C.3.2-2a: J1 Umbilical Pin Assignments

Connector Pin	Function	Max. Voltage (V)	Max. Current (A)	Max. Resistance (ohms)	Shielding Requirements	Lines to MST	Jumper Configuration
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							

Table C.3.2-2a: J1 Umbilical Pin Assignments (Continued)

Connector Pin	Function	Max. Voltage (V)	Max. Current (A)	Max. Resistance (ohms)	Shielding Requirements	Lines to MST	Jumper Configuration
46							
47							
48							
49							
50							
51							
52							
53							
54							
55							
56							
57							
58							
59							
60							
61							

Note: Indicated resistance values are from P1/P2 IFD connection to the KhSC/SC contractor EGSE interface in the Vault room (or on the MST for designated circuits).

Table C.3.2.2b: J2 Umbilical Pin Assignments

Connector Pin	Function	Max. Voltage (V)	Max. Current (A)	Max. Resistance (ohms)	Shielding Requirements	Lines to MST	Jumper Configuration
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							

Table C.3.2.2b: J2 Umbilical Pin Assignments (Continued)

Connector Pin	Function	Max. Voltage (V)	Max. Current (A)	Max. Resistance (ohms)	Shielding Requirements	Lines to MST	Jumper Configuration
46							
47							
48							
49							
50							
51							
52							
53							
54							
55							
56							
57							
58							
59							
60							
61							

Notes: Indicated resistance values are from P1/P2 IFD connection to the KhSC/SC contractor EGSE interface in the Vault room (or on the MST for designated circuits).

C.3.3 Environmental Interfaces

Item	Parameter	Units
Thermal Requirements	Provide any particular ground thermal requirements.	
	Provide any particular thermal requirements during ascent or parking orbit.	
	Provide any particular thermal requirements during transfer orbit including Sun Angle vs. Time.	
	Provide any particular thermal requirements during final injection orbit.	
Venting Analysis	Provide archimedes volume of SC in launch configuration (for venting analysis).	
SC Testing	Provide confirmation of compliance with Planner's Guide test requirements for acoustic, sine, static testing and for the fitcheck/shock test.	
EMC	Provide confirmation of compliance with EM susceptibility curve for ILV in Planner's Guide.	
	Provide confirmation of acceptability of integrated ILV radiated emissions curve in Planner's Guide.	
Humidity	Provide humidity requirements for ground transportation.	
	Provide humidity requirements for processing facility.	

C.3.4 Flight Design

Item	Parameter	Units
Parking Orbit	Define thermal conditioning maneuvers required.	
	Define sun angle constraints.	
Intermediate Orbit	Define thermal conditioning maneuvers required.	
	Define sun angle constraints.	
Transfer Orbit	Define thermal conditioning maneuvers required.	
	Define sun angle constraints.	
Injection Orbit	SC Separated mass Orbital parameters: Perigee altitude Apogee altitude Inclination Argument of perigee	kg km km degrees degrees
SC Launch Windows	Define SC constraints that affect LV launch window.	
	Provide target launch date.	
	Provide launch window at perigee passage or at SC separation for one year covering the contractual launch date. Include launch window opening and closing times in GMT for each day.	
Separation	Define type of separation: 3 axis stabilized, spinning or transverse spin.	
	Define desired separation attitude with a diagram showing the pointing vector in SC coordinates and the pointing vector relative to the relative right ascension and declination as defined in this PMPG.	
	Define desired spin rate about each SC axis. Define desired spin rate tolerance about each SC axis.	degrees degrees
	Define desired separation velocity.	m/s

C.3.5 Operations

Item	Parameter	Units
EGSE	Fill out table in Table C.3.5-1 for all EGSE to be used at launch site.	
Fluid and Gases	Fill out table in Table C.3.5-2 for quantities and types of fluids and gases.	
Contamination Control	Provide any special requirements.	
Campaign Support	Provide list of support required in each area (if non-standard):	
	Building 92A-50	
	Hall 102	
	Hall 101	
	Hall 111	
	Hall 103A	
	Control Room 4102	
	Hall 103	
	Offices	
	Launch Complex 200	
	Bunker	
	Vault	
	Pad 39	
	Launch Complex 81	
	Bunker	
	Vault	
	Pad 24	
	Breeze M Fueling Area	
	Hotel Area	
Transportation	Provide description of all items including propellant to be shipped including: Item name Quantity Weight Tie down method Storage requirements	 kg

Item	Parameter	Units
Handling	Provide description of items which require physical handling at the launch site including: Equipment name/location Dimensions Weight CG Handling method	 m kg m
Communications	Define number and type of international lines required.	
	If multiplexer provided, provide characteristics of and desired location.	
	Provide locations of all intersite data transmissions, including data type and rate and interface (analog modem, V.35 or RS232 interface).	
	Provide requirements for hardline data transmission between Area 81 or Area 200 Vault and Bunker and Building 92A-50.	
Ground Electrical Interfaces	Provide block diagrams of desired umbilical interfaces between SC and EGSE while being processed and while on the pad.	
Feedthroughs	Provide description of feedthroughs required between Control Room 4102 of Building 92A-50 and Hall 103A, including: Feedthrough designation Cable designation Cable connector diameter Cable diameter	 mm mm

Table C.3.5-1: EGSE Description

Equipment	Power Source	Power Required	Heat Output	Connectors	
				Equipment Plug Side	Facility Side
Bldg. 92A-50					
Hall 101					
Hall 103					
Hall 103A					
Hall 111					
Control Room 4102					
Office Areas					

Table C.3.5-1: EGSE Description (Continued)

Equipment	Power Source	Power Required	Heat Output	Connectors	
				Equipment Plug Side	Facility Side
Launch Complex 81 or 200					
Bunker (Room 250)					
Bunker (Room 251)					
Bunker (Room 246)					
Vault (Room 64, 76 or 79)					
Breeze M Fueling Station					

Table C.3.5-2: Fluids/Gases Requirements

Name	Conditions	Supplied By	Location of Use
Compressed air for breathing (SCAPE)	See Proton Launch Campaign Guide for maximum available	KhSC/ILS	Fueling Hall
Distilled water	See Proton Launch Campaign Guide for maximum available.	KhSC/ILS	Processing Hall Fueling Hall
Demineralized water	See Proton Launch Campaign Guide for maximum available	KhSC/ILS	Decontamination Area
Nitrogen GOST-92-93-74, Technical Grade 1	See Proton Launch Campaign Guide for maximum available	KhSC/ILS	Decontamination Area
Nitrogen GOST-92-93-74, Technical Grade 1	See Proton Launch Campaign Guide for maximum available	KhSC/ILS	Fueling Hall
Liquid Nitrogen (LN_2)	TBD liters	KhSC/ILS	Fueling Hall
Gaseous He (GHe) per spec MIL-P-27407 Type 1, Grade A	TBD K-bottles high pressure (400 bar) TBD K-bottles low pressure (135 bar)	SC contractor	Fueling Hall
MMH	TBD cylinders - total weight each TBD kg maximum, TBD kg maximum propellant weight	SC contractor	Fueling Hall
Nitrogen	TBD	SC contractor	Fueling Hall
Nitrogen Tetroxide (NTO)	TBD cylinders - total weight each TBD kg maximum, TBD kg maximum propellant weight	SC contractor	Fueling Hall
Shop Air	See Proton Launch Campaign Guide for maximum available	KhSC/ILS	Fueling Hall
Ethyl Alcohol	See Proton Launch Campaign Guide for maximum available	KhSC/ILS	Fueling Hall
Service Water	See Proton Launch Campaign Guide for maximum available	KhSC/ILS	Fueling Hall
Grade "Extra" or Highest Grade GOST 18300-87 Ethyl Alcohol	See Proton Launch Campaign Guide for maximum available	KhSC/ILS	Fueling Hall
Freon	TBD	SC contractor	
Argon	TBD	SC contractor	
IPA	TBD	SC contractor	

Note: TBD data to be supplied by the SC contractor.

Intentionally Blank