SECTION 5

Mission Integration and Management

5. MISSION INTEGRATION AND MANAGEMENT

ILS provides the Customer with a Statement of Work (SOW), which defines the management approach for a Customer Launch Service Agreement (LSA), the deliverables provided to the Customer during the course of the LSA, and a schedule for all mission integration activities. This section highlights these provisions.

5.1 MANAGEMENT PROVISIONS

5.1.1 Key Personnel

Immediately after execution of each LSA, ILS, the Customer, KhSC, and the SC manufacturer shall designate their respective Program Directors who shall be responsible for performing all management functions related to the LSA.

ILS shall ensure that personnel necessary for the performance of this contract are made available to the program to perform the work in a timely fashion and to satisfy requirements of the contract and its exhibits.

5.1.2 Interface Control Document

The Interface Control Document (ICD) shall be created by ILS based on a generic ICD template and the Customer-provided Interface Requirements Document (IRD). It will provide the Customer's technical requirements for the launch of their SC, and characteristics and constraints of the LV and launch site relating to the interface with the SC.

5.1.3 Schedule Management

ILS shall create and maintain an interface activities milestone schedule that provides all key technical interface milestones necessary for successful completion of the contract.

A typical mission integration schedule is shown in Figures 5.1.3-1a for a non-recurring, 24-month long program launching a first-of-a-kind SC which is manufactured on the basis of a new platform, or a platform that has never been launched on Proton M/Breeze M before. Figure 5.1.3-1b shows a recurring 18-month long program in which the SC is manufactured on the basis of a standard platform that has been launched on Proton M/Breeze M before. For recurring programs the integration schedule can be shortened (assuming hardware availability).

The typical meeting schedule and the deliverable milestones are provided in Section 5.1.5.1 and Section 5.2, respectively. This integrated program schedule for a particular program shall be presented and agreed upon between all parties at the Kickoff Meeting, and further changes shall be made, as necessary, and agreed upon at subsequent Technical Interchange Meetings (TIMs). In case of changes to internal schedules, the other parties shall be promptly informed.

Figure 5.1.3-1a: Baseline Integration Schedule (Non-Recurring Program)

STANDARD INTEGRATION SCHEDULE — NON-RECURRING

ID #	Activity	Resp
	MEETINGS	
1	Kickoff	All
2	Preliminary ICD Review	All
3	Preliminary Design Review (PDR)	All
4	Launch Site Visit	All
5	Ground Operations Review	All
6	ICD Sign-Off	All
7	Fitcheck	All
8	Shock Test	All
9	Critical Design Review (CDR)	All
10	Launch Vehicle Quality Review	All
11	LV Roll-out Authorization Review	All
12	LV Loading Authorization Review	All
	ICD DEVELOPEMENT	
13	IRD (Amendment for specific SC)	SCC
14	Preliminary ICD	ILS
	PRELIMINARY DESIGN	
15	Preliminary SC Dynamic Model	SCC
16	Annex [x] of PDR package, CLA	ILS
17	SC Thermal Model	SCC
18	PDR Package, all except Annex [x]	ILS
	CRITICAL DESIGN	
19	Inputs to Final Analysis (except CLA)	SCC
20	Final SC Dynamic Model	SCC
21	CDR Package; all except Annex [x]	ILS
22	Annex [x] of CDR package; CLA	ILS
	SPACECRAFT TESTING	
23	SC Environmental Test Plan	SCC
24	Inputs to Fitcheck & Shock Test Plan	SCC
25	Fitcheck & Shock Test Plan	ILS
26	Fitcheck & Shock Test Report	ILS
27	SC Environmental Test Results	SCC
	SAFETY DATA AND CERTIFICATES REQUIRED FOR LICENSING	
28	Safety Submissions	SCC
29	All Certificates	All
	LAUNCH CAMPAIGN	
30	SC Launch Operations Plan (Prelim)	SCC
31	SC Launch Operations Plan (Final)	SCC
32	Participants List w/ Passport Info	SCC
33	SC Orbital Data	ILS
34	Launch Evaluation Report	ILS

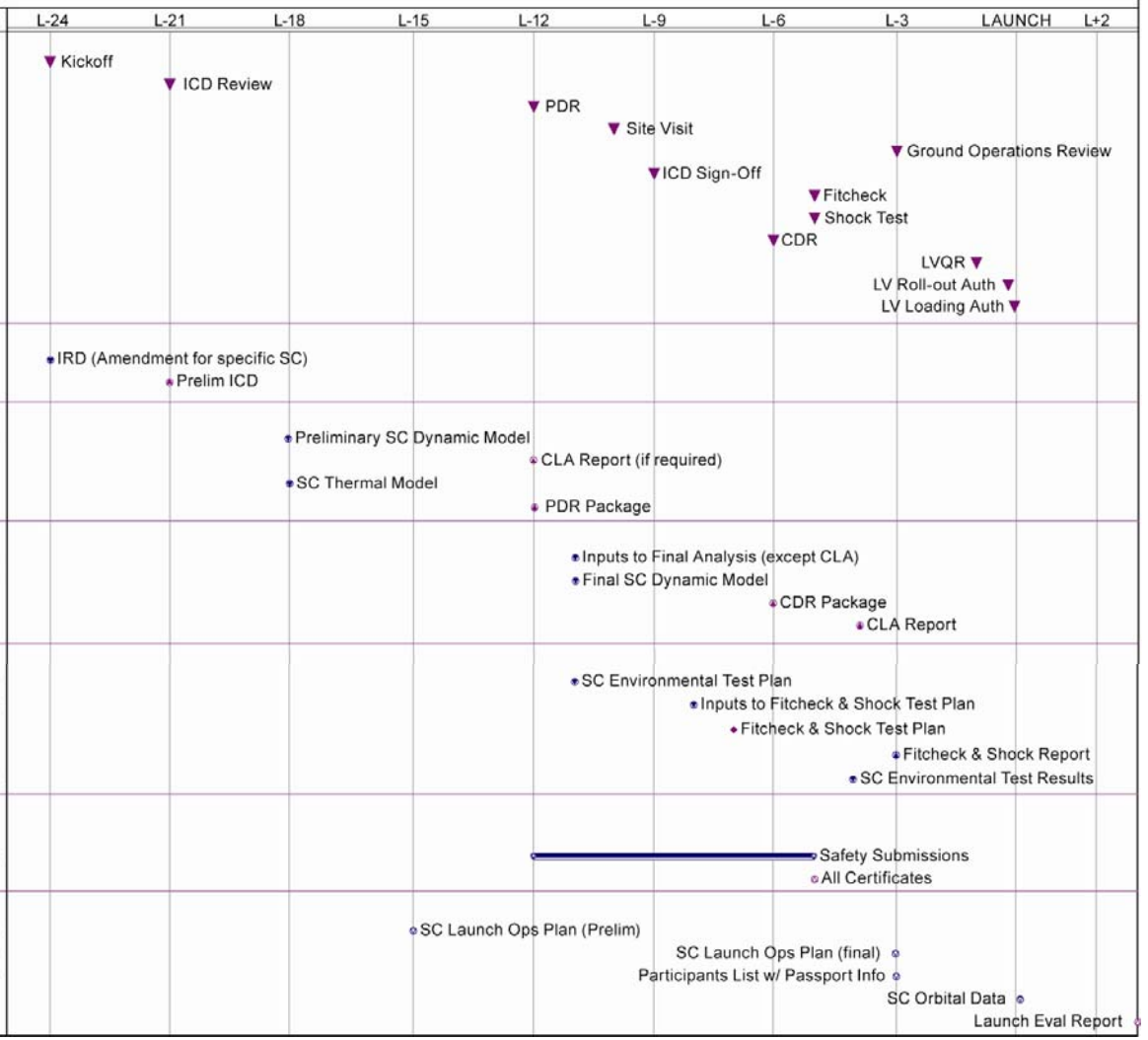
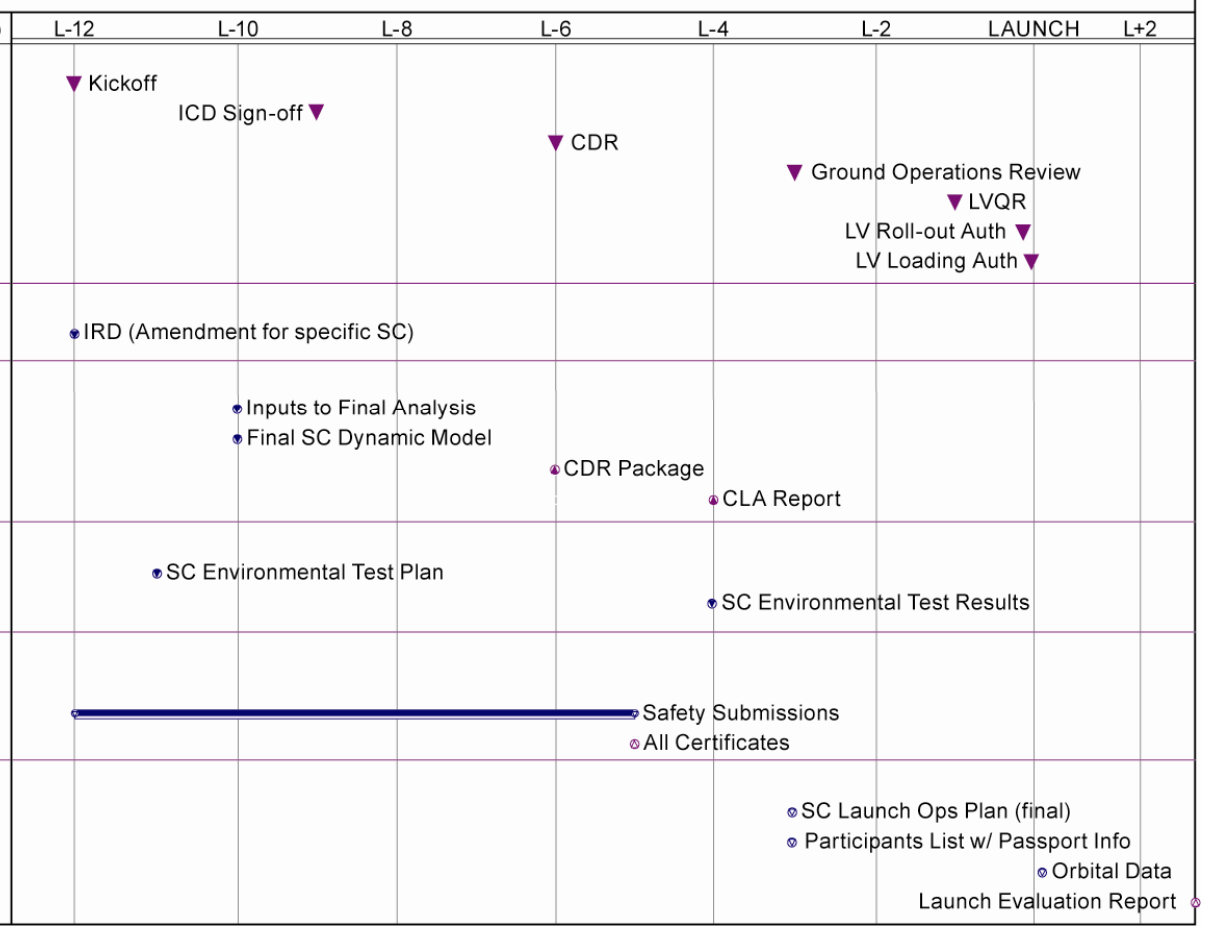


Figure 5.1.3-1b: Baseline Integration Schedule (Recurring Program)

STANDARD INTEGRATION SCHEDULE — RECURRING

ID #	Activity	Resp
	MEETINGS	
1	Kickoff	All
2	ICD Sign-off	All
3	Critical Design Review (CDR)	All
4	Ground Operations Review	All
5	Launch Vehicle Quality Review	All
6	LV Roll-out Authorization Review	All
7	LV Loading Authorization Review	All
	ICD DEVELOPEMENT	
8	IRD (Amendment for specific SC)	SCC
	CRITICAL DESIGN	
9	Inputs to Final Analysis (except CLA)	SCC
10	Final SC Dynamic Model	SCC
11	CDR Package; all except Annex [x]	ILS
12	Annex [x] of CDR package; CLA	ILS
	SPACECRAFT TESTING	
13	SC Environmental Test Plan	SCC
14	SC Environmental Test Results	SCC
	SAFETY DATA AND CERTIFICATES REQUIRED FOR LICENSING	
15	Safety Submissions	SCC
16	All Certificates	ILS
	LAUNCH CAMPAIGN	
17	SC Launch Operations Plan (Final)	SCC
18	Participants List w/ Passport Info	SCC
19	Orbital Data	SCC
20	Launch Evaluation Report	ILS



5.1.4 Documentation Control and Delivery

ILS maintains an internal documentation and configuration control system for all LSAs. Deliverable documentation shall be maintained under this configuration control system.

All technical correspondence between ILS and the Customer relating to work on the LSA shall be strictly between the Customer Program Director and the ILS Program Director.

5.1.5 Meetings and Reviews

ILS, the Customer, KhSC and the SC manufacturer shall meet as often as necessary to allow good and timely execution of all activities related to launch preparation of each satellite. A preliminary meeting schedule is defined in Section 5.1.5.1, and meeting schedules will be updated through the course of the contract as part of the interface activities milestone schedule generated by ILS. Exact dates, locations, agendas, and participation are agreed upon in advance, on a case-by-case basis, by the ILS Program Director and the Customer Program Director.

5.1.5.1 Interface Meetings and Reviews

The ILS Program Director chairs all meetings unless otherwise specified. ILS shall provide meeting minutes at the end of each meeting, signed by ILS, the Customer, KhSC and the SC manufacturer.

A baseline meeting schedule is provided in Tables 5.1.5.1-1a and 5.1.5.1-1b for a non-recurring and recurring program, respectively. A non-recurring program is one with a first-of-a-kind SC that requires two analysis cycles. A recurring program is one with a similar SC, which requires only one analysis cycle and no significant changes to the LV and the launch site.

Table 5.1.5.1-1a: Baseline Meeting Schedule for Non-Recurring Program

Meeting	Date*	Location
Kickoff/Input Data Review	L-23 months	Customer's site or SC manufacturer
Preliminary ICD Review	L-20 months	Customer's site or SC manufacturer
Preliminary Design Review (PDR)	L-12 months	Moscow
Launch Site Visit	L-10 months	Launch site
ICD Sign-off	L-9 months	Customer's site or SC manufacturer
CDR Input Data Review	L-9 months	Customer's site or SC manufacturer
Critical Design Review (CDR)	L-6 months	Moscow
Acoustic Tests and Sine Vibration Tests	L-6 months	SC manufacturer
Fitcheck/Separation Shock Test	L-5 months	SC manufacturer
Ground Operations Working Group (GOWG)	L-3 months	SC manufacturer
LV Quality Review	L-1 month	Moscow
LV Rollout Authorization Review Board	L-6 days	Launch site
LV Fueling Authorization Review Board	L-1 day	Launch site
Post-Flight Review	L+3 months	Customer site

*Date: Launch minus X months or days

Table 5.1.5.1-1b: Baseline Meeting Schedule for Recurring Program

Meeting	Date*	Location
Kickoff/Input Data Review	L-17 months	SC manufacturer
Preliminary ICD Review	L-14 months	Customer's site or SC manufacturer
ICD Sign-off	L-9 months	Customer's site or SC manufacturer
CDR Input Data Review	L-9 months	Customer's site or SC manufacturer
CDR	L-6 months	Moscow
Acoustic Tests and Sine Vibration Tests	L-6 months	SC manufacturer
Ground Operations Working Group (GOWG)	L-3 months	SC manufacturer
LV Quality Review	L-1 month	Launch site
LV Rollout Authorization Review Board	L-6 days	Launch site
LV Fueling Authorization Review Board	L-1 day	Launch site
Post-Flight Review	L+3 months	Customer site

*Date: Launch minus X months

A description of each type of meeting is provided below:

- Kickoff/Input Data Review - This meeting represents the formal start of the program. A description of overall LSA services will be presented as well as management organization and preliminary program schedules. The IRD (SC input data) will be reviewed as a prelude to the generation of the ICD.

- Preliminary ICD Review - The preliminary ICD will be reviewed and agreement reached on inputs to begin the preliminary analysis cycle.

- PDR - ILS/KhSC will present all results of preliminary analyses and compare with ICD requirements.

- Launch Site Visit - This visit to the launch site will provide a first orientation to the Customer on a non-recurring program. A key goal is to verify compliance with ICD requirements.

- Operations Review - Review of requirements and corresponding implementation for launch base operations.

- CDR Inputs Review - Agreement will be reached at this meeting to all final analysis inputs prior to starting these analyses.

- Acoustic Test - exposure of SC to acoustic environments expected during Proton LV launch.

- Sine Vibration Test - exposure of SC to vibration environments in the 5 Hz to 100 Hz frequency range expected during Proton LV launch. Also used to validate the accuracy of the SC dynamic model.

- Fitcheck - This is a fitcheck of flight adapter and separation system hardware to the flight SC at the SC manufacturer's facility.

- Shock Test - This is an actuation of the flight type separation system with the flight SC at the manufacturer's facility. It is done in conjunction with the fitcheck.

- CDR - ILS/KhSC presents all results from the final analysis cycle.

- Launch Site Acceptance Review - This review is held at the launch site prior to SC arrival to confirm the readiness of the launch site to begin the launch campaign. Compliance with requirements in the ICD will be verified.

- LV Quality Review - This meeting is held at KhSC as part of the quality control process. KhSC presents the quality status of all LV hardware per design documentation.

- LV Rollout Authorization Review Board (State Commission Meeting) - A meeting is held at the launch site to confirm readiness to rollout the LV to the launch pad.

- LV Fueling Authorization Review Board (State Commission Meeting) - A meeting is held at the launch site to confirm readiness to load the LV with propellants and confirm SC readiness to launch.

- Post-Flight Meeting - This meeting is held at the Customer site to review data obtained during the launch campaign and during flight.

5.1.6 DTSA Oversight

ILS shall arrange for Defense Technology Security Administration (DTSA) oversight, as necessary, for technical interchange involving foreign nationals.

5.1.7 Quality Provisions

Refer to Appendix B for a description of Quality Assurance provisions in place for Proton launch services.

5.1.8 Launch License And Permits

ILS/KhSC shall obtain all necessary Russian Federation permits and approvals required for the processing and launch of the Customer's SC.

The Customer shall obtain permits and approvals required to import and export the SC and associated equipment from its country of origin through the Port of Entry in Russia and Kazakhstan.

5.2 ILS DELIVERABLES

ILS provides the following deliverables during the course of each LSA. A representative delivery schedule is provided in Table 5.2-1.

Table 5.2-1: ILS Deliverable Schedule for a Recurring and a Non-Recurring Program

Document	Recurring	Non-Recurring
	Date	Date
ICD Development		
Preliminary ICD	L-14 months	L-20 months
Signed ICD	L-9 months	L-9 months
Preliminary Design		
PDR package	Not Applicable	L-12 months
Critical Design		
CDR package	L-6 months	L-6 months
SC Testing		
Sine Vibration Test (Notching) Plan Inputs	L-7 months	L-7 months
Fitcheck and Shock Test Plan	Not Applicable	L-7 months

5.2.1 ICD Development

5.2.1.1 ICD

ILS shall provide the ICD and will maintain it by issuing revisions, as necessary. The preliminary ICD will contain input data for the preliminary design effort. The signed ICD will contain input data for the critical design effort.

5.2.2 Preliminary and Critical Design

ILS/KhSC shall conduct all performance and mission analyses required for the proper implementation of the Customer's launch mission, as discussed below.

The following analyses are conducted during the mission integration effort for each satellite launch mission. For first-of-a-kind SC, one preliminary and one final analysis cycle will normally be conducted during each satellite integration effort. For follow-on SC, one analysis cycle will normally be performed; where the SC and/or LV relevant parameters have changed significantly, two cycles will be conducted.

Each cycle includes the analyses defined in Table 5.2.2-1.

Table 5.2.2-1: Design Review Analyses

No.	Title	Description
1	Design and Manufacturing	A summary of the LV design concentrating on differences with previous vehicles. Emphasis is on specificities in adapter and payload compartment design to meet specific SC payload requirements.
2	Mission Design	The flight design, including maneuvers and maneuver sequence, orbit parameters and dispersions, collision avoidance.
3	Thermal Analysis	Integrated thermal analysis of combined operations (ground and flight) for SC and LV hardware to ensure thermal compatibility. The SC mathematical model is provided by the Customer per the Thermal Model Specification provided by ILS.
4	Separation Analysis	Analysis of SC separation, including presentation of pertinent kinematic parameters and their dispersions during the separation event.
5	CLA/Acoustic/ Shock Loads Environment	1) Dynamic CLA. The SC mathematical model is furnished by the Customer according to the ILS-provided Dynamic Model Specification. The following events are analyzed: a) Lift-off b) Flight winds and gust c) First/second stage separation For follow-on satellites of the same configuration, only one verification CLA will be conducted unless significant LV configuration changes have occurred. 2) Presentation of other load environments, including acoustic, shock and ground transportation loads.
6	Contamination	Analysis of ground and flight contamination sources and effect on SC payload.
7	RF Link and EMC	Analysis of the RF link between the Bunker and the pad, and EMC analysis verifying compatibility between the SC and LV systems.
8	Clearance Analysis	Clearance analysis between the SC and the LV during flight to verify sufficient dynamic clearances.
9	Venting Analysis	Analysis of fairing depressurization during flight.
10	Operations	Detailed description of how KhSC will meet operational requirements specified by the Customer in the ICD.
11	Reliability and Quality Assurance	Description of measures to assure reliability and quality of ILV components. Certify ILV launch.
12	Telemetry System	Structure of the telemetry system and the ground telemetry complex.
13	SC Electrical Interface to SC EGSE	Description of onboard cable network.
14	Ground Cable Network and Power Supply	Description of the ground cable network, power supply, and electrical interfaces.

A softcopy of all design documentation will be provided to the Customer two weeks prior to the review.

Reports shall be provided documenting the results of the above analyses. These reports shall be provided for each analysis cycle and include the following topics: summary of results, detail of analyses performed, and comparison of analysis results with ICD requirements. The analyses required may be reduced in scope if agreed upon between ILS and the Customer.

5.2.3 SC Sine Vibration/Acoustic/Fitcheck/Shock Tests Support

ILS shall provide an overall plan describing the Fitcheck/Shock Test and a description of the responsibilities and actions for each of the participants including KhSC, ILS, the SC manufacturer and Customer.

ILS shall also provide inputs to support the SC manufacturer's Sine Vibration and Acoustic tests.

5.2.4 Data Provided After Launch

5.2.4.1 Orbital Data

ILS/KhSC shall provide the state vector data as described in Section 2.

5.2.4.2 Post-Flight Report

ILS/KhSC shall provide a post-flight report for each LSA documenting the results of ground processing of the SC and the subsequent flight.

5.3 CUSTOMER DELIVERABLES

The Customer shall provide the following deliverables during the course of each LSA. The baseline delivery schedule is provided in Table 5.3-1.

Table 5.3-1: Customer Deliverable Schedule for a Recurring and a Non-Recurring Program

Document	Recurring	Non-Recurring
	Date (Launch-Months)	Date (Launch-Months)
ICD Development		
IRD	L-18 months	L-24 months
Preliminary Design		
Preliminary SC Inputs including all models	Not Applicable	L-18
Critical Design		
Final SC inputs including all models as required	L-10 months	L-10 months
SC Testing		
SC Acoustic and Sine Vibration Test Plan	Test – 2 months	Test – 2 months
SC Acoustic and Sine Vibration Test Results	Test + 1 month	Test + 1 month
Inputs to Fitcheck and Shock Test Plan	Not Applicable	L-8 months
Fitcheck and Shock Test Report	Not Applicable	Test + 1 month
Safety And Readiness Data And Certificates Required For Licensing		
Preliminary Safety Data Submissions	L-12 months	L-12 months
Final Safety Data and Certificates	L-5 months	L- 5 months
Launch Campaign And Launch		
SC Launch Operations Plan (preliminary)	L-15 months	L-15 months
SC Launch Operations Plan (final)	L-3 months	L- 3 months
Listing of Campaign Participants with Passport Information	L-3 months	L-3 months
SC Orbital data	L+3 days	L+3 days
Hardware (Connectors)		
Electrical Umbilical Connectors (P1, P2, J1, J2 flight qualified)	L-11 months	L-11 months

5.3.1 ICD Development

The Customer shall provide an IRD to ILS with interface requirements describing all pertinent design information, including SC characteristics, mechanical and electrical interfaces, and constraints necessary to define the integration tasks and mission operation. This will be used to generate the preliminary ICD.

5.3.2 Preliminary and Critical Design

5.3.2.1 SC Dynamic Model

The Customer shall provide a SC dynamic model conforming to the requirements in Appendix C.

5.3.2.2 SC Thermal Model

The Customer shall provide a SC thermal model conforming to the requirements in Appendix C.

5.3.2.3 SC Fluid Slosh Model

The Customer shall provide a SC fluid slosh model conforming to the requirements in Appendix C.

5.3.2.4 SC CAD Model

The Customer shall provide a CAD model of the SC conforming to the requirements in Appendix C.

5.3.3 SC Testing

5.3.3.1 SC Acoustic and Sine Vibration Test Plans and Results

The Customer shall provide a test plan for ILS approval documenting the tests, including Sine Vibration and Acoustics tests that will be performed by the SC manufacturer to demonstrate compatibility with the Proton ground and flight environments. A summary of the results from these tests will be provided at test completion.

5.3.3.2 Fitcheck/Shock Test Plan, Procedures and Report

The Customer shall provide input to the ILS Fitcheck/Shock Test Plan. The Customer shall provide a SC summary report following the fitcheck and shock test documenting the results.

5.3.4 Required Safety Data and Certificates

5.3.4.1 Safety Submissions

The Customer shall provide to ILS a SC and GSE Safety Data Package, as well as other safety certificates, required to certify that the SC systems, GSE and procedures are safe during all operations at Baikonur, and during flight up to SC separation from the Breeze M. Safety certificates are to be provided per the dates and formats specified in the Proton Launch Campaign Certificates Template Document.

5.3.5 Launch Campaign and Launch

5.3.5.1 SC Launch Operations Plan

The Customer shall provide a plan that describes the SC launch operations at the launch site.

5.3.5.2 Listing of Campaign Participants

The Customer shall provide a list of all potential campaign participants three months prior to launch with all required passport information. This list will designate primary and backup personnel. This information will be included in the access list that will be provided to the Russian Government for approval. Personnel whose names are not on this access list will be denied access to the Baikonur Cosmodrome.

5.3.5.3 Orbital Data

The Customer shall provide SC state vector data complying with requirements in Section 2.

5.4 SPECIFIC CUSTOMER RESPONSIBILITIES

For each LSA, the Customer has the following responsibilities.

5.4.1 Launch Campaign Duration

The launch campaign duration from Campaign Team arrival to departure should not exceed 45 days.

5.4.2 SC and Associated Ground Equipment

The Customer shall provide at the launch site the SC and associated ground equipment and personnel required to meet the contracted launch date.

5.4.3 Final SC Data

Prior to the commencement of joint operations, the Customer shall supply the actual satellite dry and wet masses.

5.4.4 SC Readiness

The Customer shall provide a readiness to proceed with operations prior to the start of combined operations; prior to rollout to the pad; and prior to fueling of the LV. These dates will be coordinated with the Baikonur operations schedule.

5.4.5 Removal of Associated Ground Equipment

Unless prior arrangements have been made, the Customer shall remove from the Baikonur Cosmodrome all of its associated ground equipment using Customer-provided charter aircraft within three days after launch.

5.4.6 Evaluation of LV And Associated Services

As soon as practical after launch, the Customer shall provide to ILS all relevant available data from the launch necessary to assist ILS in evaluating the performance of the LV and associated services provided under each LSA.

5.4.7 SC Propellants

The Customer shall procure SC propellants to support the launch campaign and is responsible for shipment of these propellants to the Port of Entry into Russia (St. Petersburg) and through Customs. After the launch campaign, the Customer shall be responsible for removal of the propellants and associated equipment from the Port of Entry. ILS/KhSC will assist the Customer with Customs clearance procedures.

5.4.8 Connectors

The Customer shall provide flight and test connectors per mission specific requirements. These connectors will be used for the assembly of flight and test harnesses.

5.5 ILS SERVICES AND MATERIAL SPECIFICALLY EXCLUDED

ILS has no obligation to provide the following goods or services:

a) Receiving inspection of SC elements and support equipment upon arrival at the launch site.

b) Analysis of data generated by the SC through its own telemetry system.

c) The SC support consoles.

d) Shipping cost associated with the SC, its components, GSE and support equipment (except at the launch site).

e) SC RF checkout equipment (i.e., antennas, coaxial cables and checkout consoles).

f) Replacement parts for the SC or its support equipment.

g) Installation, handling, or other responsibility related to SC pyrotechnic systems or elements.

h) Responsibility for SC grounding and bonding before mating with the Contractor PLA.

i) Functional operation or installation of the airborne SC control circuits while at the Launch Complex.

j) Any tracking or commanding of the SC after separation from the LV.

k) SC propellants.

l) Fueling services for the Customer's aircraft used for delivery and return shipment of SC-related equipment.

m) Propellant sampling analysis facilities at or near the launch site are not equipped with equipment or technology necessary for analysis of SC propellants. The Customer must plan for shipment and analysis of samples outside the Russian Federation if these analyses are required.

n) Spacecraft equipment calibration services at the launch site.

o) Analysis and prediction of SC orientation, kinematic parameters and orbit parameters are not provided beyond the moment of separation.

p) Storage of SC and all its Ancillary Equipment after arrival at the launch site in excess of the period set forth in Paragraph 5.1.3 of the mission-specific Proton Launch Services Statement of Work (SOW).

q) Storage of propellants after arrival at the launch site in excess of the period set forth in Paragraph 5.1.2.2.

r) Additional analyses over and above those specified in previous sections, caused by changes to the SC design which are not in any way attributable to the Contractor and which are not required by the terms of the LSA.

s) Additional analyses over and above those required in previous sections, caused by launch postponements attributed to the Customer (unless otherwise specified in the postponement provisions of the LSA).

t) Changes to the LV and/or the launch site facilities as described in this document or the Proton Launch Campaign Guide (PLCG), caused by changes to the SC design which are not in any way attributable to the Contractor and not required by the terms of the LSA.

u) Repeated launch campaign in the event that the initial launch campaign was discontinued for any reason not attributable to the Contractor (unless otherwise provided for in the postponement provisions of the LSA).

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