APPROVAL SHEET FOR SUSPENDED LOAD OPERATIONS

SLO-KSC 2011-003

TITLE: AV-028 MSL Spacecraft Mate to Payload Adapter and Lift to Ground Handling Cart

DOCUMENT NUMBER/TITLE: X45-MUQ06-SPF SPACECRAFT TO D1666/CXX PLA MATE
XX5-PLF13-SPF ENCAPSULATION OPERATIONS

PREPARED BY: CRAIG ORNDORFF DATE: 20 OCT 2011

CHECK APPROPRIATE BOX:

☒ Single Occurrence Operation ☐ Multiple Occurrence Operation ☐ Revision to Existing SLOAA

IF REVISION TO EXISTING SLOAA, SUMMARIZE CHANGES / RATIONALE:

REQUIRED APPROVAL

CONTRACTOR	____	DESIGN	____	R & QA	X	OPERATIONS	X	SAFETY
NASA	____	DESIGN	____	R & QA	____	OPERATIONS	____	SAFETY

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1.0 OPERATION

This document is developed in support of Mars Science Laboratory (MSL) spacecraft (SC) lifting and mating operations as part of processing and integration to the Atlas V launch vehicle. These operations involve two lifts each including suspended load exposure, the first lift to a mate fixture to facilitate installation of the payload separation system, the second lift to facilitate installation to a ground handling cart. These operations are detailed in section 3.0.

2.0 SUPPORTING DOCUMENTS

2.1 Applicable Documents

X45-MUQ06-SPF	Spacecraft-to B1666/CXX Payload Adapter (PLA) Mate
XX5-PLF13-SPF	Payload Fairing (PLF) Encapsulation Operations
HR-503	United Launch Alliance (ULA) Suspended Load Exposure Control Command Media

2.2 Reference Documents

NASA-STD-8719.9	Standard for Lifting Devices and Equipment
KNPR 8715.3	KSC Safety Practices Procedural Requirements

3.0 GENERAL DESCRIPTION

The following two integrated operations require four ULA personnel maximum, for the purpose of physical verifications and mate alignment, to be directly under the flight hardware, lifting fixture, and hydraset (as required) during the last stage of a mate (approx last 2-10 inches) and the beginning of a lift (first 2-10 inches):

Operation 1 – Cleaning and inspections of the SC aft mating flange and clearance checks to verify operational envelopes while suspended above the PLA (2 personnel for approximately 5 minutes) , followed by SC mate to the PLA (4 personnel for approximately 15 minutes).

Operation 2 – SC with PLA mating to the ULA Spacecraft Transport Vehicle (STV) for ground handling and transportation operations (4 personnel for approximately 15 minutes).

4.0 RATIONALE/ANALYSIS

The two above referenced suspended load operations comply with the NASA STD 8719.9 Alternate Safety Standard for Suspended Load Operations Paragraph A.4 requirements as follows:

1a) The SC mating/separation ring is smaller in diameter than the outer diameter ring of the SC. It is necessary to position ULA personnel beneath the SC to ensure proper mating, demating, and alignment during hoisting to prevent damaging the flight mating/separation surfaces.

1b) A secondary support system is not feasible as the SC mating/separation ring is the only primary structural interface between PLA and SC.

1c) ULA procedures X45-MUQ06-SPF and XX5-PLF13-SPF limit the number of personnel working beneath the suspended load to four maximum.

1d) ULA personnel will accomplish the mating, demating, and lifting operations as quickly and safely as possible to minimize suspended load exposure. The specific procedures called out in section 2.0 will control these operations. Estimated durations of personnel exposure for nominal operations are provided in section 3.0.

2) Suspended load operations are reviewed and approved on a case-by-case and as-needed basis by ULA System Safety and Safety, Health, and Environmental Affairs (SHEA) representatives. Each suspended load operation must be evaluated against ULA command media HR-503 for procedural controls and, if applicable, suitability of offsite cranes.

3) Only those suspended load operations approved by the KSC NASA Director of Safety and Mission Assurance will be permitted, subject to NASA-STD-8719.9. A list of approved suspended load operations will be maintained by NASA Safety and made available to OSHA personnel upon request.

4) Existing ULA approved integrated operations procedures that have been approved under ULA HR-503 command media will be used for these operations. See section 2.0.

5) Any new suspended load operation not covered by this approval document, deemed necessary due to unusual or unforeseen circumstances where real time action is required, shall be documented and approved by the KSC NASA Director of Safety and Mission Assurance prior to proceeding with the subject operation.

6) The East and West 50-Ton PHSF Bldg M7-1354 Overhead Bridge Cranes are inspected, maintained, and operated in accordance with NASA Safety Standard for Lifting Devices and Equipment 8719.9. In addition, the cranes have been reviewed by the ULA Critical Hardware Handling Systems Certified Responsible Engineer against ULA HR-503.B checklist for offsite cranes which is based on Occupational Safety and Health Administration (OSHA) 29 CFR 1910.179 regulations for Overhead and Gantry Cranes.

Only crane operators and directors trained and certified by KSC will be allowed to operate the PHSF cranes. An individual will be stationed at the crane main circuit breaker during hoisting to immediately remove power, thus setting the crane brakes, if an emergency occurs with the crane. The crane will be operated in slow speed when the SC is in close proximity to other hardware.

7) The 50-ton PHSF overhead cranes have been analyzed for Single Point Failure modes (SPF). Document SAA01HS11-005 and SAA01HS11-003 respectively, include a Failure Modes and Effects Analysis, Critical Items List and a hazard analysis. There are no Single Point Failure modes in either of the PHSF HB cranes that would result in dropping the load. Passive components such as rope, drum, wire rope and hook are verified through preventive maintenance.

8) Pre-operational inspections of the lifting equipment as well as crane functional checks will be performed prior to use as documented in ULA procedures specified in section 2.0. These pre-lift inspections will be in addition to the inspections required in 1910.179(j). The SC lifting fixtures have been proof tested, inspected, and tagged and this will be verified by visual inspection prior to suspended load operations as documented in ULA procedures specified in section 2.0.

9) Only crane operators and directors trained and certified in accordance with NASA-STD-8719.9 will be allowed to operate the PHSF cranes when personnel are working beneath the suspended load.

10) Hazard control areas are established prior to suspended load operations as documented in ULA procedures specified in section 2.0. Only the minimum number of personnel required will be permitted in to the control area.

11) A pre-task briefing and safety walk down of the control area will be performed immediately prior to each suspended load operation to ensure personnel safety and readiness to support.

12) ULA personnel beneath the suspended load will be in voice contact with the certified crane operator and crane director through the suspended load operations. If communication is lost, a stop will be called to the operation and persons under the suspended load will move to a safe area outside the envelope of the suspended load until communication can be reestablished. The crane operator will have visual contact with the load throughout the operation.

13) The crane director, crane operator, and power cut-off switch operator will be in visual contact with the ULA personnel beneath the suspended load throughout the suspended load operation.

14) All hazardous procedures, including suspended load operations, will be reviewed in accordance with the standard TOPs review process as described in KNPR 8715.3. The appropriate NASA/KSC Safety organizations will review and approve all hazardous procedures well in advance of the commencement of the operation with at least seven days lead time after approval.

15) A list of approved suspended load operations, list of cranes/hoists used for suspended load operations, and copies of the associated hazards analyses will be provided to the OSHA Office of Federal Agency Programs via NASA Headquarters for distribution to the appropriate regional and area OSHA offices. (NASA Headquarters, in conjunction with OSHA, will develop a format for transmittal of this information.) Quarterly updates to the documentation will be provided as needed.

5.0 CONCLUSION

Based on the analysis and rationale provided, along with applicable supporting documentation, the two above referenced suspended load operations comply with NASA STD 8719.9 Alternate Safety Standard for Suspended Load Operations Paragraph A.4 requirements.

Richard Boutin: 10/23/2011

Date

Chief, Launch Services Division Safety and Mission Assurance