SPACE LAUNCH SYSTEM PROGRAM (SLSP) MISSION OPERATIONS PLAN
## REVISION AND HISTORY PAGE

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**NOTE:** Updates to this document, as released by numbered changes (Change XXX), are identified by a black bar on the right margin.
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1.0 INTRODUCTION

1.1 Purpose

The purpose of the SLS Program (SLSP) Mission Operations Plan (MOP) is to define the mission operations function and the roles and responsibilities of the various NASA organizations that will implement this function. The implementation of the mission operations function for the Space Launch System Program (SLSP) will be a collaborative effort among the SLS Systems Engineering & Integration (SE&I), SLS Elements, SLS Safety and Mission Assurance Organizations, JSC Mission Operations Directorate (MOD), JSC Multi-Purpose Crew Vehicle (MPCV) Program Office and the KSC Ground Systems Development and Operation Program (GSDOP) Office. The mission operations function for the SLS Program consists of the mission planning phase, the flight operations phase and the post-flight assessment phase. The facilities required to implement the mission operations function include the JSC Mission Control Center (MCC), the MSFC Huntsville Operations Support Center (HOSC) and the KSC Ground Systems Development and Operations Program (GSDOP) Launch Control Center (LCC).

1.2 Scope

This document is a data managed (Category 2) document used to describe Program Scope defined with SLS Baselined (Category 1) documentation. Work content and organizational responsibilities described within this documentation are provided to facilitate planning and to familiarize the reader with the interrelationship of activities within the SLS baseline. Specific mission operations agreements in the execution of this document's Program Scope description are defined in the SLS baseline documentation. In the event of an inconsistency of this document with SLS baseline documentation, the Baseline documentation is authoritative. See section 2.0 for guidance on the primary authoritative sources for this Plan.

1.3 Change Authority/Responsibility

The NASA Office of Primary Responsibility (OPR) for this document is NASA MSFC EO40. This document is a category 2 document. Proposed changes/revisions will adhere to the SLS-PLAN-008, Configuration Management Plan for SLS Program.
2.0 DOCUMENTS

The agreements that guide and enable the planning content contained in this document are captured in the SLSP Program Agreements Document (PAD), SLS-PLAN-186. The mission operations agreements across organizations within the SLS Program are captured in section 14.0 of the PAD and are mapped into the sections shown in Table 2.0-1.

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<th>Agreement Area</th>
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<td>Multiple Elements</td>
<td>14.2</td>
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2.1 Applicable Documents

The following documents include specifications, models, standards, guidelines, handbooks, and other special publications. The documents listed in this paragraph are applicable to the extent specified herein.

<table>
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<th>Document ID</th>
<th>Description</th>
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<tr>
<td>SLS-PLAN-020</td>
<td>Space Launch System Program (SLSP) Concept of Operations Document</td>
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<tr>
<td>Technical Task Agreement (TTA)</td>
<td>Operations Products</td>
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2.2 Reference Documents

The following documents contain supplemental information to guide the user in the application of this document.

<table>
<thead>
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<tr>
<td>SLS-SPEC-032</td>
<td>Space Launch System Program (SLSP) System Specification</td>
</tr>
<tr>
<td>MPCV 72545</td>
<td>Cross Program Mission Support Requirements Document (MSRD)</td>
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3.0 SLS Mission Operations Overview

SLS Mission Operations will be conducted as a joint team with the JSC Mission Operations Directorate (MOD) and the KSC GSDOP. For SLS, mission operations will be conducted in 3 phases: mission planning, flight operations, and post flight assessment.

The mission planning phase includes those activities that are required to adequately prepare the mission operations teams to successfully launch, operate and control a SLS mission. The mission planning phase will include the development of mission specific products, managing the mission specific flight design and the training of flight crews and flight controllers.

The flight operations phase includes pre-launch, launch, and ascent/on orbit operations. Pre-launch and launch operations are the responsibility of GSDOP and will be conducted from the KSC LCC. KSC Safety shall provide S&MA support to the GSDOP Launch Control Center team. SLS technical information and timelines needed to support the development of launch procedures will be provided to GSDOP, who is responsible for the development of the launch procedures.

Ascent and on orbit flight operations are conducted by the JSC Mission Operations Directorate (MOD) from the Mission Control Center (MCC). MOD will support the GSDOP in pre-launch/launch operations from an ascent flight management perspective. MOD will be responsible for all SLS flight operations at lift off through disposal of SLS flight hardware.

SLS engineering support will be the responsibility of the SLS SE&I, Elements, and S&MA. SLS engineering support will be conducted from the Huntsville Operations Support Center (HOSC) SLS Engineering Support Center (SESC). SLS engineering support will be provided for pre-launch/launch operations from the SESC to GSDOP LCC. At lift off, SLS engineering support will be provided from the SESC to the MCC for all ascent flight operations (<TBD-001>). Remote services will be provided to bring up SLS Discipline and Element experts for specific pre-launch/launch and ascent flight questions as needed. These remote services will include Element engineering sites located at contractor facilities as appropriate.

SLS will support the Mission Management Team (MMT). The MMT may be located in the LCC or may be geographically distributed (i.e., LCC, SESC, MCC) as necessary for a specific mission (<TBD-002>).

Post Flight assessments will be conducted by all parties for both pre-launch/launch, ascent and on orbit flight operations. SLS flight data will be stored and made available through the HOSC SESC. Data will be archived for each mission to support trending analysis and future studies of past SLS System performance.
Communications in support of all SLS mission operations functions will be documented in the Cross Program Mission Systems Requirements Document (MSRD). This includes all data, voice, and video services necessary for the HOSC SESC, MCC, and remote sites. Figure 3.0-1 shows the day of launch facilities functional interfaces.

![Diagram showing day of launch facilities interfaces](Figure 3.0-1 Day of Launch Facilities Interfaces)
3.1 Development Phase Program Agreements

Each supporting program is responsible for the development of their supporting facilities, systems, operations teams, and procedures. Listed below are the program agreements that are required to implement the tasks in the SLS Development Phase:

- JSC MOD will be responsible for the development, operation, and maintenance of the MCC.

- MOD will develop a plan to describe in detail how mission operations team activities will be conducted. SE&I Operations and the SLS Elements will provide assistance as required into the development of a MOD mission operations plan by providing expertise in the areas of SLS planning, training, and flight operations functions.

- MOD will prepare analysis tools, facilities, processes and products in support of the reconfiguration, flight design, planning, training and flight operations required to perform the mission operations function for SLS flights. The SLS SE&I Operations will review and provide feedback on the systems established by MOD to support SLS flights.

- SLS SE&I Operations will be responsible for the development, operation, and maintenance of the HOSC SESC.

- GSDOP will be responsible for the development, operation, and maintenance of the LCC.

- SLS Program, SE&I, SLS S&MA, and Elements will support MMT activities.

- SLS SE&I and Elements will be responsible for providing engineering support for all mission operations activities and events.

- SE&I Operations will provide hardware and software testing displays, tools, and command scripts as required in support of the testing and verification activities.

- The Elements will support development of flight operations handbook and mission operations capabilities (e.g. consoles) by contributing design information, operational sequence diagrams & constraints, and systems expertise.

- MOD will monitor real-time data in a flight-following mode during major element tests to exercise the mission systems as necessary.
Aborts

- The SLS SE&I and Elements will coordinate with MOD flight designers, Crew Office, and MPCV engineers on ascent targets and ascent abort considerations.

- SE&I Operations, Elements, MOD and MPCV operations personnel will coordinate the development of launch commit criteria and flight rules relative to abort scenarios and range safety.

- The SLS SE&I Integrated Avionics and Software (IAS), Vehicle Management (VM), and Elements will identify for MOD any vehicle avionics performance issues (timing, response, etc.) that may affect integrated operations of the SLS-MPCV stack, specifically integrated aborts.

- The Mission Operations Directorate will develop an integrated ascent simulation that will be used for quick-turnaround analyses of integrated SLS and MPCV aborts (product deliverable to MPCV) and as an independent verification tool of SLS ascent analyses.

Trajectory

- The SLS SE&I and Elements will coordinate with the MOD flight designers and others in the development and evaluation of trajectory analysis tools for use in flight design and real-time assessment.

- The SLS Program is lead in the development phase of the Flight Design activities with JSC MOD performing an independent integrated assessment role.

- The SLS Program will provide Marshall Aerospace Vehicle Representation in C (MAVERIC) simulation to support the development of an independent simulation by MOD.

- MOD will provide trajectory products relative to inter Design Analysis Cycle (DAC) SLS/MPCV trajectories for integrated nominal/abort scenarios.

4.0 SLS MISSION PLANNING PHASE

The SLS Mission Planning phase includes those activities that are required to adequately prepare the mission operations teams to successfully launch, operate and control a SLS mission. The Mission Planning phase will include the development of mission specific products, managing the mission specific flight design and the training of flight crews and flight controllers.
4.1 Plan Missions

Mission planning products required to successfully execute an SLS launch include launch commit criteria, flight rules, procedures, reference documents, console tools, and timelines.

4.2 Manage Flight Design

Flight Design activities (flight software and initialization load development) include the development of certified trajectories, including configuration of the SLS flight software, for the integrated SLS stack (MPCV or Cargo).

4.3 Mission Training

As part of the Mission Planning phase, training of flight controllers, crew, and support personnel must occur. The development of training materials to accomplish this task is a shared responsibility among the different programs. Training materials to be developed include a console certification plan, voice communication system familiarization, display build familiarization, command training, and simulation support products. Participation in mission simulations will be mandatory for all control room personnel. SLS Engineering Support Center (SESC) training will focus on pre-launch tanking activities, Launch Commit Criteria monitoring, and vehicle ascent and on orbit monitoring. Mission Control Center (MCC) training will focus on vehicle ascent monitoring, on orbit operations, space-to-ground communications, and abort scenarios. Launch Control Center (LCC) training will focus on the execution of pre-launch countdown timeline and Launch Commit Criteria monitoring.

4.4 Mission Planning Phase Program Agreements

Listed below are the program agreements that are required to implement the tasks in the SLS Mission Planning Phase:

- The SE&I Operations will be responsible for providing inputs to the JSC MOD and GSDOP relative to the development of mission planning products.

- The SLS Program will generate certified trajectory data for SLS flights.

- GSDOP will be responsible for developing the launch commit criteria with inputs from SE&I Operations, SLS S&MA, and Elements.

- JSC MOD will develop the integrated mission planning products for a SLS-MPCV launch. MOD will provide a subset of these services for SLS-Cargo missions.
• JSC MOD will be responsible for updating close to launch and day of launch guidance commands based on the wind conditions measured at the launch site.

• The SE&I Operations will be responsible for developing training materials and conducting the training for those flight controllers that reside in the SLS Engineering Support Center (SESC).

• JSC MOD will be responsible for developing training materials and conducting the training of flight crews (if required) and for those flight controllers that reside in the Mission Control Center (MCC).

• GSDOP will be responsible for developing training materials and conducting the training for those flight controllers that reside in the Launch Control Center (LCC).

5.0 FLIGHT OPERATIONS PHASE

The Flight Operations phase includes those day of launch activities required to successfully execute a launch of the SLS vehicle as well as the activities required during the ascent and on orbit phases of the SLS vehicle.

5.1 Day of Launch Operations

SLS day of launch countdown operations include those activities required to launch the SLS vehicle. This includes the execution of the pre-launch timeline culminating in the launch of the SLS vehicle. Launch countdown operations will begin at L-24 hours and will end at T-0. SLS launch countdown operations support will originate from various program control centers.

Ascent operations begin at T-0 and involve the real-time flight management, system monitoring, and flight control functions through vehicle Low Earth Orbit (LEO) insertion. Following vehicle LEO insertion, on orbit operations begins and ends with the disposal of all SLS vehicle elements. The highlights of the vehicle ascent include booster separation, main engine cutoff, Core Stage separation, ICPS perigee burn. On orbit operations highlights include the ICPS trans-lunar injection burn, ICPS separation and ICPS disposal.
5.2 Flight Operations Phase Program Agreements

Listed below are the program agreements that are required to implement the tasks in the SLS Mission Planning Phase:

- SLS day of launch operations will be the responsibility of the GSDO Program.

- Once the SLS vehicle is launched (T-0), the JSC Mission Control Center (MCC) will take control of the vehicle.

- GSDO will be the authoritative source for launch go/nogo with input from the Mission Management Team (MMT).

- The MMT will consist of management representatives from SLS Program, SE&I, S&MA, Elements, MPCV, MOD, and ESD.

- The SLS Program and JSC MOD will provide launch countdown support from the MSFC SLS Engineering Support Center (SESC) and the MCC, respectively.

- After liftoff, the SLS Engineering Support team will provide flight operations support to the MCC through ascent and disposal of all SLS Elements.

- The SLS Engineering Support team will consist of the Chief Engineers, Element Chief Engineers, Safety and Mission Assurance representatives, Discipline Lead Engineers (DLEs) and various Avionics and Element technical support engineers.

- The SESC will provide remote services to SLS contractor sites as required.

- For Orion MPCV missions, JSC MCC will conduct flight operations for ascent, orbit, rendezvous, entry and landing (splashdown). JSC MOD will send commands to MPCV and make voice calls as required. Commands to SLS from the JSC MCC will be via the MPCV/SLS command interface.

- For Cargo missions, JSC MOD will conduct flight operations for ascent through orbit insertion, and then handover on-orbit flight operations activities to the customer at payload deployment, if required. JSC MOD will continue to track (and perhaps manage) the separated stage from separation until completion of disposal.

- MSFC Natural Environments (NE) personnel who provide day of launch weather support from the Ascent Flight Support Area will reside in the Huntsville Operations Support Center (HOSC).
GSDO will be responsible for uplinking day of launch initialization load updates (DOLILU) to the vehicle flight computers.

Prior to launch, the SLS will transmit the telemetry stream via provided umbilicals from the vehicle to GSDO, where it will be forwarded to Mission Systems (MCC) and the SLS Engineering Support Center (SESC) per their pre-launch requirements.

6.0 POST FLIGHT ASSESSMENT PHASE

The Post Flight Assessment phase includes those activities that occur following SLS separation from the MPCV and completion of disposal for all flight hardware as well as activities associated with vehicle assessment and performance. Potential products that may be developed from these activities include the final meteorological profile, reconstructed best estimated trajectory, SLS performance (SRBs, Engines, Core Stage, ICPS), reconstructed mass properties, reconstructed aerodynamics, debris assessment, drift analysis, and imagery analysis.

6.1 Post Flight Assessment Phase Program Agreements

Listed below are the program agreements that are required to implement the tasks in the SLS Post Flight Assessment Phase:

- All SLS systems data, including DFI, will be archived by the SESC facilities.
- Orion MPCV data will be archived by JSC MCC facilities.
- Pre-launch ground system data will be archived by the GSDOP.
- Any anomalous events or conditions that occur during pre-launch, launch, and/or ascent will be investigated and assessed by the SLS program, JSC MOD, and GSDOP as appropriate.
- Post flight SLS vehicle analysis will be performed by the SLS program with support from JSC MOD and GSDOP as required.
APPENDIX A
ACRONYMS AND ABBREVIATIONS

A1.0 ACRONYMS AND ABBREVIATIONS

DAC Design Analysis Cycle
DLE Discipline Lead Engineer
DOLILU Day of Launch Initialization Load Update
GSDOP Ground Systems and Development Office Program
HOSC Huntsville Operations Support Center
ICPS Interim Cryogenic Propulsion Stage
JSC Johnson Space Center
KSC Kennedy Space Center
LCC Launch Control Center
MAVERIC Marshall Aerospace Vehicle Representation in C
MCC Mission Control Center
MER Mission Evaluation Room
MMT Mission Management Team
MOD Mission Operations Directorate
MPCV Multi-Purpose Crew Vehicle
MSFC Marshall Space Flight Center
MSRD Mission Support Requirements Document
NE Natural Environments
SE&I Systems Engineering & Integration
SESC SLS Engineering Support Center
SLS Space Launch System
VM Vehicle Management
APPENDIX B

OPEN WORK

B1.0 TO BE DETERMINED

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B2.0 TO BE RESOLVED

B3.0 FORWARD WORK