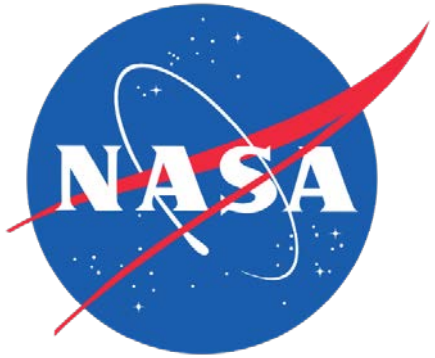



Agency Priority Goal Action Plan

# Exploration

**Goal Leader:** Thomas Whitmeyer (Acting) Deputy Associate Administrator, Exploration Systems Development (ESD)

Performance.gov

Fiscal Year 2019, Quarter 3

# Overview

## Goal Statement

- Achieve critical milestones in the development of new systems for the human exploration of deep space. By September 30, 2019, NASA will conduct the Ascent Abort-2 test of the Orion Launch Abort System, perform the green run hot-fire test of the Space Launch System's Core Stage at the Stennis Space Center, and roll the Mobile Launcher to the Vehicle Assembly Building to support the start of Exploration Mission-1 stacking operations.

## Challenge

- Develop the launch vehicle, spacecraft, and ground support systems necessary to send crew on long-duration space exploration missions.

## Opportunity

- These systems will carry humans to the Moon and farther into space than ever before.
- NASA will provide the U.S. workforce opportunities to improve its technical expertise by developing the complex, specialized systems needed for human space exploration.
- NASA's human exploration portfolio will advance American leadership in space, creating a path for peace, diplomacy, and global cooperation.

# Goal Structure & Strategies

To successfully achieve the first flight of the Space Launch System (SLS) and Orion, NASA will systematically progress through a number of major qualification, testing, and production milestones:

- The SLS, Orion, and Exploration Ground Systems (EGS) programs will continue to conduct monthly program reviews to assess development progress, risks, and technical and programmatic issues.
- NASA has a series of Systems Acceptance Reviews (SARs), Operational Readiness Reviews (ORRs), and Design Certification Reviews (DCRs) scheduled for FY 2018 and 2019 in preparation for its pre-Flight Readiness Reviews (FRRs) in FY 2020.
- The programs continue to make major hardware deliveries for integration and testing.

The Exploration Systems Integration office focuses on requirements development, management approaches, and procurement strategies across the SLS, Orion, and EGS programs, and helps to ensure that activities are well-integrated across the programs.

# Summary of Progress – FY19 Q3

Space Launch System (SLS):

- The Core Stage forward skirt, liquid oxygen tank (LOX), and intertank (IT) were mated to complete the forward join, and then the forward join was mated with the liquid hydrogen tank ($LH_2$). The engine section (with mated boattail) is undergoing final integration in preparation for integration with the $LH_2$ flight tank. The LOX structural qualification article (STA) was loaded onto the Pegasus barge for delivery to static load testing at Marshall Space Flight Center (MSFC) and the $LH_2$ STA is undergoing static load testing at MSFC.
- All ten Artemis 1 booster segments are completed and in storage. Progress continues on Aft Assemblies towards the current Exploration Ground Systems (EGS) delivery dates in Q1 of 2020. All Artemis 2 segments have been cast and six are in storage. The Design Certification Review (DCR)/Functional Configuration Audit (FCA) #4 was initiated on June 20, 2019.
- Four completed RS-25 engines were delivered to Michoud Assembly Facility (MAF) for temporary storage until installation into the Core Stage Engine Section.
- The fourth Test Readiness Review for the Flight Computer Application Software (FCAS), and the design-level test campaign, including the successful testing of Flight Software (FSW) version 14.2, were completed.

# Summary of Progress – FY19 Q3

Orion:

- As the Orion hardware continues to make good progress, testing is a primary focus. Both the Structural Test Article stack stiffness and the Forward bay cover gap testing is complete; Crew Module (CM) Stiffness Testing Underway.
- Functional testing for CM was completed and the CM was ready for mate in June.
- Service Module functional testing was completed and preparation continued for mate with the CM in July.
- Flight Software load 28E patches 1-5 were released. Verification of flight software is underway in the integrated test lab.
- In support of Artemis program launches, the Artemis 1 Launch Abort System (LAS) Tower Assembly is underway.
- The Artemis 2 CM primary structure installation is underway and plans are underway for the receipt of the heat shield and secondary structure installation.
- The Artemis 2 Crew Module Adapter arrived at KSC and it is undergoing forward wall installation.

# Summary of Progress – FY19 Q3

Exploration Ground Systems (EGS):

- The first formal training simulation that will certify the EGS launch team for the inaugural launch of the SLS vehicle and Orion spacecraft on Artemis 1, the Cryogenic Load Simulation 1 (Cryo Load SIM 1), was completed. During the Cryo Load SIM 1, a countdown for loading the SLS vehicle with Liquid Oxygen ($LO_2$) and $LH_2$ was performed. This is the first in a series of events that are part of Launch Team Training (LTT), where the entire launch team practice critical operations in a simulated (test) environment.
- Out at the launch pad, Pad B, the concrete pour for the foundation required to support the new $LH_2$ Dewar as part of the Pad B $LH_2$ system upgrade project was completed. The project includes integration of a new 1.4-million-gallon $LH_2$ storage sphere, associated vaporizers, flare stack and propane system, fill manifold, piping, valves, and controls.
- The ML/VAB Multi Element Verification and Validation (MEVV) testing was completed, and the ML was moved from the VAB to Launch Pad 39B to undergo ML/Pad MEVV activities
- Finally, the Spaceport Command and Control Software (SCCS) version 5.0 Verification and Validation, and SCCS version 6.0 development, both of which are elements on the critical path, were completed.

# Key Milestones

NASA follows an "alternative form," or milestone-based, approach to reporting on its goals. Following are key quarterly milestones that NASA tracks in support of this goal:

| Milestone Summary | | | | |
|---|---|---|---|---|
| **Key Milestone** | **Milestone Due Date** | **Milestone Status** | **Risk/ Outlook** | **Comments** |
| Begin SLS flight Core Stage liquid hydrogen tank proof testing | FY 2018 Q1 | Green | n/a | • Successfully completed. |
| Mate the heatshield to the Orion EM-1 Crew Module (CM) structure | FY 2018 Q2 | Green | ⇨ | • Heatshield was ready to mate to the CM in FY 2018 Q2. In order to preserve access to CM environmental control and life support (ECLS) systems to resolve a suspect sensor, heatshield/CM mate was completed in August 2018. Overall CM schedule and readiness for CM/Service Module mate operations in CY 2018 are unaffected. |
| Complete assembly of SLS flight Core Stage liquid oxygen tank | FY 2018 Q3 | Yellow | ⇨ | • Successfully completed in December 2018. |
| Conduct Mobile Launcher (ML) and Vehicle Assembly Building integrated verification and validation testing | FY 2018 Q4 | Green | ⇨ | • Vehicle Assembly Building (VAB) verification and validation (V&V) testing complete. Mobile Launcher (ML) rolled into VAB in September 2018 to begin integrated V&V testing. |
| Deliver Orion EM-2 Crew Module pressure vessel to the Kennedy Space Center (KSC) | FY 2019 Q1 | Green | ⇨ | • Crew Module pressure vessel was delivered to KSC in August 2018. CM primary structure installation underway. |
| Complete EGS multi-element verification and validation (MEVV) testing in preparation for Exploration Mission-1 stacking | FY 2019 Q2 | Yellow | ⇨ | • At KSC, VAB High Bay 3 and 4 completed a 90% design review, the Mobile Launcher (ML) continues outfitting and is planned to roll to Launch Complex 39B (LC-39B) for integrated verification and validation (IV&V) testing. ML/VAB teams are working constraints to Pad rollout.<br>• Construction on Pad B extensible columns completed in April 2019.<br>• SCCS 5.0 and GFAS SW continue test of integration activities. |
| Perform SLS Core Stage green run hot-fire test at the Stennis Space Center (SSC) | FY 2019 Q3 | Red | ⇧ | • Boeing Core Stage first time production challenges are being aggressively addressed. Long-term production improvements have been applied to Core Stage 2 production. |
| Conduct Ascent Abort-2 (AA-2) test of the Orion Launch Abort System | FY 2019 Q4 | Green | n/a | • Successfully completed. |

| ⇧ | Improving | ⇨ | No Change | ⇩ | Declining |
|---|---|---|---|---|---|

# Data Accuracy and Reliability

## Verification and Validation:

- NASA monitors and tracks its progress towards this goal using various Agency documents and reports, including Directorate Program Management Council materials, Quarterly Program Status Report packages, project schedules, and other program-internal documents.

## Data Source(s):

- Press releases and program-internal documents indicating whether or not NASA has met its major quarterly development milestones.

## Level of Accuracy Required for Intended Use:

- Using the documents and reports referenced above, the Agency is able to accurately report at the end of each quarter on whether or not it has met its planned milestones.

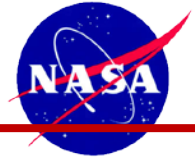
## Data Limitations:

- NASA has not identified any data limitations that would preclude it from reporting accurate, reliable, and timely performance information.

## How the Agency Compensates for Data Limitations:

- Not applicable.

# Additional Information




## Contributing Programs

NASA Program Activities:

- The principal contributors to this goal are the Advanced Exploration Systems, Exploration Ground Systems, Orion, and Space Launch System (SLS) programs.
- Other NASA programs contribute to the goal, including Space Communications and Navigation, Rocket Propulsion Test, Exploration Research & Technology organization, and Office of the Chief Technologist.

Other Federal Activities:

- Other federal contributors include the United States Air Force, United States Navy, and United States Army. NASA conducts tests at Department of Defense facilities, and the United States Navy will assist with the readiness for Exploration Mission-1 launch.

International Partners:

- The European Space Agency is a partner on the Orion Service Module, which will serve as the primary power and propulsion component of the Orion spacecraft.

## Stakeholder/Congressional Consultations

- NASA provides regular updates to Congress on the status of Exploration Systems Development (ESD), including quarterly reports on SLS funding. NASA also provides regular briefings to Congressional staff and testimony on ESD progress, most recently to the House Subcommittee on Space in November 2017.
- NASA supports regular audits by the Government Accountability Office (GAO) as part of both the annual "Assessment of Major Projects" report and other focused reviews.
- NASA regularly updates the Aerospace Safety Advisory Panel and the NASA Advisory Council on ESD progress.