Agency Priority Goal Action Plan

Exploration

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

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Fiscal Year 2019, Quarter 4

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 Q4

NASA was unable to complete this priority goal due to only fully achieving one of the three goal criteria, but will continue to make progress on advancing the Exploration program.

Space Launch System (SLS):

- The Artemis I Core Stage forward skirt, liquid oxygen tank (LOX), intertank (IT), and liquid hydrogen tank (LH_2) [4/5 of the rocket] were mated with the engine section (with mated boattail) at Michoud Assembly Facility (MAF) in Mississippi. The LH_2 structural test article (STA) static load testing was completed at Marshall Space Flight Center (MSFC) in Alabama; the LOX STA is undergoing static load testing at MSFC.
- All ten Artemis I booster segments have been completed, are in storage and ready for delivery to Exploration Ground Systems (EGS) at Kennedy Space Center (KSC) in Florida, with anticipated delivery dates in FY 2020 Q1. All Artemis II segments have been cast and are in storage. Casting Artemis III of Segment 34 complete, Segment 35 B Center Aft will be casted in FY 2020 Q1. Four completed RS-25 engines are currently being installed at MAF on the Core Stage Engine Section.
- Stage Controller Formal Dry Runs were completed in late FY 2019 Q4, in preparation for Phase I Qualification Dry Runs at MSFC in FY 2020 Q1.

Summary of Progress – FY19 Q4

Orion:

- The Orion Program conducted Propulsion Qualification Module (PQM) firings at White Sands Test Facility in New Mexico, including the most stressful test case, the Abort to Orbit.
- The Artemis I European Service Module (ESM) was mated with the Crew Module Adaptor (CMA) to complete the Service Module assembly. The completed Service Module was joined to the Crew Module, resulting in the combined Crew and Service Module (CSM). This marked the first time all three major elements were integrated. Additionally, the Artemis I Launch Abort System is substantially complete, and the System Acceptance Review/Design Certification Review (SAR/DCR) has been initiated.
- The Orion program is preparing to ship the integrated Artemis I CSM to Plum Brook Station in Ohio, for thermal vacuum and electromagnetic interference testing, after which it will be returned to KSC for final launch processing.
- For Artemis II, the program completed the Crew Module primary structure and is on track to complete the CMA primary structure. ESM-2 integration has begun, and long-lead activities, such as welding of high-pressure valves and engine manufacturing, are underway.
- On July 2, 2019, the Ascent Abort-2 flight test successfully demonstrated the ability to safely separate the Crew Module from the SLS during an ascent abort scenario.

Summary of Progress – FY19 Q4

Exploration Ground Systems (EGS):

- The Ignition Overpressure/Sound Suppression (IOPSS) water flow tests in support of Mobile Launcher (ML)/Pad Multi-element Verification and Validation (MEVV) were successfully completed. The IOPSS system is designed to distribute nearly half a million gallons of water into the ML flame hole and onto the deck during launch of SLS, in order to dampen acoustic and blast pressure waves that could damage the vehicle and ground systems.
- Successfully completed the Rotation Processing and Surge Facility (RPSF) System Acceptance Review/Operational Readiness Review (SAR/ORR). This Life Cycle Review evaluated the RPSF's readiness to receive, process, integrate, and launch flight hardware. The RPSF will receive the booster segments for the SLS rocket. All SLS solid rocket components processed in the RPSF will be transported to the VAB at KSC, where they will be lifted and transferred into High Bay 3 for final assembly on the ML.
- The oxidizer system Verification and Validation (V&V) hot flow operations at the Multi-Payload Processing Facility (MPPF) were successfully completed. The testing performed loading and draining of a test tank to verify loading accuracies for the Orion spacecraft. This concludes all planned hypergol V&V testing at the MPPF, and is a major step toward SAR/ORR in December.
- The Core Stage Pathfinder was loaded onto NASA's barge (Pegasus) and transported to KSC. The pathfinder will be used to practice offloading, moving and stacking maneuvers, using Ground Support Equipment (GSE) for training, and to certify all the equipment works properly.

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**	**Comments**
Begin SLS flight Core Stage liquid hydrogen tank proof testing	FY 2018 Q1	Green	• 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 FY 2018 Q4, with no impact to the schedule and readiness for CM/Service Module mate operations.
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	• VAB verification and validation 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	• The CM 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	• ML/Pad integrated testing is nearing completion with a planned roll-back to the VAB scheduled for FY 2020 Q1.
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	• Successfully completed.

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.

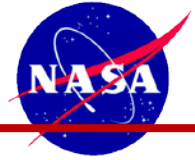
Data Limitations:

- 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.