

Agency Priority Goal Action Plan

Exploration

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Theme: General Science, Space and Technology

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 – FY18 Q2

Orion:

- Completed two of the Structural Test Article (STA) test programs, and reconfigured test article for upcoming acoustic test series.
- Completed the Exploration Mission (EM)-1 heat shield/crew module fit check. Recovery from avionics hybrid driver issue nearly completed, and successfully implemented remove and replace activities on propylene/glycol/water accumulator due to faulty sensors.
- Completed the EM-1 Service Module (SM) propellant tank and propulsion control assembly installations, and successfully installed three of four water tanks. European Space Agency (ESA) largely maintaining Kennedy Space Center (KSC) delivery date.
- Released the Flight Software load 28C, which included guidance, navigation, and control (GNC) commands (partial), ballistic entry, burn plan updates, SM heater prioritization, video, flow control assembly redesign with Compact Unique Identifier (CUI) updates, and initial European Service Module (ESM) fault detection isolation recovery.
- Completed the first four of seven EM-2 welds at the Michoud Assembly Facility (MAF) in New Orleans, Louisiana. Maintaining September delivery to KSC.

Space Launch System (SLS):

- SLS Intertank STA completed stacking and shipped to the Marshall Space Flight Center (MSFC) for qualification testing. The liquid hydrogen (LH₂) flight tank successfully completed post proof test non-destructive evaluation. The liquid oxygen (LO_x) flight tank successfully completed instrumentation installation. SLS Core Stage LO_x Structural Qualification Article (SQA) completed hydrostatic proof test and non-destructive evaluation.
- The Orion Stage Adaptor (OSA) completed assembly.
- All EM-1 booster segments (7-16) completed casting.

Summary of Progress – FY18 Q2

Space Launch System (SLS) (continued):

- RS-25 engine pathfinder was delivered to MAF. Two successful RS-25 hotfires completed.
- Completed final planned Green Run Application Software (GRAS) formal qualification testing.
- Core Stage continues to actively manage first-time assembly challenges, particularly with engine section assembly.

Exploration Ground Systems (EGS):

- At Launch Pad B, completed spraying Fondu Fyre, a fire-resistant concrete, on the Trench Floor.
- Spaceport Command and Control System (SCCS) 4.0.1 validation activities have been completed. SCCS-5.0 Build to support Orion Processing activities continue.
- The Avionics Ground and Flight Application Software Team (GFAST) and Command, Control & Communications (C3) Systems Engineering began testing at the Integration Test Lab (ITL) in Denver, Colorado, on March 13, 2018, after successfully configuring the ITL Ground Advanced Hardware Launch Control System Emulator (GAHLE) unit with the latest firmware and software and verifying functionality.

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	<ul style="list-style-type: none"> Successfully completed.
Mate the heatshield to the Orion EM-1 Crew Module structure	FY 2018 Q2	Green	<ul style="list-style-type: none"> Heatshield was ready to mate to the Crew Module (CM) in FY2018 Q2. In order to preserve access to CM environmental control and life support (ECLS) systems to resolve a suspect sensor, heatshield/CM mate was deferred until August. 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	Green	<ul style="list-style-type: none"> On track. Liquid oxygen tank completed proof, cleaning, priming, instrumentation. Beginning thermal protection system (TPS) application.
Conduct Mobile Launcher (ML) and Vehicle Assembly Building integrated verification and validation testing	FY 2018 Q4	Green	<ul style="list-style-type: none"> On track. Interim Cryogenic Propulsion Stage Umbilical (ICPSU) and Crew Access Arm (CAA) Umbilical installation on the ML is complete.
Deliver Orion EM-2 Crew Module pressure vessel to the Kennedy Space Center	FY 2019 Q1	Green	<ul style="list-style-type: none"> On track. The fifth of seven welds completed April 5 and all necessary hardware is in place at Michoud Assembly Facility (MAF).
Complete EGS multi-element verification and validation (MEVV) testing in preparation for Exploration Mission-1 stacking	FY 2019 Q2	Green	<ul style="list-style-type: none"> On track. Fire Suppression Preps/Testing, Vehicle Assembly Building (VAB) Handling, Access, and Platform Validations, and VAB Subsystems testing is complete. ‘VAB Ready for ML’ complete. The Crawler Transporter/ML/Pad Fit Check preparations are continuing as planned. VAB Comm Installation/Validation on track to support ML/VAB MEVV.
Perform SLS Core Stage green run hot-fire test at the Stennis Space Center (SSC)	FY 2019 Q3	Green	<ul style="list-style-type: none"> On track. SLS Continues to work toward 12/18 delivery to SSC with about 4-6 months of risk. Shifting later work earlier in flow to maintain delivery.
Conduct Ascent Abort-2 (AA-2) test of the Orion Launch Abort System	FY 2019 Q4	Green	<ul style="list-style-type: none"> On track. CM test article has been shipped from Langley Research Center (LaRC) to Johnson Space Center (JSC) and outfitting of that article has started.

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.