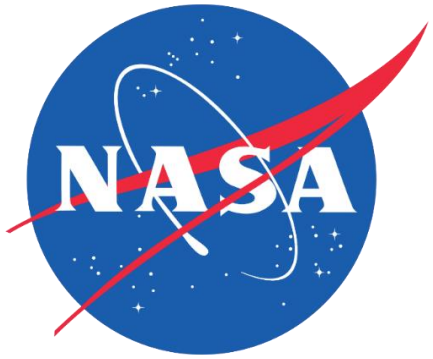

Agency Priority Goal Action Plan

Exploration

Goal Leader: William Hill, Deputy Associate Administrator, Exploration Systems Development (ESD)

Deputy Goal Leader: Thomas Whitmeyer, Assistant Deputy Associate Administrator, ESD

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Fiscal Year 2019, Quarter 1 and Quarter 2

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 Q1 and Q2

Space Launch System (SLS):

- The Core Stage forward skirt, liquid oxygen tank (LOX), and intertank (IT) were mated to complete forward join. The vent relief valve and prevalve were successfully installed on the the liquid hydrogen (LH_2) flight tank. The engine section was mated with the boattail and is undergoing final integration in preparation for integration with the LH2 flight tank. The IT structural qualification article (STA) completed static load testing at MSFC. The LH2 STA installed in the static load test stand and completed first phase of testing.
- All ten Exploration Mission (EM)-1 booster segments completed casting and all segments are in storage. Seven of ten of the EM-2 segments are cast. The thrust vector control systems (TVC) were installed on the booster left-hand and right-hand aft skirts. The booster separation motors were installed on the left-hand frustum (the first ordnance installed in EM-1 forward assembly hardware).
- RS-25 engine has completed engine hot fire testing for engine controller green run and testing of the Hot Isostatic Pressure (HIP)-bonded main combustion chamber and pogo accumulator (a component that dampens potential propellant pressure oscillations), which represent significant affordability milestones.
- The Launch Vehicle Spacecraft Adapter (LVSA) Flight Unit 1 completed installation of the Pneumatic Actuator System (PAS) brackets on the Frangible Joint Assembly (FJA), one of the last items to install before the LVSA Hardware Acceptance Review.
- Flight Computer Application Software (FCAS) Test Readiness Review Three (TRR#3) was completed. Green Run Application Software (GRAS) was delivered to the Software Development Facility (SDF) and completed regression testing. The latest scheduled update to the Advanced Real-Time Environment for Modeling, Integration, and Simulation (ARTEMIS) was delivered to the Software Development Facility (SDF) and System Integration Laboratory (SIL).

Summary of Progress – FY19 Q1 and Q2

Orion:

- Structural Test Article stack stiffness testing is complete. Plans are underway for Crew Module (CM) acoustics and forward bay cover gap testing.
- Continuing to process the EM-1 CM towards May 2019 readiness for mate.
- European Space Agency (ESA) delivered the European Service Module (ESM) to Kennedy Space Center (KSC) in November.
- CM Adapter was mated to the ESM in November,
- Flight Software load 28E was released, which included Guidance, Navigation, and Control (GNC) commands, ESM Fault Detection Isolation Recovery (FDIR) (partial GNC) and Safe Mode, Backup Flight Software, and Redundancy Management.
- Completed EM-2 Pressure Vessel delivery from Michoud Assembly Facility (MAF) in New Orleans, Louisiana, to KSC in August 2018. The primary structure installation underway.

Summary of Progress – FY19 Q1 and Q2

Exploration Ground Systems (EGS):

- An Ignition Overpressure and Sound Suppression System (IOPSS) Pad Standalone Wet Flow test was completed in October 2018. Approximately 450,000 gallons of water flowed over a span of 30 seconds.
- Underway Recovery Test-7 (URT-7) was completed in November 2018. Astronauts were on hand to add their perspective to the team working to perfect the capabilities required for recovery of future crewed missions.
- A Launch Countdown (LCD) Terminal Count Simulation was successfully conducted in December 2018 with the entire Launch Complex Center (LCC) Firing Room-1 (FR-1) Launch Control Team (LCT). The simulation demonstration successfully validated the ability of models and emulators to perform a terminal count simulation while the LCT was able to engage in problem reporting and troubleshooting in a launch-day-like environment.
- Spaceport Command and Control System (SCCS) 5.0 hardware upgrades to FR-1 began in February 2019. These hardware upgrades include the 500K changes per second (CPS) data throughput.
- Excavation for the concrete foundation required to support the new Liquid Hydrogen (LH_2) Dewar began in March 2019. This is part of the Pad B LH_2 System Upgrade Project which includes integration of a new one-million gallon storage sphere.
- Mobile Launcher Environmental Conditioning Subsystem Rollout Phase I and II tests were successfully completed. This activity tests the performance of the conditioned air purge required by the Orion spacecraft during roll from the Vehicle Assembly Building to the Pad in March 2019.

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. • Construction on Pad B extensible columns completed in April 2019. • 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	⇨	• First-time assembly challenges in engine section have delayed Core Stage shipment to SSC. Efforts underway to improve manufacturing flow.
Conduct Ascent Abort-2 (AA-2) test of the Orion Launch Abort System	FY 2019 Q4	Green	⇨	• On track. SR118 Motor and AA-2 Crew and Service Module arrived at KSC. Stacking operations underway.

Trend Legend					
⇧	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.

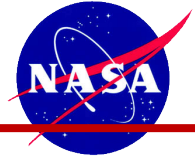
Data Limitations:

- 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.