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Year in review

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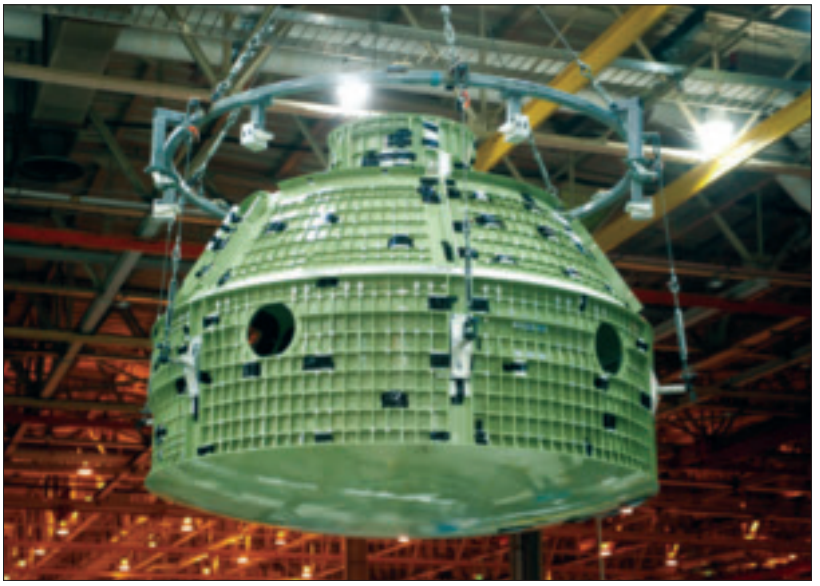
Space exploration

This year NASA's strategy of stimulating the development of commercial capabilities to launch crew and cargo to the ISS began to pay off. In May, the SpaceX Dragon capsule became the first commercial spacecraft to visit the ISS and return safely to Earth. Dragon's first ISS cargo resupply mission followed in October. Building on this success, NASA's Commercial Crew Program chose Boeing, SpaceX, and Sierra Nevada to develop integrated crew transportation systems under a third round of funded Space Act agreements. NASA also initiated processes for certifying that commercial crew launch systems meet the safety standards for human spaceflight.



The primary structure of the first Orion multipurpose crew vehicle was fabricated and delivered to Kennedy Space Center.

Progress continued in the development of transportation systems for exploration beyond Earth orbit. The primary structure of the first Orion multipurpose crew vehicle was fabricated and delivered to NASA Kennedy, where it is being prepared for the Exploration Flight Test-1 mission in 2014. Orion will be launched on a Delta IV rocket and will orbit the Earth twice before reentering. Tests of the heat shield and the parachute recovery system are the main objectives of this first flight.

In July, the Space Launch System (SLS) passed a major milestone with the completion of its system requirements and system definition reviews. The program is proceeding with the preliminary design of the Block 1 version of SLS that will be capable of lofting a payload of 70 metric tons. Six industry proposals were selected for early risk reduction activities to enable future development of advanced boosters with increased performance. Ground systems to support launches of SLS and Orion are being refurbished at Kennedy Space Center. Shuttle hardware was removed from Pad 39-B and lightning towers were erected. The crawler-transporter is being upgraded to carry the heavier SLS stack.

The first SLS launch, without crew, is planned for 2017, followed by the first crewed mission in 2021. NASA is considering the possibility of sending the SLS test flights to the Earth-Moon L2 point using the Moon for gravity assist. These flights could enable a future crew-tended habitat at L2 that would be a waypoint to more distant destinations.

When the Mars Science Laboratory arrived on Mars on August 6, it carried two payloads to gather crucial information needed for the design of future human missions. The MSL entry, descent, and landing instrumentation (MEDLI) experiment measured the temperatures, pressures, and material ablation rates at various points on the heat shield during Mars atmospheric entry. The engineering data acquired by MEDLI will be used to improve analytical models that predict aerodynamics and thermal protection system performance. The radiation assessment detector (RAD) on the Curiosity rover is characterizing the Mars surface radiation environment to increase understanding of the risks to human health. RAD also detected several major solar particle events during MSL's cruise to Mars.

Advanced exploration systems development included the NASA extreme environments mission operations underwater test to simulate human exploration of a low-gravity asteroid; demonstration of a prototype in-situ resource utilization experiment that will prospect for lunar ice; tethered flight tests of the Morpheus lander with an autonomous precision landing and hazard avoidance system; and imaging of 16 near-Earth asteroids with the Goldstone radar to identify potential targets for missions.

Finally, we honor the memories of two space explorers who achieved historic firsts: Sally Ride, the first American woman to orbit the Earth, and Neil Armstrong, the first person to walk on the Moon. We will follow in their heroic footsteps as we strive to push the frontiers of human exploration ever deeper into space.

by **Chris Moore**