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# AEROSPACE

A M E R I C A

# 2015

NASA mosaic of  
#PlutoTime photos

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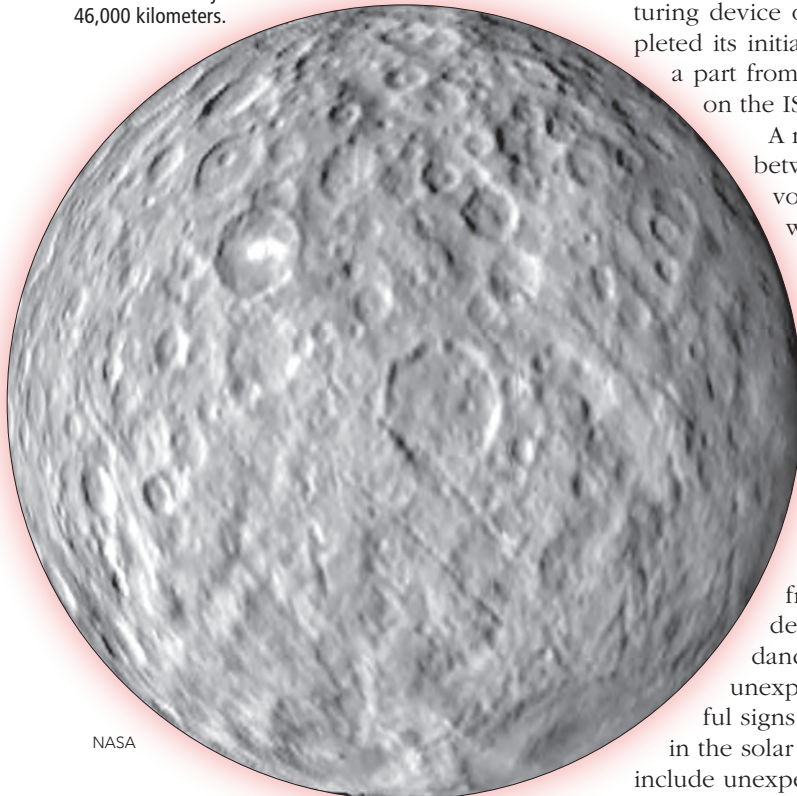


Many good steps were taken in 2015 toward expanding the human economy throughout cislunar space. Although we have yet to see unified planning of integrated infrastructure components to enable future space settlement, paths to developing bits of infrastructure that can help achieve that goal are becoming more apparent.

The **International Space Station** remains the main focus of commercialization. Multiple vehicles are delivering cargo, and the SpaceX Dragon capsule enables return of experiment results and hardware. SpaceX attempted soft landings of launch vehicle first stages in order to enable reusability and reduce costs. Both SpaceX and Orbital ATK suffered launch failures this year.

ISS was staffed with only three crew for several months in order to conserve supplies; a full crew of six was restored in order to better understand effects of long-term spaceflight on the human body. The **Commercial Resupply Services** contracts for SpaceX and Orbital are ending soon, and NASA requested bids for the CRS2 contract. Several challengers to the incumbents submitted proposals; announcement of contract awards is pending.

The surface of Ceres composed of images captured by NASA's Dawn spacecraft in February from a distance of nearly 46,000 kilometers.



NASA

SpaceX and Boeing are making progress toward restoration of U.S. capability to launch astronauts to ISS, through the Commercial Crew Program. Test flights remain scheduled for 2017.

Commercialization of ISS services through the nonprofit **Center for the Advancement of Science in Space** has made ISS more valuable as a national laboratory, including launches of cubesats from an airlock on board.

**Cubesats** are proliferating way beyond what most of the industry would have predicted only a few years ago. Miniaturization of electronics and instruments enables these tiny independent satellites to perform a variety of tasks and services. These can be launched “piggyback” with primary payloads on large launch vehicles, or can be lofted to orbit with smaller and less expensive launch vehicles. Their relative low costs, speed of development and versatility are attracting nontraditional customers.

In August, **NanoRacks** of Texas and Made In Space of California announced a partnership to assemble cubesats on the ISS for commercial clients. Interest in Solar Power Satellites continues to grow, with tracks of sessions at major conferences, and international meetings specifically on this topic.

In September, **Made In Space**, along with NASA, launched the first additive manufacturing device off planet. The machine completed its initial mission phase by uplinking a part from the ground and producing it on the ISS in a matter of hours.

A major step toward cooperation between space technical and advocacy organizations was made with the founding of the Alliance for Space to advocate for increased human presence in space. The Space Frontier Foundation and the National Space Society are the two key members.

The most spectacular achievements in space in 2015 were flybys of dwarf planets **Ceres** in the asteroid belt, and Pluto on the inner fringes of the Kuiper belt. Each destination provided an abundance of surprises in bizarre and unexpected terrain, providing hopeful signs that venturing to more places in the solar system can find surprises that include unexpected new resources, too.

## Unified paths to future space settlements coming to clearer focus

by Anita Gale, Ron Kohl and Mike Snyder

*The Space Colonization Technical Committee promotes the development of advanced concepts, science, and technology to enable and enhance permanent human presence in space.*