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IN REVIEW



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A year of space operations milestones

by Michael Squire

The Space Operations and Support Technical Committee focuses on operations and relevant technology developments for manned and unmanned missions in Earth orbital and planetary operations.

On Jan. 20, controllers in Darmstadt, Germany, received a signal from the **Rosetta** spacecraft—a “yawn” that told European Space Agency controllers that Rosetta had awoken after a 957-day hibernation and was ready for the final leg of a journey to the comet Churyumov-Gerasimenko. Rosetta arrived Aug. 6 and is now safely in orbit around the comet, which the spacecraft will accompany as it passes near the sun next year. On Nov. 12, Rosetta deployed the Philae lander, which became the first spacecraft to soft-land on a comet.

Another comet, **Siding Spring**, created a stir in October when it approached within 135,000 kilometers of Mars. Since the comet’s trail of particles posed a debris hazard, the various spacecraft orbiting Mars were maneuvered so they could use the planet as a shield. Two of those Mars orbiters had just arrived in September. One was the Mars Atmosphere and Volatile Evolution spacecraft—NASA’s mission to explore the planet’s upper atmosphere, ionosphere, and interactions with the sun and solar wind. Arriving three days after MAVEN was India’s first interplanetary mission, the Mars Orbiter Mission.

Down on the surface, the exploration rover **Opportunity** marked its 10th anniversary on Mars in January. Sporting solar panels scrubbed clean by Martian winds, which allowed more energy intake from the sun, Opportunity broke the off-Earth driving distance record when it passed the 40-kilometer mark on July 27. This broke the record held since 1973 by the Soviet Lunokhod 2, prompting the Opportunity team to name a nearby crater Lunokhod 2 as a salute. On the opposite side of the planet, the Mars science laboratory rover **Curiosity** continued its mission as well. Due to accumulating damage to Curiosity’s wheels, controllers have had to modify its driving routine to find a path with the smoothest terrain possible.

A milestone was passed on a far side of the solar system when the **New Horizons** spacecraft crossed Neptune’s orbit on its way to next year’s rendezvous with Pluto. This crossing occurred on the 25th anniversary of Voyager 2’s encounter with Neptune, the only previous visit to the planet. New Horizon was launched in January 2006.



CubeSats just released from the ISS.

NASA

Closer to home, NASA’s Lunar Atmosphere and Dust Environment Explorer, known as **LADEE**, ended its mission as planned on April 17 with an impact on the lunar surface. Controllers worked quickly to gather and download unique low-altitude science data as the spacecraft descended to just above the surface prior to the final collision. The Chinese had a softer landing on the Moon with their Chang’e 3 spacecraft on Dec. 2, 2013, which delivered the first Chinese lunar rover, Yutu. Yutu drove around on the Moon’s surface gathering data until the end of January when malfunctions brought it to a halt.

In Earth orbit, Planet Labs’ flock of 28 Earth-imaging **CubeSats**, which the company calls “doves,” was deployed from the International Space Station in February. Lithuania’s first two satellites were also CubeSats and also deployed from ISS. Peru, Iraq and Uruguay all had CubeSats as their countries’ first satellites this year. Bolivia’s first was a more traditional-sized communications satellite.

Commercial resupply of ISS continued to grow this year with the first two resupply missions by Orbital Sciences’ Cygnus spacecraft. Unfortunately, the third Cygnus mission was lost in October with the failure of the Antares launch vehicle seconds after liftoff. Nevertheless, by the end of the year, Cygnus and SpaceX’s Dragon will have transported approximately 20 percent of the total cargo delivered to ISS in 2014. ISS also had its first commander who was neither American nor Russian this year when Koichi Wakata became the inaugural Japanese ISS expedition commander. ▲

European Space Agency



Rosetta Mission Control at the European Space Operations Centre.