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Year in review

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Life sciences and systems

Astronaut Don Pettit has some fun with the CAMRAS demonstration unit during its installation on the ISS.

The life sciences and systems (LSS) community is conducting aerospace-related efforts focused on enabling human exploration of space. Science, technology, and outreach efforts have been under way at space organizations worldwide to address the anticipated life science and support needs for future space endeavors.

From our international partners, one of the most ambitious human experiments ever undertaken, the Mars500 Project, was completed in November 2011. After spending nearly 18 months in a pod mimicking a spacecraft traveling to and from Mars, the participants simulated return to Earth on November 4, 2011, as families awaited their 'arrival.' Results are available at http://mars500.imbp.ru/en/index_e.html.

Russia has since announced plans to start a Mars mission simulation on the ISS in 2015. Coordination with ISS partners is under way.

Another example of ESA/NASA cooperation in life sciences is the start of a contract for the ISS biology experiment NIH.1a (http://www.kayser.it/index.php/pressreleases/204-nih-1a-a-biology-experiment-for-the-iss), planned for launch in July 2013. Also in preparation is an analysis of an ESA experiment called BICE (biomechanical quantification of bone and muscle loading to improve the quality of 0-*g* countermeasure prescriptions for resistive exercise). This involves a combined use of NASA's advanced resistance exercise device and the Italian Space Agency's (ASI) ELITE S2 (elaboratore immagini televisive-space 2).

In the U.S., NASA implemented AES (advanced exploration system) and NIAC (NASA innovative advanced concept) projects during FY12 for the following LSS-related areas: the multimission space exploration vehicle, EVA suit and life support, suitport, habitat systems, analog missions, logistics reduction and repurposing, water recovery, spacecraft fire safety demonstrations, radiation protection, atmosphere resource recovery, and environmental monitoring. Each of the projects made progress toward FY14 integrated testing to validate that these technologies are ready to be considered for exploration vehicle designs. For more information, see http://www.nasa.gov/directorates/heo/aes/index.html and http://www.nasa.gov/offices/oct/early_stage_innovation/niac/.

The AES habitation systems (HS) project held a series of forums between December 2011 and April of this year to address critical issues facing development of deep space habitats. The first forum focused on radiation, including protecting astronauts from its effects. The second focused on life support and included AES project planning and status from each of the AES projects associated with the ECLSS (environmental control and life support system) and with EVA. The third forum focused on human health and performance issues associated with long-duration deep space missions. The AES HS project completed mission operational testing in September using the Habitat Demonstration Unit to simulate the end of exploration of a near-Earth asteroid and the return voyage to Earth.

The Mars Science Laboratory Curiosity rover landed safely in August, carrying with it the RAD (radiation assessment detector), the first radiation monitor to operate on the surface of Mars. For more about the detector, go to http://www.boulder.swri.edu/~hassler/rad/.

Also from NASA, the CO_2 and moisture removal amine swingbed (CAMRAS) technology received a boost as a demonstration payload was delivered to the ISS for long-term microgravity study, and ground testing continued. To date, the CAMRAS, which will control humidity and carbon dioxide on the multipurpose crew vehicle, had undergone extensive ground-based testing at NASA Johnson, including operation at various cabin pressures (14.7, 10.2, and 8.3 psia) and oxygen levels (21, 30, and 35%). At the end of 2011, ambient pressure suit integration testing focused on operating the CAMRAS when integrated with two developmental soft suits (ACES, advanced crew escape suit; and C-SAFE, Constellation space suit system). Human subjects were used in this test, with emphasis on the user experience resulting from changing flow rates, cycle times, and dynamic pressure effects within the loop.

All of this ground testing paved the way for a CAMRAS payload to be delivered to the ISS for testing that began this year.

by **Joe Chambliss**