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Space colonization

The end of the space shuttle program represents a symbolic interruption on the path toward space settlement. The space settlement designs created in the 1970s presumed use of the shuttle for launching construction elements. Although cost realities led to recognition that the shuttle was not an economically viable tool for the construction of space settlements, the vehicles offered a capability for large on-orbit construction projects. Now on-orbit construction capabilities are gone, and it is uncertain when and how they will be restored.

Tangible evidence of a path toward future space settlement is, however, provided by completion of the international space station. The ISS can now support a long-term crew of six, allowing more time to conduct scientific research and to develop a better understanding of the challenges and concerns associated with living in space habitats.

Work on the deep-space multipurpose crew vehicle (MPCV) continues, four companies are working commercial crew development contracts, and the design of the next-generation Space Launch System was announced in September. Reflecting more ambitious U.S. interest in space habitation was DARPA's announcement of a 100-year starship study. Expanding international interest in future space habitation was confirmed with China's launch of the first module of a future space station.

Widely available in bookstores is Haym Benaroya's *Turning Dust to Gold: Building a Future on the Moon and Mars*; although written as a 'historical record' from the year 2169, it is a serious look at infrastructure and design considerations for future space settlement. Also by Benaroya is *Lunar Settlements*, a compilation of papers from a Symposium on Lunar Settlements at Rutgers University. The AIAA-published book *Out of this World–The New Field of Space Architecture* includes a chapter on 'lunar architecture and urbanism.' And *The Highest Frontier* by Joan Slonczewski, a fictional account of life in an orbital university, weaves challenges of space living into the story.

Numerous papers related to space settlements were offered this year at the AIAA Aerospace Sciences Meeting, the National Space Society (NSS) International Space Development Conference, and AIAA Space 2011. The NSS Web site features an online library with a collection of documents covering space settlements, solar power satellites, planetary defense, and habitations on the Moon and Mars. NSS has also started an Internet-based peer-reviewed *Space Settlement Journal* that began accepting papers this year.

Astronaut Sandra Magnus exercises on the advanced resistive exercise device in the Unity node of the ISS. Long stays on the ISS will provide a better understanding of some of the challenges facing future space colonists.

Strong student interest in space settlement was demonstrated by about 1,000 participants in the AIAA-sponsored International Space Settlement Design Competition, which included semifinals in India, the United Kingdom, and Houston, Texas, with the final selection in Houston. Hundreds of students worldwide also submitted entries for the NSS space design contest.

Perhaps a reflection of interest in, and uncertainty about, future large-scale habitation of space is the 2011-2012 high school debate topic for the National Forensic League, "Resolved: The United States federal government should substantially increase its exploration and/or development of space beyond the Earth's mesosphere." For advocates of space settlements, the clear answer is "Of course, development of space is what humans are destined to do." However, the fact that this is a debate topic suggests that there are equally compelling arguments against expansion of human activities in space.

by **Mark G. Benton Sr.** and **Anita Gale**