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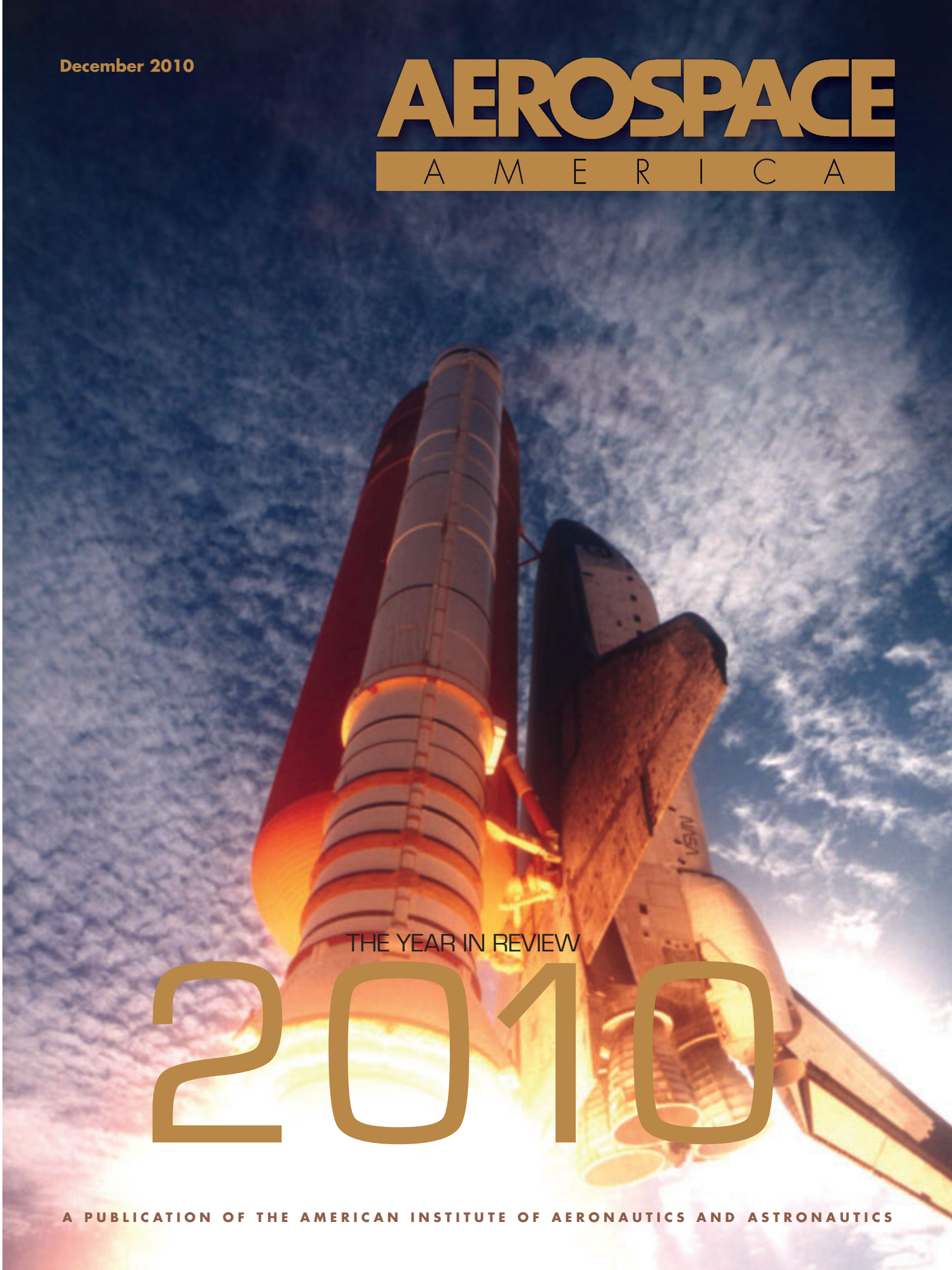

THE YEAR IN REVIEW

2010

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Space colonization

Expanding human presence beyond Earth is the long-term goal of the manned spaceflight program—a goal clearly recognized by the Augustine commission, and against which every foray into space should be measured. Progress toward future space settlements is measured in small ways, mostly as incremental changes in perception and in advances in supporting technology development. This year was full of mixed signals, with commercial entities continuing to make progress toward cargo/crew launch and the U.S. government trying to reinvent the human space program priorities and approaches.

Russia, ESA, Japan, China, and India all have proposed ambitious missions, including manned missions, to the Moon and planets. The announced finding of substantial amounts —perhaps a billion gallons—of water and other volatiles from the Lunar Crater Observation and Sensing Satellite (LCROSS) 2009 impact mission has come as a stunning revelation that warrants a second look at the Moon. The presence of ammonia in the impact ejecta is another key finding for facilitating future extended human presence on the lunar surface.

SpaceX and Orbital Sciences made continued progress in the development of commercial launch vehicles via NASA-funded programs. Several other firms reported programs for suborbital launches that could be leased for research and/or promoting science, technology, engineering, and mathematics education.

Findings from the LCROSS 2009 impact mission reveal the presence of large amounts of water on the Moon.

The year also brought significant progress in the space tourism arena. A Virgin Galactic/Scaled Composites team demonstrated a suborbital test flight of VSS Enterprise in a bid to achieve commercial manned suborbital flight. Bigelow Aerospace, teamed with Orbitec Technologies, embarked on human rating the environmental control and life-support system to be used on the Sundancer inflatable habitat in space, scheduled for a 2015 launch.

ISS activities included research on human physiology and radiation protection; microgravity disciplines such as materials science, fluid physics, and combustion; Earth observations; and education outreach.

Space settlement concepts and infrastructure supporting future space settlement were featured at the AIAA Space 2010 Conference and AIAA Aerospace Sciences Meeting as well as at the National Space Society International Space Development Conference, where the focus was on key technologies required for space colonization.

Evidence of popular acceptance of space settlement concepts is increasing. The AIAA-sponsored International Space Settlement Design Competition involved over 1,000 high-school students worldwide in designing large space settlements in a solar cycler orbit crossing the orbits of Earth and Mars Earth orbit, in Mars lunar orbit, and on the surface of Mars. The National Space Society Space Design Contest attracted hundreds of entries, primarily from individual students.

This year we have seen the U.S. space program become a political football, with passions running high in both camps. The U.S. has spent billions of dollars on developing a shuttle replacement, only to see the program fundamentally changed in midcourse. It is time for us to realize that the space program is no longer a discretionary one but rather a strategic one that is multifaceted, providing a key stimulus for technical innovation and enterprise, showcasing technical prowess and leadership, and challenging the next generation to pioneer the next frontier.

The key to success in space will be a coherent, sustained vision, adequate funding, and relentless effort. NASA should embark on the Moon-first path while keeping open the later opportunity to visit other near-Earth bodies. Moon-Base 2020 should be an engineering testbed for technologies applicable to long-term exploration missions on Mars and elsewhere. Without these technologies and demonstrable milestones, long-term exploration goals will remain elusive.

by **Ram Ramachandran** and **Anita Gale**