Commerce spreads in low-Earth orbit as government agencies set their sights higher

BY THEODORE W. HALL

The **Space Architecture Technical Committee** focuses on the architectural design of the environments where humans will live and work in space, including facilities, habitats and vehicles.

In January, **NASA** announced modifications to Space Act agreements with **Blue Origin** of Washington and **Voyager Space** of Colorado for low-Earth orbit space stations. Blue Origin, working with **Sierra Space** of Colorado and others, received an increase of $42 million for its **Orbital Reef** station. Voyager Space, working with **Airbus**, received an additional $57.5 million for development of its **Starlab** station.

In March, **NASA** confirmed that **Orbital Reef's life support system** had passed four key development tests: trace contaminant control, water contaminant oxidation, urine water recovery and water tank validation.

Sierra Space and **ILC Dover** of Delaware conducted pressure tests with models of Serra's inflatable LIFE modules that are planned to comprise much of the Orbital Reef complex. In January, they announced the results of a December 2023 full-scale test at **NASA's Marshall Space Flight Center** in Alabama. The test registered 531 kilopascals (77 pounds per square inch), which is five times the maximum intended operating pressure, before the module's explosive burst. In June, they repeated the feat, reaching 510 kilopascals (74 pounds per square inch). The LIFE module has a volume of 285 cubic meters.

Meanwhile, in April, **Mitsubishi Corp.** of Tokyo joined the Starlab partnership as an equity owner and prospective station occupant for industrial research.

Vast Space of California also pressed forward in developing **Haven-1,** the first of its planned commercial space stations. In April, the company announced an agreement with **SpaceX** to equip Haven-1 with a **Starlink laser terminal** to provide gigabit-per-second communication for the crew, payload racks, external cameras and other instruments. In June, Vast announced a memorandum of understanding with the **European Space Agency** to study future European access to Vast's planned stations.

At the other end of cradle-to-grave real-estate management, **NASA** in June selected **SpaceX** to develop a **deorbit vehicle** to guide the **International Space Station** on a controlled reentry toward a safe oceanic interment at its end of service, currently scheduled for 2030. The agency considered but ultimately ruled out proposals for preserving ISS by boosting it to a higher orbit or partially disassembling it.

In the realm of **suborbital near-space tourism**, **Space Perspective** of Florida in August completed construction of **MS Voyager**, a vessel that will serve as a marine spaceport for launching its **Spaceship Neptune** stratospheric balloon. The company is coordinating with the **U.S. Coast Guard** as well as **FAA** for sea-based launches and splashdowns.

Leaving Earth orbit increasingly in the hands of the commercial sector, space agencies increased their focus on the moon and beyond. In January, **NASA** announced that the **United Arab Emirates** would provide the **Crew and Science Airlock module** for the planned **Lunar Gateway** station, and that a UAE astronaut would fly to Gateway on a future Artemis moon mission. This demonstrated increasing global participation in space architecture, design and construction.

In March, an industrial consortium managed by **LIQUIFER Space Systems** of Germany delivered an integrated mockup of **Gateway's International Habitation module** to the module's prime contractor, **Thales Alenia Space** of Italy. **Haux Life Support** of Germany provided the primary structure, and **Spartan Space** of France provided dimensionally accurate stand-ins for interior equipment to support simulations of human activities in the habitable volume.

In July, the first four-person volunteer crew emerged from a **378-day simulated Mars surface mission**. The analog mission in the **Crew Health and Performance Exploration Analog habitat** at **NASA's Johnson Space Center** in Texas included habitat maintenance, health maintenance and crop growth, with intentional stressors of resource limitations, isolation, confinement and time-delayed communication with the outside world. ★

▼ This mockup of the International Habitation Module that would be part of NASA's Lunar Gateway space station was created by a consortium of LIQUIFER Space Systems, Haux LIfe Support and Spartan Space. NASA plans to station Gateway in a high near-rectilinear orbit around the moon, as a habitat and research facility for astronauts visiting the lunar surface under the Artemis program.

Spartan Space