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2022 YEAR IN REVIEW

The Pillars of Creation
from the Webb telescope



NASA'S DART MOVES
AN ASTEROID



NASA'S SLS ROCKET
NAILS ITS DEBUT



Robotics for in-space servicing, assembly and manufacturing is key for sustainable space infrastructure

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The **Space Automation and Robotics Technical Committee** works to advance the development of automation and robotics technologies and their applications to space programs.

▲ The Canadarm2 robotic arm maneuvers a Bishop Airlock away from the International Space Station in July. The airlock jettisoned a trash container for disposal, then the arm replaced the airlock on the exterior of the U.S. Destiny Laboratory.

NASA

NASA's **James Webb Space Telescope** completed sunshield and mirror segment deployment sequences in January after it was launched on Dec. 25, 2021. According to NASA's press release, the deployment required 178 release mechanisms, 139 just for the sunshield, including "70 hinge assemblies, eight deployment motors, roughly 400 pulleys, and 90 individual cables." These robotic operations had to go flawlessly to get the telescope operational. U.S. President Joe Biden revealed the telescope's first images in July.

In February, Tokyo-based **GITAI** completed an autonomous demonstration of its 2-meter **In-Space Servicing, Assembly, and Manufacturing, or ISAM, robotic arm** inside the **Japan Aerospace Exploration Agency's 8-meter thermal vacuum chamber**, assembling a solar panel and exchanging an orbital replacement unit. This experiment parallels GITAI's autonomous demonstration conducted in the International Space Station's **Nanoracks Bishop Airlock** last October and provides confidence for its 2023 planned demonstration outside the ISS. GITAI is also developing **RI**, a lunar robotic rover it tested in JAXA's mock lunar surface in December 2021, and **S10**, a 10-meter robotic arm that completed a proof-of-concept test corresponding to NASA's technical readiness level 3 in August.

In February, **Northrop Grumman's SpaceLogistics** announced the first sale of a **Mission Extension Pod** and a launch agreement for a **Mission Robotic Vehicle** spacecraft. These missions build on the successful docking of the **Mission Extension Vehicle-2** onto **Intelsat 10-02** in April 2021, the first satellite life-extension services flight example.

In March, the **U.S. Defense Department's Defense Innovation Unit** put out a solicitation for proposals for a geosynchronous orbit commercial satellite re-fueling service and a bulk fuel depot. DIU also continued work on its **Modularity for Space Systems** project, which has modular satellite systems under development by Colorado-based **Maxar Technologies**, California-based **Motiv Space Systems** and Washington-based **Tethers Unlimited**.

In March, **DARPA** kicked off its **Novel Orbital Moon Manufacturing, Materials, and Mass Efficient Design, or NOM4D, program** by contracting eight university and industry teams to provide proof of concepts for aspects of in-space manufacturing. In a press release, program manager Bill Carter said the needed technology innovations include "robotic manipulation sufficient to enable assembly of large structures from NOM4D-manufactured components, enhanced on-orbit mobility, and routine re-fueling of on-orbit assets."

In March, Canada-based **MDA** began preliminary design of the robotic arm for NASA's lunar Gateway space station. In April, MDA announced a partnership with **Lockheed Martin** and **General Motors** to integrate commercial robotic arm technology on their human-rated lunar mobility vehicles. In May, MDA was contracted to deliver 32 **Canadarm3** external robotic interfaces for the **Axiom Station**, a commercial space station under development by Axiom Space of Texas. In July, the **Canadarm2** on ISS assisted with trash disposal for the first time. The **Materials International Space Station Experiment-16** began in July, when the **Canadarm2** and **Dextre** robots transferred the **MISSE** tray from the Japanese airlock to the facility worksite, completing the first demonstrations of the mobile servicing system application computer.

In April, the White House's **National Science and Technology Council** released the first **ISAM** national strategy document outlining a strategy for the U.S. government regarding challenges and strategic goals for **ISAM**.

In April, **MIT's TESSERA** project, short for **Tessellated Electromagnetic Space Structures** for the **Exploration of Reconfigurable, Adaptive Environments**, tested autonomously self-assembling tiles into a dome configuration and disassembling them using electropermanent magnets. The tiles launched to ISS in April as part of Axiom's **Ax-1 mission**.

NASA's **Volatiles Investigating Polar Exploration Rover** will explore the lunar south pole in 2024 to prospect for volatiles near Nobile Crater. The third generation of the test version, the **Moon Gravity Representation Unit**, arrived at the **Simulated Lunar Operations Lab at NASA's Glenn Research Center** in Ohio, where system-level mobility verification testing was conducted by driving over a variety of terrain including slopes, rocks and craters. ★