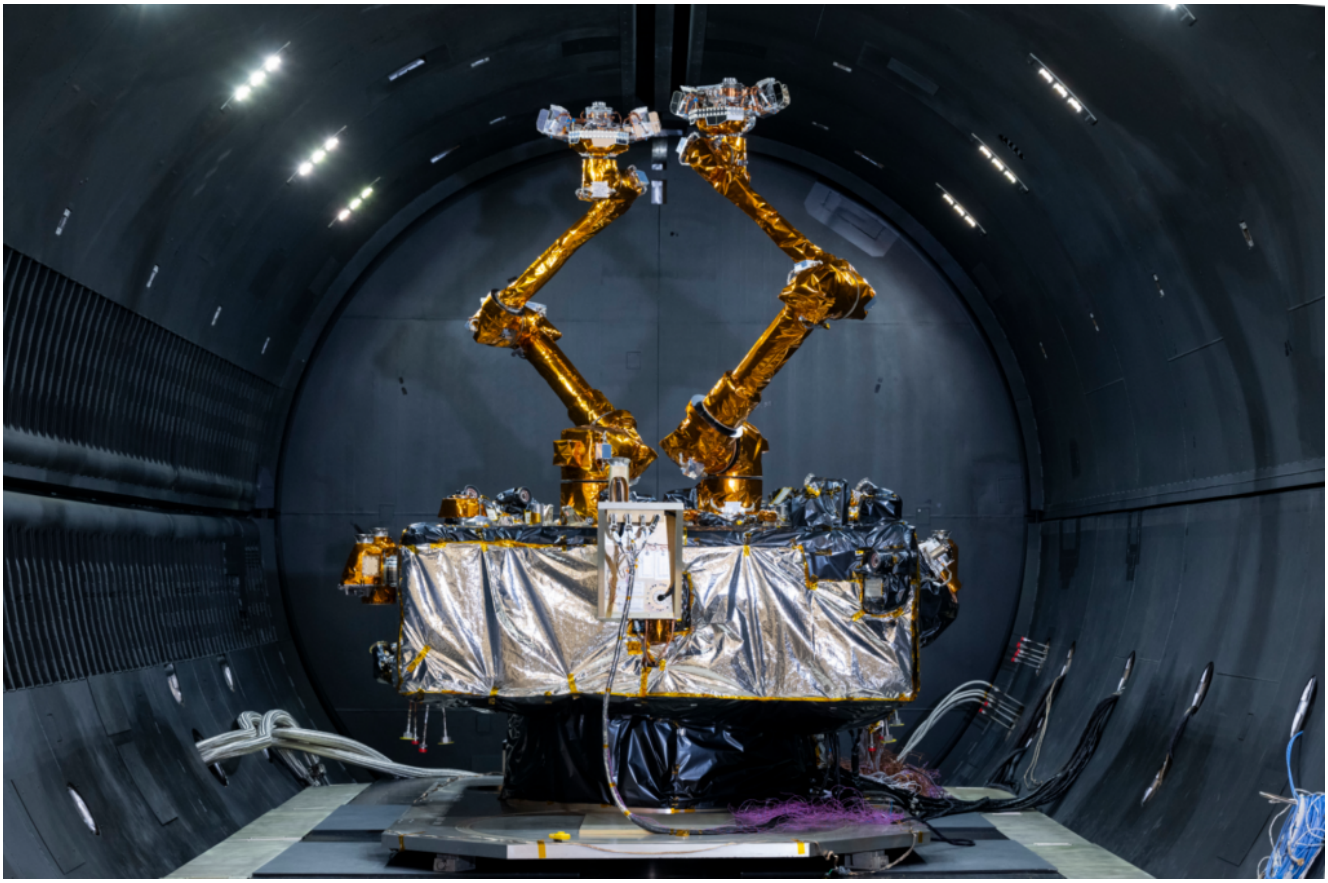
Naval Research Lab Completes Development of Satellite-Servicing Robotics



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United States Naval Research Laboratory Naval Center for Space Technology, in partnership with Defense Advanced Research Projects Agency, has successfully completed development of a spaceflight qualified robotics suite capable of servicing satellites in orbit, Oct. 8.

Under DARPA funding, NRL developed the Robotic Servicing of Geosynchronous Satellites Integrated Robotic Payload. This transformative new space capability was delivered to DARPA's commercial partner, Northrop Grumman's SpaceLogistics, for integration with its spacecraft bus, the Mission Robotics

Vehicle.

“The recent completion of thermal vacuum testing marks a major milestone toward achieving the program’s goal of demonstrating robotic servicing capabilities on orbit in the near future,” said NRL Director of Research Bruce Danly. “NRL’s contributions to the robotic payload are an essential part of realizing this vision, which promises to transform satellite operations in geostationary orbit, reduce costs for satellite operators, and enable capabilities well beyond what we have today. In fact, the anticipated capabilities are potentially revolutionary for both national security and civil applications.”

As DARPA’s robotic payload developer for the RSGS program, NRL looked to the future to design, build, integrate and test groundbreaking satellite servicing capabilities.

“This collaboration unlocks new servicing opportunities for both commercial and government satellites, enabling usual-close inspections, orbital adjustments, hardware upgrades, and repairs,” said Bernie Kelm, NRL NCST superintendent of the spacecraft engineering division. “We’ve created advanced spaceflight hardware and software that will significantly enhance satellite servicing operations, including all robotic controls.”

Satellites in geosynchronous orbit, positioned approximately 22,000 miles above Earth, are crucial for military, government and commercial communications, Earth-observing science and national security services.

Currently, spacecraft face significant challenges, in part because of the inability to perform in-orbit repairs or upgrades. To compensate for the lack of servicing options, satellites are often loaded with backup systems and excess fuel, leading to increased complexity, weight and cost. Should

this project prove successful, satellites can receive in-orbit upgrades based on new technology to extend their service life, Kelm added.

“The military regularly fixes aircraft, tanks, ships and trucks that break. We upgrade aircraft and ships with the latest radars, computers and engines,” said Glen Henshaw, NRL senior scientist for Robotics and Autonomous Systems. “Satellites are the only expensive equipment we buy that can’t be repaired or upgraded once they are in the field, and this costs the taxpayer money. RSGS is intended to change this situation; we intend to demonstrate that we can upgrade and repair these valuable assets using robots.”

Thermal Vacuum (TVAC) Testing Process

The test campaign put the robotic payload through its paces across the range of temperatures it will face while on-orbit and under vacuum conditions similar to space. Engineers tested all aspects of the payload including avionics, cameras and lights, and demonstrated all operations, with each of its two robotic arms including launch lock deployments, calibrations and tool changing. The test also verified SpaceWire communications and robotic compliance and visual servo control modes.

“NRL’s Team RSGS has spent nearly 10 years focused on the goal of completing this first of a kind, robotic servicing payload,” said William Vincent, NRL RSGS program manager. “The completion of IRP TVAC represents a huge milestone and countless hours of work from an incredible group of dedicated personnel. Like sending a child off to college for the first time, shipping the IRP to Dulles is a bittersweet experience.”

NRL worked for over two decades to mature the technology enabling the RSGS program. RSGS is designed to safely and

reliably repair and upgrade valuable commercial, civil and national security satellites, some of which cost over a billion dollars. In the near future, robotic satellite "mechanics" may extend the useful life of satellites by upgrading a variety of capabilities including new electronics, propulsion and sensors capabilities. RSGS robots could demonstrate broad servicing as a precursor to building large structures in-orbit which could include the next great observatory, solar power stations or other revolutionary new systems.

"We hope that this will eventually lead to spacecraft that are more modular and easier to maintain," Henshaw said.

Following its anticipated 2026 launch on the Northrop Grumman's MRV spacecraft bus, the robotic payload will undergo initial checkout and calibration with full operational servicing missions to follow.

"We will proudly watch RSGS as it provides resilience for the current U.S. space infrastructure and takes the first concrete steps toward a transformed space architecture with revolutionary capabilities," Vincent said.

About the U.S. Naval Research Laboratory

NRL has a long-standing relationship with academia and industry as a collaborator, contractor, and through technology transfer partnership mechanisms, such as commercial licensing, cooperative research and development agreements and educational partnership agreements.

NRL is a critical link within the Navy's research, development and acquisition chain and naval research enterprise. Through NRL, the Navy has direct ties with sources of fundamental ideas in industry and the academic community throughout the world and provides an effective coupling point to the research

and development chain for Office of Naval Research. NRL is a scientific and engineering command dedicated to research that drives innovative advances for the U.S. Navy and Marine Corps from the seafloor to space and in the information domain. NRL is located in Washington, D.C. with major field sites in Stennis Space Center, Mississippi; Key West, Florida; and Monterey, California, employing approximately 3,000 civilian scientists, engineers and support personnel.