Inspection mission of an actual piece of space debris by "ADRAS-J" satellite

Astroscale Japan Inc.

Case Overview

This initiative, conducted as Phase I of the Japan Aerospace Exploration Agency's (JAXA) Commercial Removal of Debris Demonstration (CRD2), demonstrated RPO technology for safely and precisely approaching and inspecting a target object, which is required for on-orbit services that enable debris mitigation and a circular space economy. Targeting an actual piece of debris in orbit, it achieved a world-first success in approaching to 15 m below the debris from long range, fly-around observation, and verification of collision avoidance functions, marking major progress toward realizing on-orbit services and space sustainability.

Key points regarding receiving the award (Comments from the selection committee)

The world-first success of ADRAS-J in close approach to and close-range imaging of debris is highly commendable, as it established technologies with potential not only for future debris mitigation but also for space situational awareness.

Debris removal technology itself is an extremely important technology that all of humanity should work on, and this mission is highly valued as marking its first step.

Image of the ADRAS-J mission

Concrete Results

1. Contribution to creating new areas for space development and utilization

The technology to safely and precisely approach and operate around target objects is a fundamental technology common to on-orbit services such as debris removal. "Approaching" may sound easy, but in reality it is extremely difficult. In low Earth orbit, where objects move at ultra-high speed, RPO technology for non-cooperative objects, which cannot provide positional information or control attitude, is a new and undeveloped technology of extremely high difficulty. To the best of our knowledge, this is the world's first initiative of its kind. One of the causes of the space debris issue is that space development has long followed a "disposable culture." After launch, only operation was possible, and without technologies for on-orbit servicing or maintenance, objects remained in orbit after completing their missions. Astroscale's on-orbit services aim to fill this gap as a "roadside service in space," addressing not only debris removal but also on-orbit situational awareness and satellite refueling. None of these are possible without the ability to safely approach specific objects. Being able to approach safely expands the scope and possibilities of operations in space. By succeeding in safe approach to and precise control around actual debris, this mission marked an important step toward shifting space development from a "disposable" model to a "circular" one and pioneering new possibilities ahead of the rest of the world.

2. Contribution to expanding the space development and utilization market

The world-first success in approaching debris to within 15 m and obtaining clear images has attracted wide attention and generated many inquiries. Furthermore, as countries seek to improve their ability to monitor threats and deter adversaries, national security agencies are increasingly recognizing and taking interest in the benefits and potential of on-orbit services using RPO technology. The technologies and achievements gained through this mission will be applied to future missions, further strengthening its presence in the global market as a core technology supporting space sustainability.

3. Contribution to the advancement of the economy and society

Our daily lives and economic activities, including traffic control, disaster monitoring, positioning, logistics, and communications, are supported by satellite services, and approximately 40% of the SDG targets rely on the use of Earth observation and global navigation satellite systems. In order to continue benefiting from these services, it is essential to preserve and improve the environment of Earth's orbit, where satellites operate. In recent years, however, the increasing number of satellites and debris has raised orbital density, leading to more collisions and near misses. On-orbit services are attracting attention as a solution to this space-scale problem, and this mission marked a major step toward their realization by demonstrating the RPO technology for safely approaching target objects, which is at the core of on-orbit services.

4. Contribution to technology

This mission was carried out as Phase I of JAXA's Commercial Removal of Debris Demonstration (CRD2), which aims to demonstrate technologies for large-scale debris removal. Since RPO technology for non-cooperative objects, which cannot provide positional information or support attitude control, had no precedent within the scope of publicly available information, development began from scratch. The RPO technology developed and demonstrated with JAXA's cooperation combines, for example, hardware equipped with multiple cameras and sensor systems with software featuring proprietary algorithms for safe approach to target objects using that hardware. These are just a few of the many technologies involved, but together they made it possible to determine the distance to and positional relationship with the target debris, demonstrate collision avoidance functions, and safely approach it.

5. Contribution to promoting public understanding and human resource development

Through publicity activities for this mission, Astroscale has communicated the debris problem and its efforts to address it to the world. Furthermore, by releasing actual images of debris taken by ADRAS-J at result briefings jointly held with JAXA and other events, this mission drew strong interest not only from industry stakeholders but also from non-space industries, various media outlets, and the general public. In this respect, this mission helped make the debris problem feel more immediate and widely conveyed that a "world-first" effort to solve it is underway "from Japan."

Contact
Astroscale Japan Inc.
TEL: 03-5619-2023 Mail: media_asjp@astroscale.com Web: https://www.astroscale.com/ja