National Aeronautics and Space Administration

Restore-L

Proving Satellite Servicing

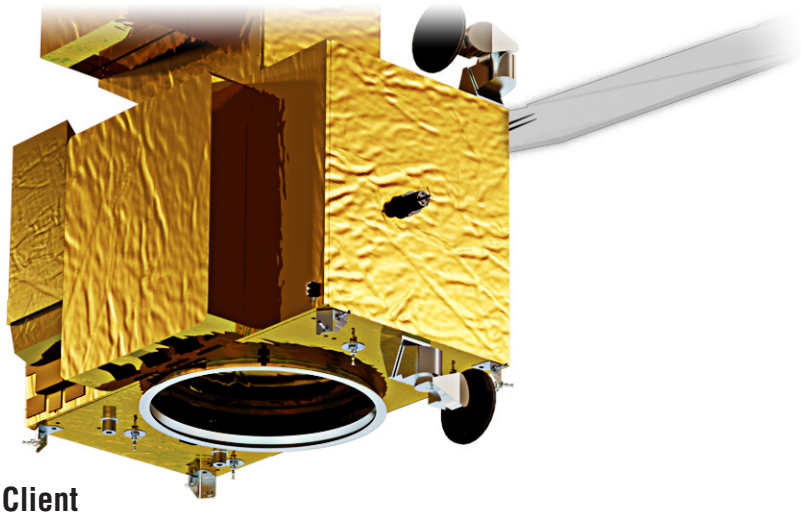
Need extra gas or a tune-up for your satellite? For years, such services were outside the realm of possibility for most spacecraft. But now, one mission will break that paradigm.

Meet Restore-L, a robotic spacecraft equipped with the tools, technologies and techniques needed to extend satellites' lifespans – even if they were not designed to be serviced on orbit.

During its mission, the Restore-L servicer will rendezvous with, grasp, refuel and relocate a government-owned satellite to extend its life. But Restore-L's effect will not end there.

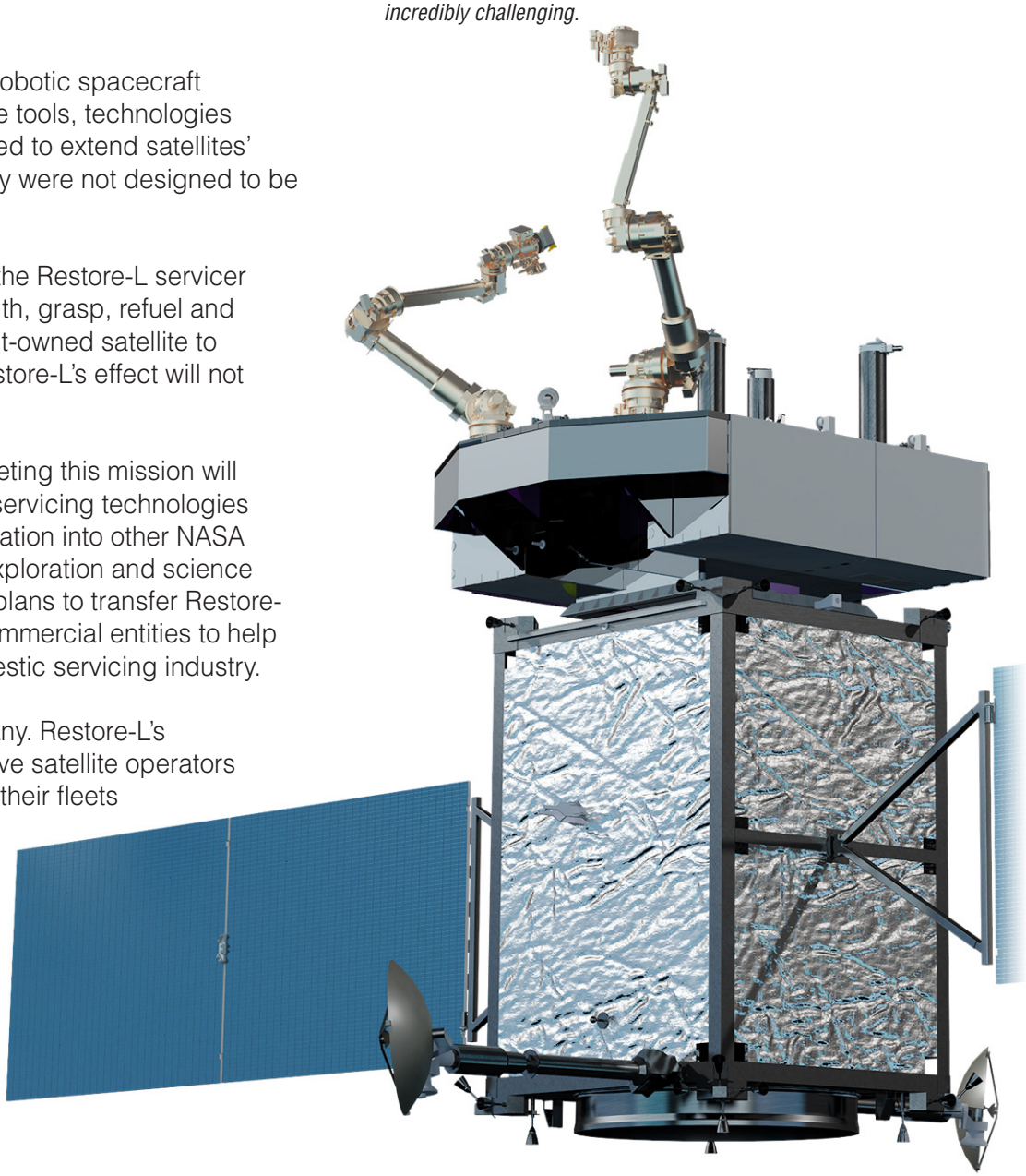
Successfully completing this mission will demonstrate that servicing technologies are ready for incorporation into other NASA missions, including exploration and science ventures. NASA also plans to transfer Restore-L's technologies to commercial entities to help jumpstart a new domestic servicing industry.

The benefits are many. Restore-L's capabilities can give satellite operators new ways to manage their fleets more efficiently, and derive more value from their initial investment. These capabilities could even help mitigate the looming problem of orbital debris.



Client

More than 1,000 operational satellites exist in space today. Of these, only the Hubble Space Telescope and the International Space Station were designed to be serviceable – in part because robotic servicing is incredibly challenging.



Restore-L Servicer Spacecraft

Think of it as a robotic tow truck in space: a free-flying spacecraft equipped with life-extension technologies for satellites.

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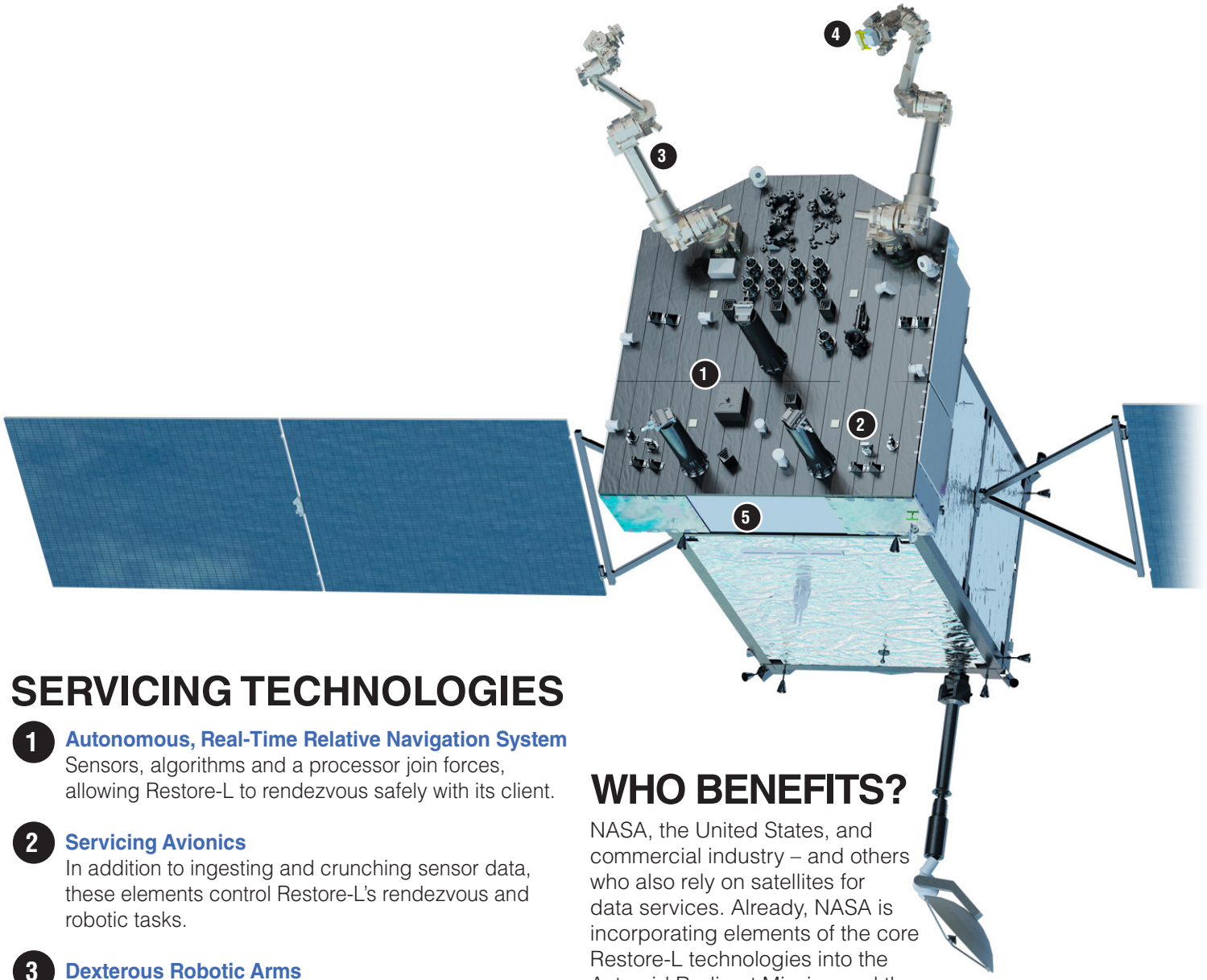
BRINGING RESTORE-L TO LIFE

It takes years of testing, countless hours of design, and five new technologies to make robotic satellite servicing a reality. Here's a breakdown of the key elements of Restore-L.



SERVICING TECHNOLOGIES

1. **Autonomous, Real-Time Relative Navigation System**
   Sensors, algorithms and a processor join forces, allowing Restore-L to rendezvous safely with its client.

2. **Servicing Avionics**
   In addition to ingesting and crunching sensor data, these elements control Restore-L's rendezvous and robotic tasks.

3. **Dexterous Robotic Arms**
   Two nimble, maneuverable arms precisely execute servicing assignments. Software comes included.

4. **Advanced Tool Drive And Tools**
   Sophisticated, multifunction tools are manufactured to execute each servicing task.

5. **Propellant Transfer System**
   This system delivers measured amounts of fuel to the client at the right temperature, pressure and rate.

WHO BENEFITS?

NASA, the United States, and commercial industry – and others who also rely on satellites for data services. Already, NASA is incorporating elements of the core Restore-L technologies into the Asteroid Redirect Mission and the architecture for the Journey to Mars.

WHAT'S IN A NAME?

NASA chose the name Restore to highlight how servicing capabilities can return a satellite to its original capability.

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