SATELLITE SERVICING PROJECTS DIVISION

ON-ORBIT SERVICING, ASSEMBLY & MANUFACTURING

Journeying Longer and Seeing Farther

INTRODUCTION

Space is vast. For the most part, when a satellite is launched, it's on its own, regardless of whether it ever needs assistance or not. It launches, operates, and is decommissioned alone, its lifespan limited by consumables, imperfect human design, the exceedingly harsh space environment, and technical obsolescence. But what if we could fix, upgrade, and augment existing satellites to enable more science for longer? Technically and economically feasible refueling, repair, and upgrade of satellites has remained elusive—until now. The combination of On-orbit Servicing, Assembly, and Manufacturing (OSAM) capabilities promises to not only offer more science by assisting existing telescopes, but also lay the groundwork for future endeavors once thought to be impossible.

OSAM AT A GLANCE

SERVICING

Covers a wide range of activities spanning fixing, improving, and reviving satellites and refers to any work to refuel, repair, replace, or augment an existing asset in space. Servicing allows for satellite life-extension and upgradability as technology evolves on Earth.

ASSEMBLY

The practice of gathering two or more parts together in space into a single, functional aggregate structure. A suite of assembly capabilities allows us to launch individual parts to space separately and bring them together, thereby overcoming the constraints of rocket fairing volume limitations.

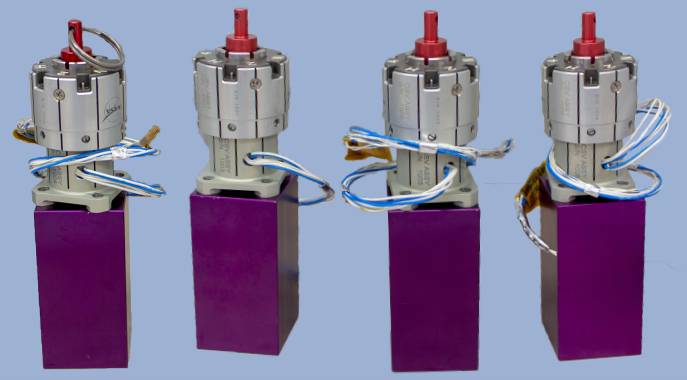
MANUFACTURING

Encompasses fabricating components in space. This capability allows for greater adaptability in dealing with unforeseen challenges and has the potential to eliminate the need to launch as many components (including contingency components) upfront. It also allows for the production of unprecedented monolithic structures, such as jointless 30-meter truss beams.

THE HUBBLE LEGACY

The pinnacle of satellite servicing was the Hubble Space Telescope Servicing Missions. Hubble's continued stellar functioning is the proof case for modular design. Between 1993 and 2009, astronauts repaired and upgraded Hubble by installing cutting-edge scientific instruments over five missions which reflected the evolution of technology on Earth. These repairs and upgrades proved to be critical to the observatory's productivity. Hubble was also designed modularly, meaning the plan was always to be able to repair and upgrade the observatory. Because of satellite servicing, Hubble has remained the most productive science machine in history—one that continues to unlock the secrets of the universe, 29 years after launch.

LAYING THE GROUNDWORK FOR OSAM

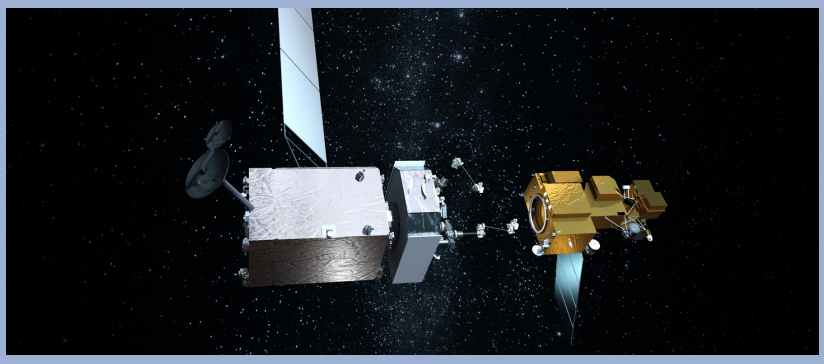


COOPERATIVE SERVICE AIDS (COSA)

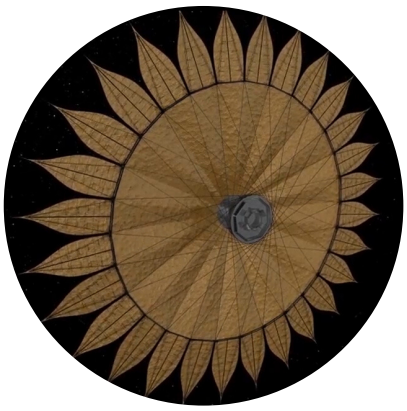
Cooperative Service Aids are elements that can be incorporated into satellites being designed or assembled today, allowing them to be more easily serviced. These can range from simple fiducials that make grappling satellites in space easier, to sophisticated valves designed for cooperative refueling, all the way to grapple fixtures that make capturing a satellite simpler. CoSA break the "one and done" paradigm, and help to make OSAM the norm in a low-mass and low-cost manner.

RESTORE-L

In collaboration with Maxar Technologies, Restore-L will use robotic arms to rendezvous with, grasp, refuel, and relocate a government-owned satellite to extend its life. Following the refueling, an attached payload called SPace Infrastructure DExterous Robot (SPIDER) will demonstrate in-space assembly and manufacturing by assembling a communications antenna, then manufacturing a 10-meter beam. The OSAM capabilities to be demonstrated by Restore-L will help usher in a new class of missions that are affordable, sustainable, and resilient.



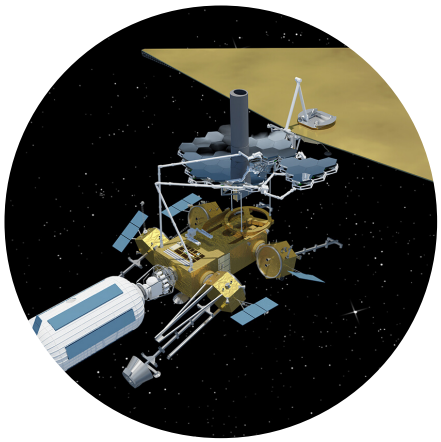
FUTURE APPLICATIONS



Starshades are large, deployable structures that can help in the search for life on planets outside our Solar System. Earth-like planets orbiting a star are about 10 billion times fainter than their star, making them difficult to see. Starshades flown between a space telescope and a star could block out a star's light to reveal any planets for direct imaging. Large quantities of fuel are required for continuous thrust to maintain the starshade's proper position, so the ability to refuel is a critical aspect of concept feasibility.

STARSHADES

Currently, the size of a telescope or other structure that can be launched to space is limited by rocket volume. Assembly promises to break this paradigm. Massive telescopes (assembled on orbit) are our best chance at finding the existence of life outside our solar system.



LARGE TELESCOPES

Learn more about Satellite Servicing: sspd.gsfc.nasa.gov