NASA’s Game Changing Technology Industry Day
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Satellite Servicing
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TECHNOLOGY DRIVES EXPLORATION
Satellite Servicing encompasses a group of technologies that work together to enable in-space life extension, upgrades, assembly, replenishment, replacement, or repair of spacecraft.

SSCO is executing projects to advance the state of satellite servicing technologies that will enable:

- Routine servicing of legacy spacecraft in government and industry
- Exploration of the solar system
- U.S. to be a global leader of in-space servicing
Current satellites cannot be repaired on-orbit and are disposed of even if a majority of the spacecraft is still functional.

Future exploration missions will not be possible without servicing technologies:

- Relative Navigation for autonomous rendezvous
- Robotics with sophisticated tools to support assembly, upgrades, or repairs
- Propellant Transfer in-space refueling

The technologies required to repair legacy satellites or enable future exploration missions are immature and must be enabled through technology demonstration missions. This is the goal of SSCO, a world leader in the field of satellite servicing.
Restore-L is a technology demonstration mission to repair a legacy satellite that encompasses all satellite servicing technology areas and represents a culmination of decades of satellite servicing technology development.
Relative Navigation

Current TRL: 3-4

- Heritage development on RNS (SM4), Argon, and Raven
- Covers vision-processing algorithms, visual and ranging sensors, and high-speed computing
- Provides client pose data for control of the servicing spacecraft during autonomous rendezvous
- Goal is to provide an off the shelf government technology set
Robotics

Current TRL: 3-4

- NASA Servicing Arm has been in development of several years and has heritage with previous robotic arms developed under NASA and DARPA projects
- System includes the Robotic Arm, Control Electronics, and Software
- Capable of autonomous and telerobotic control modes
- Goal is to provide a qualified robotic system that can be used on a wide range of future missions
• Robotic servicing tools are used for interfacing with client satellites to perform a wide range of tasks:
  • Cut wires, remove caps, manipulate MLI
  • Refueling
  • Close-up inspection
  • Repair
• Robotic Refueling Mission (RRM) has given some of these tools successful operation in space
• Goal is to provide a suite of universal tools for future missions to utilize
Propellant Transfer

- System to transfer fluid in zero-g from one spacecraft to another
- Includes flow meter and flexible hose components
- Development focusing on compatibility with hydrazine, oxidizer, and xenon
- Major development to date came from the Remote Robotic Oxidizer Transfer Test (RROxiTT)
- Goal is to provide a configurable set of technologies that can be used on missions with different propellant needs
NASA

- Expanded options for extending the lives of satellites, observatories and spaceships

Flight-proven technologies that facilitate upgrade and (self) maintenance of robotic and crewed vehicles

Capabilities that support ambitious Science and Exploration architectures: assembly of large space assets

Servicing Capabilities

Nation

- Global precedence in robotic satellite servicing

U.S. fleet management possibilities

New commercial industry boosting U.S. economy

Industry

- Receives flight-proven technologies to jumpstart a commercial industry

Direct transfer of a rolling portfolio of non-exclusive, licensed technologies

Servicing Technology Benefits
What’s Next?

SSCO near-term objectives to advance servicing TRLs:

- Complete Raven operations onboard ISS (2016-2017)
- Build, fly, and operate Robotic Refueling Mission 3 onboard ISS (2017-2018)
- **Complete Restore-L Mission (2020)**

In the meantime SSCO will:

- Release a synopsis of a technology transfer plan for industry feedback (2016-2017)
- Host Industry Days to provide data from major Restore-L reviews
- Begin efforts to transfer technology via non-exclusive licenses
- Educate the space community about how to utilize servicing technology in the development of their projects
- Provide updates on the latest developments in the advancement of servicing technology via media communications and technical papers
- Study how future missions can be enhanced through the application of servicing technology
For more information about this technology or to discuss potential collaboration efforts:

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