Workshop Goal

The goal of this exercise is to provide an overview of some of the technologies and techniques being considered for future active debris removal (ADR) and on-orbit servicing (OOS) missions and identify critical policy, legal, and international relations issues that need to be addressed to ensure the safe, sustainable, and secure future of space activities. Specific areas of interest are:

- Spectrum allocation, management, and coordination
- Compliance with international and national laws
- Communication and coordination with other space actors
- Transparency and confidence-building measures

Methodology

This workshop will use a series of simple scenarios to help focus the discussion. The scenarios are all based on actual concepts in development or being evaluated, but are not intended to exactly mirror the specifics of these concepts. In some cases, they may be composites of more than one concept, and in others certain details may have been changed or left out. In all cases, each scenario is designed to highlight particular aspects of ADR or OOS. Details may have been left out or altered in order to stimulate discussion. Each scenario contains background information about a particular ADR or OOS mission, the entities involved (which may or may not be fictional), and a description of the activities they will be performing in orbit.

Ground Rules

1. This discussion is under Chatham House rule. Participants are free to use the content of the discussions but neither the identity nor the affiliation of the speaker(s), nor that of any other participant, may be revealed
2. This discussion is at the unclassified level.
3. Unless otherwise stated, each participant is providing input based on their own personal expertise, experience, and opinions and is not representing the organization they currently work for.
4. SWF will be compiling a summary report from the workshop that will be used for our internal planning and study and also published on our website.

Scenario 1 - A ground-based laser debris avoidance system for LEO

The Australian Clean Space company has developed a ground-based laser system that can change the orbit of small debris objects in Low Earth Orbit (LEO). Clean Space uses a distributed network of 100 small optical telescopes around the world to track all debris objects down to 1 cm in size. Clean Space uses a 5 kW laser located in Australia to fires multiple pulses at a single, small debris object in one pass, changing its perigee via photon pressure. Over successive orbits these changes are enough to alter the object's orbit by several hundred meters.

Using this technique, Clean Space offers a paid collision avoidance service for satellite operators. Clean Space uses its tracking network to detect and predict collisions between debris objects and satellites. For a fee, satellite operators can subscribe to an alert service to be notified of potential collisions between one of their active satellites and a piece of debris. For an additional fee, Clean Space will use its laser to change the orbit of the debris object, thus preventing the collision without the operator needing to expend fuel. Clean Space also offers this service to owners of large, dead satellites that have been left in orbit, and for a fee will use its laser to prevent small debris objects from hitting the large satellites left in orbit.

In the near future, Clean Space plans to add a more powerful laser that is capable of removing small pieces of debris from orbit entirely through ablation.

Scenario 2 - A commercial company creating new satellites from recycled space debris

The U.S.-based Satellite Recycling Company (SRC) manufactures new communications satellites out of recycled parts from defunct satellites. Using technology originally developed by DARPA, SRC operates a robotic vehicle in and near the active GEO belt to gather parts from hosted payload slots on active GEO satellites and use them to converts pieces of dead satellites in the GEO graveyard into fully-functioning satellites. SRC works to match customer requirements for the new communications satellites with apertures available on satellites in the graveyard, including the ability to negotiate transfer of ownership of the aperture from the original owner.

After an aperture is converted to a fully functioning satellite, SRC conducts a checkout of all major systems before handing it over to the customer. In many cases, customers are using these newly created satellites as part of a cluster operating in a GEO slot.