



Promoting Cooperative Solutions for Space Sustainability

Norms and Standards to Enable Emerging Industry Segments: Satellite Servicing

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ON-ORBIT SATELLITE SERVICING (OOS) AND NORMS

Overview of the need for normative efforts in OOS

“Non-traditional” Space Applications

Rapid expansion in the number & types of commercial space applications is creating opportunities but also challenges



Image Source: NASA

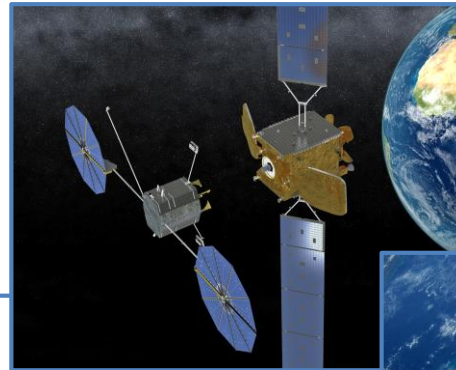


Image Source:
Orbital ATK



Image Source: Planetary Resources



Image Source: UNOOSA / Sierra Nevada Corp

How can governments and the private sector work together to set “rules of the road” for these emerging new applications?

Development of OOS and RPO Capabilities

- On-orbit servicing (OOS) and Rendezvous and Proximity Operations (RPO) are key to enabling future of on-orbit activities
- Benefits and challenges
 - Greatly increase the viability of and benefits from space activities
 - Raises a number of diplomatic, legal, safety, operational, and policy challenges that need to be tackled
- OOS and RPO are not new, and are already international
 - 50+ years of experience in doing it with human spaceflight, but increasingly shifting to robotic/autonomous
 - Multiple countries/companies developing and testing RPO capabilities
- How to develop norms and standards to enable cooperative OOS/RPO and mitigate challenges?

Current Activities in OOS & RPO

SATELLITE INSPECTION



LIFE EXTENSION



SATELLITE REFUELING



MODULAR SATELLITE ASSEMBLY



DEORBIT / END OF LIFE SERVICES



And future
activities and
applications,
which would
leverage
technology,
norms, and
standards

Selected examples of active organizations, not intended as complete listing

What are “Norms”?

- **Sociology:** informal understandings that govern the behavior of members of a society
- **International relations:** standard of appropriate behavior for actors with a given identity

Osaka



Historically –
stand on right,
walk on left

Tokyo



Historically –
stand on left,
walk on right

Norms in Space Governance

- Much of the existing space governance framework is based on norms
 - **Example:** Freedom of overflight for satellite reconnaissance
 - Launch of Sputnik in 1957 helped set the norm that satellite overflight did not breach territorial sovereignty
 - By mid-1960s, freedom of overflight was a generally accepted norm
 - Was not codified into “hard law” until Outer Space Treaty of 1967
- Norms are likely going to be the main mechanism to address future challenges
 - “Congested, contested, competitive”
 - Far more space actors than ever before, with diverse interests and goals
 - Increasingly challenging to get global consensus on new “hard law”



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CONFERS: STANDARDS FOR OOS AND RPO

Developing industry-consensus standards for cooperative OOS & RPO



DARPA and Satellite Servicing

- The Defense Advanced Research Projects Agency (DARPA) has had a long history with developing cooperative OOS technologies
 - Orbital Express, Robotic Servicing of Geosynchronous Satellites (RSGS)
 - Goal is to develop/demonstrate core technologies, and spin them off to industry
- Establishing norms and standards is essential to creating a vibrant commercial OOS industry
- Consortium for Execution of Rendezvous and Servicing Operations (CONFERS) program is meant to be a forum where industry and other stakeholders can engage to develop standards and norms



Promoting Cooperative Solutions for Space Sustainability

CONFERS Team



Advanced Technology International (ATI)

- Prime, lead for consortium development



Secure World Foundation (SWF)

- Lead for outreach and engagement



University of Southern California Space Engineering Research Center (SERC)

- Conducting research into existing standards and practices



Space Infrastructure Foundation

- Space-related standards development expertise

CONFERS Objectives

- Leverage best practices from government and industry to research, develop, and publish non-binding, voluntary consensus standards (technical and operations) for cooperative OOS and RPO
- These standards would provide the foundation for a new commercial repertoire of robust space-based capabilities and a future in-space economy
- Be open to participation by private sector stakeholders in the satellite servicing community
- Focus on RPO in the first year, and OOS in the second year
- Initially supported by DARPA, CONFERS intends to transition to fully private-sector operations over a period of several years

CONFERS: A Holistic Approach To Standards

Interfaces and Designs

- Engineering and design to increase the safety, viability, and interoperability of satellite servicing

Operational Practices

- Behavior of satellite servicing and RPO activities

Data Exchange and Sharing

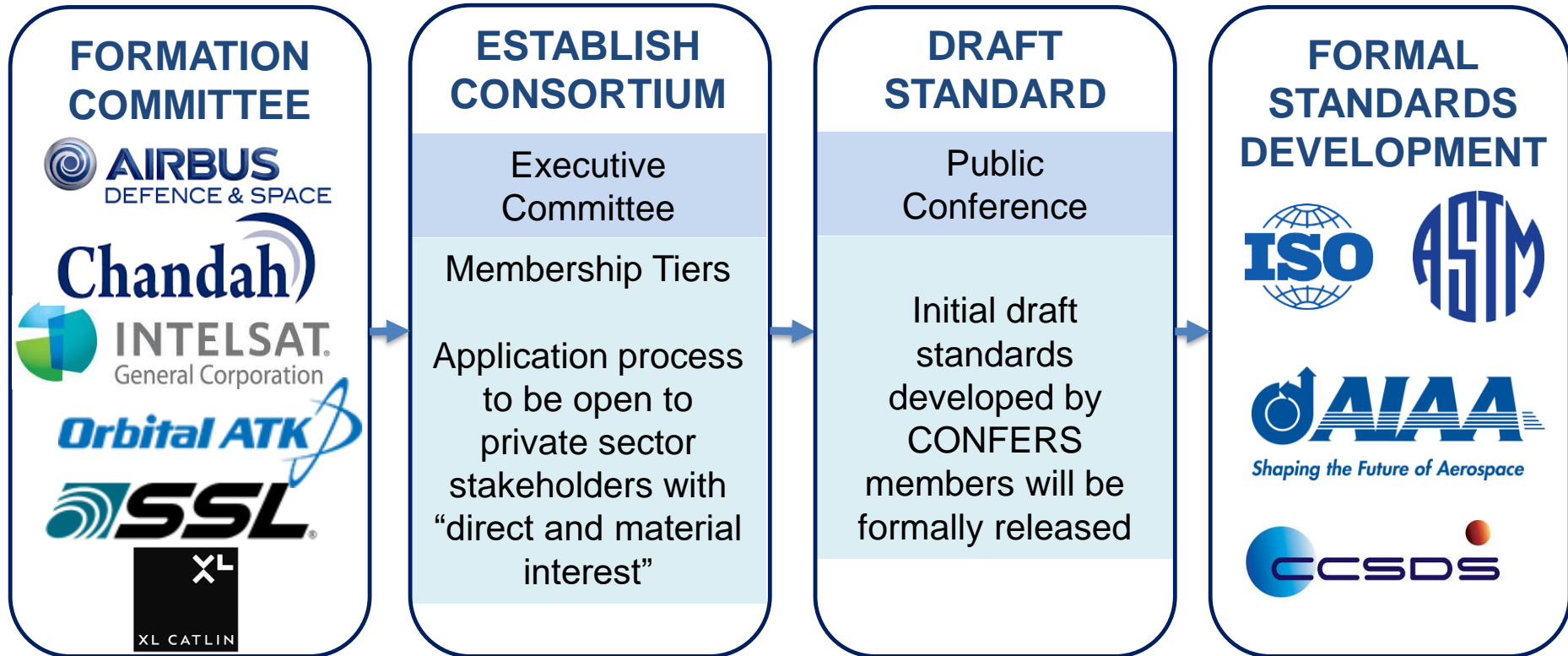
- Information sharing between servicing companies, clients, and governments

Transparency and Confidence-Building Measures

- Mechanisms to reduce misperceptions and concerns about the dual-use nature

For related reference see: Barnhart, D., Sullivan, B., Hill, L., Fowler, E., Hoag, L., Mook, M., Chappie, S., Kennedy, T., Kelm, B., and Vincent, K., "Phoenix Program Status 2013", AIAA Space 2013 Conference, AIAA 2013-5341.

CONFERS Process



Next Steps and Engagement

- Formation Committee (assisted by ATI and SWF) to finalize the Consortium structure
- Consortium will be open to participation by private sector stakeholders in the satellite servicing/RPO community
- Information on membership application process will be available on the CONFERS website at: www.satelliteconfers.org
- Contact Information:
 - Technical/Standards questions: Dr. Brian Weeden (bweeden@swfound.org)
 - Membership/Administrative: Ms. Stacey Lindbergh (stacey.lindbergh@ati.org)



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Thank You

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