



Promoting Cooperative Solutions for Space Sustainability

# Norms and Standards to Enable Emerging Industry Segments: Satellite Servicing

Mr. Ian Christensen

Secure World Foundation

Global Space and Technology Convention,

Singapore February 1-2, 2018



Promoting Cooperative Solutions for Space Sustainability

# 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

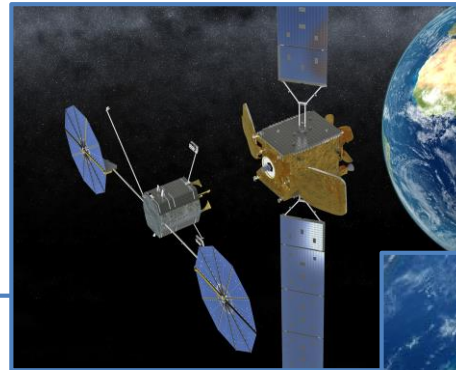


Image Source:  
Orbital ATK



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”



*Promoting Cooperative Solutions for Space Sustainability*

# 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

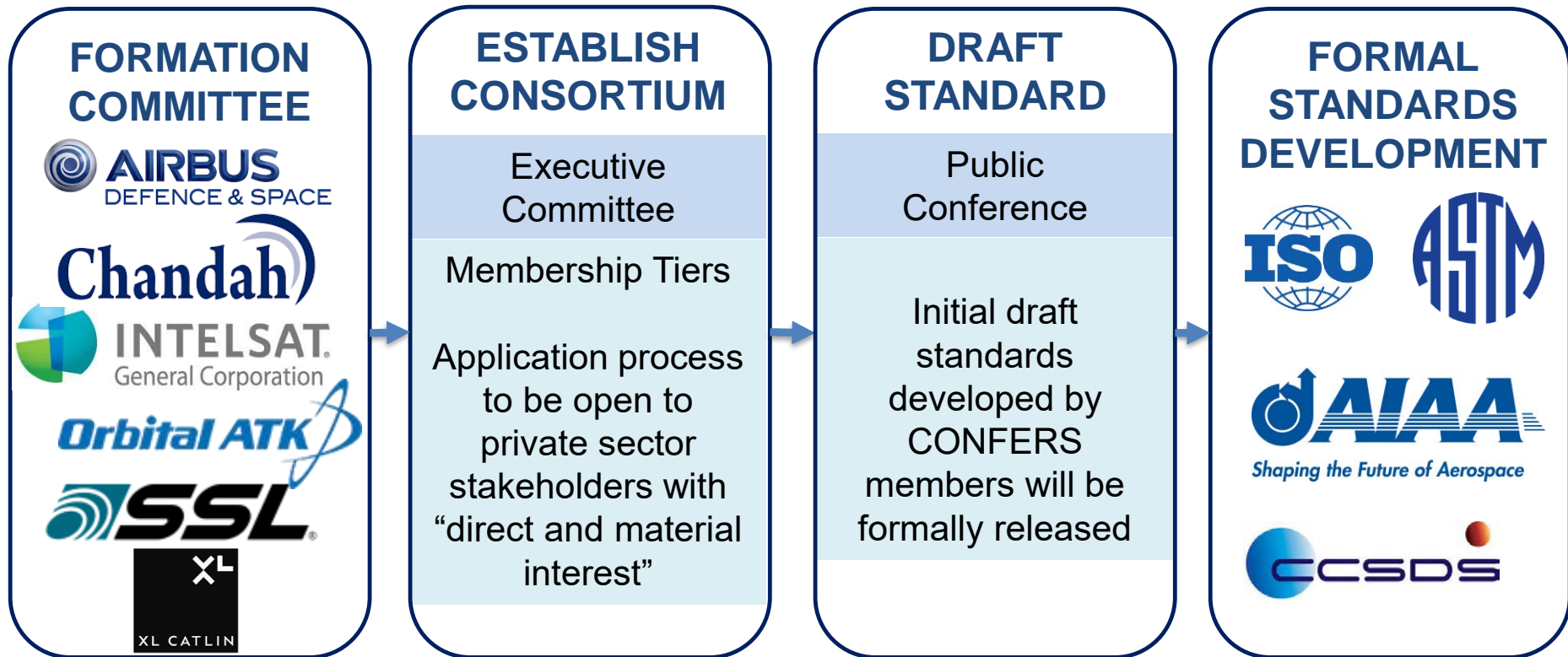
- Information sharing between servicing companies, clients, and governments

## 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](http://www.satelliteconfers.org)
- Contact Information:
  - Technical/Standards questions: Dr. Brian Weeden ([bweeden@swfound.org](mailto:bweeden@swfound.org))
  - Membership/Administrative: Ms. Stacey Lindbergh ([stacey.lindbergh@ati.org](mailto:stacey.lindbergh@ati.org))



*Promoting Cooperative Solutions for Space Sustainability*

# Thank You

ichristensen@swfound.org