

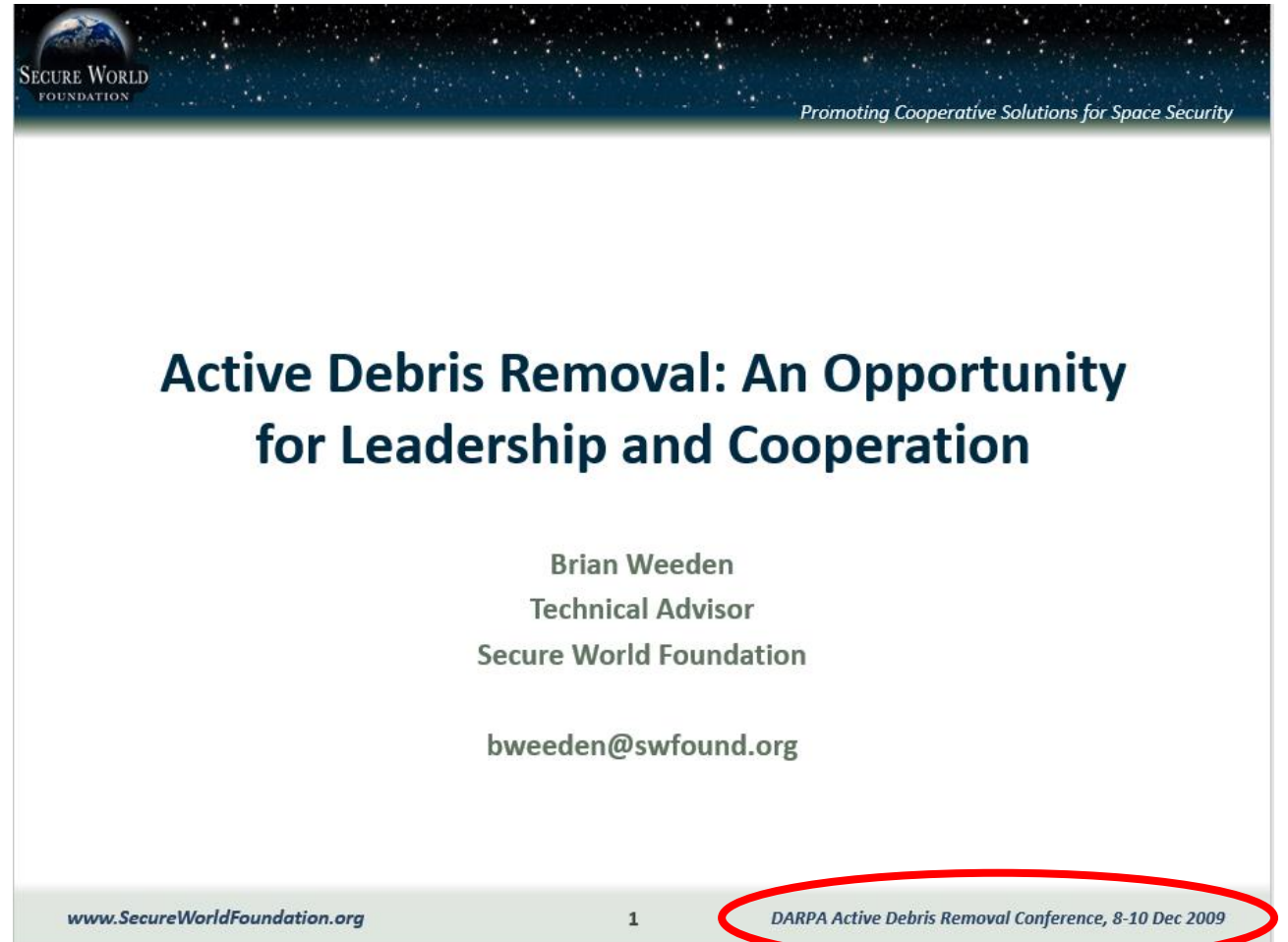


Promoting Cooperative Solutions for Space Sustainability

Overcoming Legal, Policy, and Economic Hurdles for Active Debris Removal

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- Who pays to clean up orbital debris?
- Is the legal definition of “space debris” different from “space object”?
- Who is allowed to remove an orbital debris object?
- How do you determine who owns a piece of orbital debris?
- How do I indicate my active debris removal technology is not being used as a weapon?



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Promoting Cooperative Solutions for Space Security

Active Debris Removal: An Opportunity for Leadership and Cooperation

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www.SecureWorldFoundation.org 1 **DARPA Active Debris Removal Conference, 8-10 Dec 2009**

- Orbital debris risk is worst in LEO, which is still dominated by public good services and users (governments)
- Large LEO constellations may change the situation somewhat
 - Possibly incented to help develop ADR services and use them to remove their own dead satellites
 - Unlikely to be incented to remove other people's orbital debris
- At the end of the day, governments created the orbital debris problem and will have to clean it up
 - Biggest threat comes from potential collisions of derelict large rocket bodies in high LEO and GTO orbits
 - Governments already have ultimate liability

B. Weeden, "The economics of space sustainability," [The Space Review](#), June 2012

Why isn't the U.S. leading?

- Major impediment to making further progress is the *lack of a bureaucratic champion* for space sustainability
 - If it's everyone's job, then it's no one's job
- Current policy discussions on space traffic management offer a chance to fix the situation
 - Assign responsibility for the space environment to an existing civil agency (NASA, FCC, NOAA, DOT/FAA?)
 - Merge existing authorities into a new agency (Coast Guard for Space?)
- Champion needs to focus on developing ADR capabilities
 - Competition between multiple commercial entities to develop capabilities, government(s) purchase services (e.g. NASA's Commercial Cargo & Crew?)

Priority targets for removal

Worst Offenders		
	Object	Cluster
1	27006 / SL-16 R/B	*975
2	27386 / Envisat	*775
3	9044 / SL-8 R/B	975
4	15037 / SL-8 R/B	975
5	15056 / SL-8 R/B	975
6	22308 / SL-8 R/B	975
7	8646 / SL-8 R/B	975
8	18129/COSMOS 1861	975
9	10732 / SL-8 R/B	975
10	22285 / SL-16 R/B	850
11	23405 / SL-16 R/B	850
12	23088 / SL-16 R/B	850
13	4799 / COSMOS 385	975
14	6708 / SL-8 R/B	975
15	32053 / SL-8 R/B	975
16	31793 / SL-16 R/B	850
17	28353 / SL-16 R/B	850
18	5239 / SL-8 R/B	975
19	19531 / NOAA 11	*850
20	22566 / SL-16 R/B	850

	Chigh Worst Offenders	Orbit Affecting
1	40270-PSLV R/B	MEO
2	6797-ATLAS CENTAUR R/B	GEO
3	39618-ARIANE 5 R/B	GEO
4	26762-BLOCK DM-SL R/B	GEO
5	28138-BLOCK DM-SL R/B	GEO
6	41593-ARIANE 5 R/B	GEO
7	36832-ARIANE 5 R/B	GEO
8	25405-CZ-3B R/B	GEO
9	40750-CZ-3B R/B	MEO
10	10722-ATLAS CENTAUR R/B	GEO

D. McKnight et al, "Assessing Potential for Cross-Contaminating Breakup Events from LEO to MEO/GEO", IAC-18-A6.2.9x41942

Protocol for asking permission

1. Identify the object you wish to interact with
2. Consult the UN registry to see if another State has registered the object (if yes -> ask)
3. If no, then make request to States with SSA tracking facilities for information/assistance in ID'ing the object
4. If still no resolution, then make a public announcement
 - a) Intent to interact with the object & how
 - b) Orbital parameters of the object, characterization
5. Wait (30 days?) for any Launching State to come forward
 - a) If one does -> ask them.
 - b) If none -> proceed with plan

B. Weeden, "[How Do I Ask Permission to Engage With A Piece of Space Debris?](#)" 3rd European Workshop on Space Debris Modelling and Remediation, Paris, France, June 16-18, 2014

The “weapons” problem

- “Any satellite can be used as a weapon to ram into another satellite”
 - *This is FALSE, unless said satellite is equipped with rendezvous and proximity operations (RPO) capabilities*
- “All this technology for debris removal and satellite servicing is just a covert weapons program”
 - *This is FALSE, as most of these capabilities would make very poor weapons that no military commander would choose over other options*
- Legitimate concern about the *perception* of the testing, demonstration, and use of RPO technologies

IV. **Transparent Operations:** Parties conducting commercial servicing operations will work within the principle of transparency to promote safety and trust.

- a. In keeping with Article XI of the OST, the parties conducting the servicing operation will notify the relevant State(s) of the general nature, conduct, locations, and results of servicing operations.
- b. In keeping with Article IX and Article XI of the OST, the parties conducting the servicing operation will ensure sufficient communication and coordination with entities that could reasonably be affected by the servicing operation to support safety and avoid harmful interference.
- c. The parties conducting the servicing operation will develop and implement a protocol that provides timely public notification of anomalies or mishaps that could have an adverse impact on other entities or the space environment.
- d. Parties conducting servicing operations will look for opportunities to share lessons learned from operational successes and anomalies while protecting intellectual property and competition-sensitive information, and complying with export control regulations.

[“Guiding Principles for Commercial Rendezvous and Proximity Operations \(RPO\) and On-Orbit Servicing \(OOS\),” Consortium for Execution of Rendezvous and Servicing Operations, Nov 2018](#)



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Thank You! Questions?

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