

Legal and Economic Implications of Orbital Debris Removal: A Free Market Approach



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Magnitude of the Problem

- NORAD currently tracks some 17,000 pieces of orbital debris 10 cm or larger
- It is estimated that there are some 300,000 objects between 1 and 10 cm
- The U.S. government has cataloged 13,000 objects
 - Only 6 or 7 percent of the 13,000 are operational satellites
 - 40% of the objects catalogued are from breakups, fragmentation or collisions
 - 25% are the result of “mission related” debris (e.g. upper stages, fairings, explosive bolts)
- The rest is just JUNK and 90% of all objects are currently uncontrolled



Magnitude of the Problem

Inclination (degrees)	No. of Objects	Total Mass (Tons)	Country of Origin
81-83	739	817	>97% Russian (or USSR)
69.9-74.1	644	480	>95% Russian (or USSR)
96-103	316	322	US= 155 obj. (85 tons) US Allies= 80 obj. (85 tons) Russia = 42 obj. (93 tons) China = 39 obj. (59 tons)



Who's Responsible for all that Junk?

- 1972 Convention on International Liability makes the launching state:
 - Strictly liable for any damage caused on the Earth from a launch or reentry of a manmade object
 - Liable for any on-orbit collision if fault can be found (Art. IV)
- 1976 Registration Convention requires that all launching states register space objects with the U.N.
 - Only the United States routinely registers all stages of a launch. Most countries merely register the launch vehicle and the payload(s)
 - There is no penalty for not registering



How Well Has This Regime Worked?

- The Cosmos/Iridium collision is a case of first impression for space law. There has never been a claim made under the Liability Convention for an in-orbit collision
 - Iridium carried insurance for a collision, but only for third-party damage
 - Unclear whether Iridium even knew of the probability of the collision
 - Because Iridium-33 was well passed its useful life, there is a question as to whether the operator was hesitant to use any station keeping fuel to avoid the collision
 - Russia argues that customary international law does not require it to get rid of its derelict satellites
 - Iridium argues that it is under no obligation to take active steps to avoid the collision



Is There a Duty to Dispose of Space Junk?

- Simple answer is: NO
- In 2002 ESA issued its “European Space Debris Safety and Mitigation Standards”
- In 2006 the U.S. National Space Policy reiterated that “it seeks to minimize the creation of space debris”
- Also in 2006, China released a “white paper” in which it supported debris mitigation policies at the international level



Is There a Duty to Dispose of Space Junk?

- The UN's Committee on the Peaceful Uses of Outer Space (COPUOS) in 2007 adopted its Space Debris Mitigation Guidelines (later adopted by the General Assembly). These 7 Guidelines call for launching states and satellite operators to:
 - 1) Limit debris released during normal operations including deployment;
 - 2) Minimize potential break-ups during operational phases (by utilizing better failure mode analysis);



Is There a Duty to Dispose of Space Junk?

- 3) Limit the probability of accidental collision in orbit by pre-launch prediction models, careful choice of orbits, etc;
- 4) Avoid intentional destruction and other harmful activities;
- 5) Minimize potential for post-mission break-ups resulting from stored energy;
- 6) Limit the long-term presence of spacecraft and launch vehicle orbital stages in LEO;
- 7) Limit the long-term interference of spacecraft and launch vehicle orbital stages within GEO (safe orbits).

These are all MITIGATION strategies, not orbital debris removal strategies!



Is There a Duty to Dispose of Space Junk?

- The U.S. has actually gone beyond these guidelines by requiring that all entities requiring an FCC license (for either operations or C3) provide the FCC with an orbital debris mitigation plan
 - 47 C.F.R. § 25.114(d)(14) (Adopted in 2004, amended in 2006)
 - Similar to UN guidelines, including requirements for safe disposal after end of life

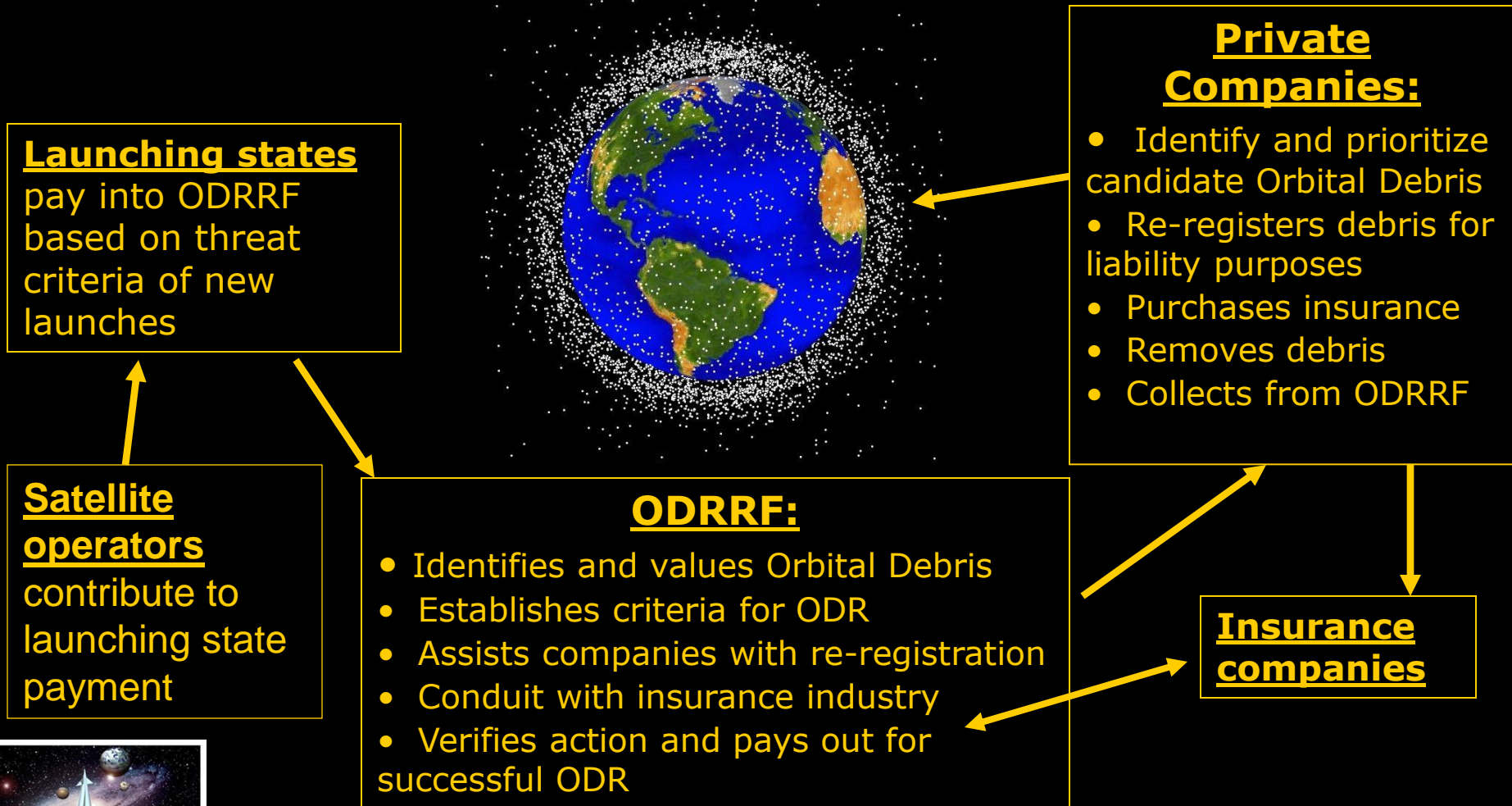


What is Stopping ODR?

- Past Practices (“Big Sky” mentality and failure to recognize cost of doing nothing at the government, industry, and insurance levels)
- Legal
 - Disparate treatment of liability as between launch and orbital activities and third party liability for harm on Earth
 - Failure to enforce Registration Convention and clearly assign duty for ODR
 - Failure to recognize debris AS debris (abandoned property)
 - Transferability of objects not easy
- Economic – no profit in ODR



An Orbital Debris Removal and Recycling Fund (ODRRF) Scenario



Some Metrics

- SIA estimates total world satellite revenues in 2008 were \$144 billion (of which \$84 billion came from satellite services) representing a 14.2 % annual average increase from 2003-2008;
- Satellite insurance annual premiums paid equal \$850 million;
- The FCC charges satellite operators between \$116,000 and \$400,000 in initial licensing fees, and then \$130,000-\$181,000 **per year** in regulatory fees (depending on the orbit of the satellite). Thus, over the expected 10 year life of a satellite, the FCC collects between \$1.4 million and \$2.2 million in fees to regulate satellites;
- Cost replacing Iridium satellite – between \$30 and \$40 million;
- Iridium revenues currently at \$160 million per year, or roughly \$25 million per satellite over 10 year lifespan.



Some Analogies

- U.S. Universal Service Fund (Wholly Private)
 - \$7 billion collected annually from telecommunications carriers (passed down to end users)
 - Used to fund deployment of telephone service to high cost (rural areas), subsidize the poor, and underwrite the provision of telecommunications services (including broadband) to schools and libraries
 - Administered by the Universal Services Administrative Company (an NGO)
- Super Fund (Public/Private Funding)
 - \$9 billion in funding based on a gas and chemical tax, which ended in 1995; shortfalls paid for out of “general fund”
 - Federal funding insufficient to clean up more than a few sites, 70% of cleanup funds come from “responsible parties”
 - EPA designates sites (currently over 1250)
 - EPA assigns liability (leads to litigation – one estimate is that more is spent on lawyers than on clean up)



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