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The Critical Mass of Orbital Debris

U.S. orbital debris has reached the arrogance that haunts Chernobyl.

"A USSR nuclear catastrophe is not possible." lambasted a KGB Chairman. Yet, like all specter, truth eventually shines. Well, most of it. After all, Kremlin propaganda, like radiation, has a long shelf life. And in this case, the heavy burden of misinformation contributed to the demise of the Soviet Union.

Today, a similar socio-political circumstance exists regarding the United States' response to orbital debris. Multiple Presidential administrations have invoked baby step measures, and Congress has been sold a false sense of security, about controlling the risk of orbital debris. While there has been very little proactive debris removal, the current 'progressive' administration has made no 'progress' toward protecting critical infrastructure satellites that support our \$22 trillion U.S. GDP. Perhaps our economy and security take back seat to covert objectives afoot. Regardless, preemptive actions are required to prevent disaster.

Lessons Learned

Historically, the top four nuclear accidents resulted in the evacuation of 585,000 total people. From Chernobyl we learned three primary lessons:

1. Government deception can neglect safety
2. Reactor design requires quality standards
3. Only trained personnel should operate or test equipment

These circumstances resulted in the 1:23 AM disaster on April 26, 1986, in which an estimated 93,000 souls died and 335,000 were evacuated. Such are the consequences when the political value of people is placed above their spiritual value. Otherwise stated as: profit oversees safety. Leaders who selfishly lose the courage to tell the truth often lead from the standpoint of not benefiting humanity and for Chernobyl, the loss of human, financial, and political impact cannot be undone. However, if we heed the value of lessons, history can be a valuable resource for learning how to avoid future mistakes.

Evidence of Critical Mass

To set the stage regarding orbital debris, evidence shows:

- In 64 years, there have been over 6,500 space missions,¹
- The resulting orbital debris has caused over 400 debris generating events.²
- NASA estimates the orbital debris population at over 100 million objects.³
- 19% of tracked debris inhabits MEO space, where GNSS/GPS backs \$92T Global GDP.⁴
- 17x more space missions are slated for the next 8 years.⁵
- Space Force wants to outsource Active Debris Removal (ADR).⁶
- NASA Office of Inspector General states the agency lacks initiative.⁷

Compared to a nuclear accident, a future orbital debris catastrophe will significantly overshadow all our nuclear accidents combined, because so many benefit from the value that our critical satellite infrastructure brings to bear for national economic prosperity and military advantage. The cascading nature of fragmentation events, which create more debris after each collision is analogous to a nuclear fission reaction, where it grows imperceptibly until critical mass is reached, whereupon it explodes without the chance of control. All because it is unclear who is responsible for ADR.

The Ecosystem of Arrogance

In stereotypical fashion, the American space ecosystem, partially responsible for polluting the common environment of Earth's orbits, has yet to get serious about the problem. Consider the following are examples:

- Previous White House administrations have published policy, directives, and plans to conquer orbital debris. Element 3 of the January 2021 [National Orbital Debris R&D Plan](#), attempts to focus the Department of Commerce, Department of Defense, and NASA upon coordination and development of ADR to increase efficiency and prioritize efforts from industry, academia, and international partners. Meanwhile, the DoC struggles with Congressional budgeting for managing civilian debris tracking, data collection, and possible collision notifications, while Space Force wants to get on with their mission of managing the battlespace to conduct global space operations. Associated USSF funding should be relinquished to the DoC to enable management of the OADR catalog.
- The 1978 NASA paper "Collision Frequency of Artificial Satellites: The Creation of a Debris Belt" spawned the Orbital Debris Program Office (ODPO) to characterize the space environment and to develop policy, safety guidelines, and best practices, although it does not financially support implementation of ADR technology. The Office of Inspector General has criticized the agency for lack of achievement in the January 2021 [OIG Audit](#), citing lack of initiative and urgency to develop or acquire ADR technology per SPD-3.
- For decades industry scientists, public servants, and concerned citizens have trudged up the steps of Capitol Hill to pour knowledge and reason into woefully interested members of committees and sub-committees to elicit resources to battle the imminent doom. To no avail. The DoD, NASA, and NOAA recently spent [\\$6 billion to improve space situational awareness](#) and on the outflow of a recent AMOS Conference attendees are pushing for yet more funding to improve debris sensors.
- The Department of Homeland Security established the Communications Sector Coordinating Council in 2005 to be responsible for protecting the communications critical infrastructure through a partnership structure framed in the National Infrastructure Protection Plan. Not until May 2021 did CISA launch the [Space Systems Critical Infrastructure Working Group](#) (SSCIWG), whose membership represents government and industry organizations including leading-edge satellite and space asset firms. Their goal to improve security and resiliency of commercial systems remains in question until definition of the group charter. Therefore, identification of critical satellites, risk assessment reports, and orbital debris remediation practices is a distant hallucination.
- The global satellite industry shares 74% of the space economy for satellite services and ground equipment with FY2020 revenues⁸ of \$270 billion. As a byproduct of corporate profitability, minimizing operational costs by avoiding the overhead of ADR is blindingly apparent. From a

critical infrastructure standpoint however, the national security and economic prosperity of our nation is at risk when integrating orbital debris into the equation. Government councils and working groups are likely not precipitating sufficient momentum from its membership due to the predominant preoccupation with profit. It's easier to justify ignoring the existing problem by placing new maneuverable satellites into orbits to avoid the orbital debris risks, which will only exacerbate the problem over time.

- There must be another reason the U.S. is not acting. Outsourcing ADR to foreign nations is a horrible option regarding our critical satellite infrastructure. Perhaps a clandestine 2011 decision in the subterranean WH bowling alley under the North Portico driveway reasoned that the \$22 trillion U.S. GDP economy needed a deterrent to decelerate national prosperity and military advantage. Are there 3-letter agencies complicit with a future cyber pandemic?

When will this madness end?

Critical Path

Outside the United States, space-faring nations have studied and characterized the space environment in sufficient detail to advance ADR development in Japan and Europe, while we disparage a majority of the 15,000 daily conjunction messages and ignore the tragedy of the orbital commons as America's hubris endeavors in a great race to the moon and Mars. Perhaps they understand the economic value of 7 billion mobile phone users or 38,000 bank transactions occurring every second.

Who is accountable for leading STM and ADR? To date, a loosely defined framework around STM has produced policy, space situational awareness, orbital debris mitigation, and has so far, overlooked ADR. From a program management perspective, waiting to develop ADR as a serial task to STM is widely known to drive costs higher, due to the time value of money. The time-sensitive requirements of ADR demands overlapping the execution order so that multiple tasks are completed in parallel, saving money and time.

Commercial satellite, service, and ground equipment providers, at this stage of the game, should be able to elicit a one-dollar monthly customer surcharge for ADR services. Space Force, NASA, and National Science Foundation have found technical feasibility in OrbitGuardians' Affordable ADR Service solution and mission ConOps for our savvy flight test. However, at half the cost of competitor solutions, our proposals have been met with an arrogant "funding is unavailable".

It's time to safeguard our critical orbital infrastructure!

Reminiscent of the JFK moonshot speech, ADR requires delivery of a deep-rooted strategic framework capable of sharing principles that transcended individual strategies and emphasize true generational change. It must have a governance structure that enables distributed groups of stakeholders across the government, private industry, academia, and civil society to focus our collective energies and activities toward this defined national objective. Strategically championed and publicly declared through a historically significant State of the Union address or to a joint session of Congress could emphasize a high level of national prioritization. The time is now, before our Chernobyl-like arrogance decimates global economies.

¹ [CelesTrak Pass Visualization \(BETA\) total objects minus \(debris + R/B\)](#)

² [NASA History of Orbital Fragmentations \(pdf\) Download \(wsimg.com\)](#)

³ [ARES | Orbital Debris Program Office \(nasa.gov\)](#)

⁴ [CelesTrak Pass Visualization \(BETA\)](#)

⁵ [107,000 Planned Satellites by 2029 - YouTube](#)

⁶ [U.S. Space Force would support commercial services to remove orbital debris - SpaceNews](#)

⁷ [Final Report - IG-21-011 - NASA's Efforts to Mitigate the Risks Posed by Orbital Debris](#)

⁸ [Bryce Tech 2021 Report](#)