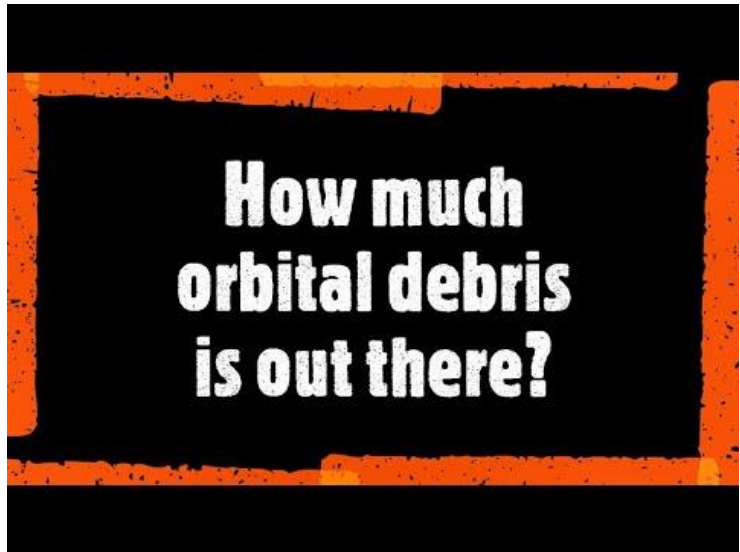


Active Debris Removal funding: the elephant in the room

For over 60 years the United States has achieved our national defense capabilities and economic growth partly through our extraordinary focus of conquering the high-ground - space. For over 40 years we have postulated, studied, characterized, communicated, and slowly established policies, guidelines, and best practices to optimistically control the growth of orbital debris. The orbital debris population has grown significantly during these early years, as shown in Video 1. Most of the federal agencies have expressed interest in Active Debris Removal (ADR) to preserve and enhance our national space interests. However, this interest has not resulted in federal RDT&E funding being made available for ADR, which is unfortunate for the financial prognosticators who have forecasted a FY2040 space economy of \$3T. After all, investors abhor risk and orbital debris is the ticking time-bomb of risk.



Video 1 - Orbital Debris Environment Population

Our national space administration, who birthed the Kessler Syndrome, has touted the high-risk nature of orbital debris for decades. Sadly, they have merely helped characterize the environment and not moved toward solving the active debris removal problem, which opposes federal law codified in [51 U.S. Code § 31501 Orbital debris](#) (2010) stating that “the (NASA) administrator, in conjunction with the heads of other federal agencies, shall take steps to develop or acquire technologies that will enable the Administration to decrease the risks associated with orbital debris.”

The U.S. Department of Defense has been concerned about replenishing missile warning systems, protecting communications, navigation, and weather satellites, but they do this whilst keeping an eye on orbital debris. In 2014, two GSSAP satellites were launched to achieve a space-based situational awareness capability. In 2016, retired U.S. Navy Admiral Cecil Haney told the National Defense University Press that in the prior year there were more than 1.2 million collision warnings sent to satellite operators which resulted in 148 collision avoidance maneuvers, including 4 by the International Space Station. In an effort to move from space situational awareness to enhanced battlespace awareness, from FY2015 to FY2020, the U.S. DoD spent \$6B to repurpose existing multi-mission sensors, built new sensors to enhance data collection, data processing, and operational systems, including Space Fence and DARPA Hallmark decision-making tools. In 2019, U.S. Air Force General John Hyten advocated to the Senate Armed Services committee how the development of norms and behaviors in space should start with debris, because it would limit future generations from accessing space. He also noted that it will become very difficult to launch, place, and operate a satellite without costly maneuvers to avoid debris. With these projects developed and transitioned to operational status,

the space community at large has been eagerly awaiting data availability to leverage the data into commercial space situational awareness and space traffic management systems, which may come to fruition now that the NAPA report has affirmed the Department of Commerce as the lead STM agency. In 2020, NASA Administrator Jim Bridenstine tweeted that “The @Space_Station has maneuvered 3 times in 2020 to avoid debris. In the last two weeks, there have been 3 high concern potential conjunctions. Debris is getting worse!”

The key word in ‘active debris removal’ is active, which certainly opposes our current state of ‘paralysis by analysis’ and suggests an opportunity to lubricate the wheels of innovation. All we must do is push the elephant out of the room. Humanity has produced sufficient studies, policies, best practices, guidelines, theatrical movies, and a plethora of articles warning us about the risk of orbital debris collisions. We have the inclination to enable us to take the first steps of vigorously focusing our aim on the problem at hand. Safeguarding our prosperous future should be our 20-year goal, of which ADR should be our 3-year goal.

At OrbitGuardians, we have defined an affordable active debris removal technology to support the ‘pursuit of active debris removal’ as defined in SPD-3. This includes the bus, payload, sensor, momentum transfer mechanism, and mission plan to test the feasibility of a low-risk solution, which deorbits multiple objects per launch. Our technology reduces the cost of deorbiting resident space objects from millions to thousands of dollars each, once at full scale operation. As such, after submitting our pitch decks and proposals, our leadership team has concluded that the federal resources responsible for moving forward the policy and guidelines from the White House has not trickled down to those accountable for availing the RDT&E funds or there exists a barrier preventing such funding. This lack of initiative is an eye-opener, not to mention that it would have made sense from a program management perspective for the DoD and NASA to develop ADR technologies parallel to SSA to reduce the development schedule.

The defense industry has recently suggested solutions to reduce risks to military space assets. One suggestion gaining traction is to leverage commercial space assets to reduce the burden, thereby blurring the lines of orbital debris responsibility even more. Given the above, and that DoD/NASA lifted most of our orbital assets into space, it is logical that NASA, in cooperation with DoD, initiate specific research topics geared toward the development of ADR technologies. The purpose of specific topics is to breakdown the typically expensive spacecraft development costs, so they will fit into typical SBIR budgets. Proposal solicitation topics should, at a minimum, include requirements definition, design, development, test, deployment, and evaluation for the following components: SSA system interface; target object(s) prioritization and mission planning; spacecraft bus; spacecraft sensors; spacecraft debris deorbit mechanisms; ground segment operations, spacecraft system integration; customer engagement; international agency partnerships; launch vehicle integration; flight operations; test and evaluation; and ultimately fleet implementation. In addition, the Department of Commerce / Office of Space Commerce should provide oversight to ensure SBIR funding is available from congress and that the Government Accounting Office is tracking schedule and funding budgets.

Humanity has reasoned our future orbital debris catastrophe. Orbital collisions are already happening. The time to act is now. The time to safeguard our future prosperity is now.