



# IDA Forum on Orbital Debris Risks and Challenges

**During two half-day sessions on October 8 and 9, 2020, IDA hosted the virtual forum “Orbital Debris Risks and Challenges.” The goal of the forum was to highlight and share IDA’s expertise across different dimensions of orbital debris, from orbital debris detection and satellite risk assessment to U.S. policy underpinning the licensing regime for satellites. The forum was also an opportunity for a group of researchers from across two of IDA’s Federally Funded Research and Development Centers to solicit both military and civilian perspectives in offering a whole-of-government voice to orbital debris issues.**

Donald Kessler, retired Senior Scientist for Orbital Debris Research at National Aeronautics and Space Administration (NASA), delivered a keynote address each day. He spoke on the history of space debris programs, particularly within NASA and the Department of Defense (DoD), and outlined the implications for military assets of future sources of orbital debris. The Kessler effect, named after the keynote speaker, is a condition of orbital debris population self-sustainment and growth due to mutual collisions in space.

Government experts who sponsor IDA research and attended the forum include Director of Operational Test and Evaluation Robert Behler and two of his deputies, Ray O’Toole and Mitch Crosswait. Another IDA sponsor, Mike Squire of NASA’s Engineering and Safety Center also attended. Attendees from other defense organizations included representatives of Space Command, Defense Intelligence Agency, Air Force Research Laboratory, Naval Research Laboratory, Air Force Institute of Technology, National Reconnaissance Office, Defense Innovation Unit, and the National Air and Space Intelligence Center. On the civilian side, representatives from NASA, Department of Commerce, Federal Aviation Administration, and Federal Communication Commission (FCC) also attended.

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Several IDA researchers from IDA's Systems and Analyses Center presented on technical aspects of their research on orbital debris issues. Joel Williamsen gave a talk on "Evaluating Spacecraft Risk from Debris Impacts—Twenty Years of IDA Support," highlighting the challenges of assessing orbital debris impact risk. He also discussed "Characterizing the Orbital Debris Environment Using Satellite Movement Data," the 2020 winner of IDA's Welch Award for best external publication. Daniel Pechkis discussed surveillance and technical challenges of maintaining the space object catalog in "Introduction into the U.S. Space Surveillance Network and Space Catalog Maintenance." Jason Sheldon presented "Orbital Position in Space: What Is 'Truth'?" on challenges of quantifying the uncertainties in orbital debris determination. Jim Heagy discussed antisatellite (ASAT) testing and the implications for the debris environment in "ASAT Considerations."

Policy-focused talks from members of IDA's Science and Technology Policy Institute were also featured. Asha Balakrishnan gave two talks, one was related to research and development (R&D), "Orbital Debris R&D Challenges and Opportunities," and the other was on domestic and international policies, "U.S. Policies Relevant to Orbital Debris." Thomas Colvin discussed a set of new regulatory reforms related to orbital debris by the FCC in his talk "FCC Oversight over Orbital Debris."

Following each half-day session, IDA researcher Stephen Ouellette moderated a question-and-answer panel on the topics presented that day. Themes that emerged from these discussions covered a range of topics:

- A whole-of-government approach to addressing orbital debris risks is key to improving the space environment.
- More engagement is needed between the DoD, NASA, and other relevant agencies across all topics related to space debris, from research and development to testing and demonstrations.
- DoD capabilities should be developed with protection from the debris environment and sustainability in mind.
- It will be important to determine the extent to which the Kessler Effect could become critical to the ability to maintain a military presence in space at certain altitudes.
- Opinions differed on what type of debris poses the greatest risk—large debris, lethal untrackable debris, or a mix of both.
- More research is needed to characterize the debris environment. In particular the amount of debris between 1–5 millimeters in size, particularly in low Earth orbit, is not well understood.
- The effects of the sudden growth of satellite "mega-constellations" on orbital debris (and vice-versa) are not understood or included in planning.
- Computational advances, investment in the workforce, and new sources of data are also needed.
- Coordinated U.S. orbital debris policies are needed, but what the best approaches are, how policies can be enforced, and who the principal agencies should be are less clear.



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and Analyses. All are members of IDA's Space Working Group and the primary planners of the Orbital Debris Risks and Challenges forum.

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