



SPACE DEBRIS: A LAW AND ECONOMICS ANALYSIS

The dawn of the space age began in 1957 with the launch of Sputnik 1, and ever since, debris from man-made objects launched into space has increased at a significant rate. This debris creates difficulties similar to those typically associated with goods and resources that are available for use by anyone at any time, known as public goods or common pool resources. Orbits have become cluttered as those launching objects into space have little incentive to mitigate or remove debris.

A new paper for the Mercatus Center at George Mason University conducts an economically rigorous analysis of the problems posed by space debris and concludes that the problem is significantly more legally, institutionally, and economically complicated than some may believe.

Past studies of space debris have too quickly assumed that the space debris problem resembles the tragedy of the commons and concluded that public sector action is therefore justifiable. While a public policy response is reasonable, including a role for the public sector better specify the “rules of the game,” previous academic analyses have been too hasty and casual in arriving at their conclusions. In order to find a solution, policymakers must pay attention to the economics and institutional factors involved in the space debris problem.

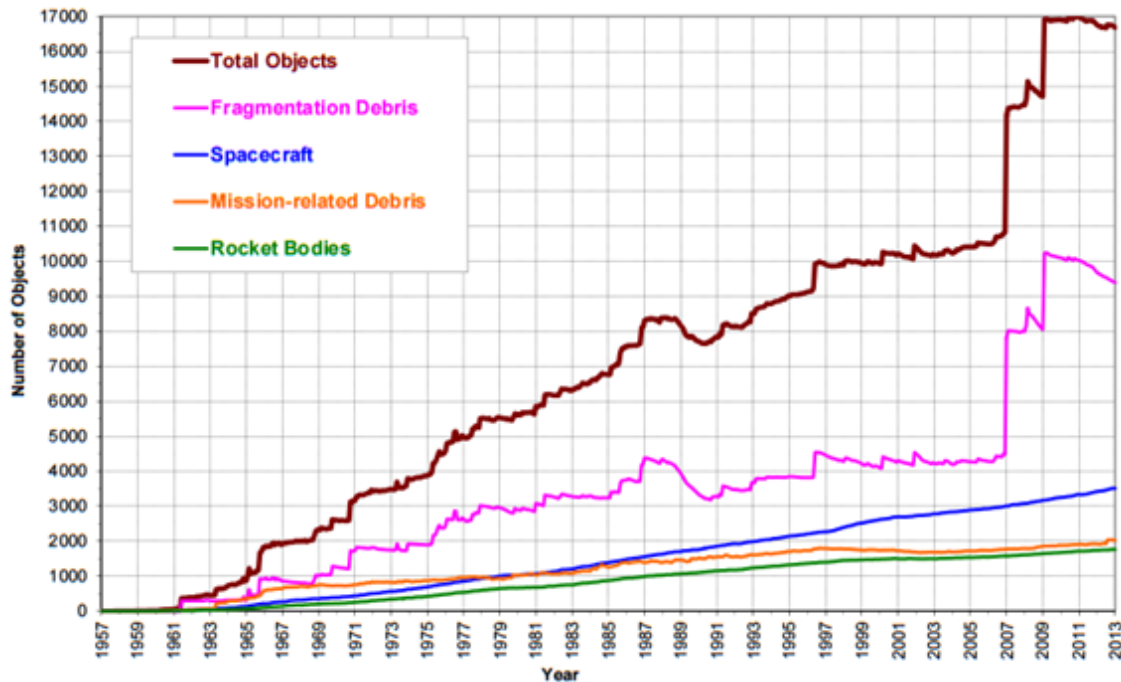
To read the paper in its entirety and learn more about its author, [Alexander Salter](#), see “[Space Debris: A Law and Economics Analysis](#).”

BACKGROUND

Today, there are more than 21,000 known pieces of large space debris, an estimated 500,000 pieces of medium-sized debris, and more than 100 million pieces of small debris. The large debris is tracked with sufficient accuracy to maneuver around it, and the small debris is small enough for a spacecraft to withstand impact. It is the medium-sized debris (between 1 cm and 10 cm) that poses a great risk to the future of outer space commerce.

The amount of debris in space has increased significantly over time, often from accidental collisions but also from the intentional destruction of satellites. See the figure on the next page for more information on the rise of various types of space debris.

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Three countries are responsible for a large percentage of the debris: China (42 percent), the United States (27.5 percent), and Russia (25.5 percent). Current efforts to mitigate space debris are under the purview of each nation’s space agencies and other administrative bodies, which issue their own guidelines and regulations to public and private organizations. To date, there is little international cooperation to mitigate or remove space debris, and some treaties signed by spacefaring nations may even prohibit any one nation or party from removing debris created by another.

KEY FINDINGS

Current policy debates usually assume that space debris must be reduced without giving serious consideration to economic efficiency or international legal considerations. This creates a gap in knowledge by failing to address the specific problems that must be solved involving incentives, property rights, and international law.

- *Outer space resembles a common pool resource.* The space debris problem has much in common with textbook common pool resource problems and public goods problems. No single entity controls the resource that is outer space and therefore, no one has an incentive to take care of it at the current time.
- *Defining private property rights is likely not feasible.* Defining and enforcing private property rights, which is a standard solution to this sort of problem, is probably not feasible because defining property rights in outer space would be significantly more costly than it is worth.
- *As more debris is created, the use of outer space becomes more challenging.* The Kessler syndrome describes the potential for debris to collide and snowball, cluttering the orbit to

the point of rendering its use extremely difficult and costly. If the problem progresses to this degree, the costs of dealing with space debris in the future will be high. The more cluttered orbital access and specific orbits become, the higher the costs the private sector must incur to protect against damage. And as collisions become more likely, insurance will be less effective.

- *Other solutions, such as taxes, have their own significant issues.* One proposed solution is to impose taxes on those that launch objects into space, which could force them to take into account the costs they impose on others. These taxes are intended to offset externalities by allocating resources more efficiently, but regulators would have difficulty setting the optimal tax rate, and it is unclear how governments would use taxes to solve the problem.
- *New international legal framework.* Solving the space debris problem by reducing debris must involve a clearer international legal framework that explicates the “rules of the game” for launches that create debris. This will necessarily involve bargains among nation-state actors that, unfortunately, have incentives to bargain strategically in their own interest.

CONCLUSION

Space debris is a serious problem that threatens the viability of outer space commerce, a growing industry that could potentially create enough wealth to raise standards of living. There needs to be a better international legal framework to deal with the mitigation and removal of space debris, or else outer space commerce may become significantly more challenging and expensive.