



Orbital dumpster diving and international law

WRESTLING WITH THE TRAGEDY OF THE CELESTIAL COMMONS

It's a pretty exciting time for the commercial space industry. SpaceX and Blue Origin are competing to offer the best space transport services. Planetary Resources and Deep Space Industries are racing to mine asteroids for rare and valuable minerals. And the potential for space tourism — orbital and suborbital flights for ordinary, if wealthy, people — looks bright with companies like Virgin Galactic on the job.

But while the future is promising for creative commercial entities looking to blaze the final frontier, existing space companies — particularly those with a focus on aerospace and communications — have more mundane concerns. Operating communications satellites isn't as romantic as mining asteroids. But it's essential for the use of technologies we utilize and take for granted every day. It increasingly looks like the growing problem of space debris will threaten these operations.

Orbital paths around the Earth, and especially low Earth orbit, are becoming increasingly crowded with space debris. NASA defines space debris as "all man-made objects in orbit about the Earth that serve no useful purpose."

There are about 300,000 known pieces of space debris in orbit that can destroy a communications satellite upon collision. Loss of key satellites can cause a wide range of problems, such as impeding global positioning systems, causing financial sector turbulence, and inhibiting military operations. Space debris is

currently not a huge threat, but without mitigation, it could very well be in the not-too-distant future.

The problem of space debris is a textbook example of what economists call the "tragedy of the commons." Organizations, both private and public, that launch things into space don't care very much about what they leave up there. Nobody owns orbital space around the Earth, meaning nobody has the right to exclude others from accessing orbit or using an orbital trajectory once it's been reached. As economists are fond of saying, "That which nobody owns, nobody cares for." Organizations that create debris currently face little cost to cluttering up valuable orbits, and so they don't try very hard to mitigate debris. But when everyone thinks that way, orbital space comes to be treated like a celestial dumpster. Although it's in nobody's interest to mitigate debris, everyone failing to mitigate debris makes everyone worse off.

The ordinary solution to these kinds of problems is to create property rights. But in this case, property rights would be incredibly costly to define and enforce. How exactly do you create a property right to a particular orbital trajectory? Another solution economists sometimes propose, special taxes on polluting behavior, is also problematic. We don't know the tax rate that would discourage space clutter without creating excess efficiency losses in the private sector.

The situation gets more complicated >

The 1967 Outer Space Treaty says that nations retain jurisdiction over objects they put in space. This includes space debris.

< > once we realize that space debris is really an international problem. The three biggest space polluters are the United States, Russia, and China. Making progress on the space debris problem will probably require international cooperation, among these nations, rather than unilateral action. But even if one nation wanted to act unilaterally, their ability to do so under current international law is limited. The 1967 Outer Space Treaty says that nations retain jurisdiction over objects they put in space. This includes space debris. It turns out that China might object to the U.S. removing China's space junk, because that 'junk' is frequently valuable scrap metal that is already in orbit. The most costly part of space commerce is almost always launch, because it takes lots and lots of energy to escape Earth's gravity. Material already in orbit is material that does not have additional launch costs, and can be used, for example, for in situ manufacturing and repairs.

Given these constraints, how should the space debris problem be addressed? Although securing consent may be difficult, the best avenue will probably be changing international law through treaty amendment, to address specifically the space debris problem. Coming to a common definition of what space debris is, and then making explicit that nations do not have the right to claim non-interference with their debris, would be a good start. In the meantime, at the national level,

some amount of unilateral action is probably unavoidable. Here in particular, market mechanisms have a role to play. Governments can offer to pay private companies to remove or destroy debris, once the technology to do so is better developed. But this is not the only option. Remember that space debris is frequently valuable because it is already in orbit, and can potentially be used

for manufacturing and repairs. Thus governments could also auction off the right to specific pieces of space debris. If these debris pieces are truly valuable, private companies should be willing to bid something to claim them, and perhaps move them temporarily to a less cluttered orbit until they can be used.

Right now, nobody can propose a definitive plan for debris mitigation and removal. Crucial technology is still in development, and the legal framework needs to be clarified.

But understanding the law and economics of the situation, which is necessary to ascertain the costs and benefits of eventual proposals, is a crucial first step. **SN**

ALEXANDER SALTER IS AN ASSISTANT PROFESSOR OF ECONOMICS IN THE RAWLS COLLEGE OF BUSINESS AT TEXAS TECH UNIVERSITY. THIS PIECE IS BASED ON HIS SCHOLARLY PAPER, "SPACE DEBRIS: A LAW AND ECONOMICS ANALYSIS OF THE ORBITAL COMMONS," RECENTLY PUBLISHED IN THE STANFORD TECHNOLOGY LAW REVIEW.

In 1979, ABC's made-for-TV movie (and short-lived series) *Salvage-1* starred Andy Griffith as a junkyard owner who builds his own spaceship to fly to the moon to salvage equipment NASA abandoned there.

