

Debris or not debris

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Abstract

With the launch of Sputnik 1 on October 4, 1957, humanity launched the first artificial object into space. Or rather: the first two, because the central stage of the R-7 launcher also ended up in orbit for almost two months. It would turn out to be the prelude to an indispensable role for space travel in our society, with a more than considerable number of objects in space: according to the Space Debris Office of the European Space Agency (ESA), at the time of writing there are approximately 30,000 detectable objects in orbit. This includes active satellites, satellites no longer operational, burnt-out rocket stages, fragments from explosions and collisions, etc. Add to that about 900,000 non-visible objects (less than 10 cm, too small to be observed from Earth), and it is clear that the immediate vicinity of Earth is far from empty. This also means that the chance of collisions between random objects is by no means negligible. And, because these objects have velocities of up to 28,000 km/h and are often uncontrolled, any collision is in principle fatal.

Virtually all space specialists therefore agree that action must be taken. This could include actively removing inactive satellites and rocket stages from their orbits, partly to counter the so-called Kessler syndrome. Even though there are many small debris particles in space with possible collisions as a result, if two large objects collide, this will lead to an explosive further growth of the space debris. The Kessler syndrome is the scenario where the density of objects in low Earth orbit is so high that collisions between objects can cause a chain reaction with each collision producing space debris that increases the likelihood of further collisions. However, it is not just removing these large objects from space that will solve the problem. Developing new detection techniques, increasing the accuracy of trajectory predictions, and developing better protection against the impact of small debris particles must also receive attention in the near future. Finally, if space debris does eventually end up in the atmosphere, it is crucial to know where on Earth this debris crashes. With the increase in space debris returning, these predictions also become increasingly important.

Short Bio

Erwin Mooij received his MSc and PhD degree in Aerospace Engineering in 1991 and 1998, respectively, from Delft University of Technology, The Netherlands. From 1995 until mid 2007, he worked for Airbus Defence and Space, The Netherlands, on re-entry systems and (real-time) simulator development. Currently, he is an Associate Professor in the Faculty of Aerospace Engineering, Delft University of Technology. His research interests include launch and re-entry systems, trajectory optimisation, space-situational awareness, and guidance and control system design. He is an Associate Fellow of AIAA, and a member of the AIAA GNC Technical Committee.