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## A LOW-COST WAY TO REDUCE SPACE JUNK



### The passive system rapidly clears debris in orbit around the Earth

**Spotted:** The total mass of all space objects in Earth's orbit is more than 11,000 tonnes, and the European Space Agency (ESA) expects the number of debris objects in space to rise "steadily" in coming years. Now, a multi-disciplinary team of students from Brown University has designed a low-cost, low-tech deorbiting system to help reduce the amount of debris in space.

The bread-loaf-sized, cube-shaped satellite was built as part of the Design of Space Systems course taught by Adjunct Associate Professor of Engineering Rick Fleeter in Spring 2021. Costing around \$10,000 (around €9,300) to build, the satellite SBUDNIC includes a Kapton polyimide drag sail. Kapton polyimide is often used in spacecraft insulation, and the sail opens like an umbrella when the satellite reaches its point of orbit.

The goal of the project was to demonstrate ways to reduce space debris without relying on expensive and complicated machines and without the need for propulsion. The proof-of-concept satellite was built with materials found in most hardware stores, and it reached orbit via a SpaceX rocket launch in May 2022.

After deployment of the sail, SBUDNIC began a descent much more rapid than other satellites launched at the same time. Early in August 2023, after around 445 days in orbit, SBUDNIC burned up upon reentry into Earth's atmosphere, approximately five years earlier than expected. If implemented more widely, the SBUDNIC system could help to ensure the quicker de-orbiting of disused satellites and prevent the junk from colliding with other active satellites in space. Professor Fleeter continues to work with students on passive debris control projects along with members of the SBUDNIC team.

spotting more satellite-based innovations, with the archive including other projects for the junk and new methods of monitoring ecosystem restoration through satellite imagery.

Written By: Keely Khoury

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Email: [Rick\\_Fleeter@brown.edu](mailto:Rick_Fleeter@brown.edu)

Website: [brown.edu](http://brown.edu)

Contact: [brown.edu/about/contact-us](http://brown.edu/about/contact-us)

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## Takeaway:

NASA considers debris mitigation “a high priority” for the agency and its international partners. In 2022, the USA’s Federal Communications Commission (FCC) set a five-year limit for the removal of unused items in Low Earth Orbit (LEO), and ideally, “as soon as practicable.” Considering that most satellites remain in orbit for up to 25 years after their launch, installing drag sails like the one used on SBUDNIC could have an immediate impact on the volume of space debris. The project showcased an affordable, easy-to-build and install means of rapidly removing spacecrafts from LEO, leaving more funding for use on the satellites themselves.