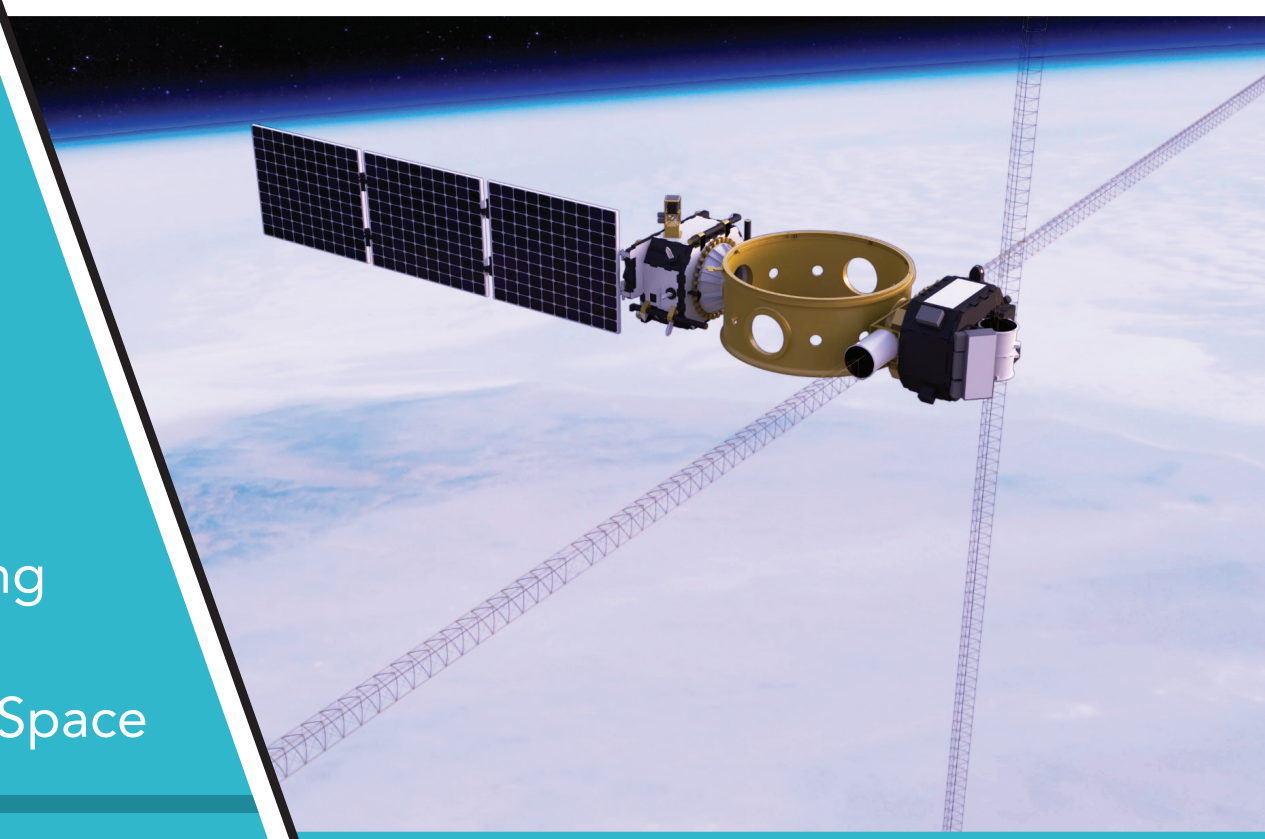
National Aeronautics and Space Administration

SET

Space Environment Testbeds



Supporting Satellite Safety in Space

Space Environment Testbeds, or SET, studies how to protect satellites in space. SET characterizes space radiation and how it affects spacecraft and their instruments. This information can help improve spacecraft design, engineering, and operations in order to protect spacecraft from harmful radiation. Protecting spacecraft is a key part of NASA's mission as the agency sends both crewed and robotic missions to explore the Moon, Mars and beyond.

www.nasa.gov

Did You Know?

- Space isn't empty. It's teeming with radiation from the Sun and deep space.
- Earth's magnetic field traps radiation in two doughnut-shaped belts around our home planet. Some particles there move close to the speed of light.
- SET is slightly bigger than a briefcase, while its space weather monitor is roughly the size of a brick.

SET's Science

Energetic particles in space can cause computer upsets in spacecraft, memory or circuit damage, and hardware degradation over time. Ultimately, SET aims to understand these effects in order to reduce future spacecraft anomalies and failures.

SET will fly through medium Earth orbit, a region of space some 1,200 to 22,000 miles above sea level. There lies the gap between Earth's two doughnut-shaped belts of intense radiation, known as the Van Allen belts. This relatively unexplored region, also called the slot region, is thought to have less radiation than other parts of near-Earth space — although it is variable — and holds promise as a home for navigation and communication satellites.

The main sources of energetic particles with which spacecraft designers are concerned are protons and electrons trapped in the Van Allen belts; galactic cosmic ray protons and heavy ions; and protons and heavy ions energized by solar eruptions, such as solar flares or coronal mass ejections.

SET's Experiments

SET is equipped with a space weather monitor and three circuit board experiments — each about the size of a postcard — to characterize how our space environment impacts spacecraft and their instruments.

COTS-2
Commercial Off the Shelf

Techniques of Informatics and Microelectronics for integrated systems Architecture, France

COTS-2 collects information on single event effects — that is, what happens when an ion that's been accelerated by a solar eruption or from a galactic cosmic ray pierces onboard electronics — and how to mitigate them, especially in specialized computer chips. Understanding these events is important because they can damage memory, add noise to data, and even cause system crashes.

ELDRS
Enhanced Low Dose Rate Sensitivity

Arizona State University

ELDRS studies something called the ELDRS effect: the intensified damage that electronics face when they're exposed to space radiation over time — as opposed to the lesser damage they would experience were they exposed to the same total radiation dose all at once. Information from this experiment will help develop improved test methods on Earth to make electronics space-ready.

CREDANCE
Cosmic Radiation Environment Dosimetry and Charging Experiment

Surrey Space Center, England

CREDANCE is SET's space weather monitor, which surveys cosmic rays and particles in the radiation belts zipping through space. These are the high-energy fragments of atoms from the Sun and outer space that can pierce through the walls of spacecraft, damaging electronics.

DIME
Dosimetry Intercomparison and Miniaturization Experiment

Clemson University, South Carolina

DIME consists of two separate circuit boards that together demonstrate six different ways to measure space radiation using affordable, commercially available parts. The experiment can help future missions decide the best way to monitor radiation for their spacecraft, as well as test computer models that determine the effects of radiation on electronics.

SET Quick Facts

- SET is an experiment aboard the Demonstration and Science Experiments, or DSX, spacecraft being launched by the U.S. Air Force.
- DSX is scheduled to launch aboard a SpaceX Falcon Heavy rocket in June 2019.
- DSX flies in an elliptical medium Earth orbit, inclined at 42 degrees, going at its farthest to 12,000 miles above Earth's surface.

For more information, please visit:

- *www.nasa.gov/set*

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