AEROSPACE

RAPID PROTOTYPING

Aerospace is exploring a wide range of uses for additive manufacturing, both for use in space and for production on orbit.

The accelerated pace of space development has created demand for continuous upgrades of on-orbit technologies to stay ahead of emerging threats. Large constellations of smaller satellites, shorter satellite lifespans, and more frequent launch intervals provide both an opportunity and an obligation for enabling greater resilience of space assets. By evaluating and testing emerging technology as it is developed, advancements can be made in realtime rather than having to adhere to traditional constellation refresh schedules.

xLab's Small Satellite Program

Rapid prototyping capabilities are essential to providing alternative solutions in a timely manner. To address this need, The Aerospace Corporation has established the Experiments Lab (xLab) to coalesce our vast rapid prototyping capabilities for architecting, developing, and delivering advanced prototypes at speed. Aerospace has also developed, flown, and maintained a fleet of CubeSats, or "AeroCubes," for over two decades. We leverage this small satellite expertise, when necessary, to facilitate rapid technology insertion and transport for prototypes.

Our small-scale experimentation and testing capabilities have generated insights into artificial intelligence, additive manufacturing, data science, IR focal planes, nano-technology, CubeSat propulsion, photonics, digital twins, compressive sensing, chip-scale atomic clocks, hyperspectral sensors, and autonomous systems. By partnering with our customers for both the development and integration of experimental technologies, the results can have extensive effects on new architecture designs and capabilities for next-generation space systems.

The Aerospace xLab:

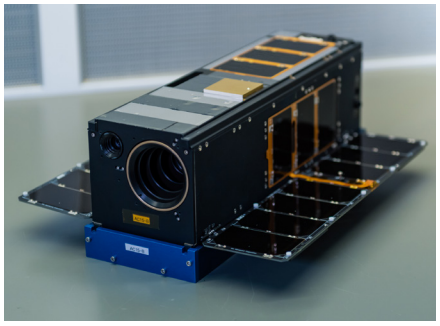
- Builds and operates advanced prototypes for the national space enterprise
- Partners with customers to prototype solutions to complex problems
- Leverages state-of-the-art hardware fabrication technologies
- Develops advanced electronics with embedded software for realtime systems
- Advances system autonomy with AI and machine learning techniques adapted for space systems
- Develops technology transition strategies
- Performs mission operations of on-orbit prototypes

Recent Prototypes

ROGUE ALPHA/BETA CUBESATS

Threats facing orbiting satellites are proliferating, and the ability to field an agile response and quickly restore lost functionality is a critical capability. The Rogue CubeSats, also known as AeroCube-15, are a pair of identical 3-unit (AKA 3U) CubeSats launched from the International Space Station on Nov. 2, 2019.

The CubeSats were developed to investigate rapid reconstitution of an infrared remote sensing capability to ensure mission capabilities if on-orbit satellites are compromised. The Rogue Alpha/Beta CubeSats have demonstrated how a small satellite can deliver large amounts of remote sensing data.

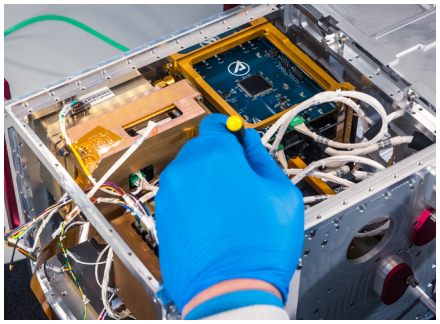


The Rogue satellite in the lab prelaunch.

SLINGSHOT

Slingshot 1 is a 12U CubeSat launched by Aerospace in July 2022. Hosting 19 payloads requiring on-orbit testing for evolution and maturity, Slingshot 1 carries a myriad of autonomous technologies, robotics, novel propulsion, onboard processing, and communications systems.

Slingshot leverages the potential of open standards and nonproprietary interfaces to simplify and expedite payload development and integration. The mission's modular architecture and autonomous technologies are a precursor to a new era of increased space system agility, resilience, and extended lifespans.

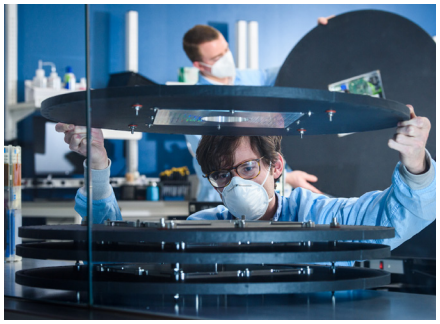


The Slingshot assembly.

DISKSAT

DiskSat is an alternate approach to satellite containerization, providing the benefits—standardized launch interface, low launch costs, and simple mechanical design—with large aperture, surface areas that can be dedicated to large antennas or instruments that need exposure to space, and high power.

The plate-shaped DiskSat satellite measures 1 m in diameter and 2.5 cm thick. For launch, several DiskSats can be stacked to fit within a launch vehicle's fairing and deployed one at a time after the launch vehicle reaches orbit—an ideal approach to building large constellations of small spacecraft, allowing 20 or more satellites to be containerized in a single small launch vehicle.



The plate-shaped DiskSat satellite measures 1 m in diameter and 2.5 cm thick and can accommodate the volume of a 20U CubeSat.

The Future of the Space Enterprise

The requirements for national security space create distinct challenges that necessitate well-defined, innovative solutions. Applying systems engineering principles across the space enterprise, Aerospace employs advanced information technology, new approaches for disruptive space technologies, and novel acquisition strategies to achieve broader mission effectiveness and efficiency. Rapid prototyping serves this need by enabling faster technology insertion to maintain leading-edge capabilities in space.

Learn more about xLab and take a virtual tour of the facility at aerospace.org/aerospace-virtual-tours.

The Aerospace Corporation

The Aerospace Corporation is a national nonprofit corporation that operates a federally funded research and development center and has more than 4,500 employees. With major locations in El Segundo, California; Albuquerque, New Mexico; Colorado Springs, Colorado; and the Washington, D.C. region, Aerospace addresses complex problems across the space enterprise and other areas of national and international significance through agility, innovation, and objective technical leadership. For more information, visit www.aerospace.org.