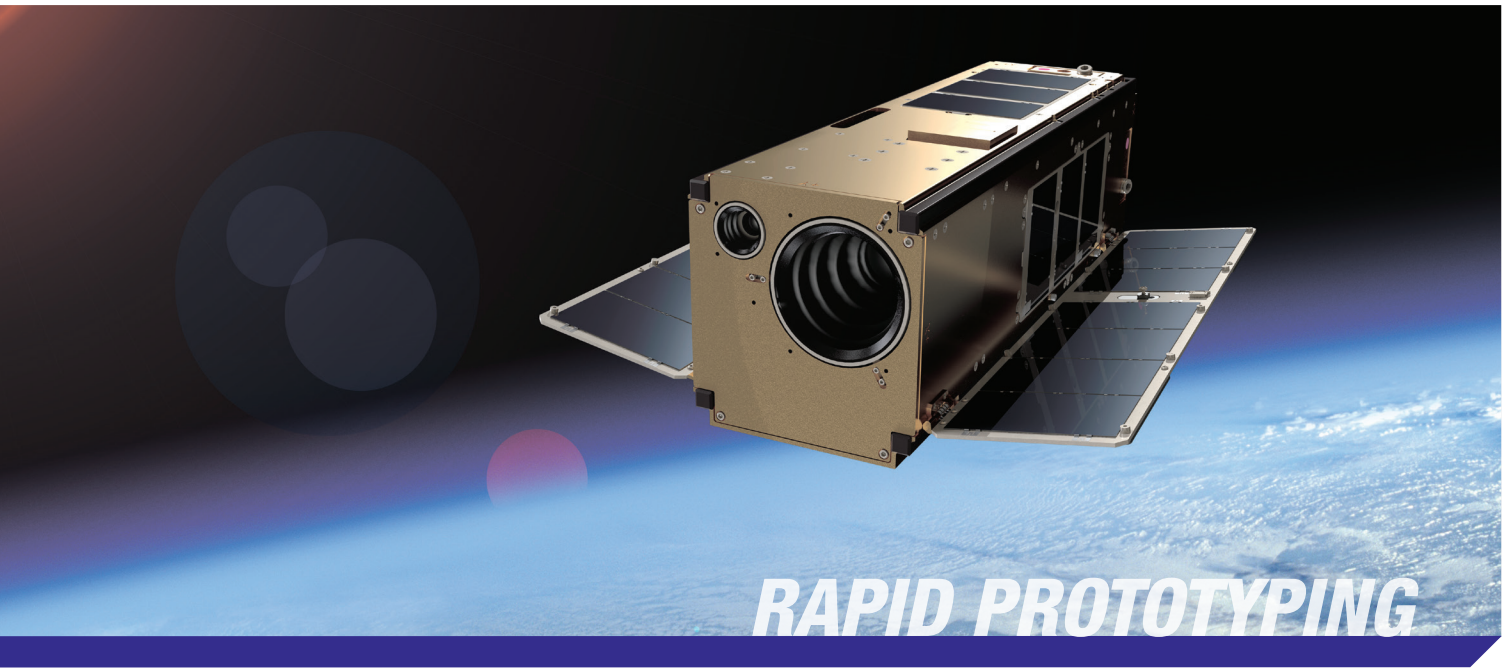
AEROSPACE



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.

Experiments Lab (xLab)

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.

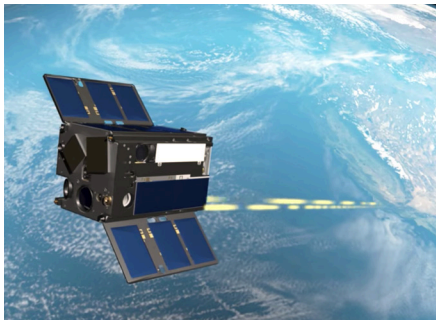
The Aerospace xLab:

- 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

OCSD

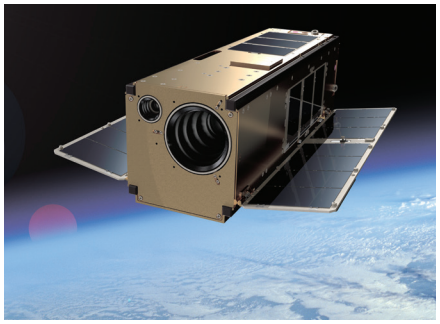
The Optical Communications and Sensor Demonstration (OCSD) mission demonstrated an optical laser communications capability operating at a rate 50 times greater than similar systems on a pair of CubeSats. A laser hard mounted to the satellite, was directed by a precision attitude control system that moved the entire satellite for transmission. Additionally, the CubeSats were equipped with novel water-based propulsion systems that enabled the satellites to perform precise movements for proximity demonstrations.



The OCSD satellite beamed data to the ground via laser communications, transmitting 100 megabits of data per second. Photo courtesy NASA

ROGUE-1

Challenged with reconstituting national ballistic missile launch warning capability within a month, the Aerospace team developed an innovative concept employing commercially available technology and a small satellite platform. The team quickly assembled a first-generation, low Earth orbit, CubeSat-based sensor concept that is now being built for launch and characterization to support future space-based missile warning development decisions. Rogue-1 is scheduled to launch in late 2019.



Artist's illustration of the Rogue-1 prototype.

NIRAC

The Near Infrared Airglow Camera (NIRAC) takes nighttime imagery and studies lower atmospheric processes that affect space weather. Airglow is a natural atmospheric emission related to aurora. NIRAC studies the infrared portion of the airglow spectrum with a camera able to capture images of the ground and clouds at night when there is no other light. NIRAC observations of airglow could also lead to new science investigations studying the coupling of the lower atmosphere to space.

The red swaths in the upper atmosphere are airglow, a natural emission studied by NIRAC. Photo courtesy NASA

Affecting 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.

The Aerospace Corporation

The Aerospace Corporation is a national nonprofit corporation that operates a federally funded research and development center (FFRDC) and has approximately 4,000 employees. The Aerospace FFRDC is aligned to support the most critical programs of the Department of Defense and the nation, and to serve as its customers' innovation partner across the space enterprise. Consistent with the competencies outlined in our sponsoring agreement, Aerospace provides strategic value through independent, intellectually rigorous, relevant, and timely products and services. With three major locations in El Segundo, Calif.; Colorado Springs, Colo.; and Washington, D.C., Aerospace addresses complex problems across the space enterprise and other areas of national significance.

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