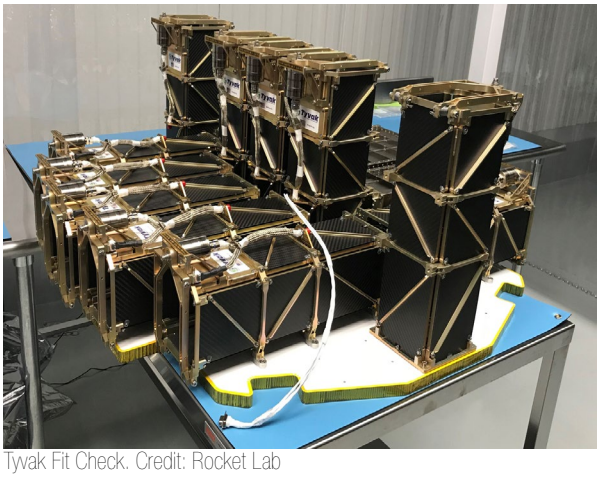
NASAfacts

ELaNa XIX CubeSat Launch on Rocket Lab Electron Mission
December 2018

OVERVIEW
NASA enabled the launch of 10 small research satellites, or CubeSats, selected through the CubeSat Launch Initiative (CSLI) for seven universities, three NASA centers and a middle school as part of the Educational Launch of Nanosatellite (ELaNa) XIX mission. Over 250 students have been involved in the design, development and construction of the CubeSats that were flown as payloads on the Rocket Lab Electron 'This One's For Pickering' mission. It was the first launch for Rocket Lab under NASA's Venture Class Launch Services (VCLS) to provide a dedicated launch capability for smaller payloads. These VCLS launches of small satellites are able to tolerate a higher level of risk than larger missions and will demonstrate, and help mitigate risks associated with, the use of small launch vehicles providing dedicated access to space for future small spacecraft and missions. ELaNa XIX launched Dec. 16 at 1:33 a.m. EST from Mahia, New Zealand.

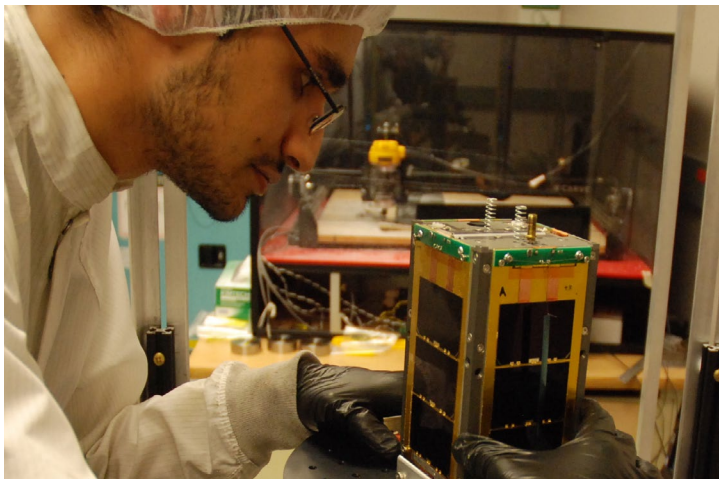
CSLI enables the launch of CubeSat projects designed, built and operated by students, teachers and faculty. CSLI provides access to space for CubeSats developed by the NASA Centers and programs, educational institutions and nonprofit organizations giving all these CubeSat developers access to a low-cost pathway to conduct research in the areas of science, exploration, technology development, education or operations. ELaNa Missions, managed by Launch Services Program at KSC, launch the CubeSats selected through CSLI into space. ELaNa mission managers and their team reach students by introducing educational spaceflight in schools and colleges across the United States through the preparation of payloads that are flown in space. Since its inception in 2010, the initiative has selected more than 160 CubeSats and launched 74 CubeSats missions from primarily educational and government institutions around the U.S. These miniature satellites were chosen from a prioritized queue established through a shortlisting process from proposers that responded to public announcements on NASA's CubeSat Launch Initiative. NASA will announce another call for proposals in early August 2019.


Tyvak Fit Check. Credit: Rocket Lab

Basic CubeSat Facts:
- Built to standard dimensions of 1 unit (1U), which is equal to 10x10x10 cm
- Can be 1U, 2U, 3U or 6U in size
- Typically, weighs less than 3 lbs (1.33 kg) per U – 6U may be up to 6.3 lbs (14 kg)

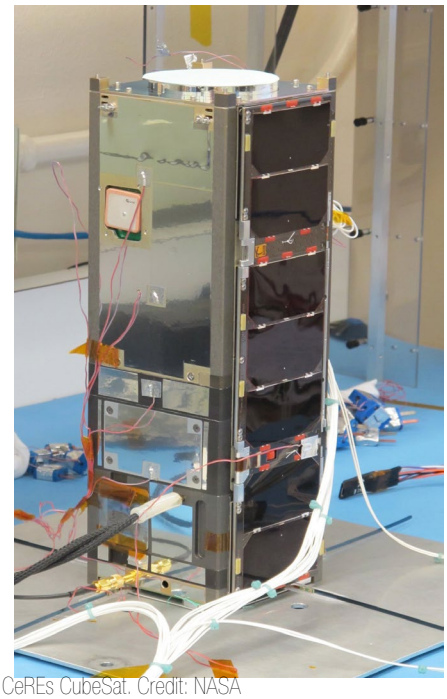
CUBESAT DEPLOYMENT
Ten CubeSat projects were selected for the ELaNa XIX mission. They will be placed in RailPODs aboard the Electron rocket that will ferry them to space. The RailPOD was designed and manufactured by the California Polytechnic State University of San Luis Obispo, California, to integrate CubeSats onto launch vehicles. After the main payload deploys, the CubeSats will separate from their RailPODs. After 15 minutes in orbit, the CubeSat transmitters will turn on and university ground stations will listen for their beacons, determine their small satellites' functionality and announce operational status. CubeSat mission durations and orbital life vary, but are anticipated to last at least 90 days. Upon mission completion, the CubeSats fall to Earth, burning up in the atmosphere.

SAFETY AND MISSION ASSURANCE
Each CubeSat developer verified that its satellite complied with the RailPOD, launch range, launch vehicle and regulatory requirements. Each ELaNa CubeSat complies with U.S. and NASA orbital debris mitigation standard practices.



University of Illinois student testing CubeSail. Credit: University of Illinois

CubeSail
University of Illinois at Urbana-Champaign – Urbana
CubeSail is a technology demonstration mission jointly developed with Colorado University Aerospace to demonstrate in-space propulsion using solar sail technology. It will significantly reduce risk for the "UltraSail" concept proposed for interplanetary and interstellar missions and take the UltraSail technology to Technology Readiness Level 7.

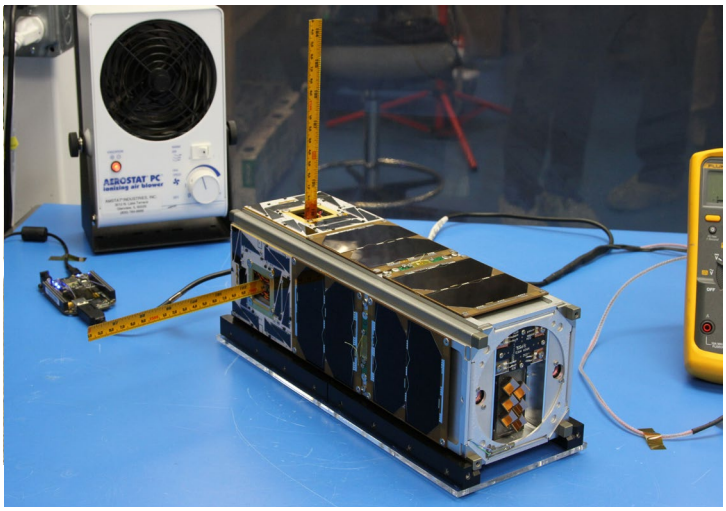


CeREs CubeSat. Credit: NASA

CeREs
Compact **R**adiation **B**elt **E**xplorer to **S**tudy Charged Particle Dynamics in Geospace
Goddard Space Flight Center – Greenbelt, Maryland
CeREs is a scientific investigation mission to advance understanding of the radiation belt electrons energization and loss processes (a goal of the Geospace program), as well as characterizing solar electrons and protons by making high-cadence, high-resolution measurements of the energy spectra of electrons and protons over a broad energy range. It will also provide flight validation for a new, small lightweight instrument with future applications in magnetospheric, planetary and interplanetary space studies.

Students integrating NMTSat into the dispenser. Credit: New Mexico Institute of Mining

NMTSat
New **M**exico **T**ech Nano**sat**ellite
New Mexico Institute of Mining – Socorro
The NMTSat CubeSat is an educational mission to provide graduate and undergraduate students with hands-on experience designing and building flight hardware. It hosts three space weather instruments, plasma probe, magnetometers and GPS occultation experiment. In addition, it contains an electrical health monitoring system and an optical status beacon experiment.



CHOMPTT CubeSat. Credit: University of Florida

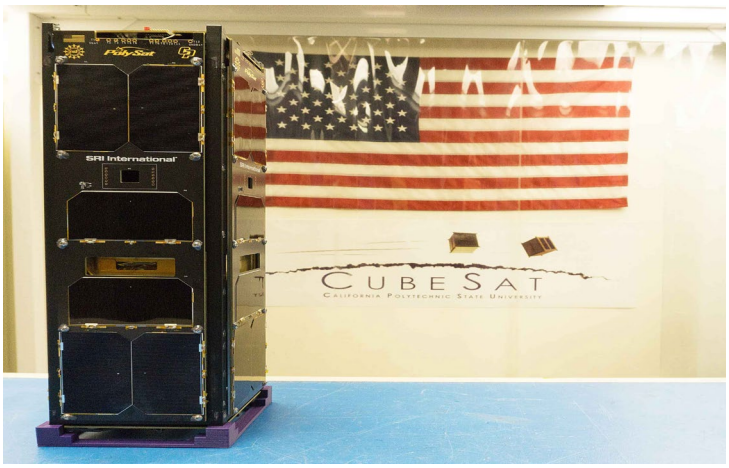
CHOMPTT
CubeSat **H**andling of **M**ultisystem **P**recision **T**ime **T**ransfer
University of Florida – Gainesville
NASA Ames Research Center – Moffett Field, California
CHOMPTT is a technology demonstration of precision ground-to-space time-transfer using a laser link to an orbiting CubeSat. The mission uses a satellite laser ranging facility located at the Kennedy Space Center to transmit short infrared laser pulses to the CHOMPTT CubeSat. By comparing the transmitted and received times on the ground and the arrival time of the pulses at the CubeSat, the time difference between the ground and space clocks can be measured with an accuracy of 200 ps (6 cm light-travel time). This compact, power efficient and secure synchronization technology will be useful for future space navigation, communications, networking and distributed aperture telescopes.

NASA Engineers working on the ALBus CubeSat. Credit: NASA

ALBus
Advanced e**L**ectrical **Bus**
NASA Glenn Research Center – Cleveland, Ohio
The ALBus CubeSat is a technology demonstration mission of an advanced, digitally controlled electrical power system capability and novel use of Shape Memory Alloy technology for reliable deployable solar array mechanisms. It will demonstrate power management and distribution of 100 watts of electrical power to a target load, system performance of a high power density CubeSat and successful deployment of solar arrays and antennas using resettable shape memory alloy mechanisms.

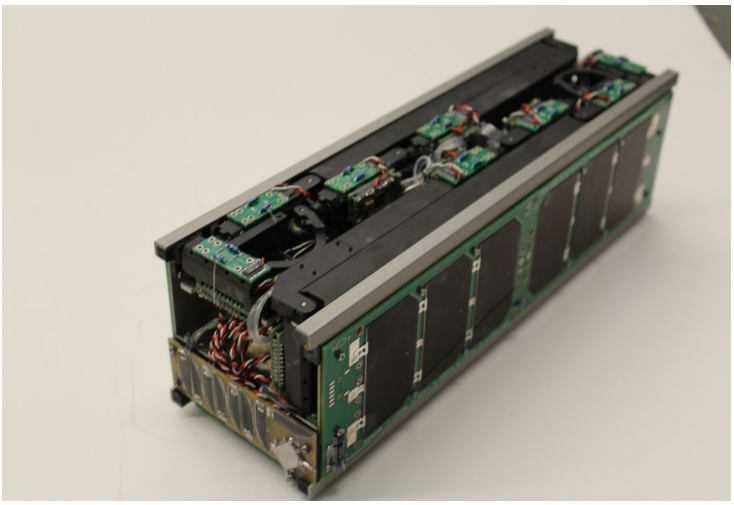
West Virginia University Students preparing STF-1 for integration. CubeSat. Credit: West Virginia University

STF-1
Simulation **T**o **F**light
West Virginia University– Fairmont
NASA's Independent Verification and Validation Facility
The primary objective of the STF-1 mission is to demonstrate the utility of the NASA Operational Simulator for Small Satellites (NOS3) across the CubeSat development cycle, from concept planning to mission operations. It demonstrates a highly portable simulation and test platform that allows seamless transition of mission development artifacts to flight products. Additionally, STF-1 is equipped with a set of diverse science experiments developed by WVU. The instruments include a cluster of Micro Electro-Mechanical Systems (MEMS) Inertial Measurement Units to produce attitude knowledge; a space-weather experiment including a Geiger counter and Langmuir probe; a III-V Nitride-based materials optoelectronics experiment; and a Novatel OEM615 GPS coupled with advanced algorithms for precise orbit determination.



ISX CubeSat Credit: Cal Poly

ISX
Ionospheric **S**cintillation **E**xplorer
SRI International – Menlo Park, California
California Polytechnic State University, San Luis Obispo, California
The Ionospheric Scintillation Explorer (ISX) CubeSat is a space weather investigation to better understand the multifrequency radio wave interference produced by the atmosphere at sunset near the equator. The spacecraft will receive multiple broadcast digital television channels to probe the ionospheric irregularities. SRI is responsible for the payload design and construction, and the interpretation of mission data. Cal Poly is responsible for the CubeSat design and construction, and ground station operations.

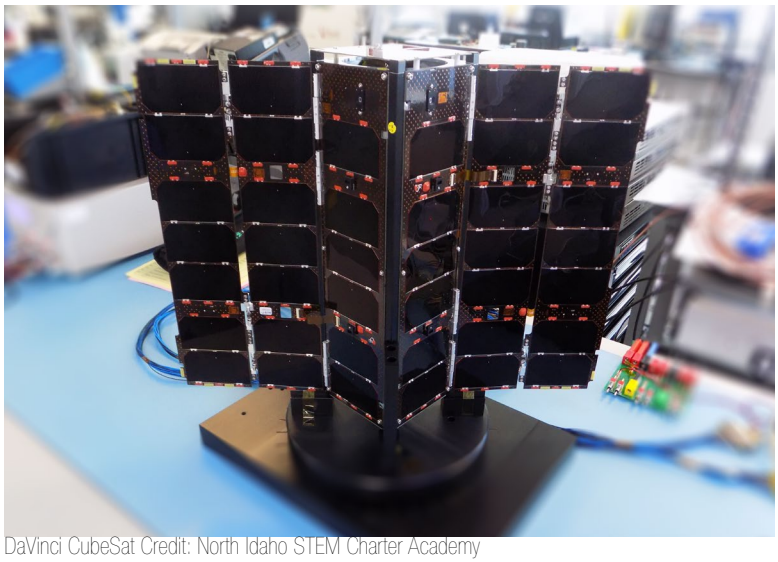


RSat CubeSat Credit: U.S. Naval Academy

RSat
United States Naval Academy – Annapolis, Maryland
RSat is a technology demonstration to potential future missions that may be able to provide an in-orbit mobile platform to survey and possibly repair a much larger, conventional spacecraft. The satellite has two 60 cm, 7 degree-of-freedom robotic arms fitted with claws and is intended to operate in constant contact with a host spacecraft. It will be equipped with a suite of equipment, including cameras at end-effectors to provide any diagnostic information. This iteration of RSat mission will test out performance of robotic arms in space as a free-flyer.

Shields-1 CubeSat Credit: NASA

Shields-1
Langley Research Center – Hampton, Virginia
Shields-1 is a technology demonstration of environmentally durable space hardware to increase the Technology Readiness Levels (TRL) of new commercial hardware through performance validation in the relevant space environment. It incorporates three experiments: vault electronics, charge dissipation film resistance and vault shielding development.



DaVinci CubeSat Credit: North Idaho STEM Charter Academy

DaVinci
North Idaho STEM Charter Academy – Rathdrum, Idaho
DaVinci is an educational mission that will provide education for students worldwide about radio waves, aeronautical engineering, space propulsion and geography, as well as inspiration to enter STEM careers, thus feeding the pipeline for future engineers and scientists. DaVinci will send communication signals to schools across the globe, utilizing amplified radio frequencies to deliver inspirational Morse Code messages to Space Ambassadors with the theme of "Lighting Up Minds Around the World."

To contact the ELaNa XIX Launch Public Affairs Office, call 202-358-1100

For more information about NASA's CubeSat Launch Initiative, visit: http://go.nasa.gov/CubeSat_initiative

For more information about the ELaNa XIX CubeSats, visit:

CubeSail: www.cubesail.us/videos
STF-1: www.stf1.com
ISX: www.polysat.org/in-development/
DaVinci: www.projectdavincicubesat.org

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