ELaNa 22 International Space Station CubeSat Deployment

August 2017 - deployment November 2017

NASAfacts

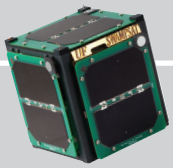
OVERVIEW

NASA will enable the deployment of three small research satellites, or CubeSats, developed by two universities and one NASA Center. These CubeSat missions were selected through the CubeSat Launch Initiative (CSLI) as part of the 22nd installment of the Educational Launch of Nanosatellites (ELaNa) missions. The ELaNa 22 mission will embark on Space-X's twelfth contracted commercial resupply services mission for NASA to the International Space Station (ISS), guided to space by an Falcon 9 rocket scheduled to lift off Aug. 13 from Cape Canaveral Air Force Station, Florida, at 12:56 p.m. EDT. Over the past three years, more than 100 students have been involved in the design, development and construction of these CubeSats that will be deployed from the ISS via the commercially-developed NanoRacks CubeSat deployer system.

CubeSats are playing an increasingly larger role in ex¬ploration, technology demonstrations, scientific research and education at NASA. These miniature satellites provide a low-cost platform for NASA missions, including planetary space exploration; Earth observation; fundamental Earth and space science; and technology demonstrations such as cutting-edge laser communica¬tions, energy storage, in-space propulsion and autono¬mous movement capabilities. They also provide educators an inexpensive means to engage students in all phases of sat¬ellite development, operation and exploitation through real-world, hands-on research and development experience on NASA-funded ride-share launch opportunities.

CSLI enables the launch of CubeSat projects designed, built and operated by students, teachers and faculty, as well as, NASA Centers and programs, and nonprofit organizations. Managed by the Launch Services Program at NASA's Kennedy Space Center in Florida, ELaNa missions provide a deployment opportunity or ride-share launch to space for CubeSats selected through CSLI. ELaNa mission managers and their teams engage schools and colleges across the United States, providing spaceflight education through the preparation of payloads (licensing, integration and testing) flown in space. Since its inception in 2010, the initiative has selected more than 150 CubeSats and launched 49 CubeSats primarily developed by educational and government institutions around the United States. These miniature satellites were prioritized and selected through a formal NASA review of proposals submitted to CSLI announcements. NASA will announce another call for proposals in early August 2017.

Basic CubeSat Facts:



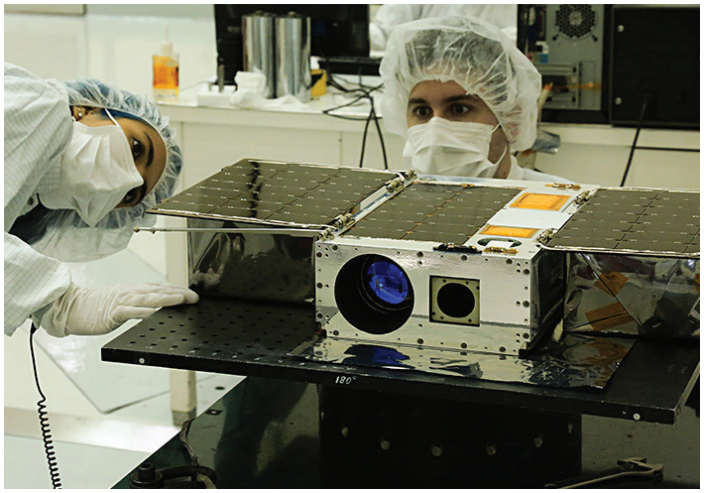
- Built to standard dimensions of 1 unit (1U) which is equal to 10x10x10 cm
- Can be 1U, 2U, 3U or 6U in size
- Weigh less than 3 lbs (1.33 kg) per U – 6U may be up to 6.3 lbs (14 kg)

CUBESAT DEPLOYMENT

In preparation for deployment, the CubeSats are placed inside the NanoRacks CubeSat Deployer, or NRCSD. The NRCSD is a stackable, modular, ground-loaded launch dispenser built by NanoRacks LLC in Webster, Texas, and each deployer accommodates up to 6.5U of CubeSat volume. Astronauts aboard the space station stack the NRCSDs into an eight-dispenser con¬figuration, which are then mounted on the Japanese Experiment Module airlock slide table and moved out¬side of the station. The robotic arm captures the table and positions the facility toward Earth. Upon the approval to proceed from NASA and the Japan Aerospace Exploration Agency, the NRCSDs are commanded one-by-one. The dispenser doors open and the large internal spring releases, deploy¬ing the CubeSats into an orbit similar to the space station, around 400 km above Earth. After 30 minutes in orbit, the internal timers on the CubeSats allow their on¬board computers to activate and begin transmitting. The CubeSat teams utilize ground stations to listen for beacons to determine their small satellite's function¬ality and operational status. CubeSat missions are anticipated to last at least 120 days, although durations sometimes vary. Upon mission completion, the CubeSats begin a final fall through Earth's atmosphere, where tremendous heat caused by friction causes them to disintegrate.

SAFETY AND MISSION ASSURANCE

Each CubeSat developer has verified that their satellite is compliant with the NRCSD requirements. Each ELaNa CubeSat complies with U.S. and NASA orbital debris mitigation standard practices.



ASTERIA Spacecraft final closeout at the Jet Propulsion Laboratory Credit: Jet Propulsion Laboratory

ASTERIA

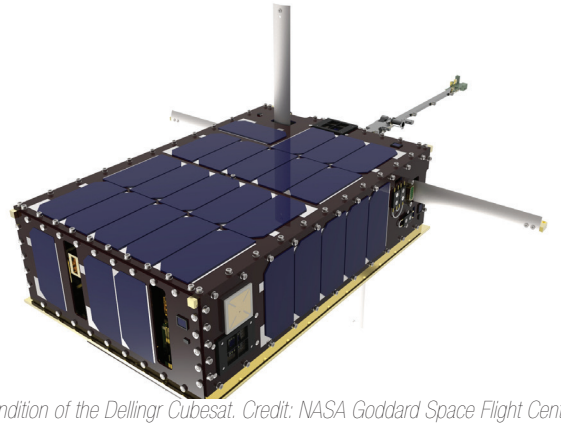
Arcsecond **S**pace **T**elescope **E**nabling **R**esearch **I**n **A**strophysics
Massachusetts Insitute of Technoloy – Cambridge, Mass.
Jet Propulsion Laboratory – Pasadena, Calif.

ASTERIA is a technology demonstration and opportunistic science mission to advance the state of the art in CubeSat capabilities for astrophysical measurements. The goal of ASTERIA is to achieve arcsecond-level line of sight pointing error and highly stable focal plane temperature control. These technologies will enable precision photometry, i.e., the careful measurement of stellar brightness over time. This in turn provides a way to study stellar activity, transiting exoplanets and other astrophysical phenomena, both during the ASTERIA mission and in future CubeSat constellations.

Dellingr

NASA Goddard Space Flight Center – Greenbelt, Md.

The Dellingr mission is a technology demonstration of 6U CubeSat bus while gathering data about the sun's influence on Earth's upper atmosphere using a suite of miniaturized instruments and components. The Ion-Neutral Mass Spectrometer is designed to sample the densities of neutral and ionized atom species in the atmosphere. During the Dellingr mission, it will measure the equatorial ionosphere, the atmospheric layer that affects the transmission of radio waves. The Diminutive Assembly for Nanosatellite Deployables, or DANY, stows antennas, solar panels, magnetometer booms, and even sunshades on CubeSats and the Fine Sun Sensor will provide orientation data

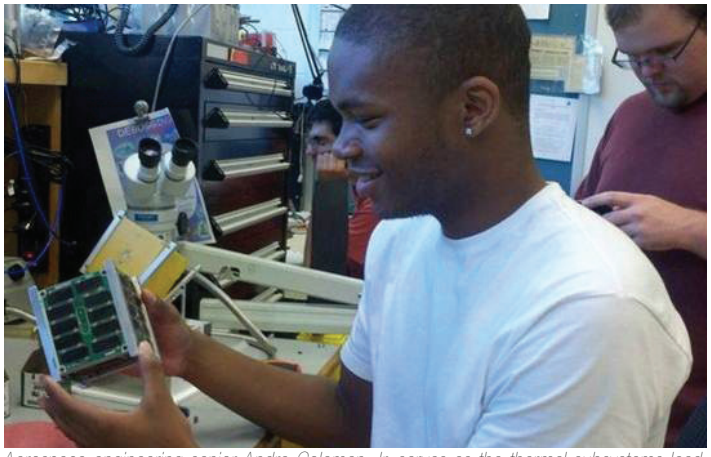


Artist rendition of the Dellingr Cubesat. Credit: NASA Goddard Space Flight Center

OSIRIS-3U

Orbital **S**atellite for **I**nvestigating the **R**esponse of the **I**onosphere to **S**timulation and Space Weather
Pennsylvania State University – University Park, Penn.

The OSIRIS-3U CubeSat will conduct atmospheric research on the effects of solar flare activity on the Ionosphere. Ground-based heaters will stimulate the Ionosphere to create artificial space weather events. While within the heated events, the science instruments measure the electron content, electron density, and electron temperature of the stimulated Ionosphere which OSIRIS-3U then stores internally and later transmits to the SSPL Ground Station. This data will aid research on radiowave-plasma interactions and plasma transport.



Aerospace engineering senior Andre Coleman Jr. serves as the thermal subsystems lead for the Penn State OSIRIS nanosatellite mission.

To contact the ELaNa 22 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 22 CubeSats, visit:

ASTERIA: www.jpl.nasa.gov/cubesat/missions/asteria.php
OSIRIS-3U: sites.psu.edu/sspl/osiris-3u-poster/

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