NASAfacts

CubeSat ELaNa IV Launch on ORS-3

November 2013

OVERVIEW

NASA will launch eleven small research satellites, or CubeSats, for nine universities, one high school and one NASA Center as part of the fourth installment of the Educational Launch of Nanosatellite (ELaNa) mission. Over 300 students have been involved in building the CubeSats that will be flown as auxiliary payloads on the U.S. Air Force-led Operationally Responsive Space-3 (ORS-3) launch planned for November 2013.

The ELaNa CubeSat Launch Initiative enables students, teachers and faculty to obtain hands-on flight hardware development experience and gives them access to a low-cost vehicle to conduct research in the areas of science, exploration, technology development, education or operations. Since its inception in 2010, the initiative has selected more than 90 CubeSats 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 pubic announcements on NASA's CubeSat Launch Initiative. NASA will announce another call for proposals in mid-August 2014.

Ho`oponopono-2 (H-2)

University of Hawaii – Honolulu

Ho`oponopono-2 (Hawaiian for "to make right") will provide a student-built, low-cost radar calibration nanosatellite carrying a C-band transponder and high-accuracy GPS payload to continue a long-existing radar calibration and performance service supplementing two existing, aging spacecraft.

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 $1^{1/3}$ kg (3 lbs) per U – 6U may be up to 12-14 kg
- Deployed from standard Poly-Picosatellite Orbital Deployer (P-POD)

CUBESAT DEPLOYMENT

Eleven CubeSat projects were selected for the ELaNa IV mission. There will be eight Poly Picosatellite Orbital Deployers (P-PODs) aboard the Minotaur-1 rocket that will ferry them to space. The P-POD was designed and manufactured by the California Polytechnic State University (Cal Poly) of San Luis Obispo, Calif., to integrate CubeSats onto launch vehicles. After the main payload deploys, the CubeSats will separate from their P-PODs. After 45 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 180 days. Upon mission completion, the CubeSats fall to Earth, burning up in the atmosphere.

SAFETY AND MISSION ASSURANCE

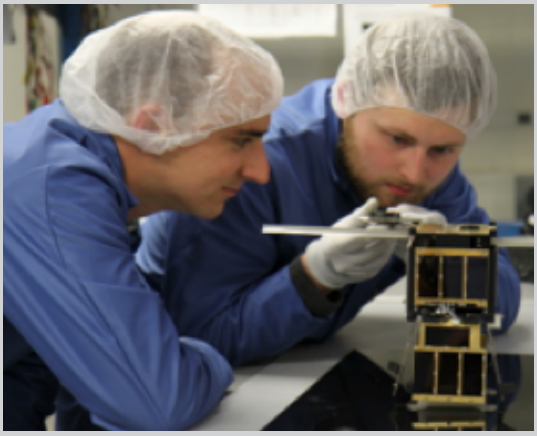
Each CubeSat developer verified that its satellite complied with the P-POD requirements. NASA jointly conducted a mission readiness review with each CubeSat developer.

ORS-3 MISSION

The ORS-3 Mission, also know as the Enabler Mission, will demonstrate launch and range improvements to include: automated vehicle trajectory targeting, range safety planning, and flight termination; a commercial-like procurement with FAA licensing of a Minotaur 1; and integration of the Air Force's Space Test Program Satellite-3 and a total of 24 cubesats on an Integrated Payload Stack.These enablers not only focus on the ability to execute a rapid call-up mission, they automate engineering tasks that once took months and reduce those timelines to days and/or hours resulting in decreased mission costs.

KySat-2

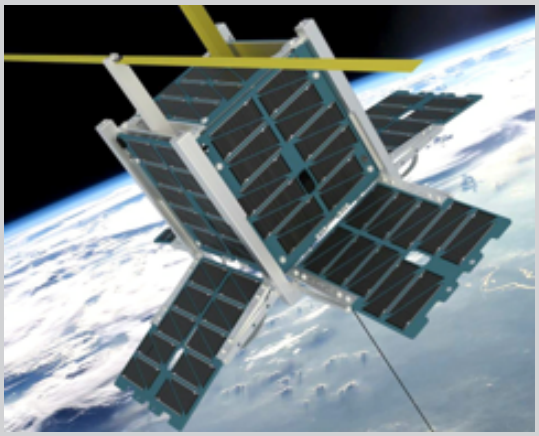
University of Kentucky – Lexington, Ky.
Morehead State University – Morehead, Ky.



KySat-2 is a technology demonstration mission that builds upon KySat-1 by expanding the K-12 outreach goals to interest students to science, technology, engineering and mathematics (STEM) fields and space technology. It also will test components of a novel attitude determination system called a Stellar Gyroscope that uses sequences of digital pictures to determine the three-axis rotation rate of the satellite.

ChargerSat-1

University of Alabama Huntsville – Huntsville, Ala.



ChargerSat-1's mission is to conduct three technology demonstrations: a gravity gradient stabilization system will passively stabilize the spacecraft; deployable solar panels will nearly double the power input to the spacecraft; and the same deployable solar panels will shape the gain pattern of a nadir-facing monopole antenna, allowing improved horizon-to-horizon communications.

SwampSat

University of Florida – Gainesville, Fla.

SwampSat's mission is to demonstrate precision three-axis attitude control in orbit using a pyramidal configuration of control moment gyroscopes (CMG). The goal is to advance the technology readiness level of CMGs appropriate for smallsats and hence the utility of CubeSats.

Trailblazer

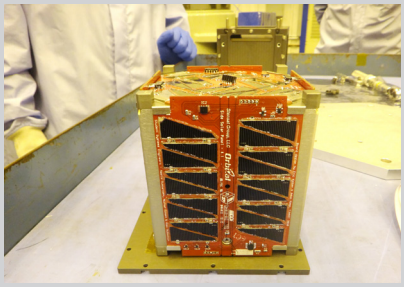
University of New Mexico – Albuquerque, N.M.

Trailblazer's primary mission is a flight test of the space plug-and-play architecture, an open-source satellite bus architecture that can be used for rapid satellite development. Secondly, this project will fly a space weather sensor to capture data on the space environment to help explain the effects of space weather on future satellite activities.

TJ3Sat

Thomas Jefferson High School – Alexandria, Va.

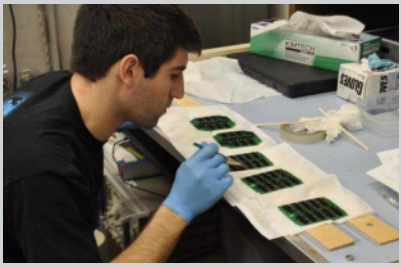
This CubeSat's mission is to create educational resources through which other K-12 institutions can learn about aerospace engineering and be encouraged to seek careers in the STEM fields. The primary payload is a voice synthesizer module that takes written phrases in the form of code and produces a phonetic voice reading on the satellite's downlink frequencies.



DragonSat-1

Drexel University – Philadelphia
U.S. Naval Academy – Annapolis, Md.

DragonSat-1's primary mission is education of undergraduate and graduate students by providing a hands-on experience in space system development. The secondary focus is to address two scientific objectives: observe the radiation dissipation intensity during solar events by studying digital photography of auroras and demonstrate a gravity-gradient boom deployment mechanism.



CAPE-2

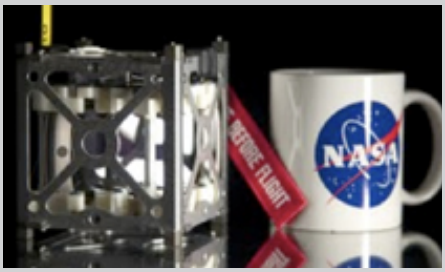
The University of Louisiana at Lafayette – Lafayette, La.

CAPE-2's primary mission is to engage, inspire and educate K-12 students to encourage them to pursue STEM careers. The secondary focus is the technology demonstration of deployed solar panels to support the following payloads: text to speech, voice repeater, tweeting, email, file transfer and data collection from buoys.

PhoneSat

NASA Ames Research Center, Moffett Field, Calif.

PhoneSat2.4 is the third in a series of missions designed to use commercially available smartphone technology as part of its low-cost development for basic spacecraft capabilities. The technology demonstration is a pathfinder for the Edison Demonstration of Smallsat Netowrk (EDSN) and will collect data on the long term performance of consumer technologies in space.



COPPER

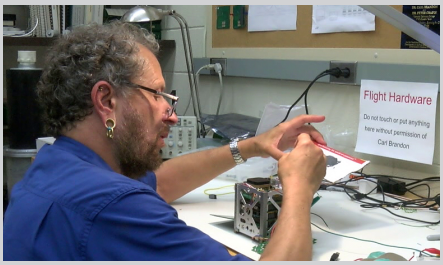
Infrared Imaging on a CubeSat
St. Louis University – St. Louis

The Close Orbiting Propellant Plume Elemental Recognition (COPPER) is a technology demonstration mission whose objective is to test the suitability of a commercially-available compact uncooled microbolometer (tiny infrared camera) array for scientific imagery of Earth in the long-wave infrared range (LWIR, 7-13 microns).

Vermont Lunar CubeSat

Vermont Technical College – Randolph Center, Vt.

The Project's mission is to explore the technologies required for building a viable CubeSat device that can orbit and/or land on the moon. This CubeSat is designed to test the GPS Enhanced Onboard Navigation System that uses GPS enhancement and celestial navigation via optical means using sun, moon and Earth tracking.



To learn more about NASA's CubeSat Launch Initiative program, visit: http://go.nasa.gov/CubeSat_initiative

For additional information about the ELaNa IV CubeSats, visit:

- **KySat-2**: kysat2.engr.uky.edu
- **Trailblazer:** cosmiac.org/trailblazer.html
- **ChargerSat-1**: space.uah.edu/chargersat1
- **Vermont Lunar CubeSat**: cubesatlab.org
- **SwampSat**: www.swampsat.com
- **CAPE-2**: www.ulcape.org
- **PhoneSat**: www.phonesat.org
- **TJ3Sat**: www.tjhsst.edu/students/activities/tj3sat/
- **COPPER**:astrolab.slu.edu/AstroLab/SLU-01__COPPER.html
- **Ho`oponopono-2 (H-2)**: cubesat.eng.hawaii.edu/nanosat6/hooponopono.html

To contact the ELaNa IV Launch Public Affairs Office, call 202.358.1100.

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