



University Nanosat Program

04/19/2012

Lt Kelly Alexander
UNP, DPM
AFRL/RVEP

Air Force Research Laboratory

Integrity ★ Service ★ Excellence



Overview



- **What is UNP**
 - Mission and Focus
 - History and Competition Process
- **Current Microsats and CubeSats**
 - Sats in development
 - Sats in the queue





Who We Are



- Competition between 10-12 universities
 - design and build flight spacecraft
- Winning university selected for flight
- Currently in our 7th competition cycle
- Sponsored by:

***Focus is on
Design &
Fabrication***

AFRL/RV



- Manages Competition
- Manages winner delivery
- Assists in post-launch ops

AFOSR



- Sponsors competition schools
- Sponsors winner final development

AIAA



- Sponsors Flight Competition Review

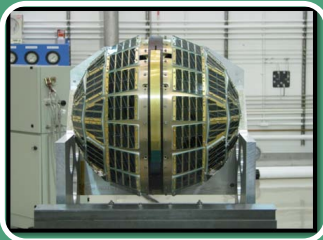


Program Objectives



Primary Objective: Education

- Systems engineering training
- Workforce development
- Foundation for all UNP decisions



Secondary Objective: Technology

- Innovative, low cost technology development
- Motivation for Gov. and industry sponsors
- DoD relevant



Tertiary Objective: University Development

- Develop space hardware laboratories
- Support university PI's



Competition Cycle



Programmatic Element	Approximate Date
Kickoff	January, 2011
System Concept Review	February, 2011
System Requirements Review	April, 2011
Student Hands On Training Workshop I	June, 2011
Preliminary Design Review	August, 2011
Satellite Fabrication Course	October, 2011
Critical Design Review	Spring, 2012
Students Hands On Training Workshop II	June, 2012
Proto-Qualification Review	August, 2012
Flight Competition Review	January, 2013

- Reviews held through telecons, site visits, and co-located reviews
- Technical deliverables required at each review
- Reviewers drawn from UNP Program Office, sponsoring entities, industry, academia, government, and educational activists

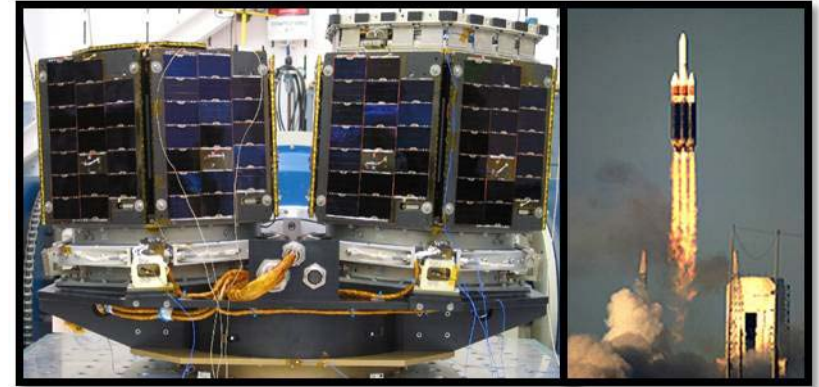


Microsats: Launched Flight Programs



3 Corner-Sat – NS 1 & 2 Participants

- Partnership between New Mexico State, University of Arizona, and University of Colorado-Boulder
- Objective to determine stereoscopic imaging of clouds
- *Launched by STP on Delta IV Heavy Demo in Dec 2004*
- Launch anomaly, suborbital trajectory
- <50 Kg, 36” tall fully stacked



FASTRAC – NS 3 Winner

- University of Texas
- Formation Autonomous Satellite with Thrust, Rel-nav and Crosslink
- Meter accuracy relative navigation
- *Launched by STP on STP-S26 in Nov 2010*
- Currently in mission operations
- 56.5 Kg, 50” tall fully stacked





Microsats: Upcoming Launches



CUSat – NS 4 Winner

- Cornell University
- Relative Navigation and centimeter ranging capability
- *Manifested by STP to fly on upcoming SpaceX Falcon 9*
- 50 Kg, 19” tall full stacked



DANDE – NS 5 Winner

- University of Colorado – Boulder
- Drag and Atmospheric Neutral Density Experiment
- *Manifested by STP to fly on upcoming SpaceX Falcon 9*
- 43 Kg, 18.6” diameter





Microsats: A few years out

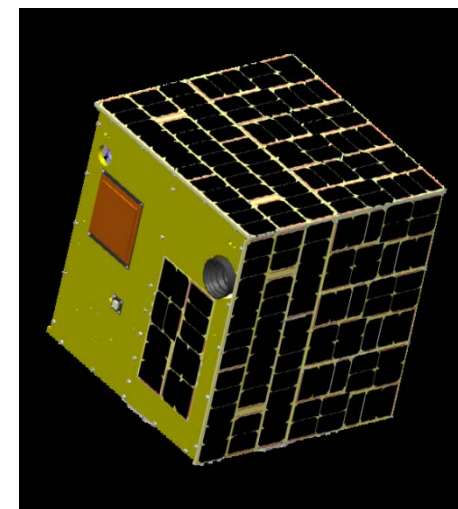


Oculus-ASR – NS 6 Winner

- Michigan Technological University
- Optical characterization for ground based assets
- Delivery to AFRL in Spring, 2013
- 70 Kg, 31.5” tall

Violet – NS 6 Participant

- Cornell University
- Sponsored by AFRL RVS division in collaboration with the UNP Program Office
- Flight qualify control moment gyroscopes (CMG), and demonstrate new algorithms and topologies for the CMGs
- 51 Kg, 23.6” tall





CubeSats: In Final Development



University of Hawaii (Ho'oponopono): 3U



- Provide orbital radar calibration support to the Air Force by collecting and disseminating ephemeris data in response to radar interrogation
- Manifested on ELaNa 5 launch



St Louis University (COPPER): 1U



- Evaluate the effectiveness of long-wave infrared imagery for Space Situational Awareness by in-situ detection of a thruster plume
- Manifested on ELaNa 4 launch



**Manifested via NASA's ELaNa program.
Participants in NS-6 Competition Cycle.**



CubeSats: Currently Competing



St Louis University (Argus-Hi): 2U

- Effects of space radiation on modern electronics



University of Michigan (CADRE): 3U

- Measure thermospheric properties using Wind Ion Neutral Composition Suite (WINCS)
- Test low-cost, dual-frequency GPS to measure atmospheric and ionospheric total electron content



University of Michigan

University of Texas at Austin (ARMADILLO): 3U

- Characterize unknown sub-centimeter level dust and debris particles to improve atmosphere models and assess operational risks to LEO



**Selected for potential launch via NASA's ELaNa program.
Participants in NS-7 Competition Cycle.**



CubeSats: Currently Competing



Montana State University (SpaceBuoy): 3U

6

- Provide space weather data for use in ionospheric forecasting models
- Provide electron density measurement and Total Elec Content derived data product



University at Buffalo (GLADOS): 6U

7

- Use a space-based platform for collecting multi-band photometric data of glinting geostationary space objects



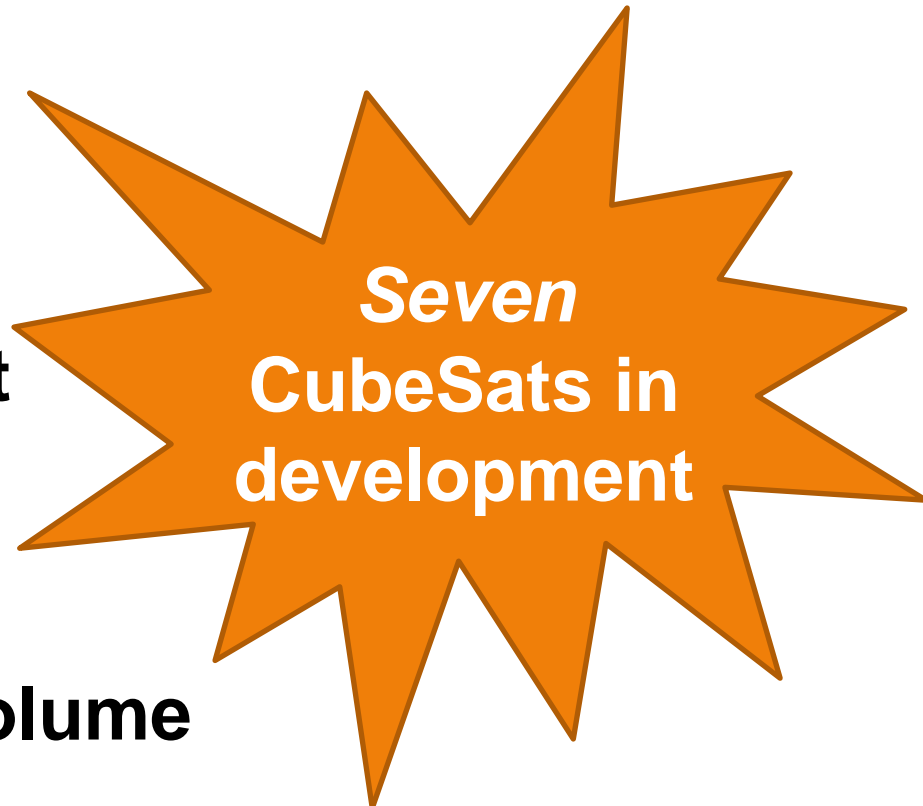
**Participants in NS-7 Competition Cycle.
NOTE: First 6u CubeSat in Competition!**



Take-Aways



- **Focus is on *building***
 - systems engineers
 - satellites
 - programs
- **Two areas of intent**
 - Military Relevance
 - Technical Maturity
- **University picks volume**
 - Mission requirements
 - Program capability





Questions?



**Apply for our NS-8 BAA this summer
on Fedbizopps!!**