



2014 Ground Systems Architecture Workshop

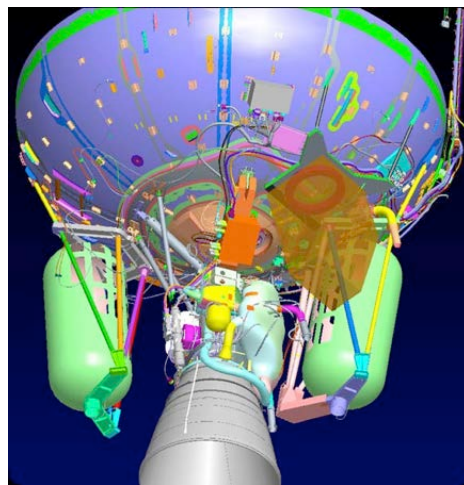
Current and Future Ground Systems for CubeSats

Panel Discussion

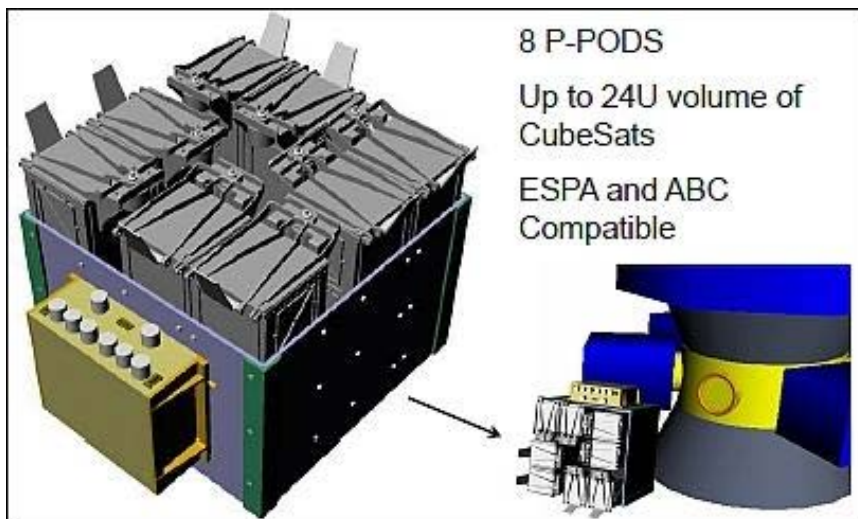
Dr. Charles D. Norton
Jet Propulsion Laboratory
California Institute of Technology

ELaNa-II GEMSat (NROL-39) December 5, 2013

ELaNa-X Manifest for October 31, 2014



VAFB Manifest of MCubed-2 and IPEX on GEMSat NRO L-39
12/5/13 launch and operational

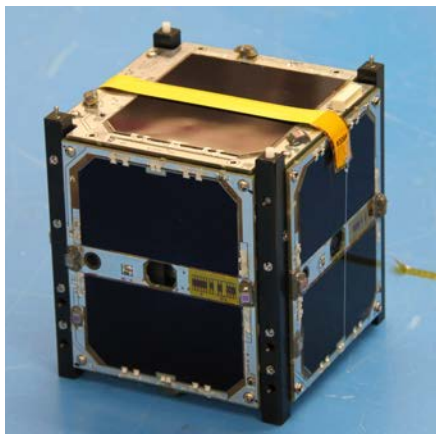


8 P-PODS
Up to 24U volume of
CubeSats
ESPA and ABC
Compatible



VAFB Manifest of GRIFEX on ELaNa-X planned for
10/31/14 launch

Active JPL Projects (Earth Technology and Science)



M-Cubed/COVE-2 (NASA ESTO)

High data-rate on-board processing

P. Pingree: JPL, U. Michigan

Launched VAFB: Dec. 5, 2013 (NASA CLI)

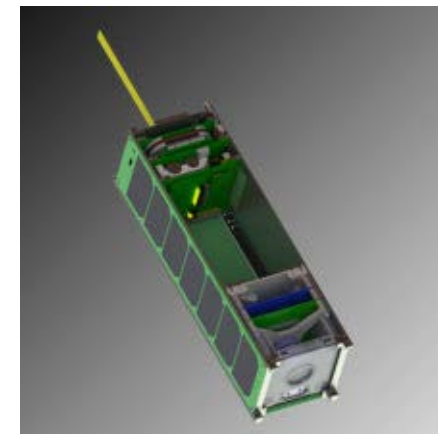


IPEX/CP-8 (NASA ESTO)

Autonomous low-latency product generation

S. Chien: JPL, GSFC, Cal Poly SLO

Launched VAFB: Dec. 5, 2013 (NASA CLI)

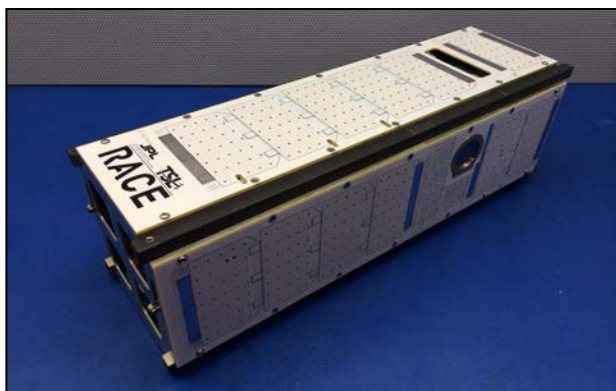


GRIFEX (NASA ESTO)

Unprecedented frame-rate ROIC/FPA

D: Rider JPL, U. Michigan

Launch Manifest: Oct. 2014 (NASA CLI)

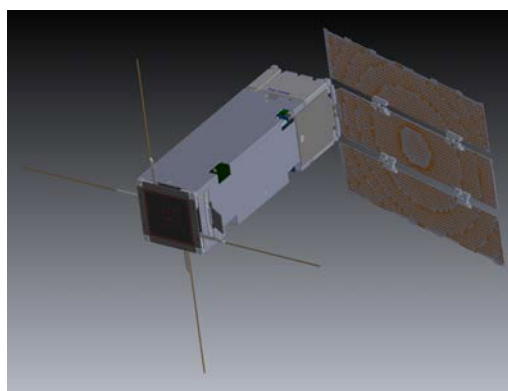


RACE

Hydrometric Atmospheric Radiometer

B. Lim: JPL, ARC

Launch Awarded (NASA CLI)

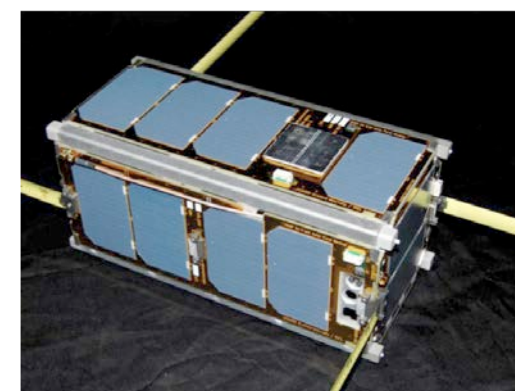


ISARA (EDISON)

Integrated Solar Array & Reflectarray Antenna

R. Hodges: JPL, Pumpkin Inc.

Launch Awarded (NASA CLI)



LMRST

Low Mass Radio Transponder

C. Duncan: JPL, Stanford

Launch Awarded (NASA CLI)

Active JPL Projects (Beyond LEO Exploration)



INSPIRE

Interplanetary NanoSpacecraft Pathfinder In a Relevant Environment

Low-cost mission leadership with the world's first CubeSat beyond Earth-orbit



INSPIRE

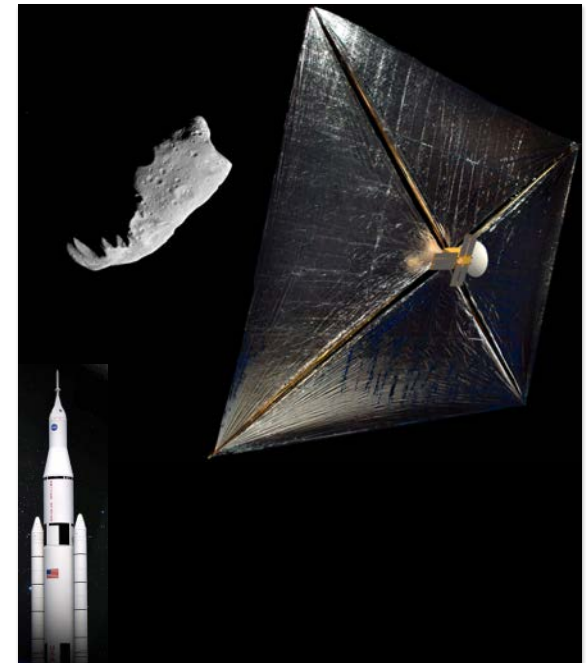
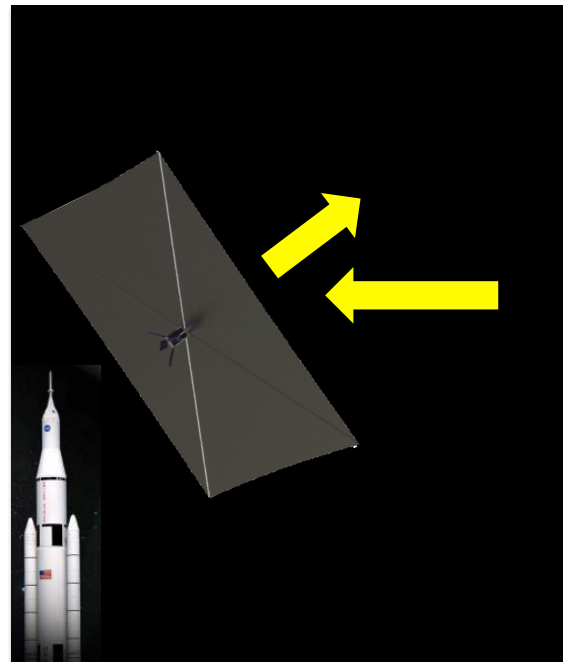
Interplanetary Nano-Spacecraft Pathfinder in Relevant Environment

A. Klesh: JPL, Cal Poly SLO, UM, UT Austin

Launch Awarded (NASA CLI)

Lunar Flashlight*

First lunar CubeSat to search for ice deposits in permanently shadowed craters
JPL, MSFC



NEA Scout*

Asteroid characterization mission
MSFC, JPL

**Proposed Mission - Pre-Decisional – for Planning and Discussion Purposes Only*

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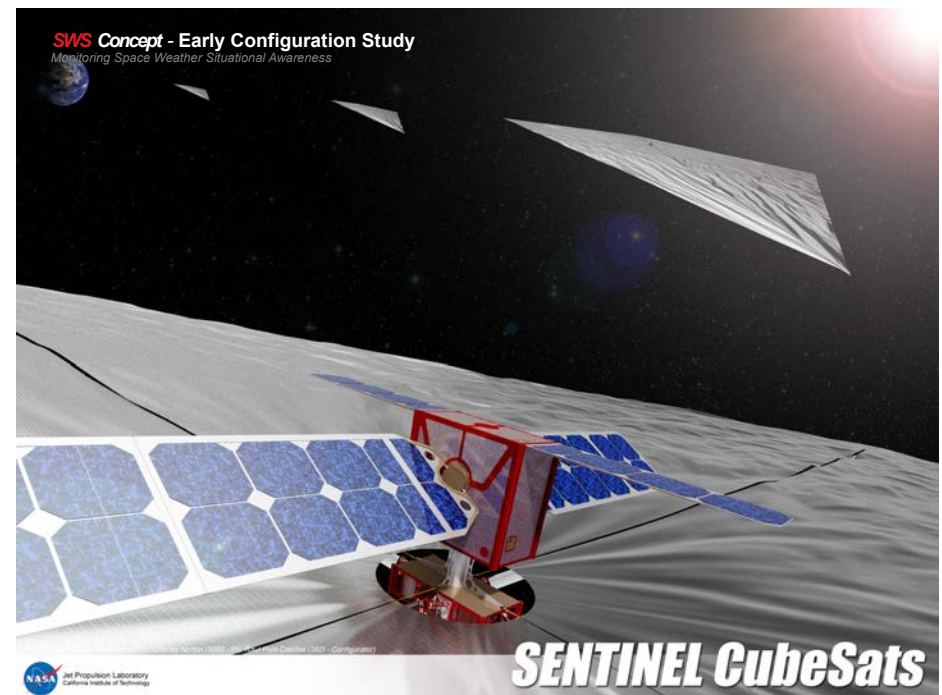
Future Mission Concepts (Many Others In Formulation)



RELIC*

Understanding energy transport from black holes
to the intergalactic medium

Keck Institute for Space Studies (KISS)



SWS*

Fractionated Earth-Sun L5 space weather base for
prediction and understanding solar variability effects

Keck Institute for Space Studies (KISS)

Ground Systems Challenges for CubeSats



Future Challenges

- Throughput and bandwidth
- Maintenance and use of amateur antenna systems
- Distributed data management
- Use and planning of large dish systems for future deep space exploration
- Standards and architectures for reusable systems, especially GDS software
- Global networked access to spacecraft