https://ntrs.nasa.gov/search.jsp?R=20120008744 2019-08-30T20:13:04+00:00Z

JOHN F. KENNEDY SPACE CENTER

LAUNCH SERVICES PROGRAM

# ELaNa

## *Making it Happen!*

## CalPoly CubeSat Workshop 2012
## April 18 - 20

Garrett Skrobot

ELaNa Project Manager

Launch Services Program

**NASA**

# ELaNa

## Educational Launch of Nanosatellite

*"Science, Technology, Engineering, and Mathematics"*

*"Launching Education into Space"*

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# ELaNa CubeSat Missions

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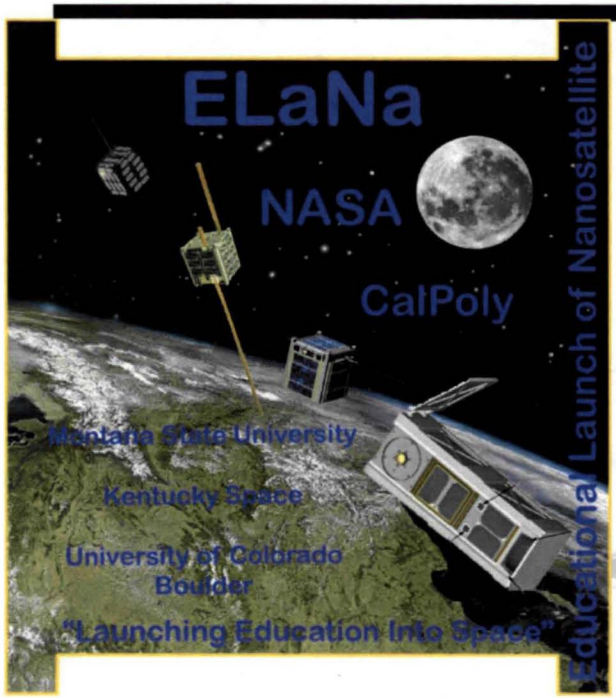


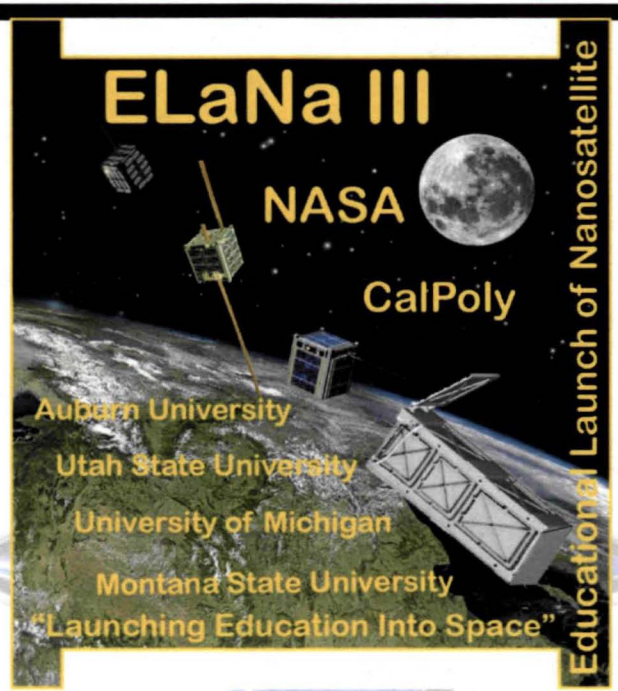

CUBESAT

CALIFORNIA POLYTECHNIC STATE UNIVERSITY

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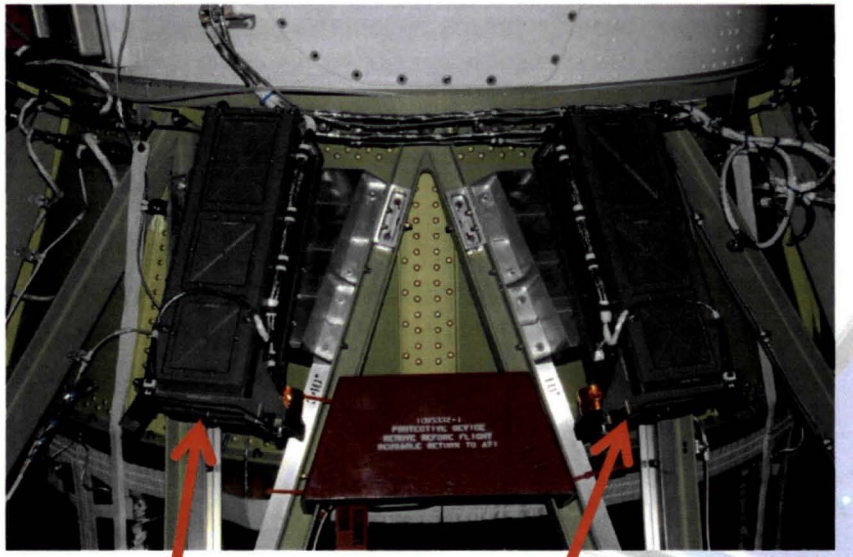
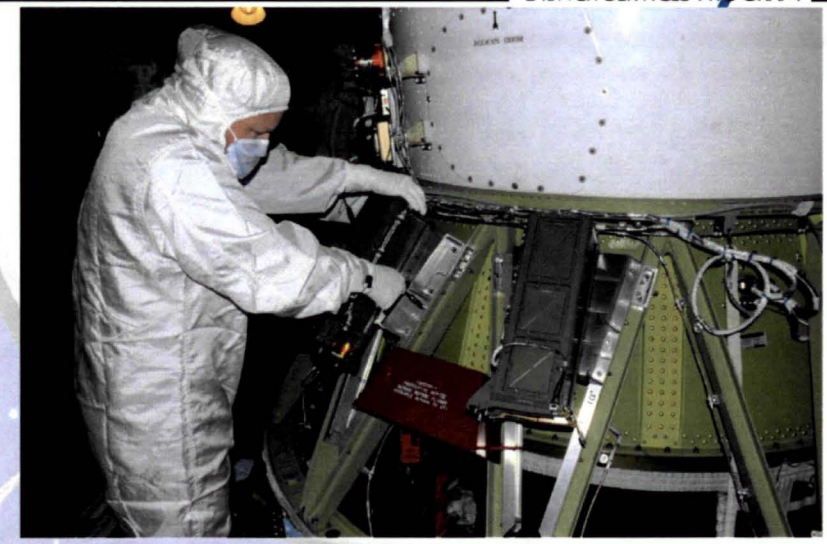
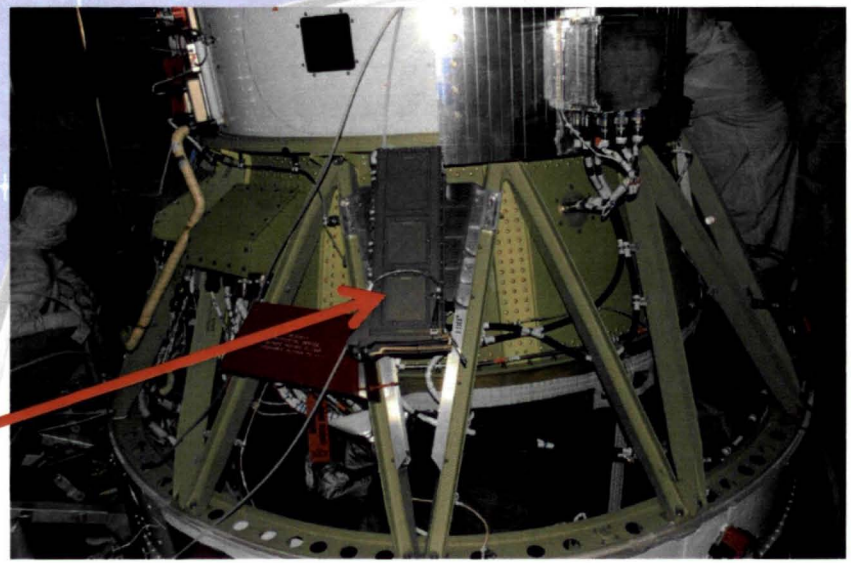
# ELaNa III

LAUNCH SERVICES PROGRAM







**P-POD #3**
**DICE**

**P-POD #1**
**E1P-F2**
**AubieSat**
**Mcube/Cove**

**P-POD #2**
**RAX 2**

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# ELaNa III

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PRIME

MONTANA STATE UNIVERSITY

SPACE SCIENCE AND ENGINEERING LABORATORY

DICE

ASTRA
USU/SDL
Clemson
Embry Riddle

AubieSat-I

DELTA 2 | VANDENBERG AFB, CALIFORNIA | ELaNa

RADIO AURORA EXPLORER

NATIONAL SCIENCE FOUNDATION

M-CUBED

MICHIGAN MULTIPURPOSE MINISAT

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# NASA CubeSat Initiative

LAUNCH SERVICES PROGRAM

## *3 Calls for CubeSats has reached 24 States*

## *68 CubeSats Selected with 23 Manifested*

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# NASA CubeSat Initiative Proposals

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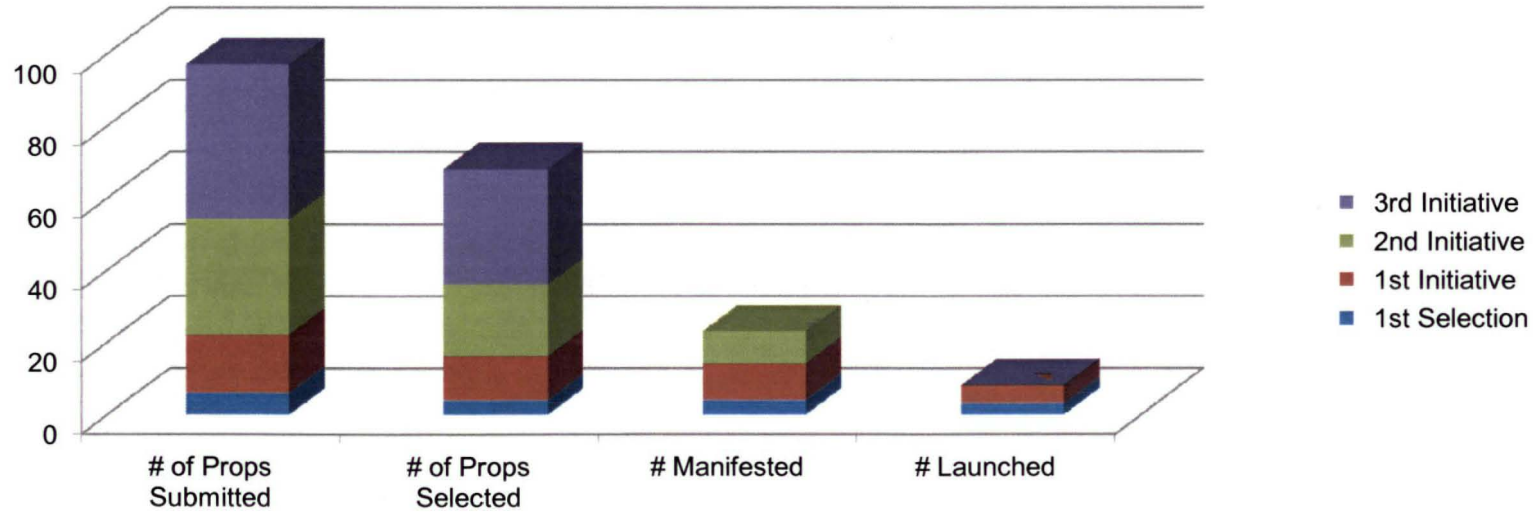
| | # of Props Submitted | # of Props Seleced | # Manifested | # Launched |
|---|---|---|---|---|
| 1st Selection | 6 | 4 | 4 | 3 |
| 1st Initiative | 16 | 12 | 10 | 5 |
| 2nd Initiative | 32 | 20 | 9 | 0 |
| 3rd Initiative | 43 | 32 | 0 | 0 |
| Total | 97 | 68 | 23 | 8 |



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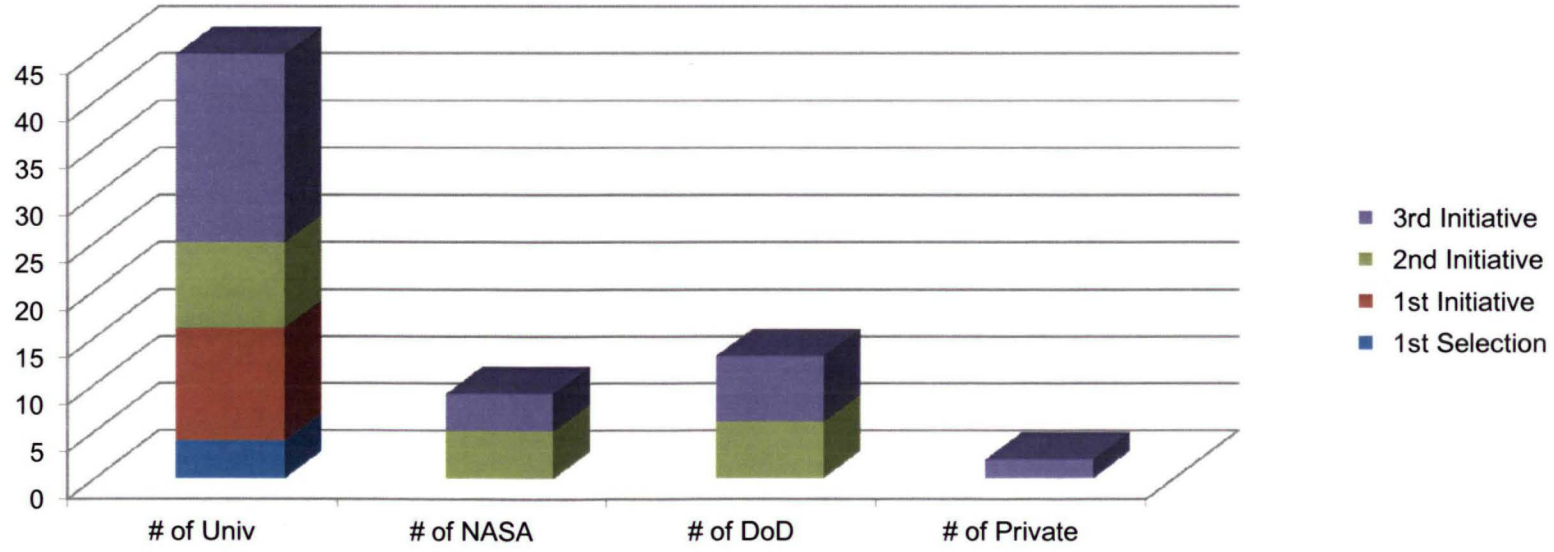
# NASA CubeSat Initiative Proposers

LAUNCH SERVICES PROGRAM

| | # of Univ | # of NASA | # of DoD | # of Private |
|---|---|---|---|---|
| 1st Selection | 4 | 0 | 0 | 0 |
| 1st Initiative | 12 | 0 | 0 | 0 |
| 2nd Initiative | 9 | 5 | 6 | 0 |
| 3rd Initiative | 20 | 4 | 7 | 2 |
| Total | 45 | 9 | 13 | 2 |



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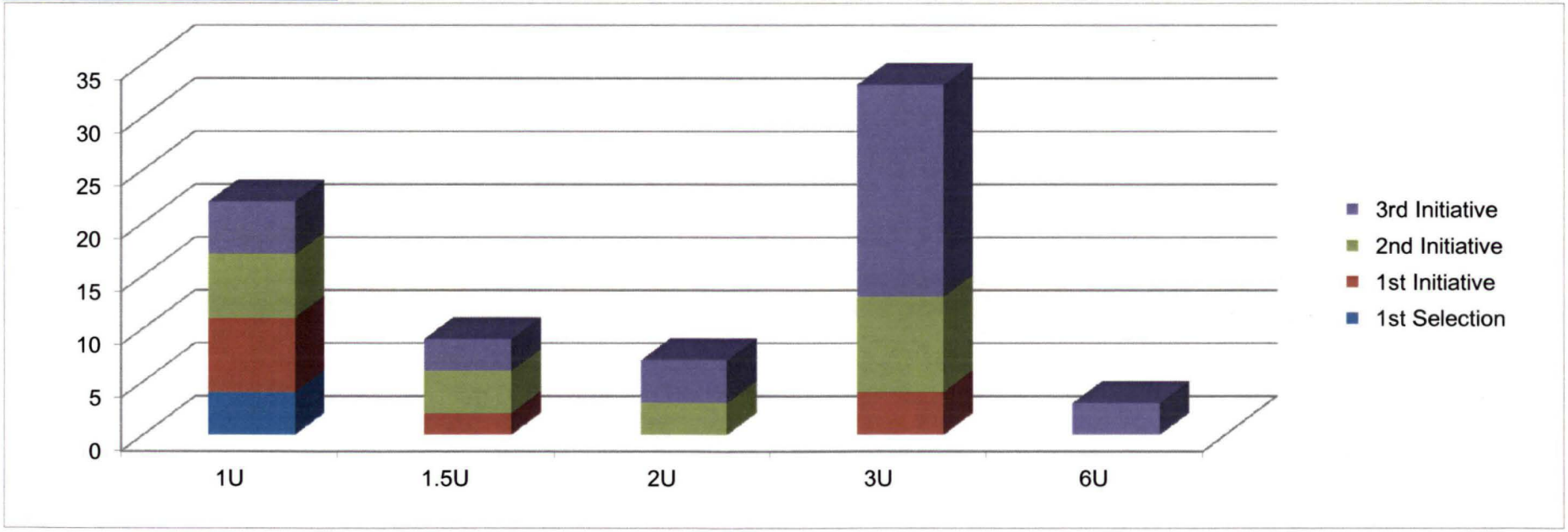
# NASA CubeSat Initiative
# CubeSat Sizes

LAUNCH SERVICES PROGRAM

| | 1U | 1.5U | 2U | 3U | 6U |
|---|---|---|---|---|---|
| 1st Selection | 4 | 0 | 0 | 0 | 0 |
| 1st Initiative | 7 | 2 | 0 | 4 | 0 |
| 2nd Initiative | 6 | 4 | 3 | 9 | 0 |
| 3rd Initiative | 5 | 3 | 4 | 20 | 3 |
| Total | 23 | 9 | 7 | 33 | 3 |



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# NASA CubeSat Initiative CubeSats by Orbit

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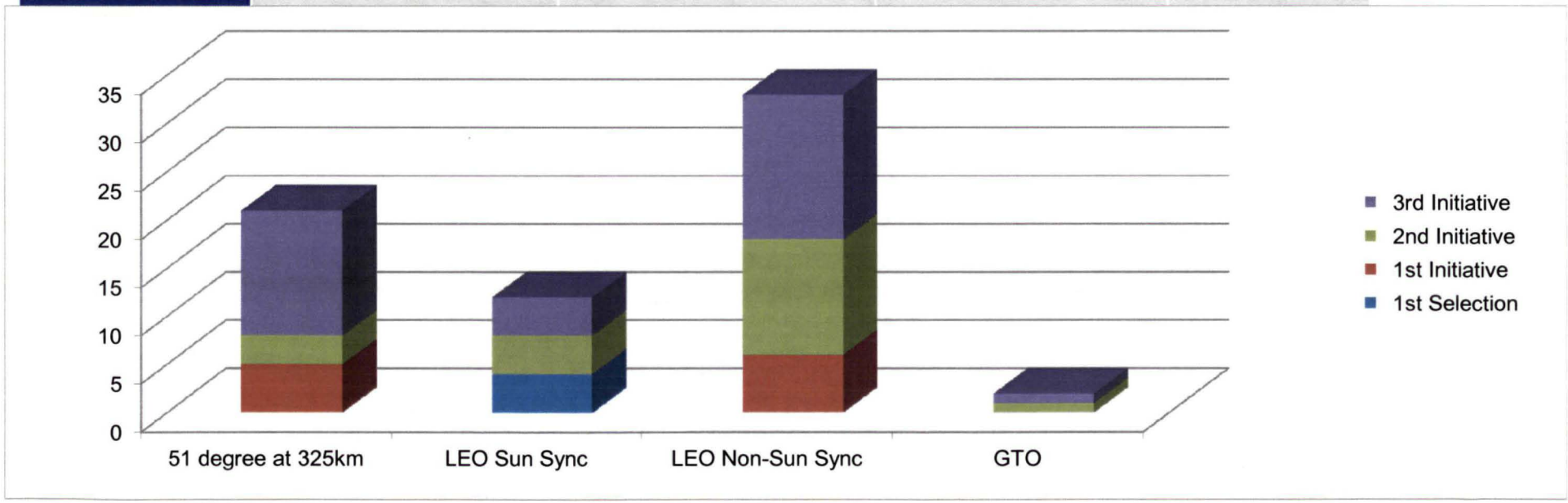
| | 51° at 325km | LEO Sun Sync | LEO Non-Sun Sync | GTO |
|---|---|---|---|---|
| 1st Selection | 0 | 4 | 0 | 0 |
| 1st Initiative | 5 | 0 | 6 | 0 |
| 2nd Initiative | 3 | 4 | 12 | 1 |
| 3rd Initiative | 13 | 4 | 15 | 1 |
| Total | 21 | 12 | 33 | 2 |



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# NASA CubeSat Carriers

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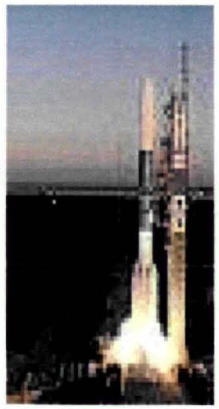
| Atlas V | | Delta IV | Delta II | Taurus XL | Athena | Falcon 9 | |
|---|---|---|---|---|---|---|---|
| Common | ABC | Common | 2nd Stg Struts Section | Aft End 3rd Stg | Aft End | CRS | Fairing |
| Studied | In Development Aug '12 | Studied | Flown | Flown | Studied | In Development Dec '12 | Starting Development 2014 |



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# Manifested Missions

FY08 | FY09 | FY10 | FY11 | FY12 | FY13 | FY14

Failed to reach orbit

ELaNa I

March 4th

Sucessful

ELaNa III

October 25th

ELaNa VI

August

ELaNa IV

June

ELaNa V

December

Sept

Feb

Demo Flight

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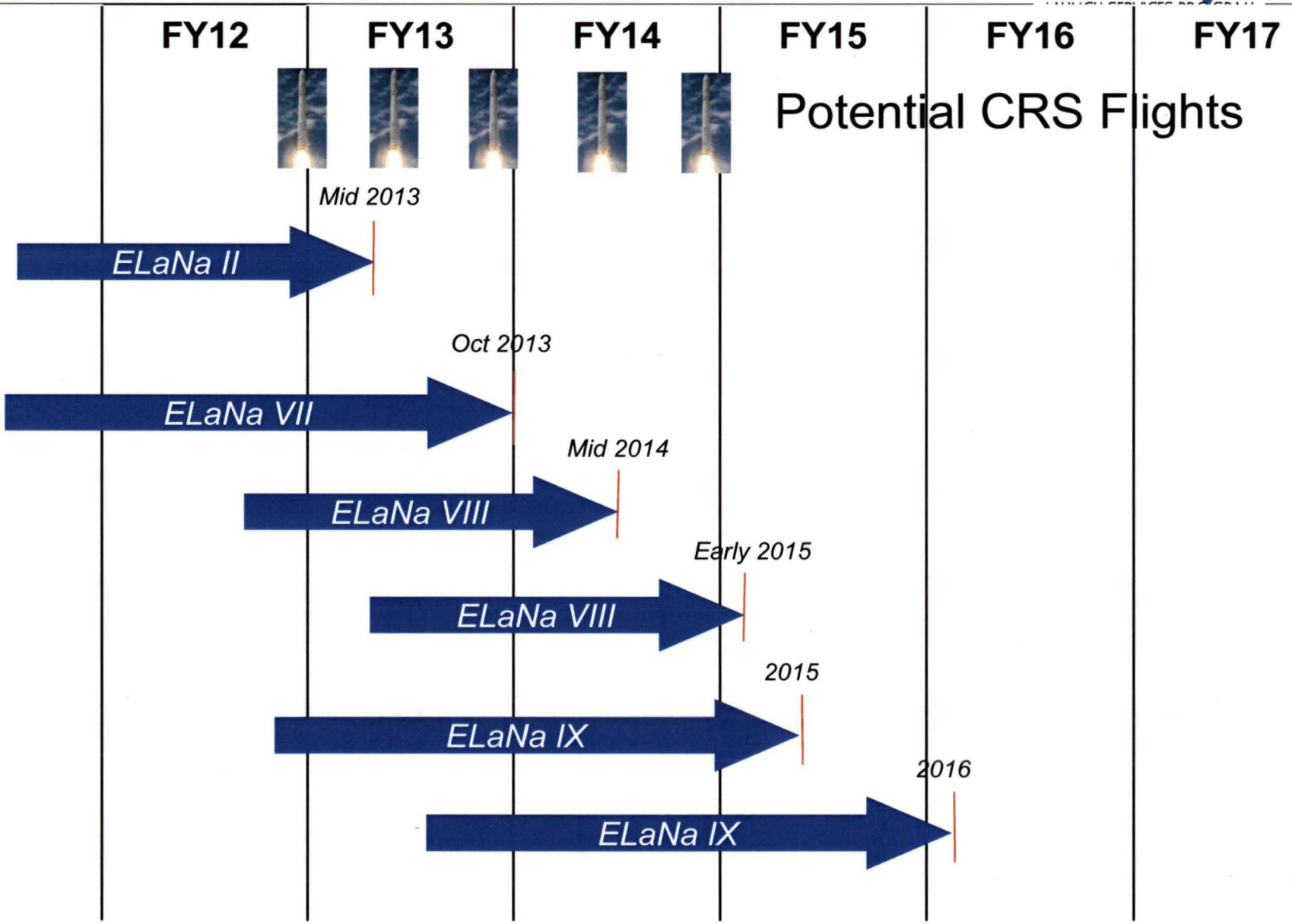
# Mission of Opportunities



Potential CRS Flights



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# Nano Launcher System

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- During the CubeSat Workshop in August 2011, we talked about the Next Logical Step for the launching of CubeSats
- Our own Nano Launcher System
- *So where are we today?*

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# Nano Launcher System

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## Conceptual

### Phase I ---- Phase II ---- Phase III

**High Altitude**

1 Stage system

15k to 100k feet flights

**Sub Orbital**

1 Stage system
Large Tanks
Increase Engine

185 Km flights

**Orbital**

2 Stage system
Large Tanks
Increase Engine

450 Km flights

6 to 12 months

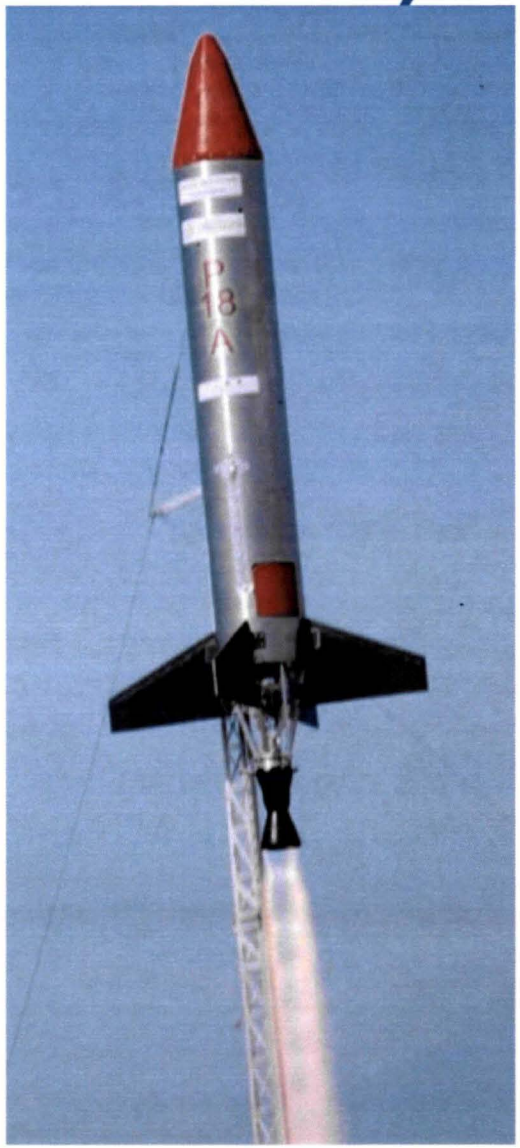
12 to 18 months

12 to 24 months

# High Altitude Launcher



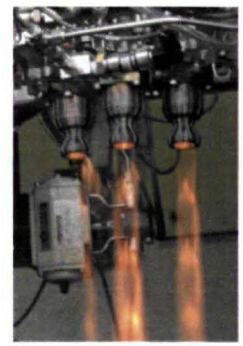
- **Launch Service Program has placed Garvey Spacecraft Corporation on contract for a series of high altitude launches**
  - **Flight 1**
    - » **Looking for riders!**
    - » **Launch Date Sept 2012**
    - » **Developing a system to eliminate P-POD and attach the CubeSat to the interface Deck**
  - **Flight 2**
    - » **CP9 Mus-StangSat CubeSat system to test data collect system between two cubesats**
      - **CP9 Mus being developed by CalPoly**
      - **StangSat is a Merritt High School CubeSat project**
  - **Options for three additional flights**



# Nano Launcher SBIRs



- **Three NASA 2012 Phase I SBIR have been awarded under the Nano Launcher Technology topic**
  - **Garvey Space**
    - » **Alternative Hydrocarbon Propulsion for Nano / Micro Launch Vehicle**
      - **Modify design of flight proven 5K lbf LOX/ethanol engine to use propylene instead**
  - **Interorbital Systems**
    - » **Neptune modular rockets for breakthrough low-cost space access**
      - **A single CPM adapted as a rocket, such as the flight-ready Interorbital CPMTV, can be used as an ultra low-cost entry level rocket vehicle for educational programs**
  - **Ventions**
    - » **A High-Payload Fraction, Pump-Fed, 2-Stage Nano Launch Vehicle**
      - **The proposed nano launch vehicle is aimed at providing low-cost and on-demand insertion of NASA cube- and nano-satellites into LEO as primary payloads**



# Future P-POD Task



- Development of a CubeSat Developers User Guide
- P-POD Power-On System
- Orbital Debris Request for Information
- Six U Carrier System
- ESPA Six U Mount
- Alternative Micro Switch
- RF Gasketing
- Purge System
- CubeSat Propulsion System

# In Closing



***Questions?***