ELaNa
Making it Happen!

CalPoly CubeSat Workshop 2012
April 18 - 20

Garrett Skrobot
ELaNa Project Manager
Launch Services Program

NASA
ELaNa CubeSat Missions

ELaNa
NASA
CalPoly

ELaNa III
NASA
CalPoly

ELaNa VI
NASA
NRO
CalPoly
NPS SRI

Montana State University
Kentucky Space
University of Colorado
Boulder
"Launching Education Into Space"

Auburn University
Utah State University
University of Michigan
Montana State University
"Launching Education Into Space"

Washburn State University
University of California
Berkeley
California Polytechnic State
University - 2015
University of Colorado - Boulder
"Launching Education Into Space"

CUBESat
California Polytechnic State University
ELaNa III

P-POD #3
DICE

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

P-POD #2
RAX 2
ELaNa III

Here we are...

...and here we go!
NASA CubeSat Initiative

3 Calls for CubeSats has reached 24 States
68 CubeSats Selected with 23 Manifested
# NASA CubeSat Initiative Proposals

<table>
<thead>
<tr>
<th>Initiative</th>
<th># of Props Submitted</th>
<th># of Props Selected</th>
<th># Manifested</th>
<th># Launched</th>
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<tbody>
<tr>
<td>1st Selection</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>3</td>
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<tr>
<td>1st Initiative</td>
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<td>12</td>
<td>10</td>
<td>5</td>
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<td>0</td>
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<td>3rd Initiative</td>
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<td>32</td>
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<td>0</td>
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<td><strong>Total</strong></td>
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<td>68</td>
<td>23</td>
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</table>

![Graph showing the number of proposals submitted, selected, manifested, and launched across different initiatives.](image-url)
### NASA CubeSat Initiative Proposers

<table>
<thead>
<tr>
<th></th>
<th># of Univ</th>
<th># of NASA</th>
<th># of DoD</th>
<th># of Private</th>
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<tr>
<td>2nd Initiative</td>
<td>9</td>
<td>5</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>3rd Initiative</td>
<td>20</td>
<td>4</td>
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<td>2</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>45</strong></td>
<td><strong>9</strong></td>
<td><strong>13</strong></td>
<td><strong>2</strong></td>
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</table>

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![Bar chart showing the distribution of proposers across different initiatives](chart.png)

- **3rd Initiative**
- **2nd Initiative**
- **1st Initiative**
- **1st Selection**

---

Source: [NASA CubeSat Initiative](https://www.nasa.gov/cubesat)
## NASA CubeSat Initiative CubeSat Sizes

<table>
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<tr>
<th></th>
<th>1U</th>
<th>1.5U</th>
<th>2U</th>
<th>3U</th>
<th>6U</th>
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<td>6</td>
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<td>3</td>
<td>4</td>
<td>20</td>
<td>3</td>
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<tr>
<td><strong>Total</strong></td>
<td>23</td>
<td>9</td>
<td>7</td>
<td>33</td>
<td>3</td>
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![Bar chart showing the distribution of CubeSat sizes across different initiatives.](chart.png)
# NASA CubeSat Initiative

## CubeSats by Orbit

<table>
<thead>
<tr>
<th></th>
<th>51° at 325km</th>
<th>LEO Sun Sync</th>
<th>LEO Non-Sun Sync</th>
<th>GTO</th>
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<tbody>
<tr>
<td><strong>1st Selection</strong></td>
<td>0</td>
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<td>4</td>
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<td>1</td>
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<tr>
<td><strong>Total</strong></td>
<td>21</td>
<td>12</td>
<td>33</td>
<td>2</td>
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</tbody>
</table>

**Graph:**

- **3rd Initiative**
- **2nd Initiative**
- **1st Initiative**
- **1st Selection**

**Legend:**

- 51 degree at 325km
- LEO Sun Sync
- LEO Non-Sun Sync
- GTO
<table>
<thead>
<tr>
<th></th>
<th>Atlas V</th>
<th>Delta IV</th>
<th>Delta II</th>
<th>Taurus XL</th>
<th>Athena</th>
<th>Falcon 9</th>
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<tbody>
<tr>
<td>Common</td>
<td>ABC</td>
<td>Common</td>
<td>2nd Stg Struts Section</td>
<td>Aft End 3rd Stg</td>
<td>Aft End</td>
<td>CRS</td>
</tr>
<tr>
<td>Studied</td>
<td>In Development Aug '12</td>
<td>Studied</td>
<td>Flown</td>
<td>Flown</td>
<td>Studied</td>
<td>In Development Dec '12</td>
</tr>
</tbody>
</table>

**Images:**
1. Rocket launch
2. Rocket on launchpad
3. Rocket in flight
4. Rocket on launchpad
5. Rocket launch
Manifedted Missions

- FY08: Failed to reach orbit (ELaNa I)
- FY09: Successful (ELaNa III)
- FY10: March 4th
- FY11: October 25th
- FY12: August
- FY13: June
- FY14: December

- FY08: Demo Flight
- FY09: ELaNa I
- FY10: ELaNa III
- FY11: ELaNa VI
- FY12: ELaNa IV
- FY13: ELaNa V
- FY14: ELaNa V
Mission of Opportunities

<table>
<thead>
<tr>
<th>FY12</th>
<th>FY13</th>
<th>FY14</th>
<th>FY15</th>
<th>FY16</th>
<th>FY17</th>
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<tr>
<td></td>
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</tr>
</tbody>
</table>

Potential CRS Flights

- **ELaNa II**: Mid 2013
- **ELaNa VII**: Oct 2013
- **ELaNa VIII**: Mid 2014
- **ELaNa VIII**: Early 2015
- **ELaNa IX**: 2015
- **ELaNa IX**: 2016
Nano Launcher System

- 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?
Nano Launcher System

Conceptual

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

High Altitude

1 Stage system

15k to 100k feet flights

6 to 12 months

Sub Orbital

1 Stage system

Large Tanks

Increase Engine

185 Km flights

12 to 18 months

Orbital

2 Stage system

Large Tanks

Increase Engine

450 Km flights

12 to 24 months

JOHN F. KENNEDY SPACE CENTER

LAUNCH SERVICES PROGRAM
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?