1st International African CubeSat Workshop

ELaNa
Educational Launch of Nanosatellite, Developing the Process and Requirements to Launch On NASA ELVs

Garrett Skrobot
Mission Manager
Launch Services Program

NASA
ELaNa
Educational Launch of Nanosatellite

"Science, Technology, Engineering, and Mathematics"

"Launching Education into Space"
ELaNa
NASA
CalPoly

"Launching Education into Space"

KySat™

COLORADO SPACE GRANT CONSORTIUM

CUBE Satellite
CALIFORNIA POLYTECHNIC STATE UNIVERSITY
CubeSats

Stage 2/3 Coast

Stage-2 Separation
T = 314.7 sec
h = 369.4 km
V_i = 6483 m/s
R = 1057 km

Stage-3 Burnout
T = 669.9 sec
h = 640.9 km
V_i = 7537 m/s
R = 1363 km

Stage-3 Ignition
T = 537.7 sec
h = 640.9 km
V_i = 7537 m/s
R = 3960 km

Glory Separation
T = 784.9 sec
h = 640.8 km
V_i = 7537 m/s
R = 3960 km

Cubesat Deployment
T = 794.9 sec
h = 640.9 km
V_i = 7537 m/s
R = 4029 km

This Happened!
The Cubes Separated
Approval Process

LSP P-POD CoFR Process

This process has been pre-briefed to the following:

SOMD – July 1, 2009
SMD – August 4, 2009
OCE (charts only) – October 16, 2009
OSMA – October 28, 2009

Approved
Special FPB - January 6, 2010
CubeSat Initiative Manifesting

CubeSat Initiatives
- CubeSat Missions
- NASA CubeSat Missions
- DoD CubeSat Missions

Selection Representatives
- SOMD
- OCT
- ESMD
- DoD
- SMD
- Education

Launch Services Program perform manifesting and management of CubeSats integration on ELVs

CubeSat Missions
- Selection List
- CubeSat 1
- CubeSat 2
- CubeSat 3
- CubeSat 4
- CubeSat N
Let’s take a look at ELaNa
Introduction

ELaNa

Educational
Was ELaNa I a Success?

First NASA Selected CubeSat mission

Approval to fly on Glory

The design and build of CubeSat

Educational experience of working through a NASA Integration cycle

Annual Call for CubeSats

Lead the way to launch on other NASA vehicle

Lessons Learned applied to future mission

Students are prepared to enter the aerospace workforce
What’s Planned for the Future
### NASA CubeSat Initiative

#### Number of CubeSats

<table>
<thead>
<tr>
<th>First Selection</th>
<th>First Initiative</th>
<th>Second Initiative</th>
<th>Prior Selected</th>
<th>Total</th>
<th>First Flight</th>
<th>Re-Flight</th>
<th>Still to Fly</th>
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<tr>
<td>4</td>
<td>12</td>
<td>20</td>
<td>1</td>
<td>37</td>
<td>3</td>
<td>3</td>
<td>37</td>
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#### CubeSat by Orbits

<table>
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<tr>
<th>325km@51.6°</th>
<th>LEO SunSync</th>
<th>LEO other then SunSync</th>
<th>GTO</th>
<th>GSO</th>
<th>MEO</th>
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<tbody>
<tr>
<td>14</td>
<td>14</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>1</td>
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**LEO is a Range of 350km to 650km**

#### Number of CubeSats Manifested

- Currently Manifested: 26

- Manifested: 37
# NASA CubeSat Carriers

<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>Struts</td>
<td>Aft End</td>
<td>Unknown</td>
<td>CRS</td>
</tr>
<tr>
<td>In Development</td>
<td>In Development</td>
<td>In Development</td>
<td>Flown</td>
<td>Studying</td>
<td>In Development</td>
<td>Studied</td>
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</table>

**Imagery:**
- Atlas V launching
- Delta IV launching
- Delta II launching
- Taurus XL launching
- Athena launching
- Falcon 9 launching
Don’t rest on your laurels …don’t dwell on failure

Let’s Keep Moving Forward!