



# **NASA Launch Services Program**

## **Project ELaNa and Educational CubeSat Initiative**

**Garrett Skrobot  
NASA**

**Small Payload Rideshare 2010**

**May 20, 2010**



# 2010 Small Payload Rideshare Workshop

LAUNCH SERVICES PROGRAM

## Launch Services Program Bottom Line

- **LSP—Assured access to space for civil spacecraft**
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- **Provide Launch Capabilities to meet customer needs**
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  - 265 civilians, including matrixed support from KSC and other centers
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  - Average government experience level in launch: 15 years
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\* NSPD-40: U.S. Space Transportation Policy





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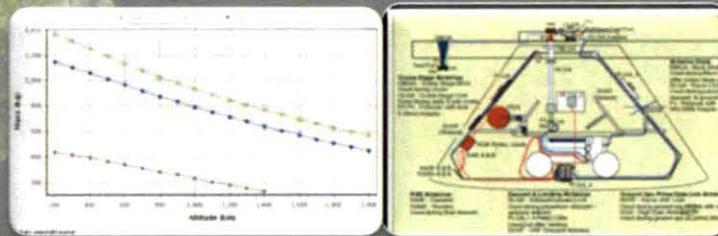
LAUNCH SERVICES PROGRAM

## Launch Services Overview

Acquire Launch Services



Verify and validate mission engineering and analysis



Insight and approval of production, integration, testing and processing



*Provide technical, operational, contractual, budget and business knowledge and expertise to future missions*

Manage launch vehicle to spacecraft integration



Certify launch systems for NASA use



Establish strategic partnerships and make investments to satisfy Agency Launch Service needs

Perform NASA launch Management activities



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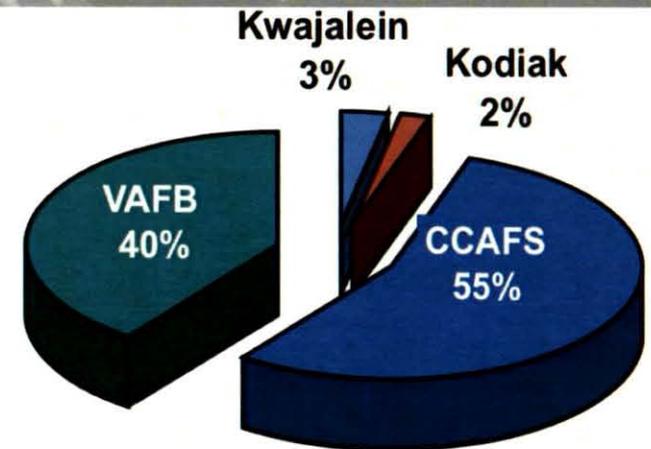
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## Launch Site Locations Available



These launch sites provide a variety of inclinations to meet mission requirements

## LSP Launch Site Utilization Percentage Breakdown





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## Launch Vehicles

Current launch vehicles on NLS contract that could possibly be used by NASA for Rideshare opportunities if mass margin is available

LSP considers Rideshare or auxiliary payloads as those in the 1kg to 180 kg range

Why this range in mass?

Payloads about 150kg could fly as a small payload on a commercial launch vehicle



Pegasus



Taurus



Atlas V



Delta II



Delta IV



Falcon 1



Falcon 9

## Emerging Vehicles



Minotaur IV/V



SLV-A



SLV-B



Taurus II



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## Launch Vehicles Rideshare Capabilities

Performed study to integrate PPOD



Pegasus

First NASA Educational PPOD manifested - DPAF



Taurus

ESPA - Flown  
ABC - In Development  
DPAF



Atlas V

Auxiliary Payload systems in development or have flown by STP, NRO, ORS, or NASA

### Emerging Vehicles

Developing PPOD capability



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ESPA - In development



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Integrated and flown PPODs  
F1e - NLAS Wafer PPOD capability



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Now that we have our first educational PPOD manifested, what's next?

Transformed the ELaNa mission into a sustainable project

Studies are under way for a possible eight PPOD mission in December 2012

Additional work continues in support of launch opportunities for a limited number of CubeSats for possible launches currently planned for 2011 and 2012

With these possible opportunities, how will NASA determine and select CubeSats for these missions?



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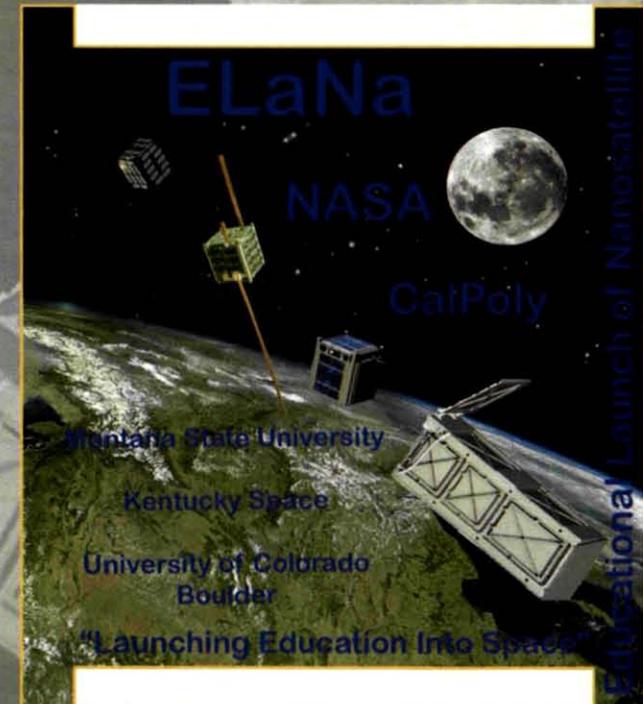
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## *ELaNa - Educational Launch of Nanosatellite*

*Mission Statement*  
*"Launching Education into Space"*

### *First ELaNa Mission*

- Montana State University – E1 Prime*
- University of Colorado, Boulder - Hermes*
- Kentucky Space – KySat*



*Launch Date November 22, 2010 on a Taurus XL carrying the Science Mission Directorate (SMD) Glory Spacecraft*



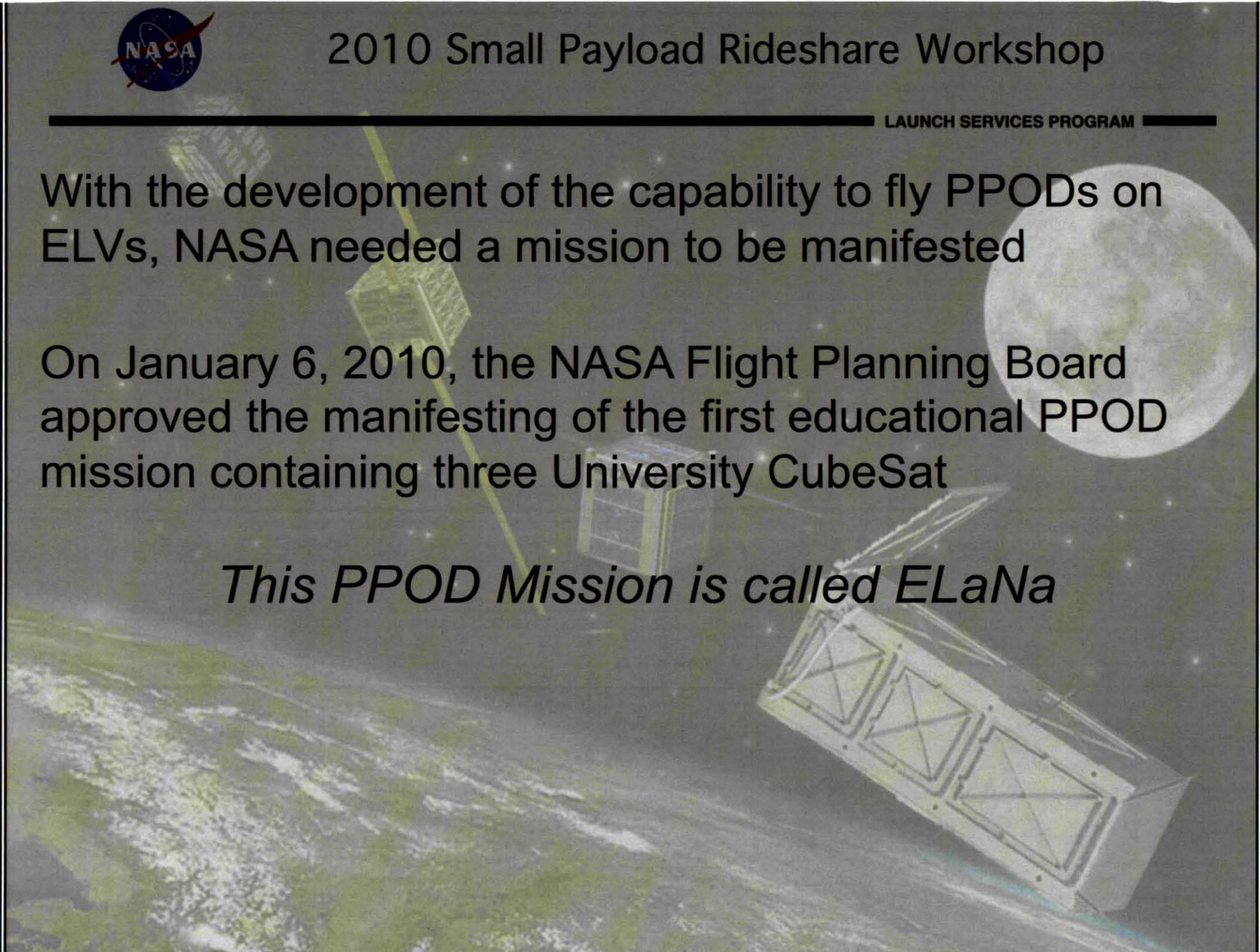
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With the development of the capability to fly PPODs on ELVs, NASA needed a mission to be manifested

On January 6, 2010, the NASA Flight Planning Board approved the manifesting of the first educational PPOD mission containing three University CubeSat

*This PPOD Mission is called ELaNa*





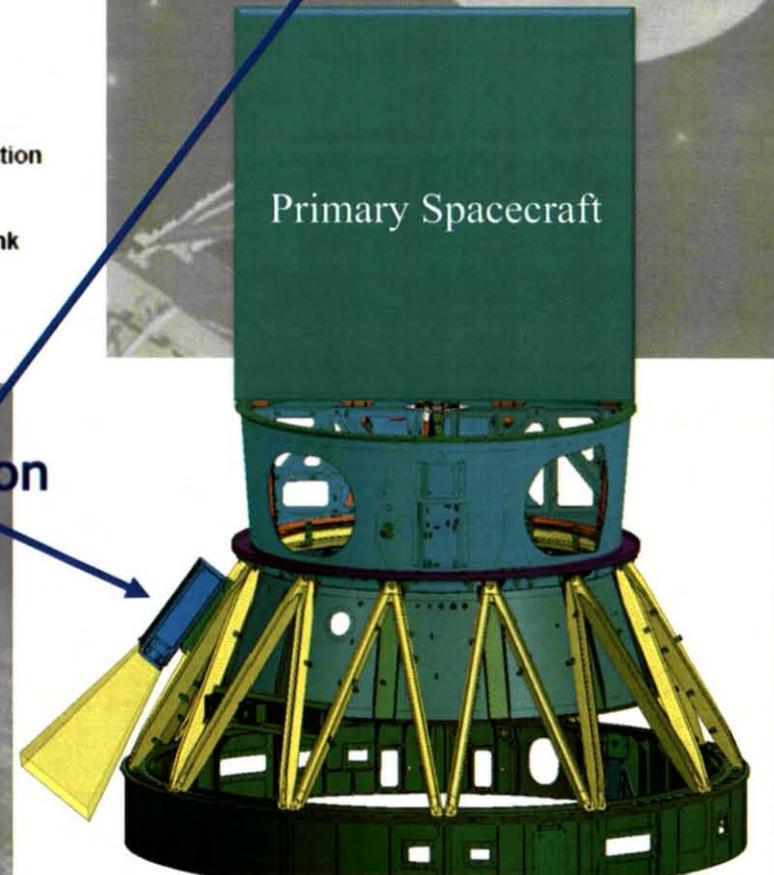
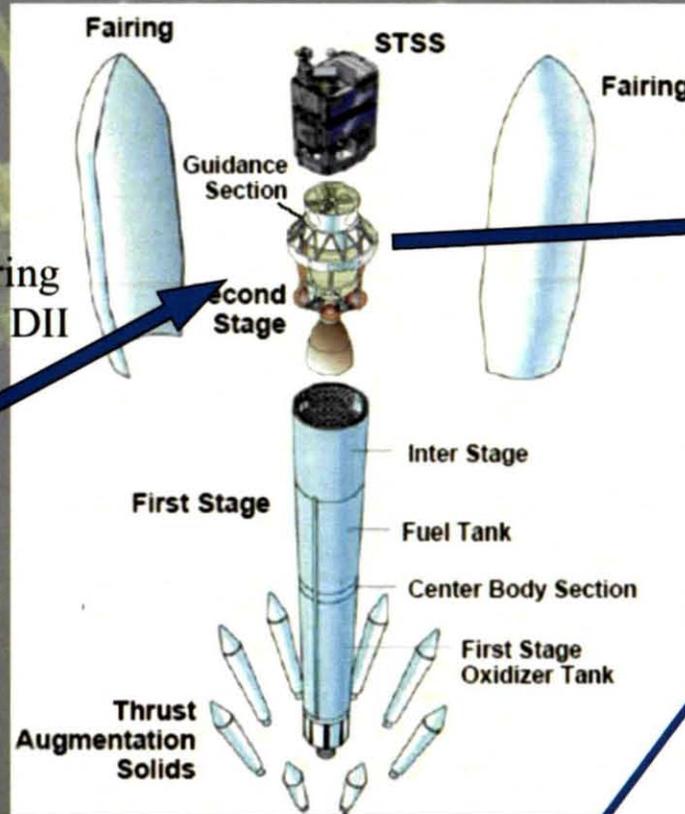
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## Delta II PPOD Deployment

Completed the Non Recurring Engineering

Working the Recurring Engineering and Integration for an upcoming DII Launch



What have we learned from performing the NRE and RE for Delta II

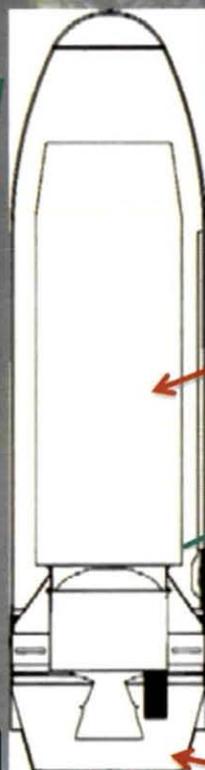
- Both teams are working together to keep cost down
- ULA and NASA will present at a Compatibility Review to ensure both side have performed their verifications
- ULA only has one POC for the PPOD and CubeSat that is NASA
- This style of Integration if successful, could be adopted by the EELV class vehicles



## Taurus PPOD Deployment

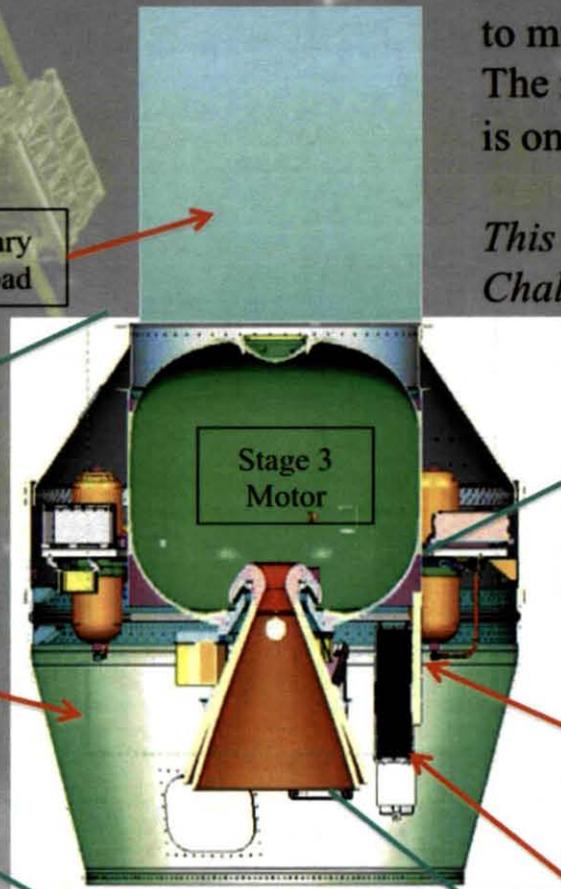
For a vehicle generic solution and to minimize Primary SC interaction The mounting location of the PPOD is on Stage 3 Aft Skirt

*This location has had it's share of Challenges!*



Primary Payload

Boat tail

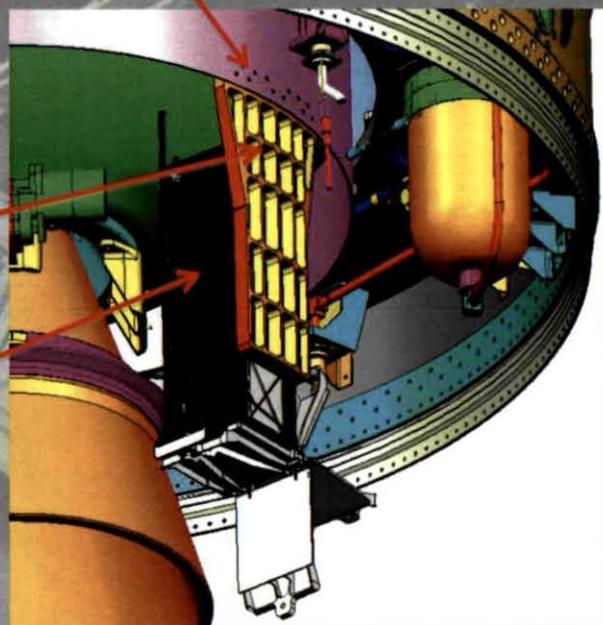


Stage 3 Motor

PPOD Bracket

PPOD w/ Door Open

S3 AFT Skirt



Completed the Non Recurring Engineering

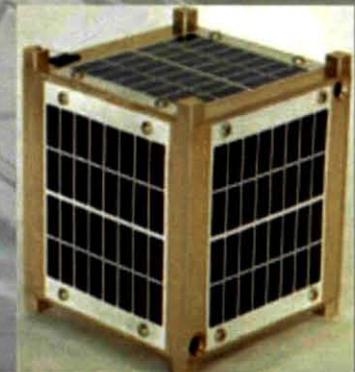
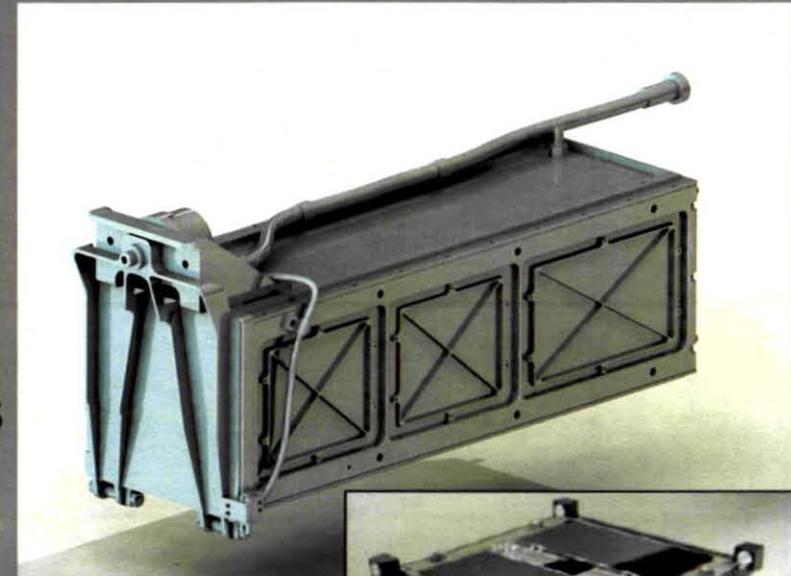
Working the Recurring Engineering and Integration for an upcoming Taurus launch



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- In 2007, LSP Management (Ray Lugo) gave direction to go forward and investigate how NASA can fly the Poly Picosatellite Orbital Developer (PPOD) system on Expendable Launch Vehicles (ELVs)
- Over the next three years the LSP PPOD team has worked to identify launch vehicles where PPODs could be integrated
- From this work, the LSP PPOD team has started the integration of PPODs on two launch vehicles





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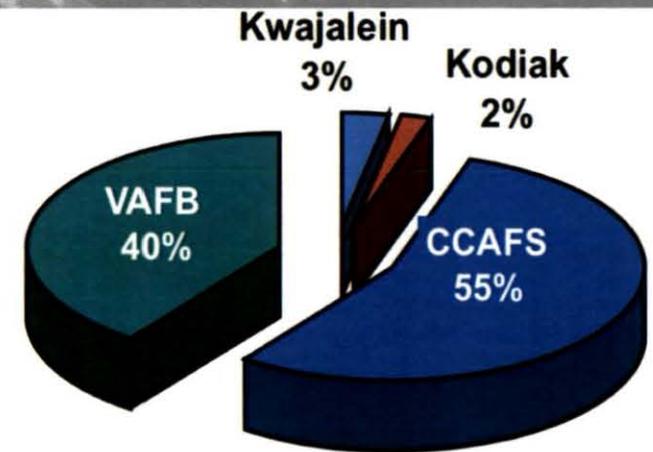
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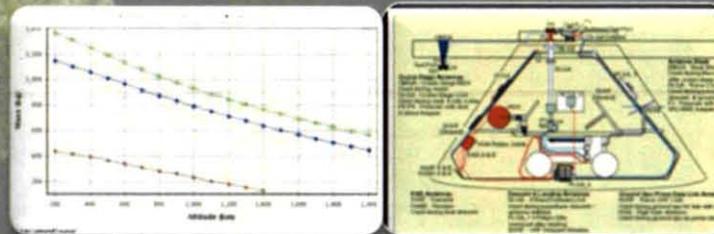
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## ***Announcement of CubeSat Launch Initiative***

***February 23, 2010***

The National Aeronautics and Space Administration (NASA) Space Operations Mission Directorate (SOMD) anticipates that launch opportunities for a limited number of CubeSats may be available on launches currently planned for 2011 and 2012. These launch opportunities would constitute a pilot project intended to demonstrate viable launch opportunities for CubeSat payloads as auxiliary payloads on planned missions.

Response Date: Apr 15, 2010

Selection Notification: Selection is anticipated by June 30, 2010.

The intent of the initiative is to provide Educational CubeSat flight opportunity

NASA is working to provide a sustainable Educational CubeSat flight project with a sustainable flight rate



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## *Requirements*

### *LSP-REQ- 317.01 Rev Basic*

*Launch Services Program Level Poly Picosatellite Orbital Deployer (PPOD) and CubeSat Requirements Document*

If you want to fly on a NASA ELV, then the CubeSat/PPOD will need to meet the requirements in this document

Requirements Document identifies criteria that PPOD and CubeSats are required to conform to – precludes specific hazards

The requirements document is developed as generic, not LV fleet specific

At this point in time there are no waivers for these requirements – We can make changes, but they will need to go to NASA Engineering Review Board (ERB)

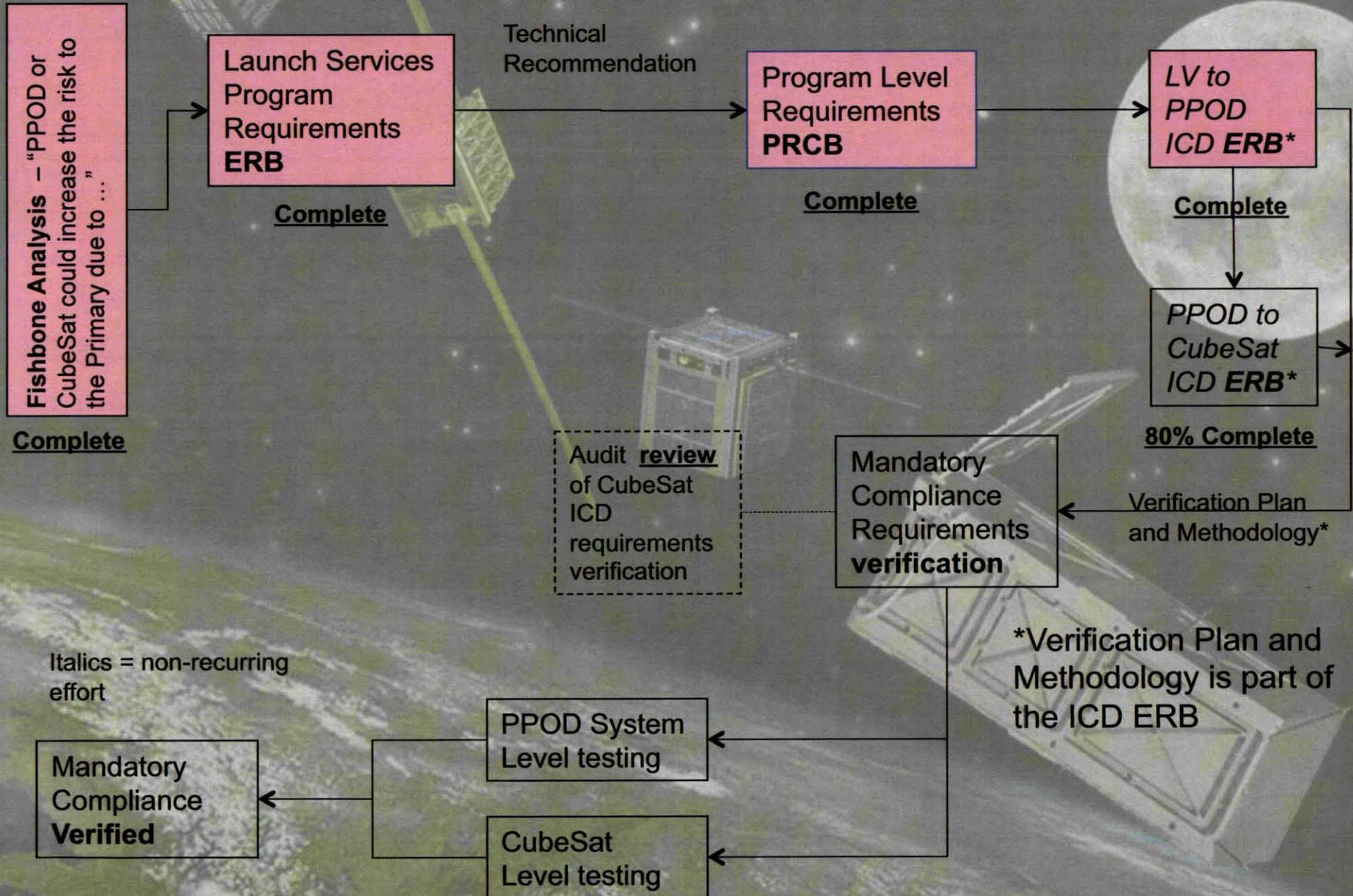
The approval of LSP-REQ- 317.01 Rev Basic laid the foundation for the LSP Certification of Flight Readiness ( CoFR ) process



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## CoFR Process for Taurus Mission

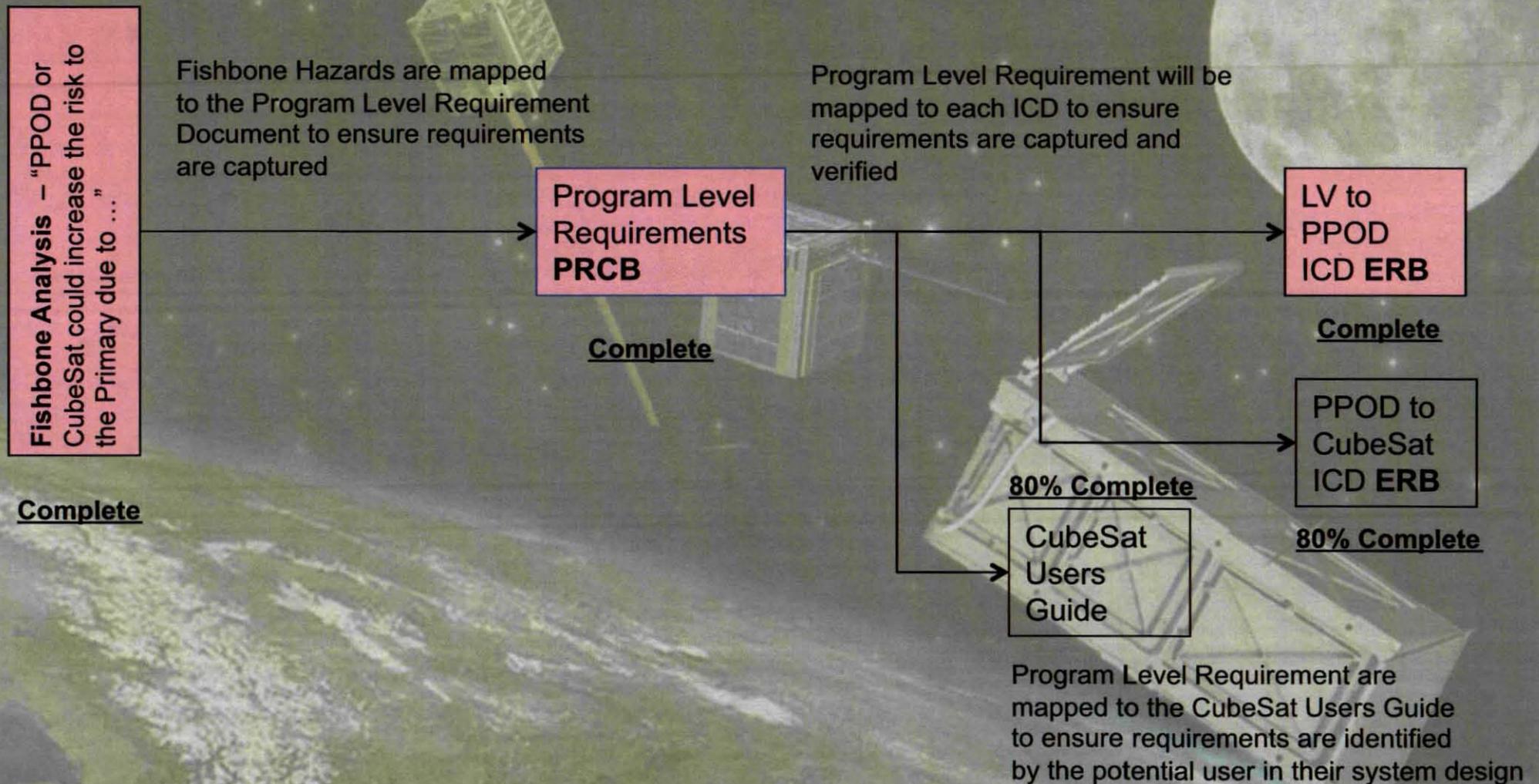




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## Requirements Mapping Process



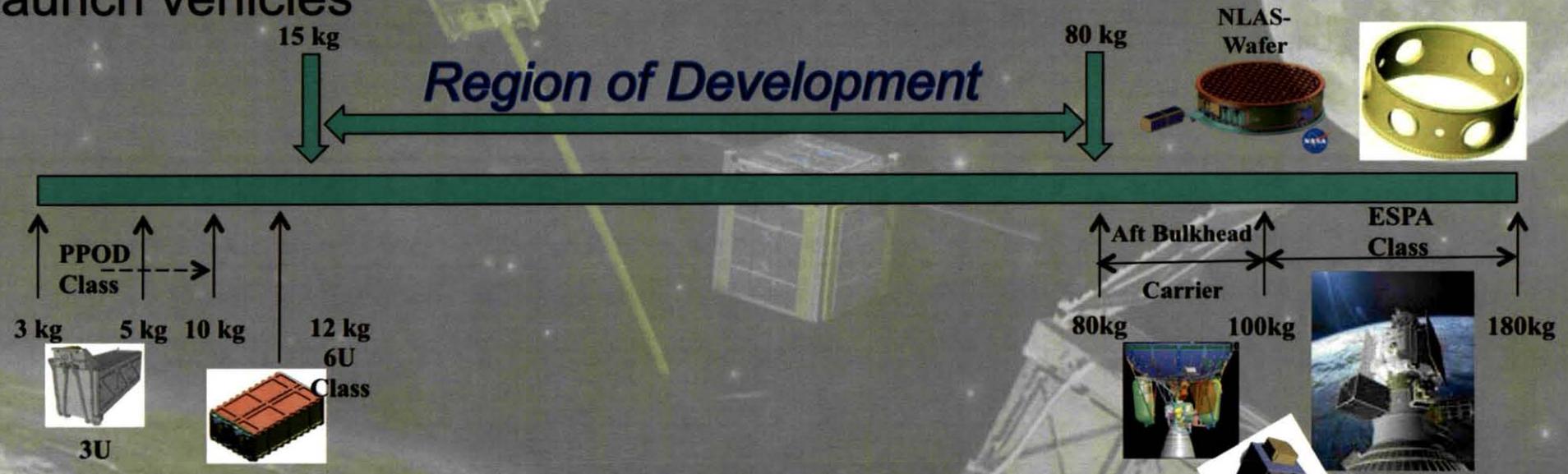


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## Where should the Small Payload Community be heading

The Small Sat community should work together to determine standard for small payload to try to make them common amongst all launch vehicles



What are the next standards for small payloads?

Are standards set by the first small sat that develops a new system?

Should there be some commonality between small sat systems?



## Small Payload Challenges

- Convincing the Mission Directorates and Primary Mission that the small payload have been well analyzed/tested and the mission risk is at baseline
- Small Payload being ready and on time to fly on the day of launch
- Understanding of what is required from the small payload in the verification of Interface Control Document (ICD) requirements
  - Deviation from the standard
- Funding, there are costs associated with integrating a mission on to the launch vehicle
- Understanding that they are the auxiliaries and not a primary



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*Questions?*