

NATIONAL RECONNAISSANCE OFFICE

# 2012 CubeSat Workshop

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Office of Space Launch

18 April, 2012



FREEDOM'S SENTINEL IN SPACE



# OSL's Vision & Mission

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- + OSL delivers the highest standard of launch and operations support to ensure 100% mission success
- + OSL earns the confidence of our valued space vehicle customers and mission partners to deliver vital NRO capabilities to orbit



# OSL's Interest in CubeSats

- ✦ The NRO is investigating meeting – some – not all - future NRO needs with cubesats – they need a way to orbit
- ✦ Director-NRO, Mr Bruce Carlson, provided keynote speech at 2011 Smallsat Conference, Logan, Utah
  - Explore new phenomena to regain strategic advantages over adversaries
  - Demonstrate revolutionary new technologies that enable new intelligence missions
  - Develop our future workforce
  - Rapidly change on-orbit configurations and formation geometry
- ✦ Cost and availability of launch opportunities an obstacle



# OSL's Efforts to Increase CubeSat Launch Opportunities

- ✦ Developed capability to deliver 175 lbs to orbit using Aft Bulkhead Carrier on aft end of ULA's Atlas Centaur upper stage
  - Single separating or non-separating spacecraft
  - 8 P-Pods to orbit using the Naval Postgraduate School Cubesat Launcher (NPSCuL)
    - ✦ First flight scheduled for this August on NROL-36: Operationally Unique Technologies Satellite (OUTSat)
    - ✦ Integrated satellite delivered to VAFB and ready for mate to the Centaur later this month; launch 2 Aug
  
- ✦ Funded Adaptive Launch Services' A-Deck structure from PDR to CDR
  - Capable of carrying 2,000 lbs of auxiliary payloads on both Atlas V and Delta IV EELV's
  - Stand-alone structure or used in conjunction with ESPA
  - Structure successfully completed qual vibration testing last week
  - CDR next week



# OSL's Efforts to Increase CubeSat Launch Opportunities (continued)

- ✦ Collaborate with NASA LSP, SMC/SDTD, STP, industry, academia and others to ensure breadth of knowledge
  - NASA/LSP-sponsored CubeSats part of NROL-36 ABC manifest
  
- ✦ Host annual Small Payload Rideshare Conference
  - Cleveland, OH 5-7 June 2012 [www.sprsa.org](http://www.sprsa.org)
  
- ✦ Participate in conferences and workshops like this one
  
- ✦ Maintain close relationship with NRO's CubeSat program office
  - Working with mission partners, program office currently has over 30 CubeSats awaiting launch in next four years



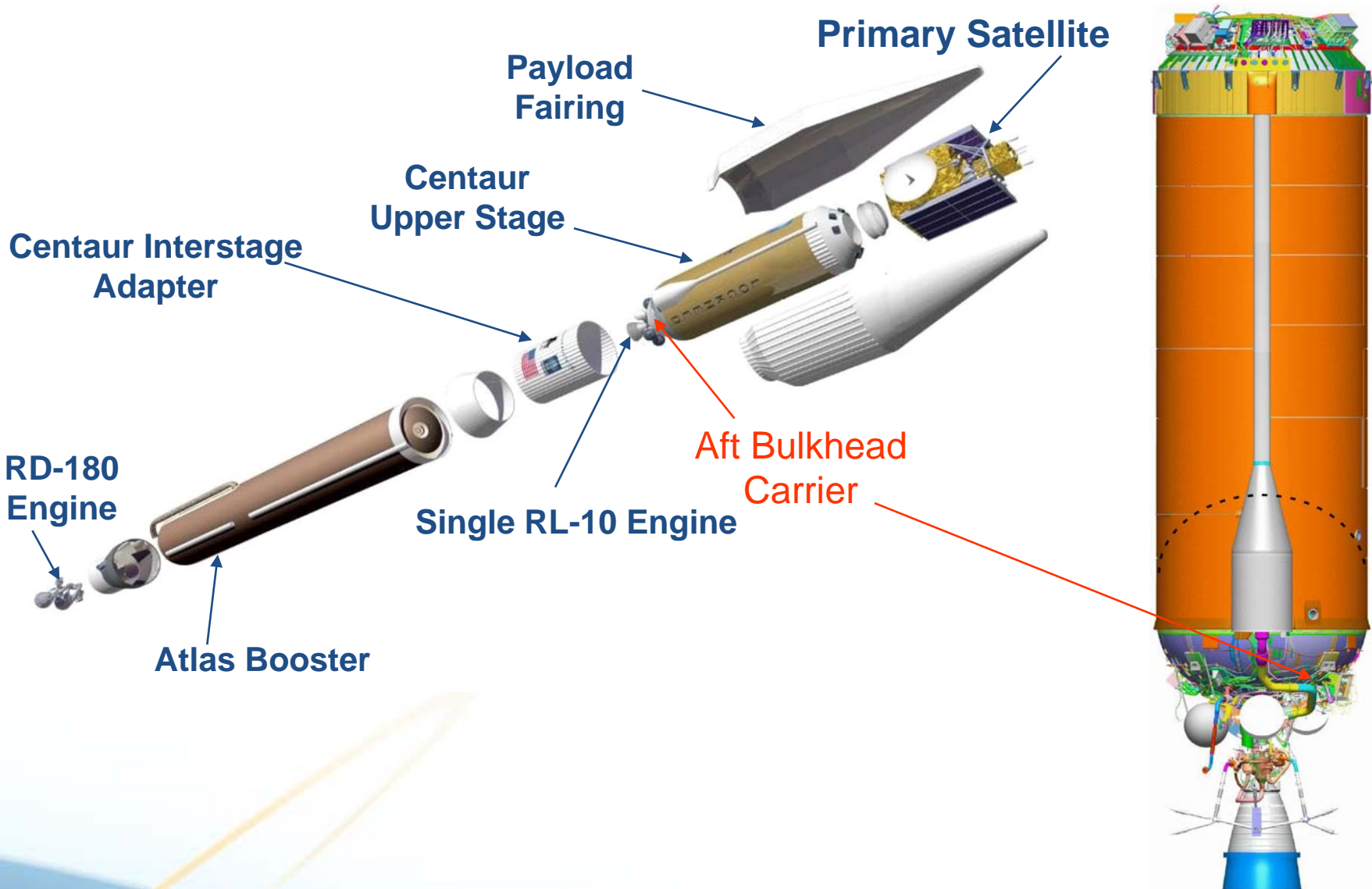
# Incremental Approach to Complexity

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- ✦ NRO primary SV programs extremely risk adverse
- ✦ OSL taking incremental approach to getting primary customers comfortable flying auxiliary payloads
  - Provides experience for cubesat integration team before working more complex missions
  - Provides confidence to primary customer risk is manageable
- ✦ Example: NROL-36 mission ground rule: no propulsion
  - Plan to relax for future missions – although systems will have to meet the letter of the law for inhibits, testing, documentation, etc



# (U) Atlas V with Aft Bulkhead Carrier



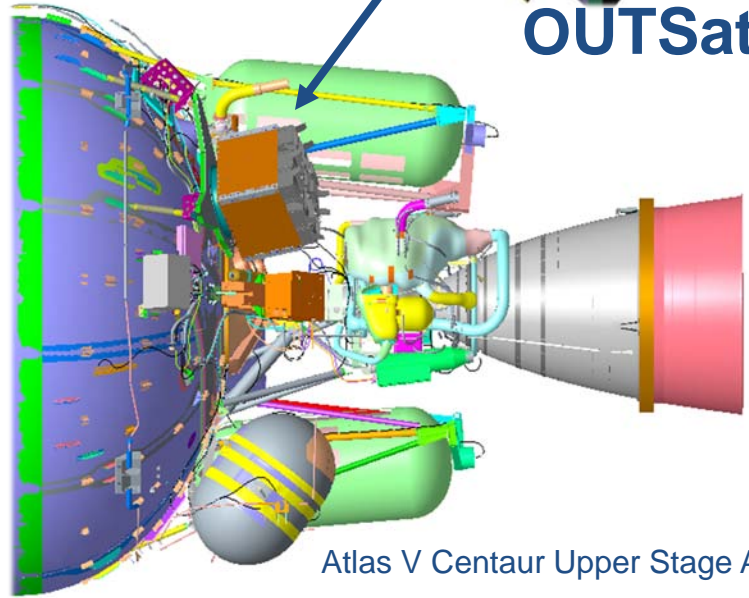
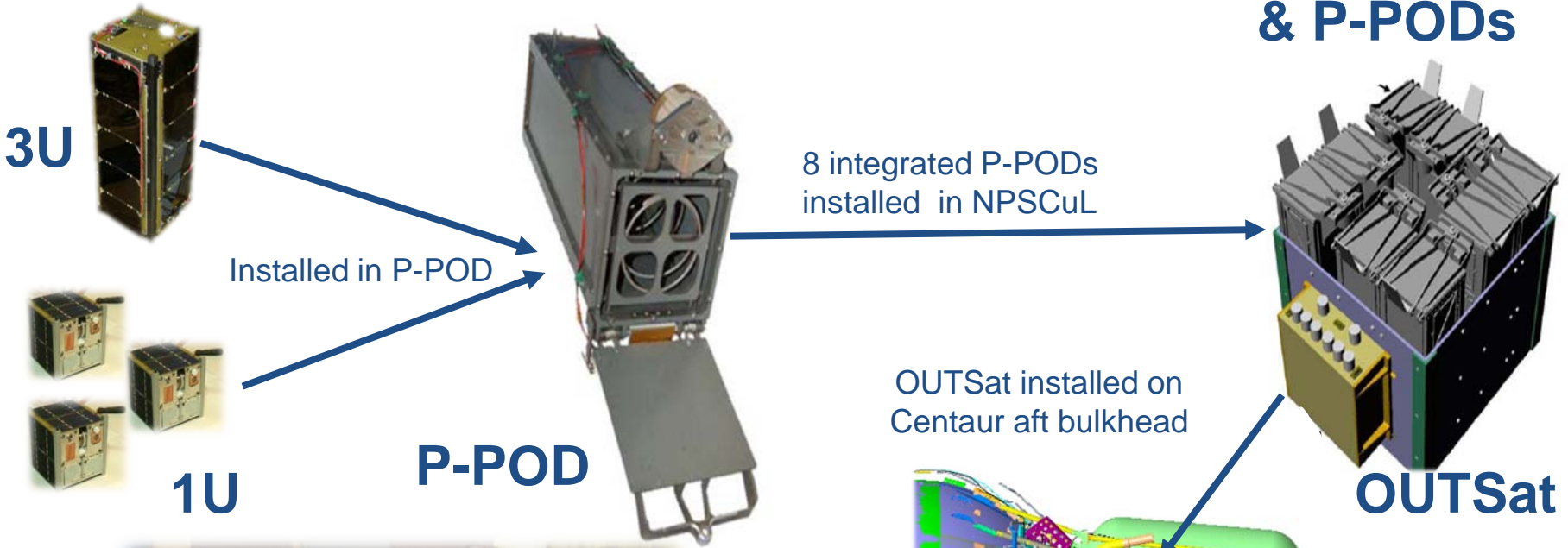




# NROL-36/OUTSat Auxiliary Payload

**CubeSat**

**NPSCuL  
& P-PODs**



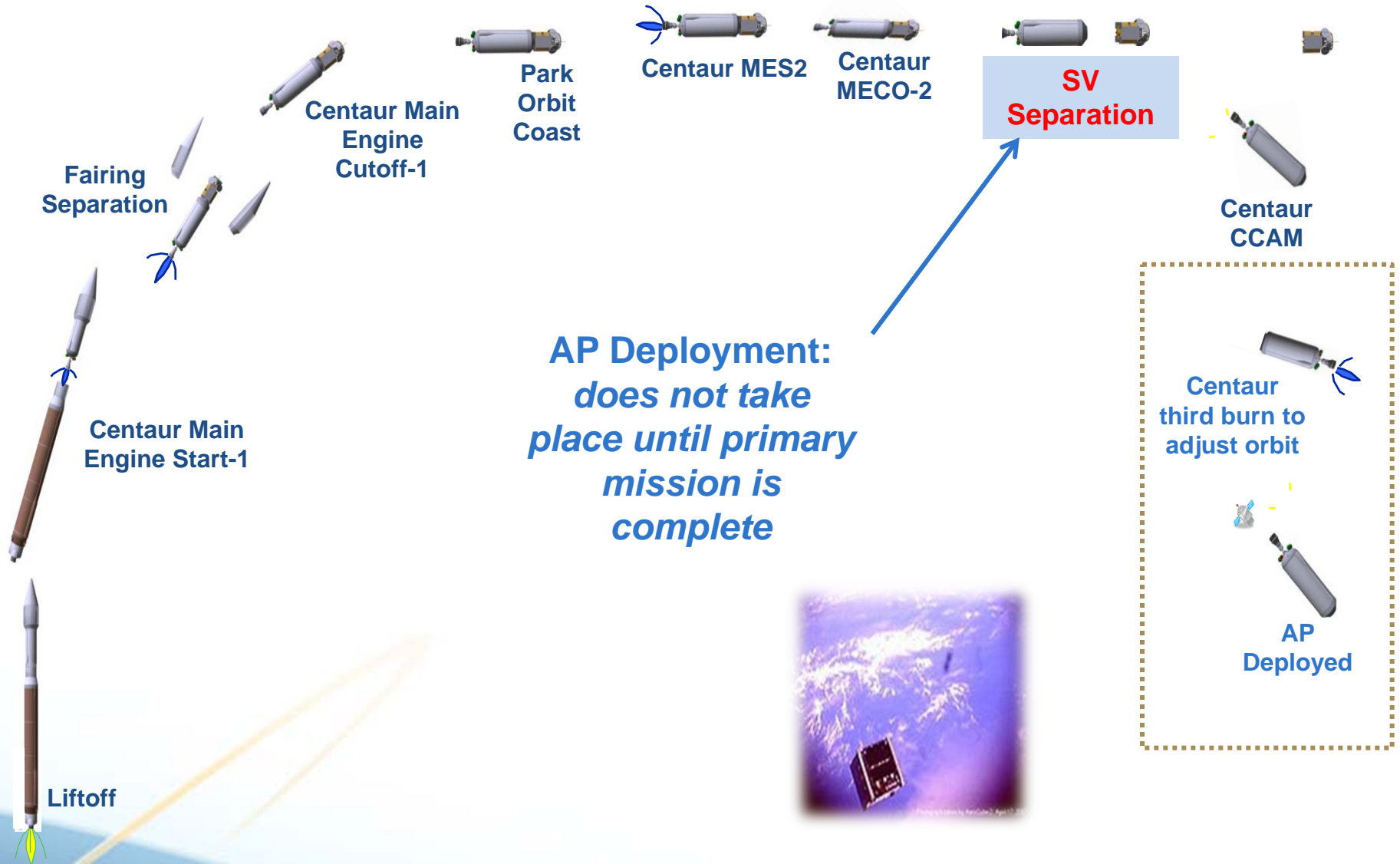
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Atlas V Centaur Upper Stage Aft End



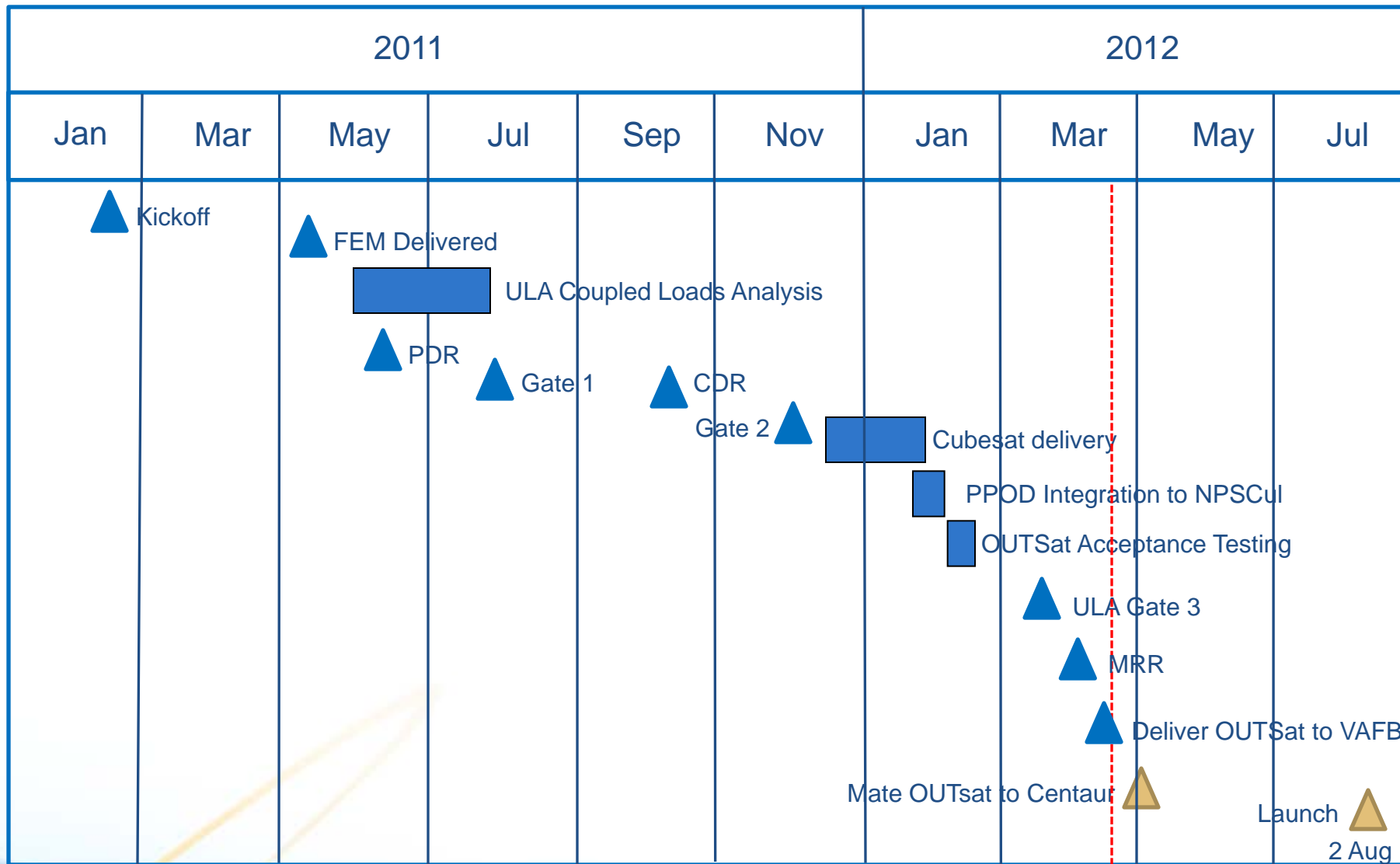


# Nominal Auxiliary Payload Mission





# (U) NROL-36/OUTSat Schedule



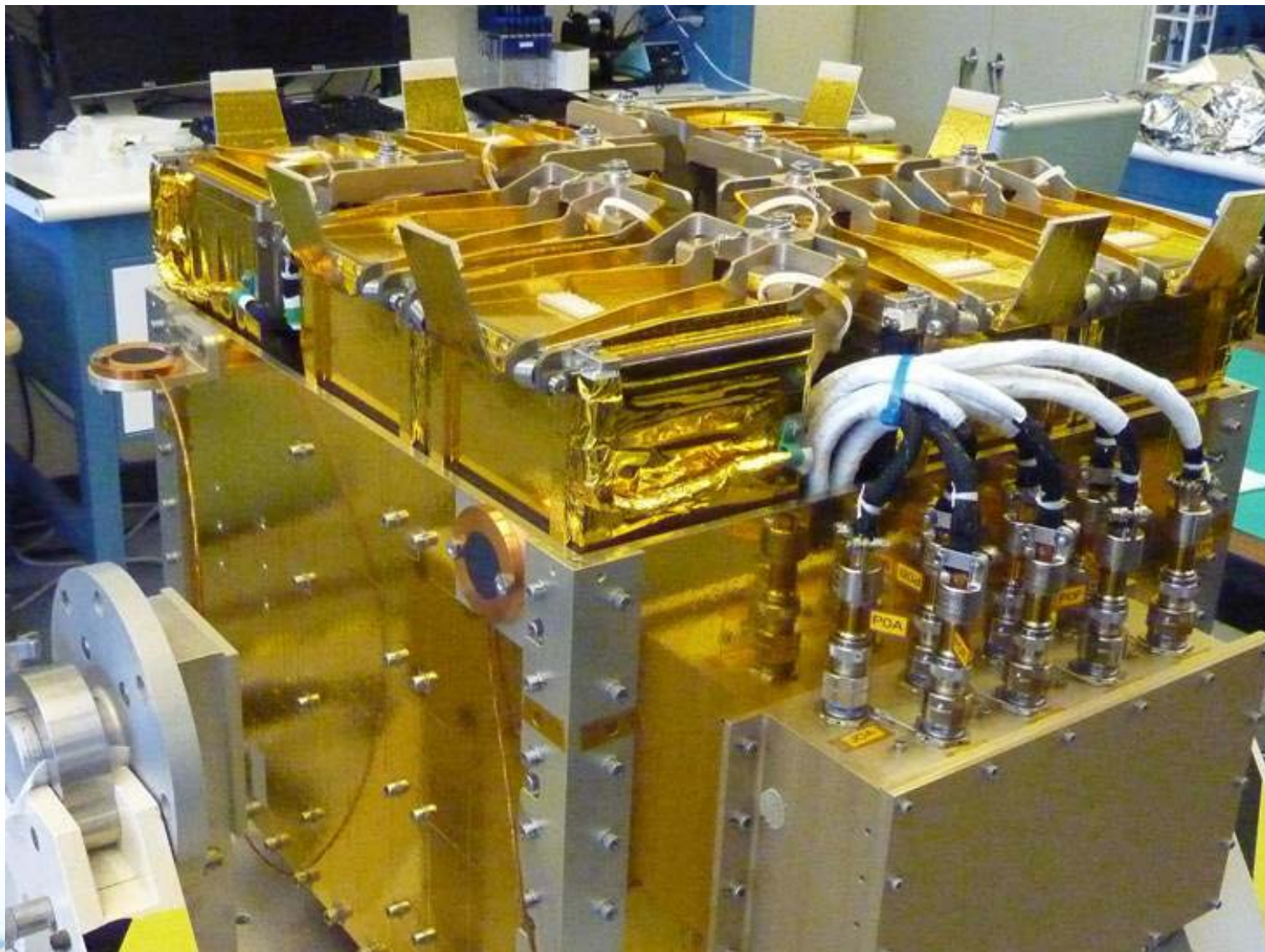


# NROL-36/OUTSat CubeSat Manifest

P-POD	Sponsor	CubeSat Name	Organization	Size	Mass (kg)
1/8	NRO/MSD	ORS Enabler Sat	Army SMDC	3U Qty 2	4.1
2	NRO/MSD	AeroCube-4.5	Aerospace Corp	1U Qty 2	1.3
2	NRO/OSL	AeroCube 4.0	Aerospace Corp	1U	1.1
3	NRO/MSD	AENEAS	USC	3U	3.7
7	NRO/MSD	Re	LLNL	3U	4.0
4	NASA/LSP	CSSWE	Univ of Colo/NSF	3u	3.5
5	NASA/LSP	CXBN	Morehead State University and Kentucky Space	2u	2.6
5	NASA/LSP	CP5	Cal Polytechnic San Luis Obispo	1u	1.1
6	NASA/LSP	CINEMA	NSF/Cal Berkeley	3u	2.8



# (U) Completed OUTSat Ready for Flight







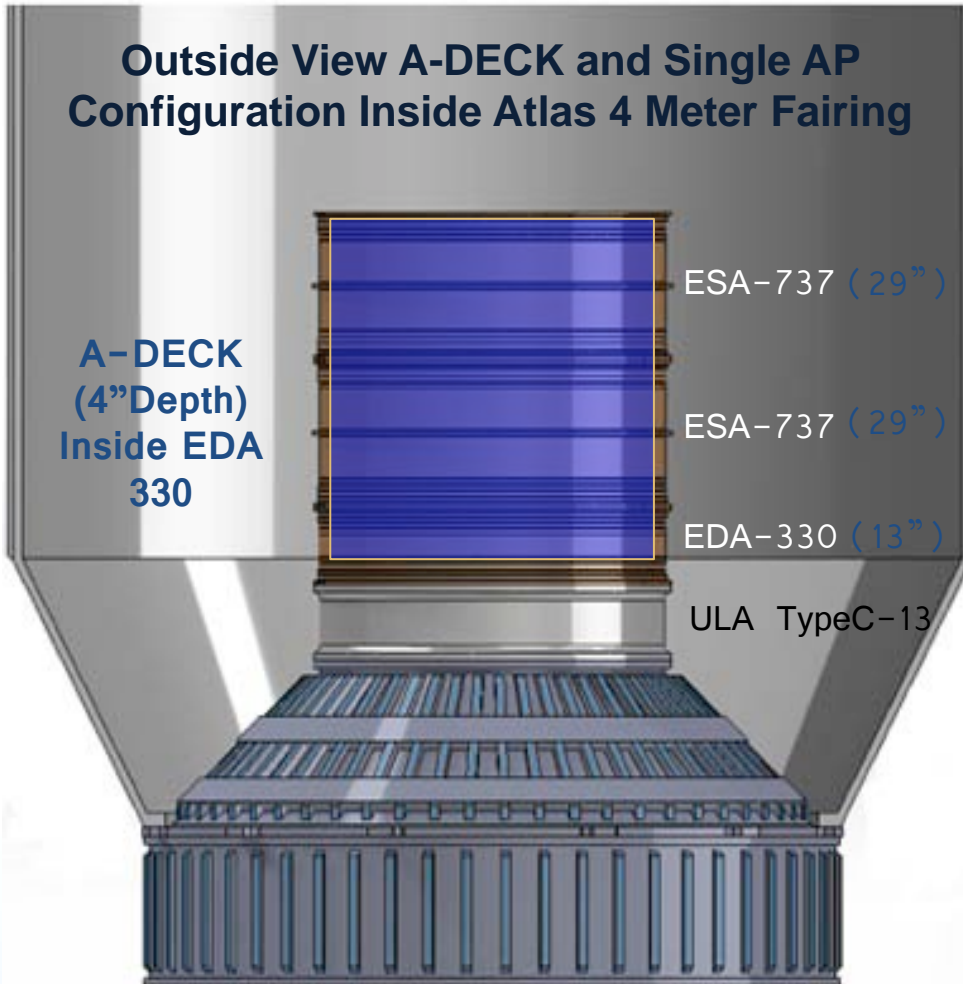
# A-DECK Configuration – Auxiliary Payload (AP) Capabilities

## ➤ APSYSTEM CAPABILITY

Weight	2,200 lbs	1000 kg
Diameter	50 in	127 cm
Height	60 in	154.4 cm
AP c.g. ½ height	21 in	21 x 2.54

## ➤ OTHER CAPABILITIES

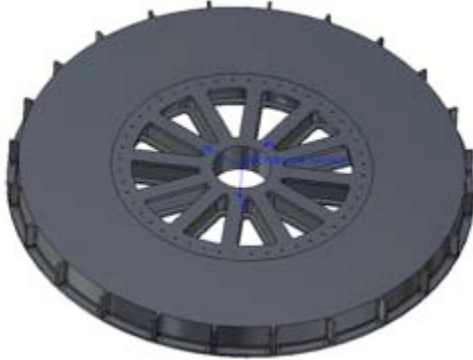
- Multiple AP's accommodated
- Variable intervals between APL release signals with Auxiliary Payload Support Unit (APSU) avionics system with up to 32 separation events
- Options for AP telemetry, AP power and release video
- Compatible with all EELV 1575 Interface
- Compatible with all EELV Separation Adapter
- Compatible with ESPA



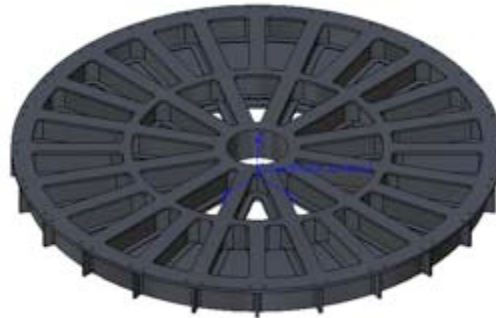


# A-Deck Structure

TOP VIEW

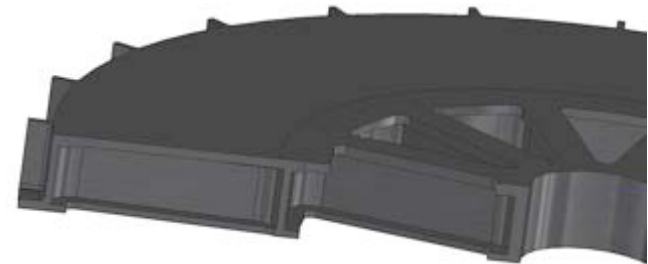
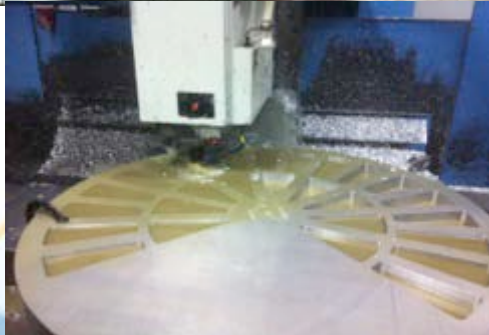
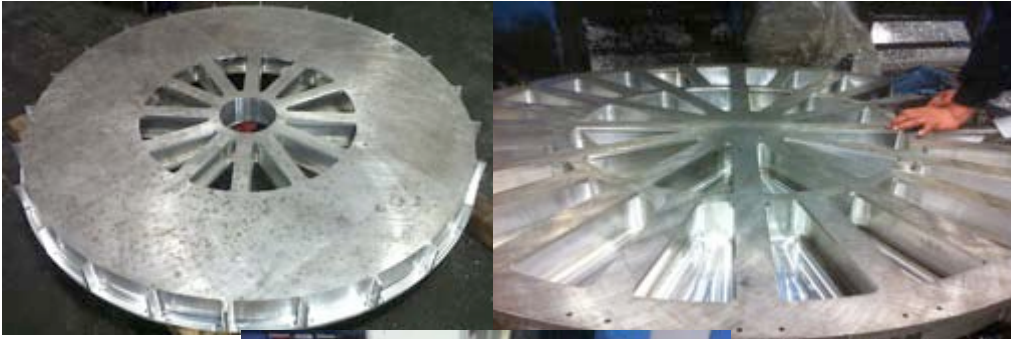


BOTTOM VIEW



One Mini-Spacecraft Configuration

- **Structural Component Approach**
  - Monolithic Aluminum Design
  - Spider Pattern Centered Drilled
  - CNC Machined
  - Designed for 1000 kg Load Bearing Capability
  - MiL Spec Drilling for Fasteners







# A-Deck Structural Testing

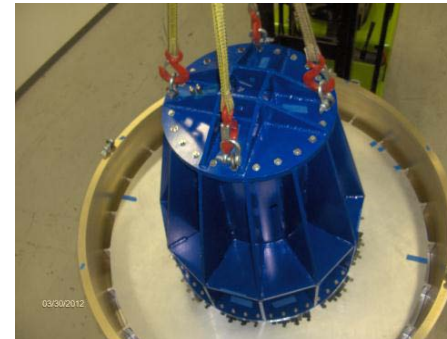
**A-DECK arrives at NTS Test Facility**



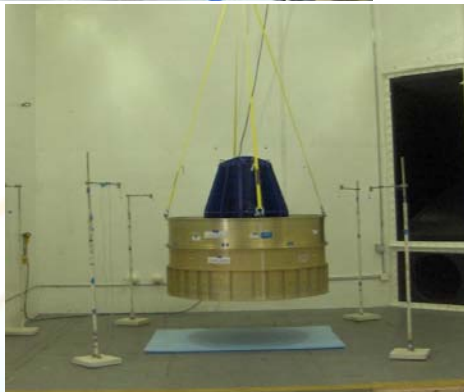
**A-DECK carried to EDA 330**



**A-DECK lowered in EDA 330**



**Mass Simulator on A-DECK**



**A-DECK Suspended in Acoustic Test Chamber**



# Summary

- ✦ The NRO is aggressively seeking CubeSats as a solution to some of its challenges
- ✦ The NRO's CubeSat program office is teaming with multiple partners to provide these solutions
- ✦ OSL has demonstrated willingness to invest in platforms that offer rideshare opportunities
- ✦ Willing to work with primary SV customers, Range, Air Force, and others to overcome technical, management, and emotional roadblocks to flying auxiliary payloads
- ✦ Demonstrated capability to work with teammates –NASA LSP's ELaNa program for example – to bring a mission to fruition
- ✦ Ready for NRO's first rideshare mission – 11 cubesats – this August
- ✦ Intent is to fly one rideshare mission per year

**Rideshare platform development nearing end – focusing on getting cubesats into orbit**

# NATIONAL RECONNAISSANCE OFFICE

[WWW.NRO.GOV](http://WWW.NRO.GOV)

