2012 CubeSat Workshop

Lt Col Guy Mathewson
Office of Space Launch

18 April, 2012
OSL’s Vision & Mission

- 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

- 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

- 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

- Atlas Booster
- RD-180 Engine
- Centaur Interstage Adapter
- Single RL-10 Engine
- Payload Fairing
- Centaur Upper Stage
- Aft Bulkhead Carrier
- Primary Satellite
NROL-36/OUTSat Auxiliary Payload

CubeSat

3U Installed in P-POD

1U P-POD

8 integrated P-PODs installed in NPSCuL

OUTSat installed on Centaur aft bulkhead

NPSCuL & P-PODs

Atlas V Centaur Upper Stage Aft End
Nominal Auxiliary Payload Mission

AP Deployment: *does not take place until primary mission is complete*
(U) NROL-36/OUTSat Schedule

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<td>PPQD Integration to NPSCul</td>
<td>OUTSat Acceptance Testing</td>
<td>ULA Gate 3</td>
<td>MRR</td>
<td>Deliver OUTSat to VAFB</td>
<td>Mate OUTSat to Centaur</td>
<td>Launch 2 Aug</td>
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UNCLASSIFIED
# NROL-36/OUTSat CubeSat Manifest

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<tr>
<th>P-POD</th>
<th>Sponsor</th>
<th>CubeSat Name</th>
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(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 cm)

- **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

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

One Mini-Spacecraft Configuration
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.