PPOD Accommodations on EELV Missions

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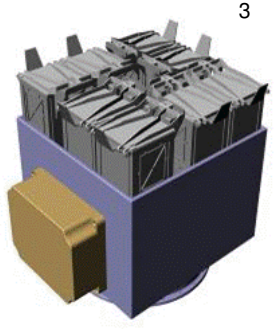
File no.

Images Courtesy of Lockheed Martin and The Boeing Company

Background

- USAF Briefing on Auxiliary Payloads (a.k.a. Secondary) and Dual Payloads
  - Gen Kehler on DMSP: “Never shall a mission with this much excess capacity go unused.”
- ULA Focus
  - Overview of capabilities
  - New developments, Current status
  - Recommendations, Mission opportunities

Rideshare Spectrum of Capabilities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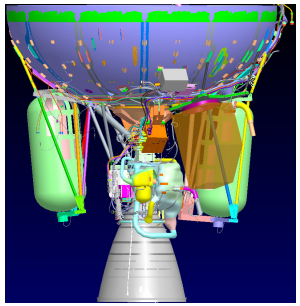

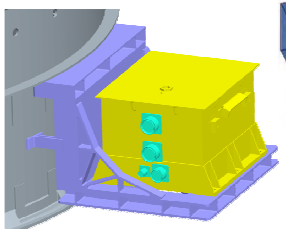

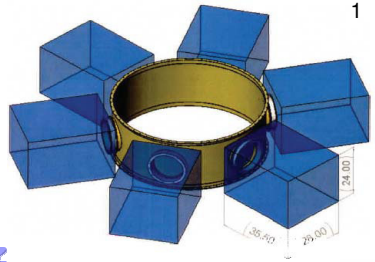
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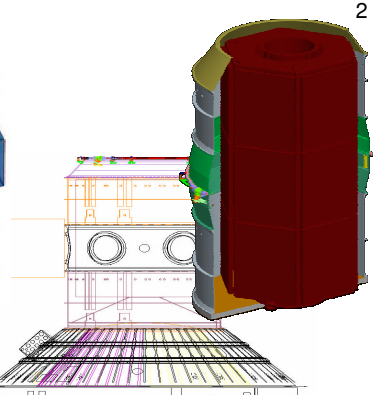
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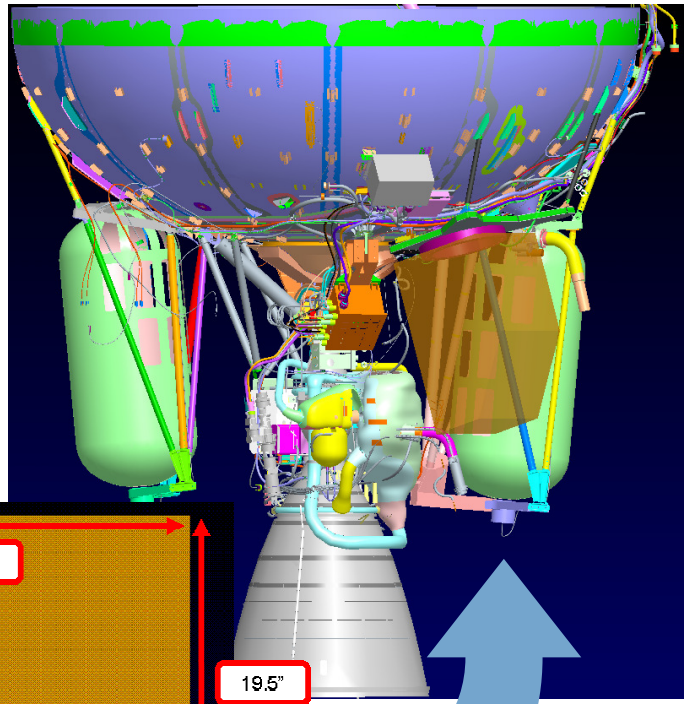
P-Pod°	ABC	CAP+	ESPA*	IPC	A-Deck	DSS
Poly PicoSat Orbital Deployer	Aft Bulkhead Carrier	C-Adapter Platform+	EELV Secondary P/L Adapter	Integrated Payload Carrier		Dual Satellite System
10 kg	**80 kg**	**100 kg**	**200 kg/ea.**	**500+kg**		**5000 kg**
R&D Development	USG sponsor	AF sponsor - GSO Kit	AFRL sponsor phase III	New A-Deck contract		In Proposal
License from NPS pending	Isolated from Primary S/C	Shelf and plate variants 2-4 Slots per Launch	STP-1 Flew 2007	SP to 50 in. diameter And up to 7 feet tall		SP to 100 in diam. Lower volume expandable
First flight ILC 2011	First flight ILC 2011	First flight ILC 3Q 2010	SERB List from the DoD Space Test Program	Last Flight LRO/LCROSS 2010		CDR 4Q 2009 ILC 2011

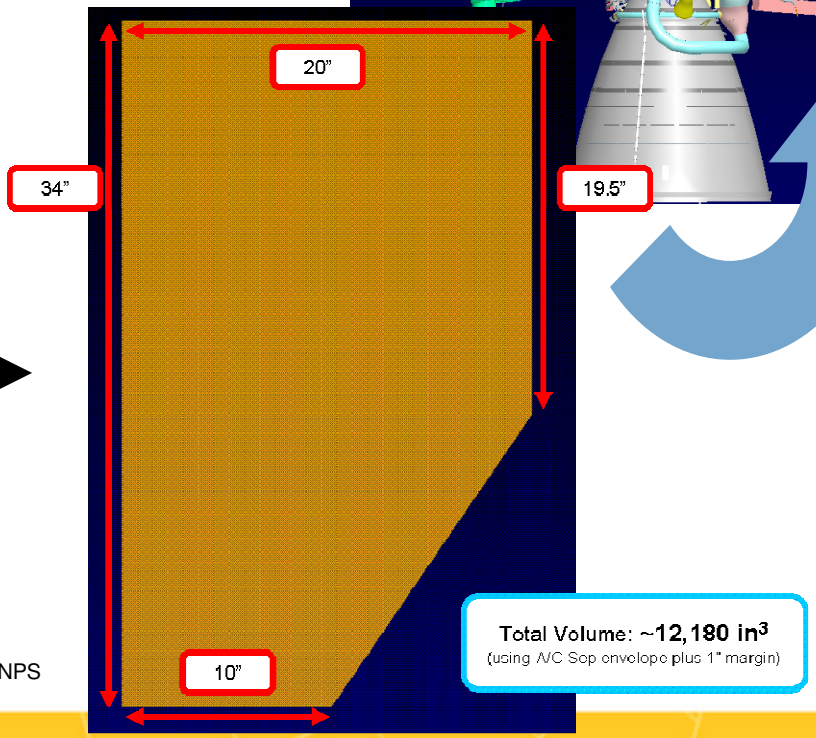
Delivering a Wide Range of Small Spacecraft with the Appropriate Conops and Technical Accommodations

1 ESPA Graphic courtesy of CSA Engineering, Inc
2 COTSAT courtesy of NASA/AMES
3 NPSCuL courtesy of NPS

Aft Bulkhead Carrier (ABC)

- "Inverted Shelf" on the Centaur aft bulkhead
- Kit will be standard for all Atlas vehicles
- Able to accommodate single 15" Lightband or multi-pack CubeSat deployer up to 170 lbs
- Aft location simplifies primary S/C load path, eliminates contamination concerns, permits first-coast deployment in LEO
- Funded by USG (mission assignment TBD)

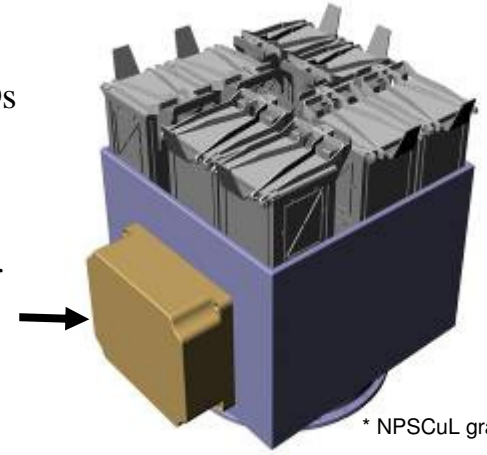




NPS CubeSat Launcher (NPSCuL-Lite)

8 PPODs

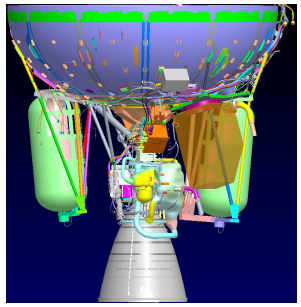
Sequencer



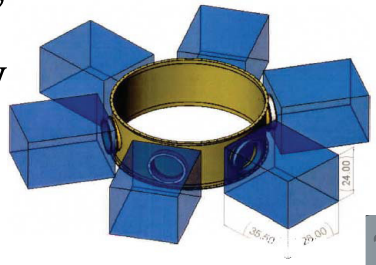
* NPSCuL graphic courtesy of NPS

CubeSat Applications

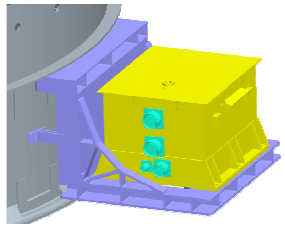
- ULA is in the process of licensing the NPSCuL from NPS and using it in multiple applications to save cost
- The same NPSCuL saves on multiple integration efforts (attachments, avionics, etc.)
- Familiarity breeds acceptance by Primary
- Potential to deploy in LEO



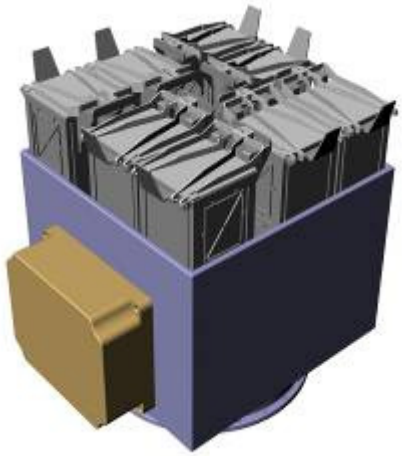
ABC



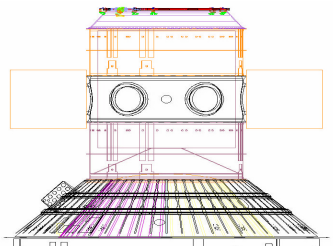
ESPA



CAP+



NPSCuL



A-Deck

Recommendations

- Considerations
  - GPS/MEO unpopular destination for SP and risky, crowded with high value assets
    3 navsat constellations in close proximity
  - Additional burns, adding solids not effective solution to change orbit for SP after Primary payload separation

	Constellation Altitude (nmi)	Distance from GPS (nmi)
GLONASS	10,306	594
GPS	10,900	--
Galileo	12,531	1,631

- Recommendations
  - Incorporate ESPA for all USG missions with excess performance
    - Include empty ESPA upon ATP for all USG mission with excess capacity
    - STP to fill SP capacity and provide associated funding
  - Request support to standardize SP separation prior to primary SC separation
    - Not a technical or system constraint; avoided due to perceived risk to primary
    - Effective use of excess performance
    - Not a current ESPA standard capability

Rideshare Issues

- SP Risks / mitigation
  - Delay of primary mission – gated acceptance, parallel processing, contingency ops
  - Reduces operational performance use - for some missions
  - Reduces disposal performance use – upper stage alternate disposal concepts
  - Space debris – SP incorporate new de-orbiting technologies as standard ops
- Contracting
  - Dual Manifesting - 2 dissimilar spacecraft in similar orbits
    - treat Rideshare (ESPA, CAP, A-Deck) as single SC element
- Integration
  - Independent integration of Rideshare from Primary – until final stack/encapsulation
  - Standard integration facility for Rideshare – in work for Cape and VAFB
- Rideshare mission opportunities
  - GPS IIF (2011-13), and III (4 per yr, 2015>)
  - DMSP 19 (2012), and 20 (~2014)
  - TDRS (~2012)
  - Landsat (~2012)