



Department of Defense Space Test Program



*Lt Charlie Galland
Cubesat Developers
Workshop 2009*



Agenda



- **STP Background**
- **STP Enablers**
- **Rideshare Opportunities**
- **Summary**



Agenda



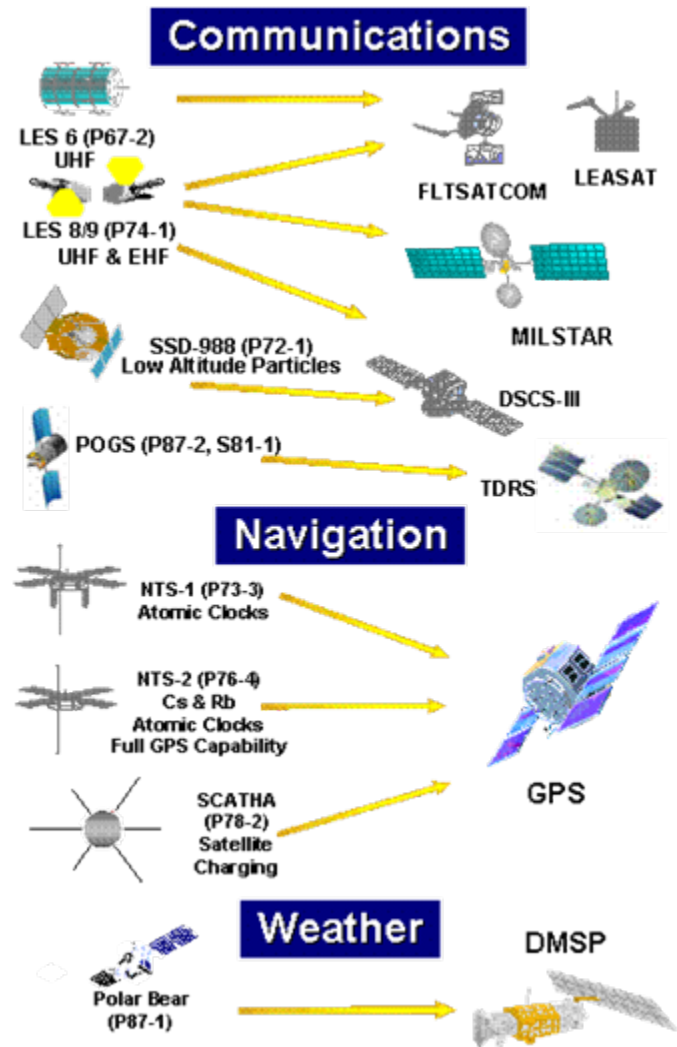
- **STP Background**
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DoD Space Test Program (STP)



- Chartered by OSD in 1965
 - First flight in 1967
- Primary provider of mission design, SC acquisition, integration, launch, and on-orbit ops for DoD space experiments, technologies & demos
 - All spaceflight services except the experiment itself
- Single manager of all DoD payloads on the Space Shuttle and ISS
- Since 2004 designated the Auxiliary Payload “front door” for AFSPC
 - Payload and SC





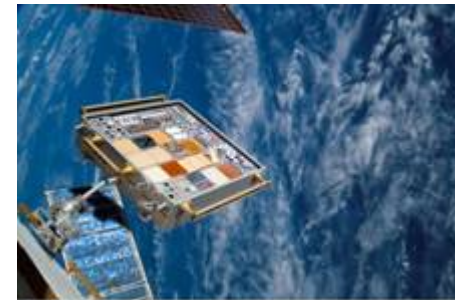
How do you access STP services



- **Space Experiments Review Board (SERB)**
 - Need DoD Sponsor
 - Vetted and Ranked
 - STP can spend money for space access
- **Reimbursable**
 - Customer brings all the money
 - STP provides expertise
 - Helps if you have government connection
 - We are willing to work to make the mission happen
 - Find other partners to off set cost
- **Call us**
 - STP can advise and walk you through the process



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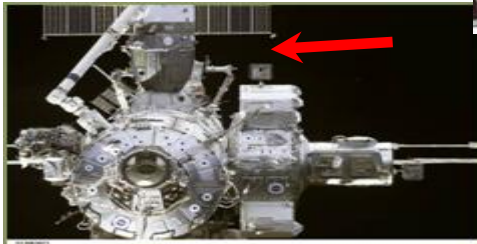
STP Spaceflight Methods



- **Shuttle/International Space Station (ISS)**
 - Deployable, payload bay, mid-deck lockers, ISS internal/external
- **Auxiliaries**
 - Piggybacks payloads: leverage margin on existing SC
 - Secondary SC: leverage margin on existing LV
- **Dedicated Launches**
 - STP managed SC that are launched by a dedicated LV
- **Also high-altitude balloons, sub-orbital sounding rockets, and zero-g flights**



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Space Experiments Review Board (SERB) Process



- Experiments must address operational need
- Strategic S&T investment for DoD
- Military Relevance is 60% of AF/DoD SERB score

AF
AFRL

Navy
NRL

Army

DARPA

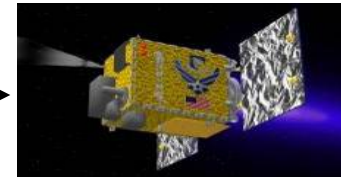
MDA

NRO

DoD SERB

SAF/USA

STP



DoD SERB

- SAF/USAL chairs
- Hears 15-min. brief from experimenter
- Multi-service membership
- Evaluates military relevance
- Does not evaluate funding
- Experiment may be kept off by maj. vote

SAF/USA

- Approves SERB List
- Approves missions (>\$10M)
- AF funding via Corporate process
- EA for DoD

STP

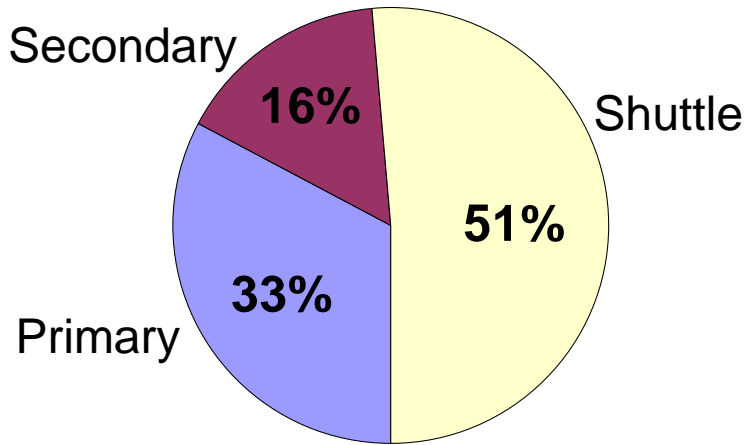
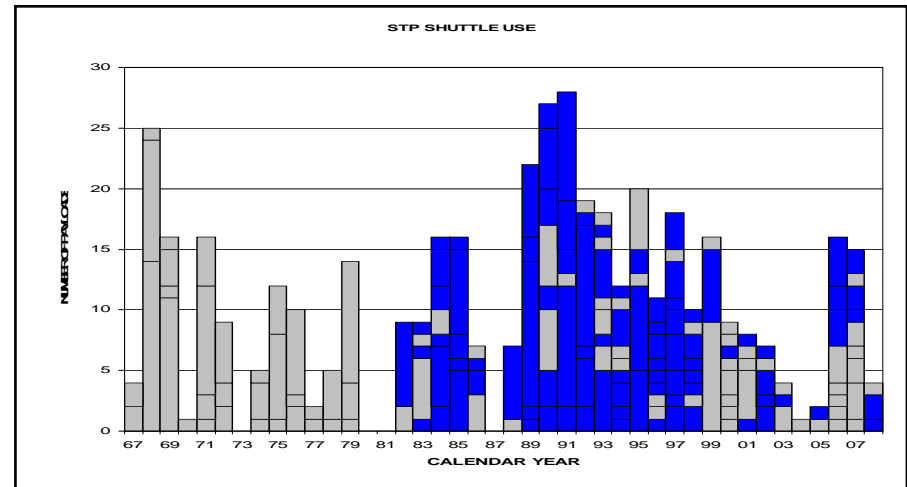
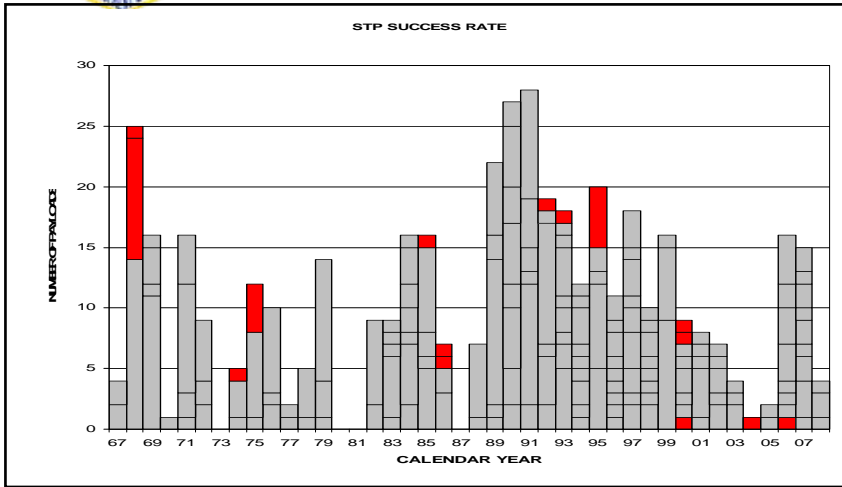
- Executes mission
- Approves missions <\$10M
- Satellite bus development
- Launch
- Operations (1 yr)
- Shuttle/ISS ops
- Does NOT fund experiments

Service & Lab SERBs

- Rank experiments
- Submit to DoD



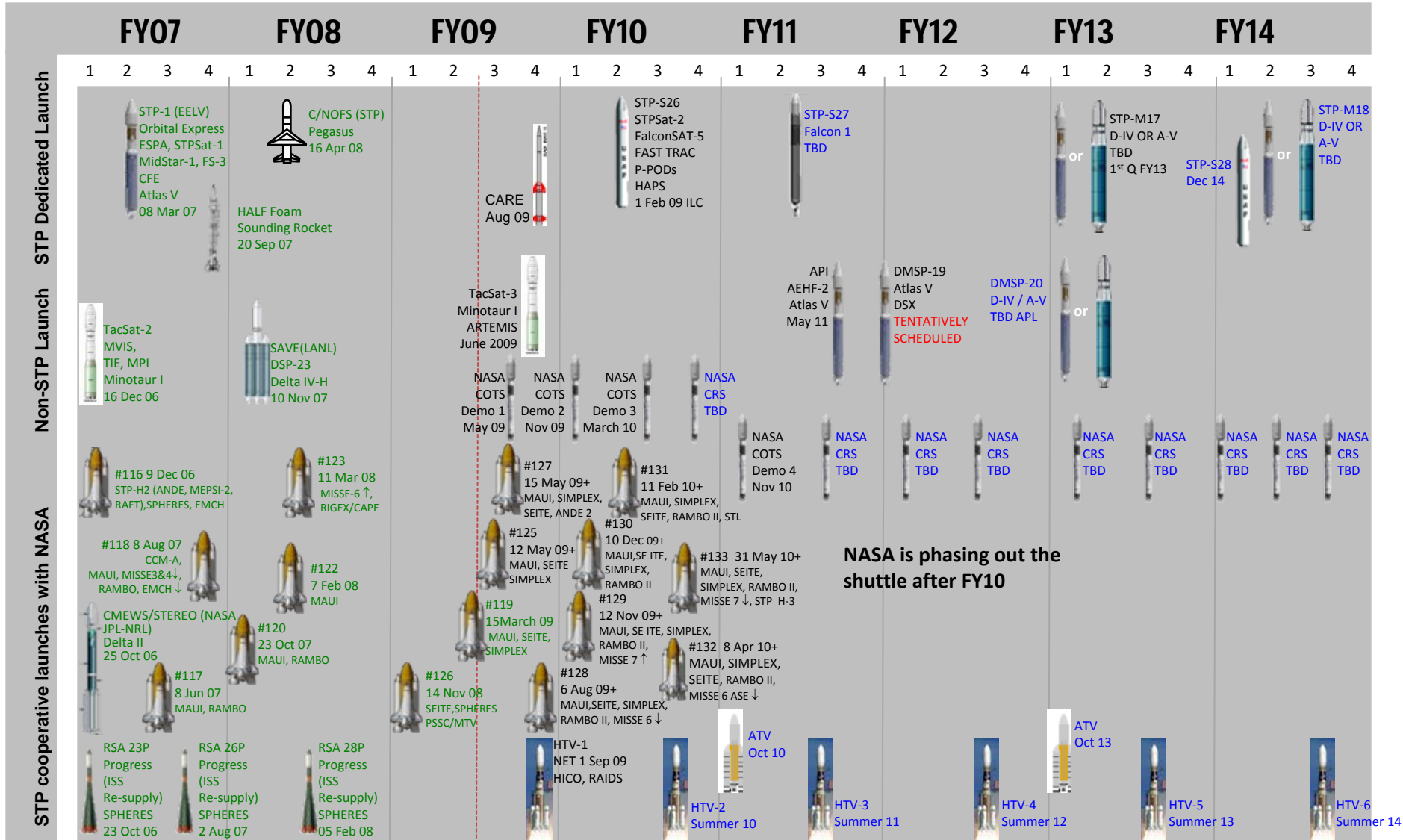
STP By The Numbers



- 476 experiments on 193 missions
- 92% mission success rate
- Average flight rate of 4 missions per year



Current STP Launch Schedule



NASA is phasing out the shuttle after FY10

As of 1 April 2009

KEY Completed Scheduled Proposed



STP Rideshare Past/Present/Future



- **Flown rideshare missions**

- NASA GeneSat on TacSat-2
- Space Shuttle/ISS
- CMEWS on NASA STEREO (hosted)
- 5 STP experiments on NASA Kodiak Star

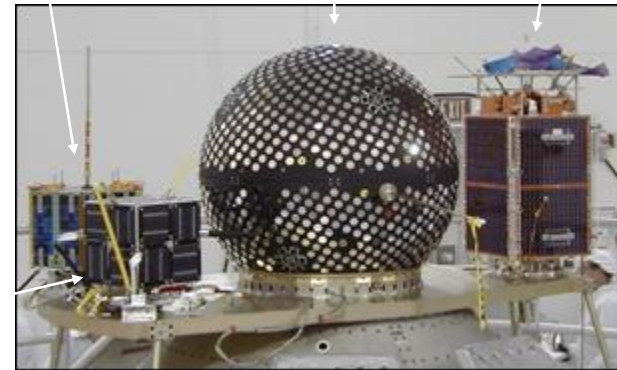
- **Planned rideshare missions**

- STP Experiment on AEHF (hosted)
- NSF and NASA Ames cubesats on STP-S26 (secondary)
- Cubesats On TacSat-3 (secondary) launch
 - Cubesat Tech Demo - NASA Wallops
 - Pharmasat - NASA Ames
- DSX on DMSP F-19 (in pre-manifest coordination)
- STP-M17 and M18 with ESPAs
- Space Shuttle/ISS

- **STP-S27 proposed as potential rideshare partnership mission**

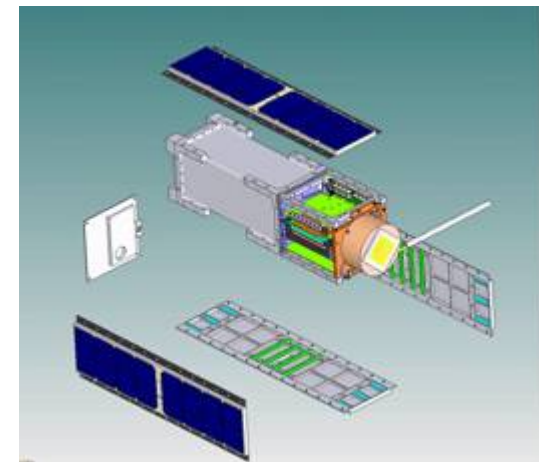
SAPPHIRE

PICOSat



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Kodiak Star spacecraft suite



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Pharmasat



Auxiliary Payload Process



START

STP receives APL request & evaluates maturity
IDs possible flight opportunities

Flight opportunity exist? **STOP**

LV and/or PP conduct Feasibility Studies

STP submits Manifest Package
Final approval by SMC/CC & AFSPC/A3

STP drafts MOA & MRD describing opportunity

APL is compatible **STOP**

APL Manifest Approval **STOP**

LV or PP initiates APL integration

Mission, Flight & Launch Readiness Reviews



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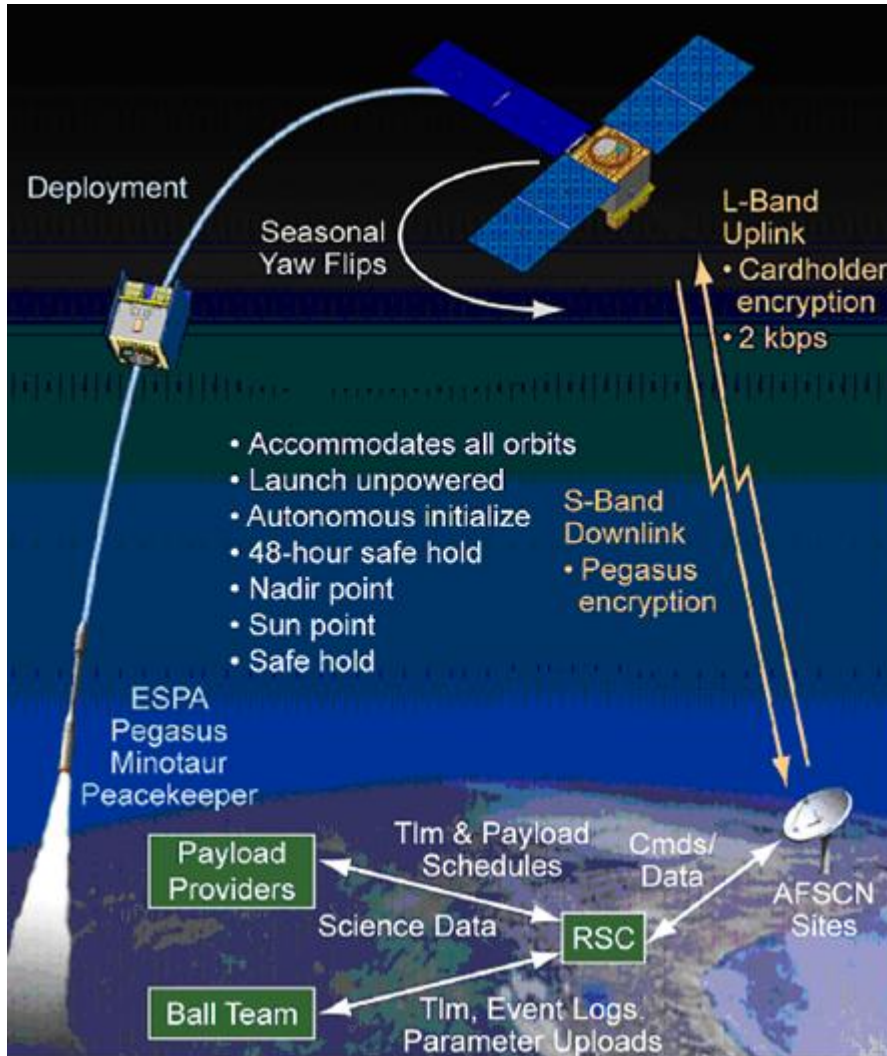
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STP-Standard Interface Vehicle (SIV) Overview



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- **Small spacecraft, 180kg or less, on IDIQ contract: ESPA Class S/C**
 - Up to 6 vehicles w/ 90 day turn-on
 - Operable in a wide variety of orbits
 - Heritage subsystems, reliable, low risk, low complexity
- **Standard Payload-to-S/C Interface**
 - Flexible design/acquisition cycle
 - Easy integration w/small payloads
 - Payload swap out capability
 - Standard hardware/software interfaces
- **Compatible w/ many launch vehicles**
- **Compatible w/ MMSOC & AFSCN**
- **Storable until launch identified**

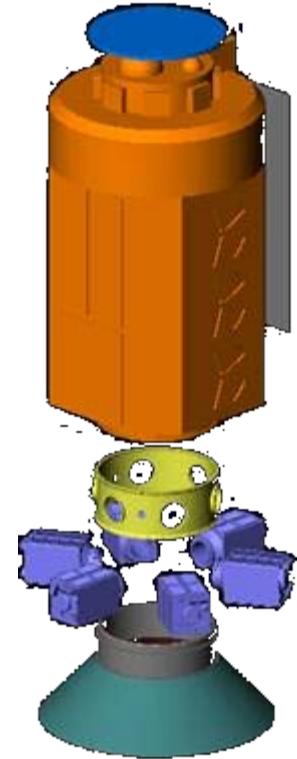
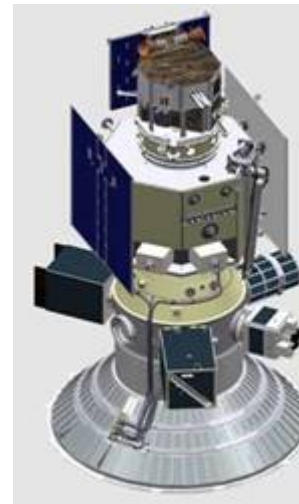
Payload mass	60 kg (goal 85 kg)
Payload OAP	100 Watts
Payload Volume	0.12 m ³



EELV Secondary Payload Adapter (ESPA)



- **ESPA first “normalized” secondary payload capability for US**
 - Fits EELV-M (Delta IV & Atlas V)
 - Utilizes excess lift capability
 - Prime payload interface the same
 - 1 prime and up to 6 secondary
- **First flight on STP-1 (8 Mar 07)**
 - Fully successful deployments
- **ESPA Standard Service pending funds availability**



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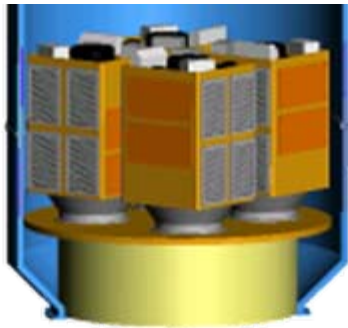
- Top & Bottom Interfaces Correspond to EELV Standard Interface Spec (SIS)
 - Qualified to 6800 Kg for Primary SV
- ESPASat Envelope (6 each): 24” x 28” x 38”
- CG Constraint: 400 lb (180 Kg) @ 20” radial



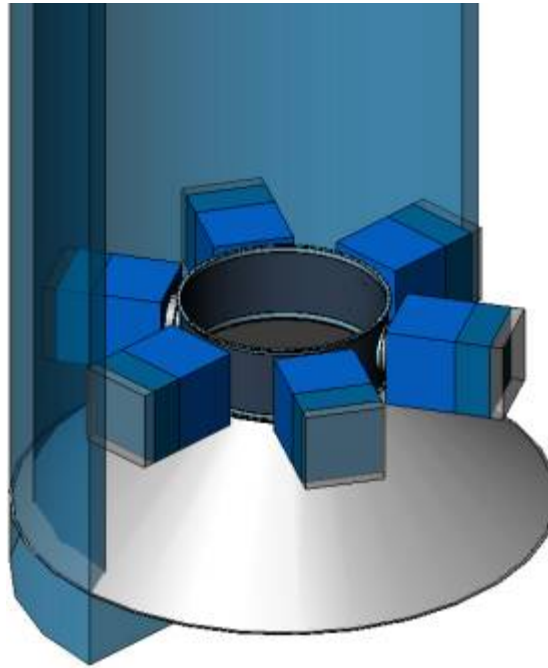
Maximize Launch Opportunities using ESPA Class Spacecraft and Secondary Payload Adapters



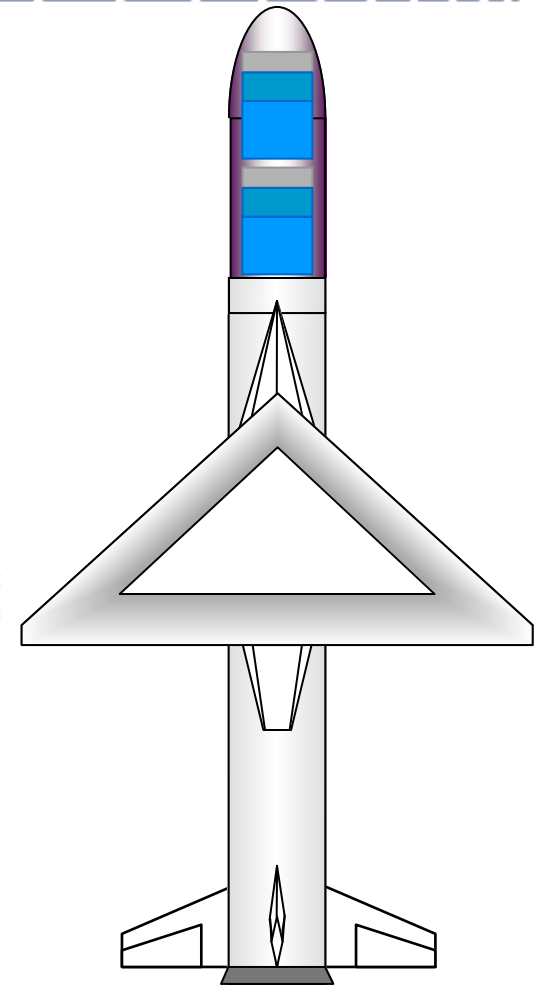
Minotaur I



Minotaur IV



**EELV Medium
(Atlas and Delta) ESPA**



PEGASUS

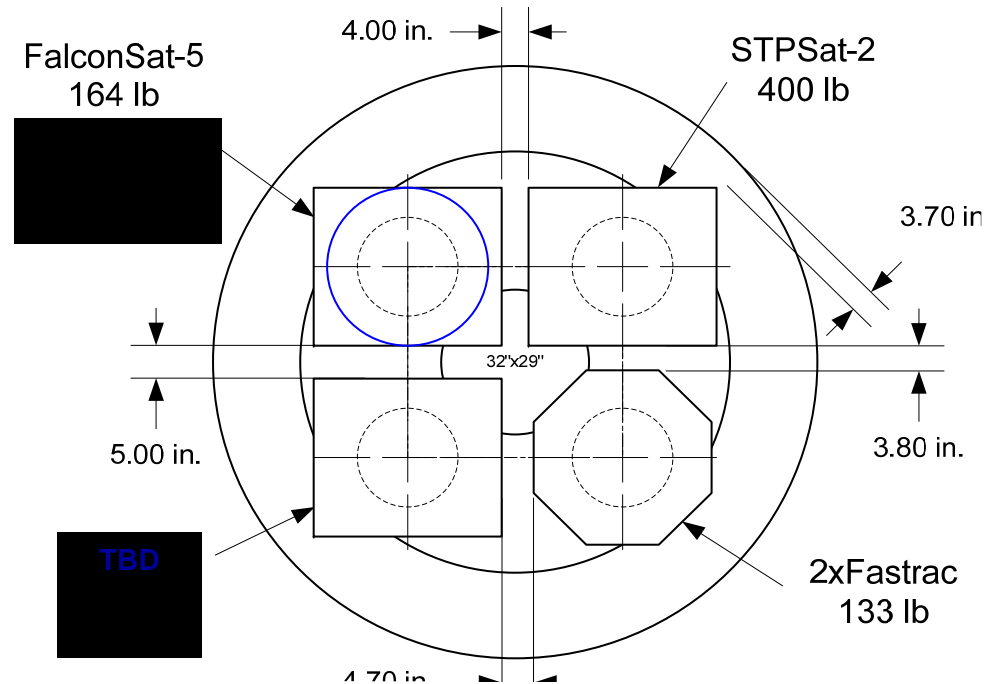
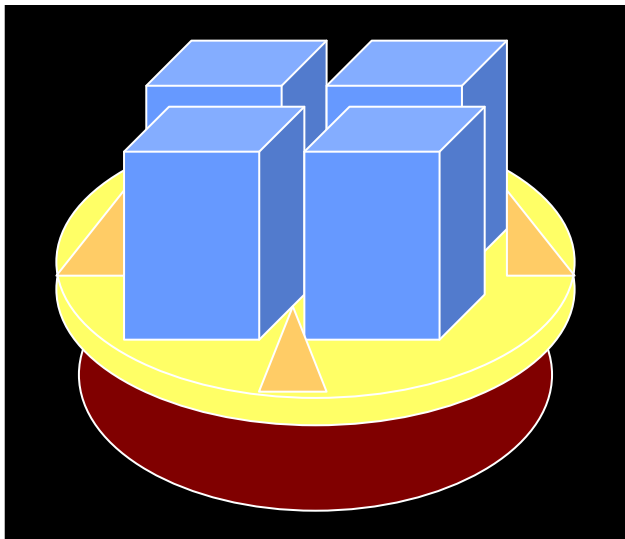
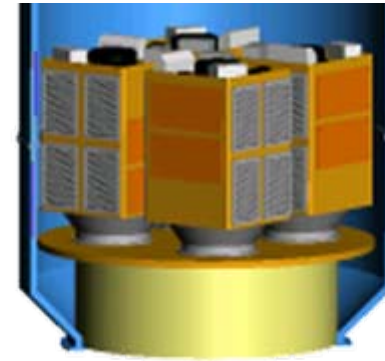


Minotaur IV Multi-payload Adaptor (MPA)



- **Multi-payload Adaptor Plate**

- Developed to support ESPA class SC
- Holds up to 4 ESPA SC
- Utilizes all lift capability
- First demonstration STP-S26
- ILC early FY10





STP Has Access to Multiple Launch Vehicles



- Minotaur launchers through 10-year IDIQ
 - Minotaur 1
 - Minotaur 4
- A low-cost launcher IDIQ
 - Falcon 1
 - Raptor 1
 - Raptor 2
- EELVs with ESPA
- The ISS, Shuttle, HTV, Progress, NASA COTS



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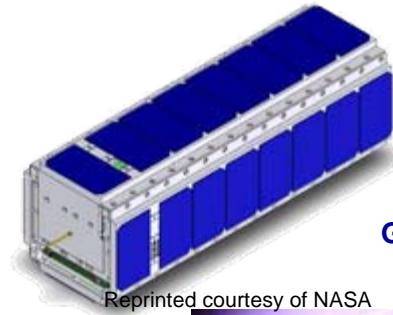
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Poly-Picosat Orbital Deployers (P-PODs)



- Design standard developed by Stanford and Cal Poly in 2000
 - 10 cm cube, < 1 kg mass (1U cube)
 - 3U cube NASA GeneSat-1 flown in Dec 08 as secondary payload on TacSat-2 mission
- NASA exploring standard integration of P-PODs on all NASA Atlas V LVs
- Wide range of payloads – optical & magnetic sensors, tethers, computer processors, ADCS components, batteries, solar cells, MEMS
- Can fly on wide range of launch vehicles
- P-PODs added to STP-S26 mission



NASA GeneSat-1

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Photo taken by Aerocube2



Cal Poly PPOD

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Options to ISS Access



Operational

Pre-Operational



- Shuttle:**
- Middeck
 - Cargobay
 - Return
 - 10,000's of Kg



- ATV:**
- IOC 1Q CY08
 - Logistics
 - Experiments
 - No return
 - 7,500 Kg



- Progress:**
- Logistics
 - Experiments
 - No return
 - 10's of Kg



- Soyuz:**
- Crew Rotation
 - Experiments
 - Return
 - Few Kg

- ISS:**
- Express Rack (internal)
 - Optical Window
 - Columbus
 - External Attach
 - Expose & Retrieve



- HTV:**
- IOC 3Q CY09
 - Logistics
 - Experiments
 - No return
 - 6,000 Kg



- Commercial:**
- IOC CY2010
 - Logistics
 - Experiments
 - Return
 - 2,300-2,500 Kg



- ISS:**
- Express Logistics Carrier (external)
 - Optical Window (WORF)
 - FRAM-based sites
 - JEM and JEM-EF
 - National Lab

- Ares/Orion:**
- IOC FY15
 - Crew Rotation
 - Logistics
 - Experiments
 - Return
 - TBD Kg



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STP-S27 Rideshare Opportunity



- **FY 10 or 11 launch**
- **Falcon or Minotaur LV**
- **Orbit TBD based on needs of mission partners**
- **Looking for multiple ESPA class partners**
- **Looking for multiple PPOD partners**



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Summary



- STP has a long history of creating collaborative missions and providing access to space for experiments.
- Experiments can come to STP either via the SERB for a subsidized flight or as a reimbursable.
- Personnel at STP are experienced and well versed at developing creative and cost effective missions designed to maximize all government or customer resources.

