Space Development and Test Directorate

Department of Defense Space Test Program

"Access to Space"

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Space Development and Test Directorate

Missions:

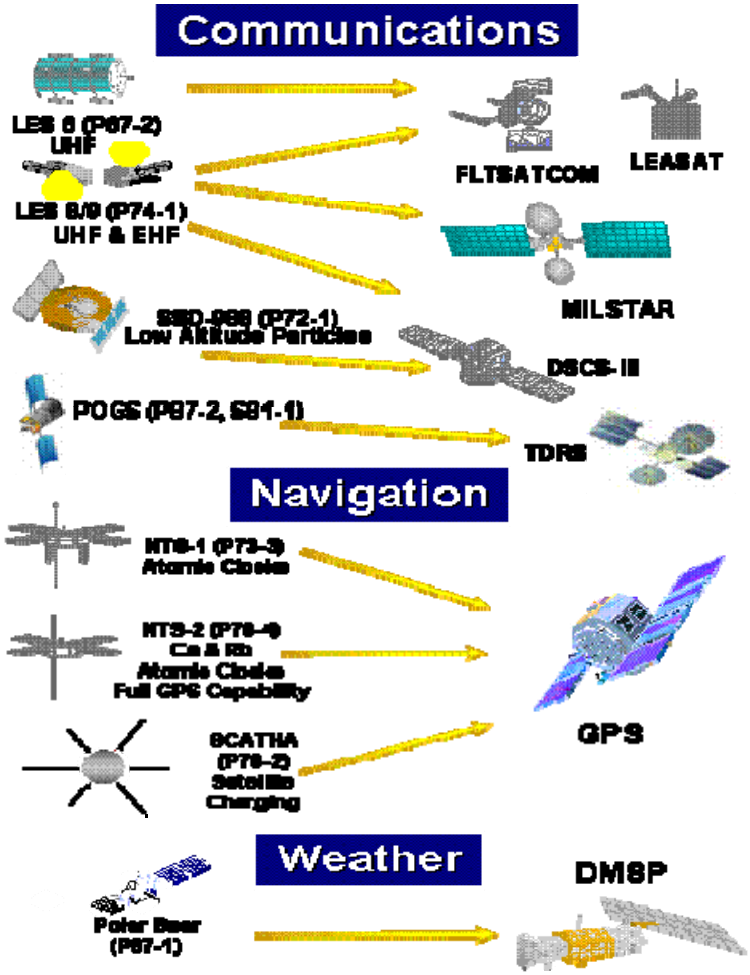
(1) Develop, test, and evaluate National Security Space systems
(2) Execute advanced space development and demonstration projects
(3) Develop and launch small launch vehicles and missile defense targets
(4) Rapidly transition capabilities to the warfighter




"One Team…Delivering Small, Responsive Space Capabilities"

DoD Space Test Program (STP)

- **Chartered by OSD in 1965**
  - **First flight in 1967**
- **Primary provider of mission design, s/c acquisition, integration, launch, and on-orbit ops for DoD and DoD sponsored space experiments, technologies & demos**
  - **Ability to provide all spaceflight services <u>except</u> the experiment itself**
- **Single manager for all DoD payloads on the Space Shuttle and ISS**
- **Designated AFSPC's "Front door" for all auxiliary payloads seeking flight opportunities on DoD missions**



STP has flown 493 experiments on
Over 205 missions since 1967

(As of 10 June 10)

Access to STP Services

- **Space Experiments Review Board (SERB)**
  - Manifest based on:
    - SERB rank
    - Flight opportunities
    - Mission requirements
    - *Available <u>STP</u> funds*

      >$10M = SAF/USA approval

      <$10M = STP director approval
- **Reimbursable flight basis**
  - Manifest based on:
    - Flight opportunities
    - Available manpower
    - *Available <u>customer</u> funds*
    - SMC/CC and HQ AFSPC approval

Space Experiments Review Board (SERB) Process

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

AF
AFRL

Navy

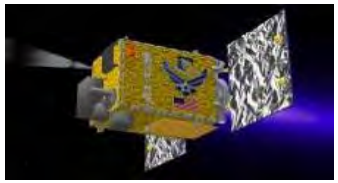
Army

DARPA

MDA

NRO

→ DoD SERB → SAF/USA → STP →



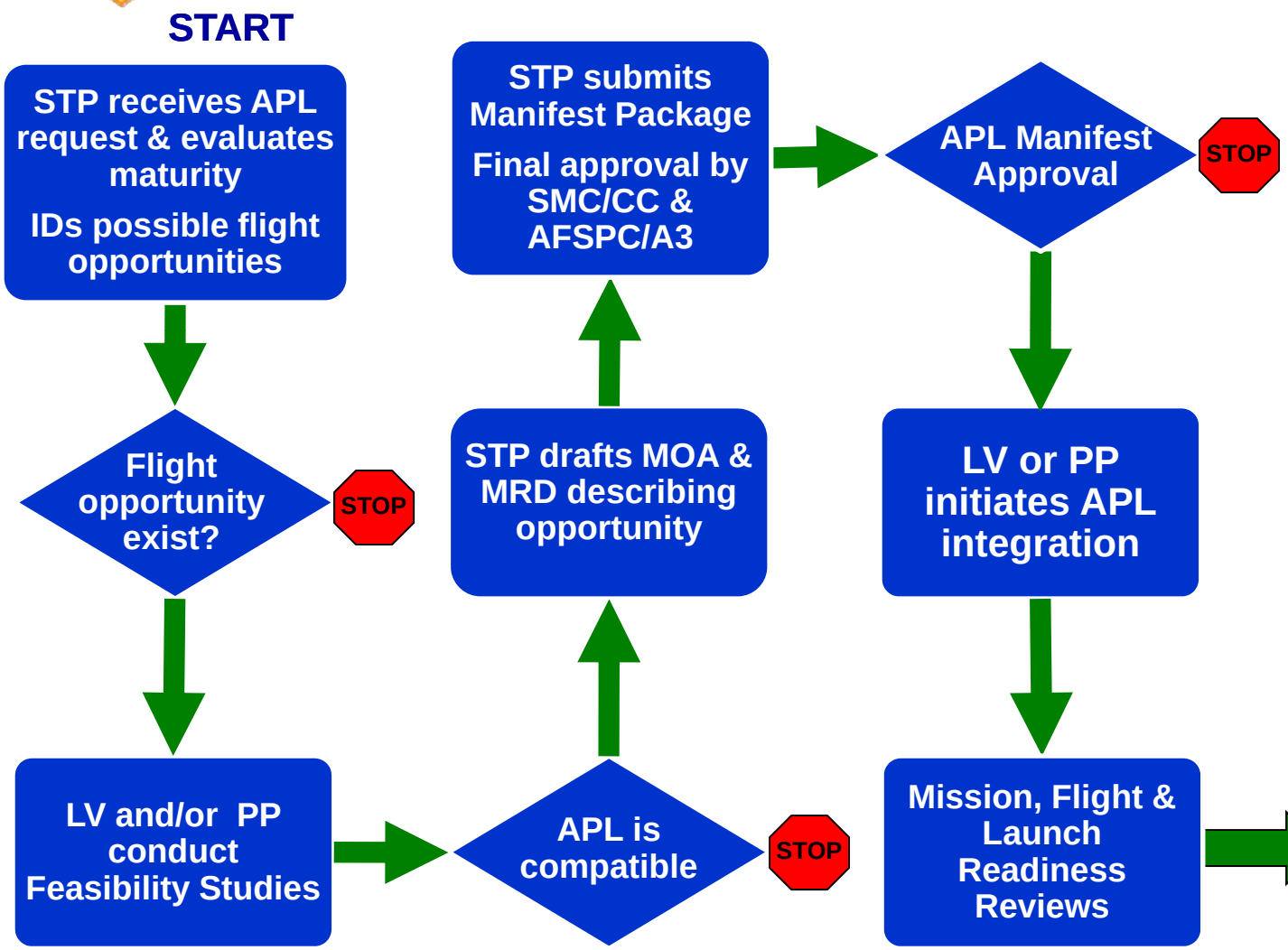
Service & Lab SERBs
- Rank experiments
- Submit to DoD

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

Auxiliary Payload Process

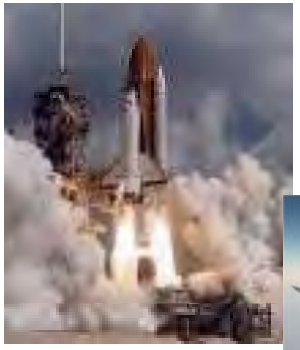


Reprinted courtesy of USAF

STP Access to Space

- **Spaceflight Methods:**
  - Shuttle/International Space Station (ISS)/Other NASA vehicles
    - 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 (Minotaur, Falcon, Raptor, EELVs, sub-orbital sounding rockets)
  - Also high-altitude balloons and zero-g flights


Atlas V


Space Shuttle


ISS


Zero G Flight


High-altitude balloon


Sounding rocket


Minotaur IV

Setting Standards through Enablers

- Proactive measures to standardize SC design & construction
  - Based on 40+ years of lessons learned
  - Cohesive approach throughout space community
    - AFRL, ARMY, DARPA, NASA, NRL, NRO, SMC, along w/contractors and universities
- STP Enablers
  - EELV Secondary Payload Adapter (ESPA) CLASS SC
    - Standard Interface Vehicle (SIV)
    - Fast Affordable Science & Technology Satellite (FASTSAT)
  - Multi-Payload Adapter (MPA) - Minotaur IV
  - Hydrazine Auxiliary Propulsion System (HAPS) – Minotaur IV
  - Poly Picosatellite Orbital Deployer (P-PODs) / CubeSat
    - Accommodations on multiple LVs/SVs, Space Shuttle
  - Multi-Mission Space Operations Center (MMSOC) GSA

Maximize Launch Opportunities using Standardization

Spaceflight Standards ("Enablers")

ESPA
(EELV Secondary Payload Adapter)

- SC weight ≤ 180kg
- SC Volume – 35.5" x 28" x 24"
- CG Location - < 20" from the SSIP
- Mechanical Interface – 15"
- Electrical: Battery charge/monitor
- Fundamental Frequency > 35hz

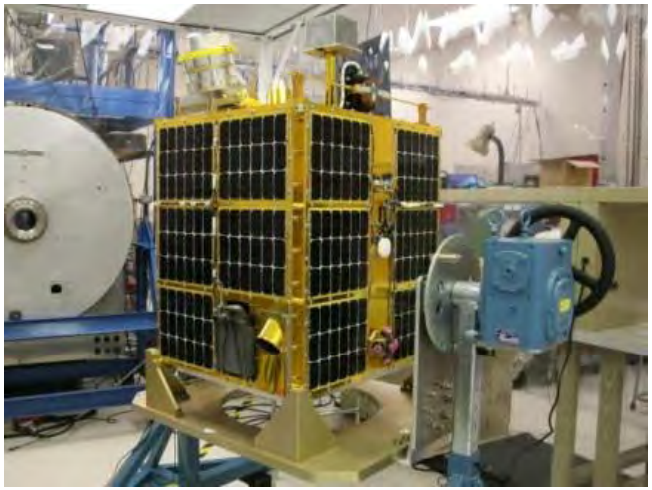
SIV
(Standard Interface Vehicle)

- ESPA Class SC ≤ 180kg
- 1-4 Experiments
- Heritage subsystems
- Compatible w/ multiple LVs
- Compatible w/ MMSOC & AFSCN
- Storable until launch identified

Spaceflight Standards ("Enablers")

FASTSAT: Fast Affordable Science & Technology SATellite (FASTSAT-HSV01)

- Flight of up-to 6 SERB experiments
- Sponsor: NASA MSFC
- Size: 30" x 27" x 41" tall
- Mass: 328 lbs



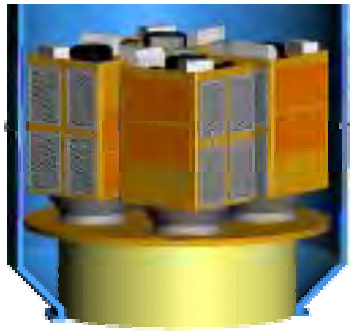
MPA

(Minotaur IV Multi-PL Adapter)

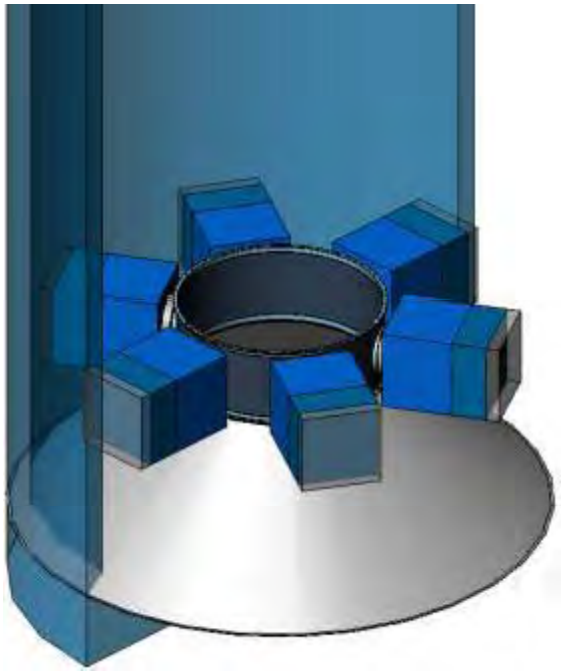
- Holds up to 4 ESPA Class SC
- Mass ≤ 180kg
- Volume – 35.5" x 28" x 24"
- Maximizes lift capability
- First demo - STP-S26 ILC May 10

ESPA-Class Satellite Launch Vehicle Compatibility

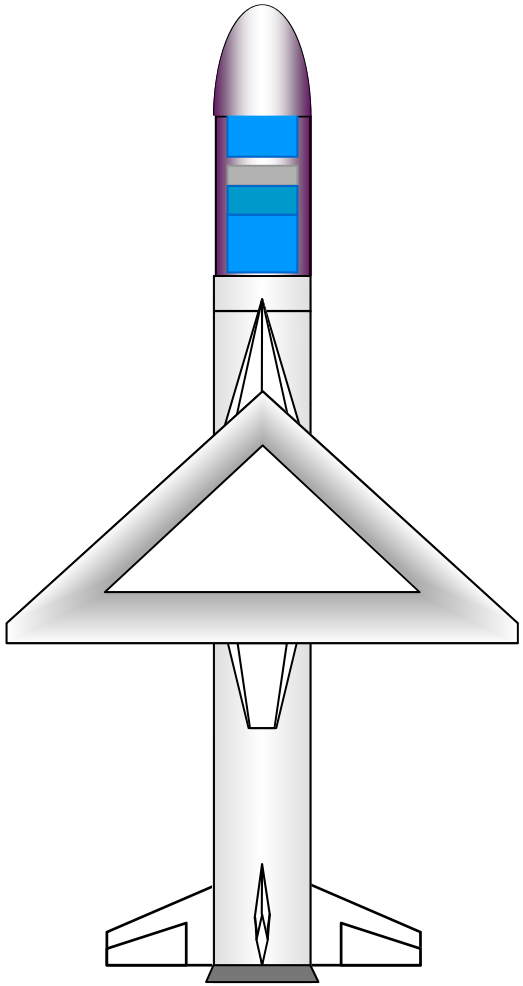
Minotaur I



Minotaur IV



EELV Medium (Atlas and Delta) ESPA



PEGASUS

Maximize launch opportunities using 180 kg satellites & secondary adapters

Spaceflight Standards ("Enablers")

HAPS
(Hydrazine Auxiliary Propulsion System)

- Dual orbits from small LVs
- Precise orbit insertion
- First demo - STP-S26 ILC May 10

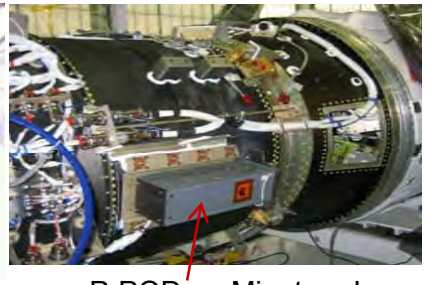
P-POD
(Poly-Picosat Orbital Deployer)

- 10x10x10 cm cube, ~ 1 kg mass ("1U")
- LVs: Rockot, Dnepr, Minotaur I, Falcon-1, Minotaur IV

1 U CubeSat
(Cal Poly1)

Cal Poly P-POD

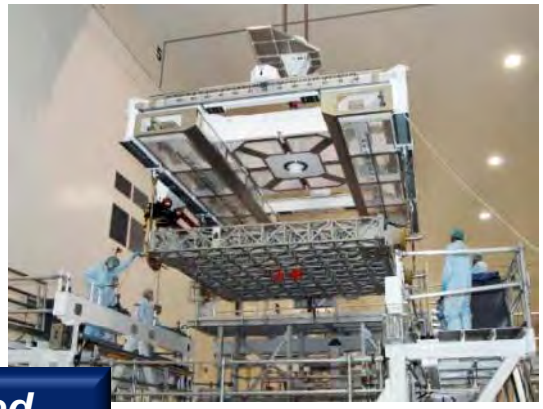
MEPSI on STS-113



P-POD on Minotaur I

Spaceflight Standards ("Enablers")

ELC
(Express Logistics Carrier)
- Reusable external platforms on the ISS
- 8 experiment locations
- 500 pounds, > 500 watts
- High and Low rate data
- 24 month design-to-flight ready



ELC 1 & 2 Installed During STS-129 mission 16 Nov 2009

JEM-EF, COL-EPF
(Japanese Experiment Module External Facility, Columbus External Payload Facility)
- International Partner external ISS sites
- 4 JEM-EF, 2 COL-EPF available to US
- Similar to ELC; JEM-EF higher mass
- 30-36 month design-to-flight ready

Both Operational

Spaceflight Standards ("Enablers")

ISS - Pressurized

- Internal experiment volume
- Express Rack, power and data
- Human in the loop testing
- 18-24 month design-to-flight ready

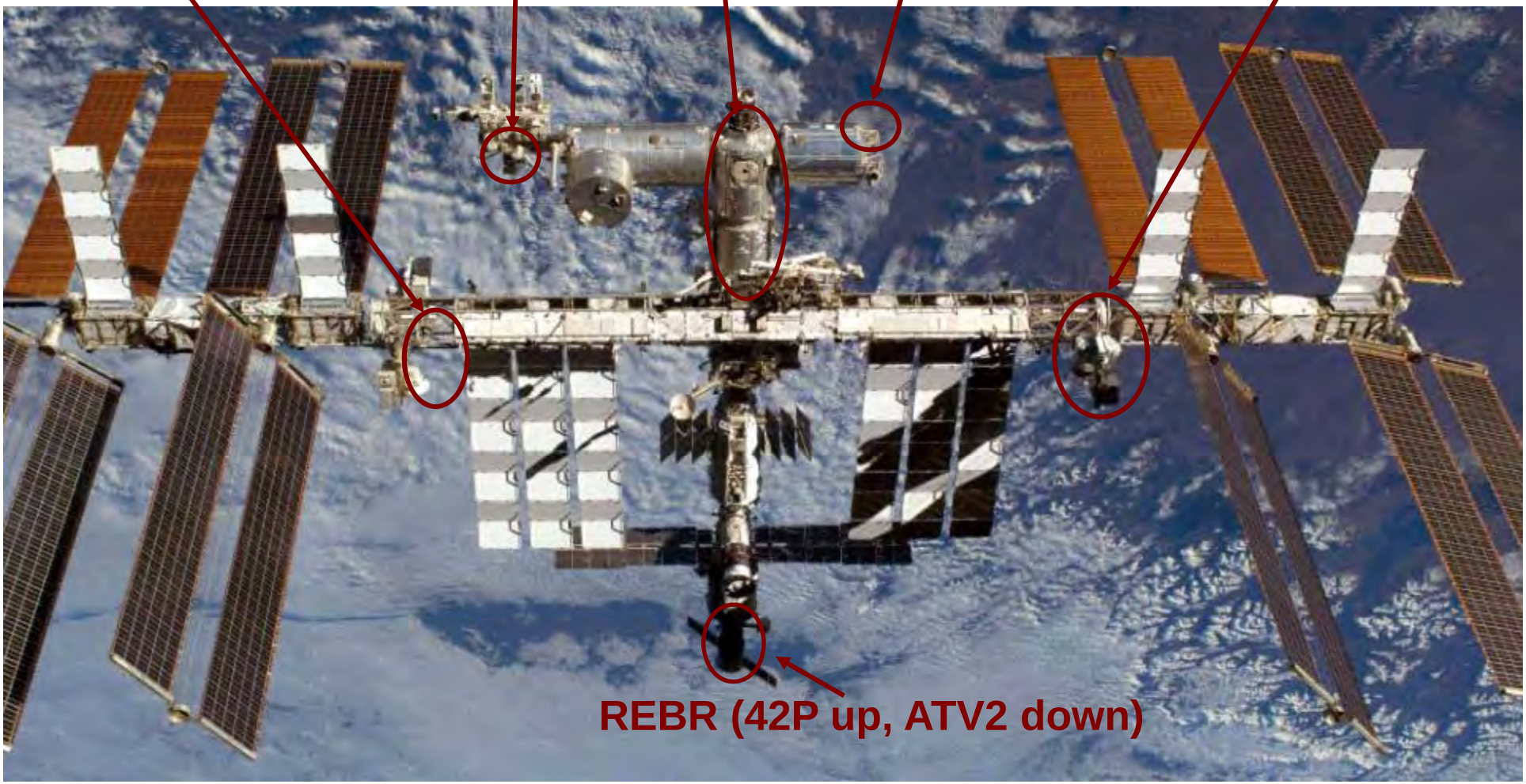
CRS

(Commercial Resupply Services)

- SpaceX and Orbital Sciences Corp
- Pressurized and unpressurized lift
- Sample return via SpaceX Dragon
- Exploring small sat deployment options

Expected to be Operational 2011

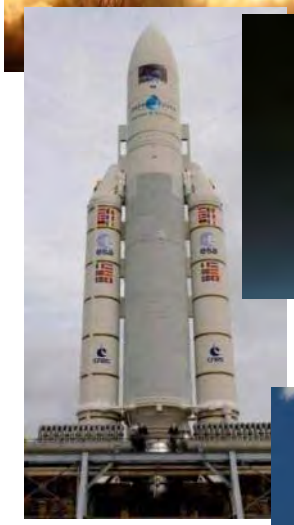
Current/Planned ISS External Payloads



Spaceflight Standards ("Enablers")

NASA International Partner Vehicles

- Japanese H-IIB Transfer Vehicle
  - Pressurized and Unpressurized
  - JEM-EF & ELC payload lift
  - No return
- European Automated Transfer Vehicle
  - Pressurized payload lift
  - No return
- Russian Progress
  - Pressurized payload lift
  - No return
- Russian Soyuz
  - Primarily crew rotation
  - Very limited payload lift
  - Very limited sample return



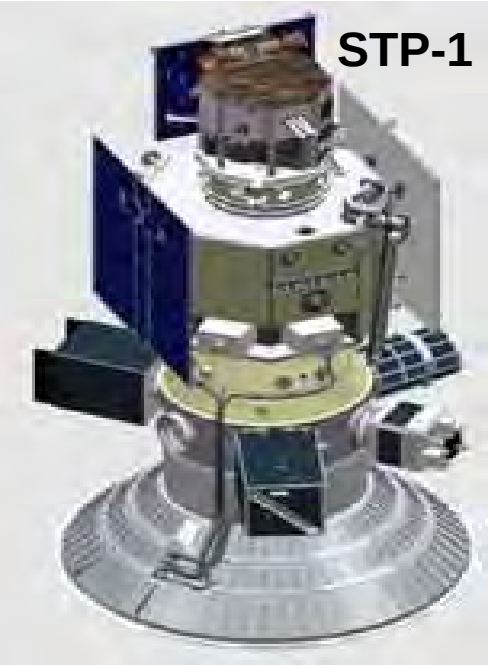
All Operational

STP Rideshare

- **Why Rideshare?**

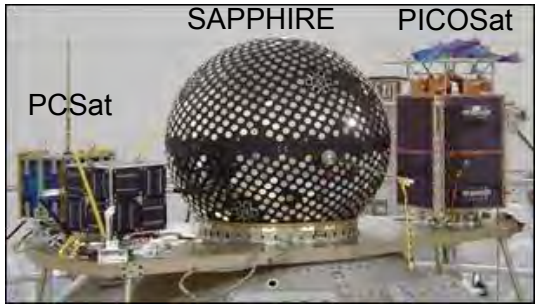
• ESPA Standard Service
• Standard Interface Vehicle
• M-IV Multi-Payload Adapter
• PPODs

Standardization Reduces:
Risk
Complexity
Cost



  - **Dedicated launches too expensive**
  - **Partnerships share the financial burden**
- **Innovation key to success**

- **DoD STP leads USG Rideshare Working Group**
  - **Explores USG, commercial & foreign launch opportunities**
  - **Builds partnership missions**
    - **Payloads include STP experiments & USG Auxiliary Payloads (APL)**



Kodiak Star spacecraft suite

EELV Standard Service

- **Expect one ESPA ring to fly one/year starting 2012**
- **Multiple ESPA class SC opportunities a year**
- **All APLs through STP**
- **Various Orbits**
- **Cost TBD**

SECRETARY OF THE AIR FORCE
WASHINGTON

February 13, 2008

MEMORANDUM FOR AFSPC/CC

SUBJECT: EELV Secondary Payload Adapter (ESPA) Policy

The Air Force has many Evolved Expendable Launch Vehicle (EELV) missions programmed across the FYDP with anticipated excess weight margin. We should leverage this excess capacity by maximizing our use of the EELV Secondary Payload Adapter (ESPA), which was successfully demonstrated in March 2007 on STP-1. As such, it is my policy to make ESPA-hosted satellite launches a routine operation starting NLT FY12.

I would like Air Force Space Command (AFSPC) to develop an ESPA utilization plan and implementation guidance in time to support the FY10 POM. AFSPC should also continue near-term efforts to make the ESPA available as a low-cost, highly reliable, standardized service for small payloads when technically feasible and consistent with overall mission assurance.

This policy is an important milestone in our efforts to provide routine and affordable access to space for scientific, research, development, and Operationally Responsive Space (ORS) missions. I look forward to your continued support in this endeavor.

Michael W. Wynne

cc:
SAF/US
AFPEO/SP
AF/A3/5
AF/A8
AFRL/CC

Summary

- **Rapid Development & Acquisition**
  - Small Launch Vehicles
  - Small Spacecraft
  - Satellite C2 Systems
- **Providers of Access to Space**
  - RDT&E Launch Operations
  - RDT&E Satellite Operations
- **Space Developmental Test and Evaluation**
  - SDTD missions
  - Other missions (as assigned)
- **End-To-End Space Mission Management**
  - Mission Design
  - Systems Engineering
  - Payload Integration
  - Mission Assurance
  - Launch Operations
  - Satellite Operations
  - Transition to Operations
- **Development of Space Professionals**
  - Military
  - Gov't Civilians
  - Others

"Masters of the Calculated Risk"

QUESTIONS?