A New Space Launch Vehicle: Low Cost Access to Space Using Surplus Peacekeeper ICBM Motors

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Agenda

• Overview
• Vehicle Description and Heritage
• Vehicle Performance
• Spacecraft Accommodations
• Mission Development Process
• Summary
OSP-2 Organizational Structure

US Govm't Customer / Sponsored Payload

USAF
SMC Det 12/RP

Det 12 Technical & Ops Support

OSP-2 Contractor

Minuteman-based Launch Vehicles

Peacekeeper-based Launch Vehicles

Commonality

- Avionics
- Subsystems
- GSE
- Processes

Orbital
Launch Systems Group

NORTHROP GRUMMAN Mission Systems
Orbital Suborbital Program (OSP)-2 Launch Vehicle Fleet

Minotaur-based Vehicles
- Shroud: OSP-1 TLV 3 Flight Heritage
- OSP-1 GCA Module
- OSP-1 Sep Module
- M57A1
- MM 2/3 Interstage
- SR19
- MM 1/2 Interstage
- M55A1

Peacekeeper-based Vehicles
- Fairing: OSP-1 SLV & Pegasus, 33 Flight Heritage
- Propulsion Wafer Combined Attitude/Axial Propulsion System (CAAPS)
- Adapter Module
- Orion 50XL
- OSP-1 SLV 2/3 Interstage
- MM 1/2 Interstage
- SR19

TV Shrouded (Configuration B)  TV Unshrouded (Configuration A)  TV Heavy Lift (Configuration C)  Space Lift Vehicle (SLV)  PK Target Vehicle (TLV)  PK Space Lift Vehicle (SLV)
**OSP Minotaur: Mission History**

### JAWSAT Mission: 26 Jan 00

<table>
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<tr>
<th>Criterion</th>
<th>Requirement</th>
<th>Performance</th>
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<tbody>
<tr>
<td>Insertion Apse</td>
<td>405 ±50 nm</td>
<td>406 nm; Δ = 1 nm</td>
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<tr>
<td>Non-Insertion Apse</td>
<td>405 ±50 nm</td>
<td>435 nm; Δ = 30 nm</td>
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<tr>
<td>Inclination</td>
<td>100° ±0.2°</td>
<td>100.2°; Δ = 0.2°</td>
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### MightySat Mission: 19 Jul 00

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<th>Requirement</th>
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<td>Insertion Apse</td>
<td>297 ±50 nm</td>
<td>297.7 nm; Δ = .7nm</td>
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<tr>
<td>Non-Insertion Apse</td>
<td>297 ±50 nm</td>
<td>321 nm; Δ = 24 nm</td>
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<tr>
<td>Inclination</td>
<td>97.6° ±0.2°</td>
<td>97.8°; Δ = 0.2°</td>
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OSP Target Launch Vehicle History

- 100% Successful with Five Flights to Date
- Demonstrated Highly Accurate Trajectory Targeting
- Designed for Severe Silo Launch Environment
PK SLV Design

• 92 in. Taurus Payload Fairing
  ➢ Flight Proven
  ➢ Spacecraft Encapsulation
    Independent of Launch Vehicle

• Guidance Control Assembly (GCA)
  ➢ OSP-Standard Avionics
    • Inertial Guidance
    • Modular Avionics Components
    • Versatile Spacecraft Interface
      Capabilities

• Orion-38 Insertion Stage 4

• Taurus-Derived Composite Structure

• Peacekeeper Boosters: Stages 1-3
  ➢ Solid Rocket Motors
  ➢ Unmodified, GFE Systems
PK SLV Performance

Payload to Orbit (kg)

Orbital Altitude (km)

Sun-Synchronous: 1107 kg to 740 km (2440 lbm to 400 nm)

28.5 Deg Inclination: 1769 kg to 185 km (3900 lbm to 100 nm)

Taurus w/ 92" Fairing 28.5 deg, 100 nm

Legend
- VAFB (SSI CLF), CA
- KLC, Kodiak, AK
- KSC, FL

Orbital Altitude (km)

Payload to Orbit (kg)
PK SLV Fairing and Envelope

Proven Orbital 92” Taurus Fairing
- Vertical Integration
- Aft Shield Isolates Payload Envelope
- S/C Encapsulated Independent of LV
• Baseline Fixed Interface Based on Standard EELV Interface
  – 62.01 in. Diameter Bolt Pattern, 111 Fasteners

• Optional Payload Attach Fittings and Separation Systems Support Other Interfaces
  – Orbital-Standard 38.81 in. Separation System
  – SAAB 37 in, 47 in. or 66 in. Separation Systems
  – Mission-Unique Interfaces Are Negotiable
PK SLV Design Supports Growth Options

- Modular GCA Accommodates Alternate, Non-Baseline Stage 4 Motors

- Standard, Simple Interface Readily Support Multiple Payload Configuration
Flexible Interface Design Accommodates Mission-Unique Requirements
PK SLV Can Launch from All US Space Launch Facilities

Flat Pad Stool Launch

Portable Control Consoles

KODIAK LAUNCH COMPLEX
Kodiak Island, AK

VIRGINIA SPACE FLIGHT CENTER
Wallops Island, VA
• Commercial Launch Sites at NASA's Wallops Flight Facilities

WESTERN RANGE
Vandenberg AFB, CA
• Government Launch Sites
• California Spaceport SSI CLF

EASTERN RANGE
Patrick AFB, FL
• Government Launch Sites
• Spaceport Florida

Minimal Infrastructure and Portable GSE Allows Operations from Multiple Ranges
OSP-2 Mission Development Process

**Notional Eighteen Month Schedule**

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<th>Year 1</th>
<th>Year 2</th>
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<td>Qtr 2</td>
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<td>Qtr 3</td>
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- ATP
- Requirements Development
- System Design
- Mission Design Review
- Procure/Fabricate Hardware
- Factory Integration & Test
- Ship to Launch Site
- Launch Site Operations
- Mission Readiness Review
- Launch Window (w/grace period)

- 1st PK (SLV or TLV) mission: 24 month Schedule
- Subsequent PK SLV missions 18 months
- Mission Initiation via SMC Det 12/RP Program Office
Summary

• PK SLV Based on Flight Proven Components and Processes

• Performance Bridges the Small-to-Medium Launch Vehicle Design Space

• Payload Accommodations are Flexible

• Launches Are Available as Early as 2005 for US Government-Sponsored Spacecraft