Operationally Responsive Spacecraft

Colonel Michael Leahy
Director, Air Vehicles
Air Force Research Laboratory

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Research Direction

Space Launch Systems

- Expendable launch is mature technology
  - 50 years of experience
  - Evolutionary improvement--SLV will approach asymptote
- Tech investment focus on reusable launch vehicles
  - Air vehicle like ops
  - Air vehicle like effects delivery
  - Order of magnitude decrease in costs

Revolution is a Flight Demo Away!
Path Forward

Integration

Subsystems Integration Manufacture

Airframe TPS

Propulsion

Aircraft Like Space Access

Flight Demo

04 09/10 First Spiral
Manhour Data from STS-85 Plus
Engine Shop Total 146,000
(Shuttle Typical)

- HOW IS RAPID TURN
OF TPS POSSIBLE?

- Durability
- Mechanically Attached
- Integrated Health Management
- Configuration - -

Rapid Turn = Lower Costs
Durability - CMC Wrapped Tile TPS

Order of Magnitude Higher Impact Damage Threshold -
Mechanically Attached

- Mechanical attachments replaces adhesive bonding
- TPS thickness & weight reduced
- Quick-release fasteners provide easy access

TPS: R&R 500X Faster

High Temperature Flexible Ceramic Blanket

Tubular Titanium Frame and Fasteners Inside Blanket

Prototype Quick-Release Fastener

Titanium Stud
TPS

Tanks

Ground Demo Objectives
- Conduct large scale thermal, acoustic, & mech load tests
- Validate structural design tools
- Refine weights, costs & rapid turn estimates
- Lower flight demo risk
Flight Demonstrator

Key Demo Objectives
- Integration of fully reusable stage
- Responsive operations
- Mature technologies
- Scalability & traceability

Multiple Options
- Text Sweet Spot
- Residual Capability
- Technology
- Adaptive GN&C
- Cryogenic Tank

Demo Cost
- X-45A (Ref)
- <$100M
- ~$500M
- <$2,000M

Integrated Structures
Thermal Protection Systems

Demo Cost
- <$100M
- ~$500M
- <$2,000M

Multiple Options
- Tech Only
- Residual Capability

X-45A (Ref)
Air Vehicles Directorate

. . . 100 years of flight and counting . . .

“We give the Air Force its Wings”