
Operationally Responsive Spacecraft
4 Mar 04
Colonel Michael Leahy
Director, Air Vehicles
Air Force Research Laboratory

Research Direction

Space Launch Systems

ELV

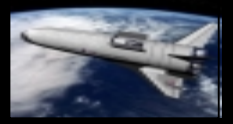
Hybrid R/ELV

TSTO RLV

Time/Cost/Risk/Technology

Advanced Concepts

Hypersonic



Rocket SSTO

- 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

Subsystems
Integration
Manufacture


Airframe
TPS

Propulsion



Integration

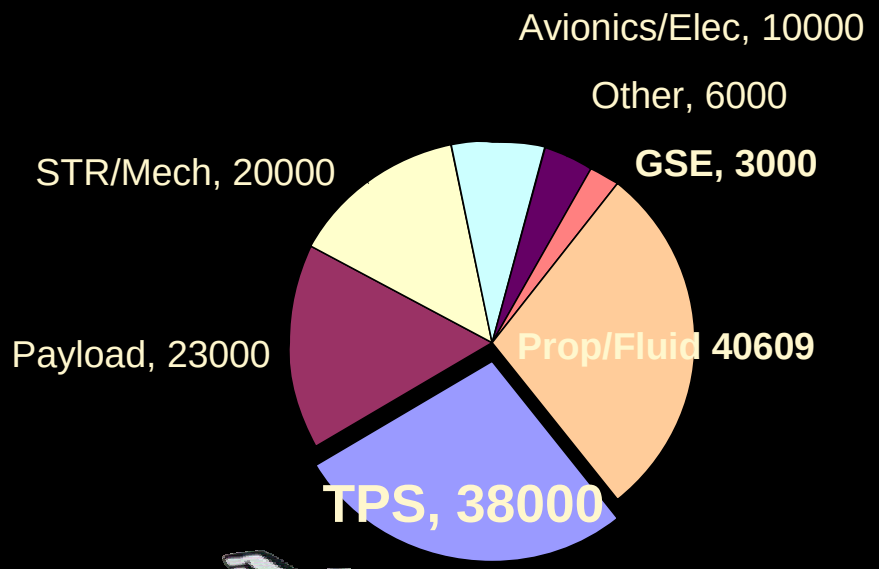
Flight Demo

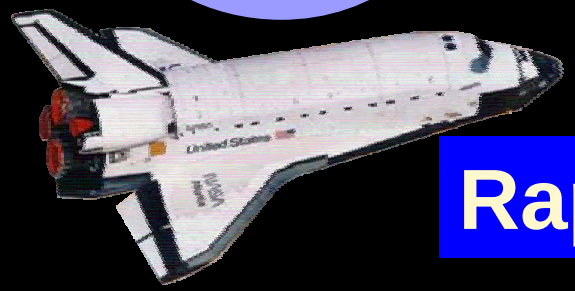
Aircraft Like
Space Access

04 → 09/10 → First Spiral

Thermal Protection System (TPS)

Manhour Data from STS-85 Plus Engine Shop Total 146,000 (Shuttle Typical)

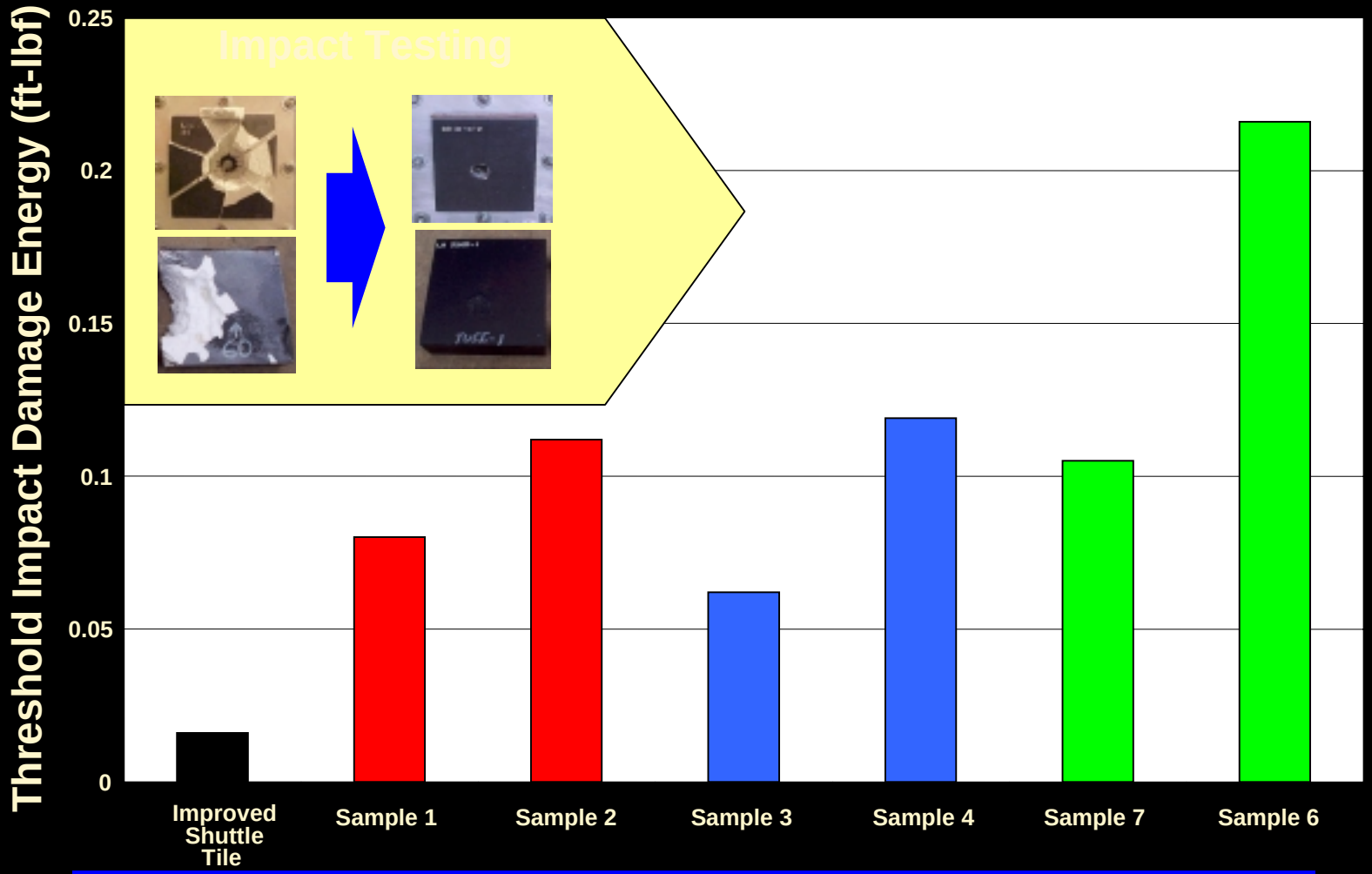




- **HOW IS RAPID TURN OF TPS POSSIBLE?**
- **Durability**
- **Mechanically Attached**
- **Integrated Health Management**
- **Configuration** -
  -

Rapid Turn = Lower Costs

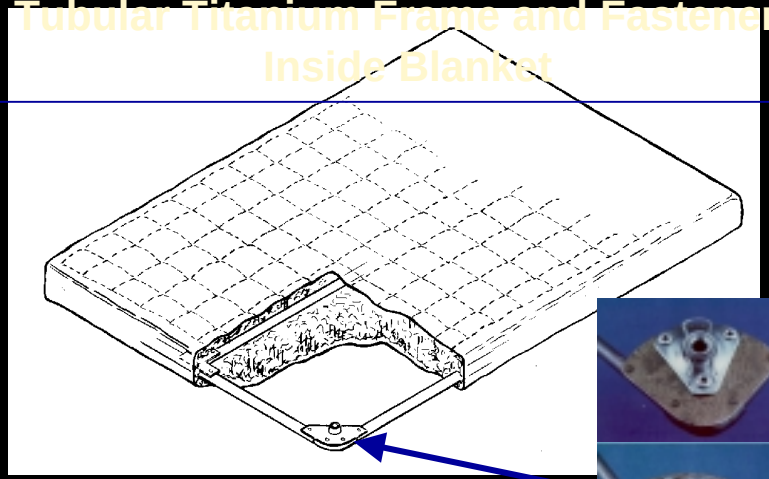
Durability - CMC Wrapped Tile TPS

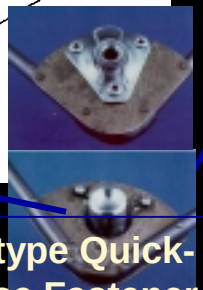


Order of Magnitude Higher Impact Damage Threshold -

Mechanically Attached

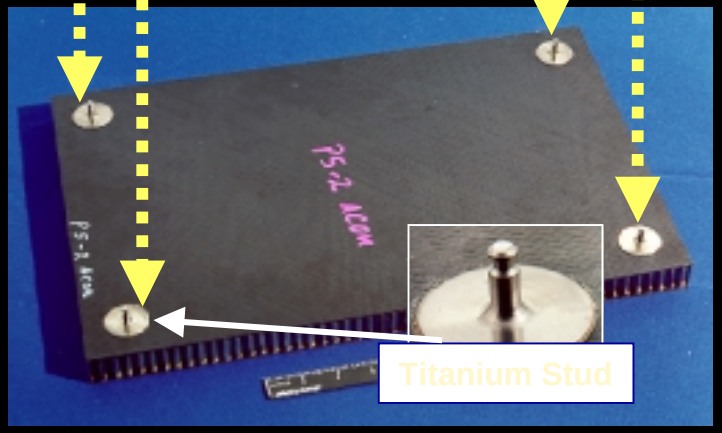
Tubular Titanium Frame and Fasteners Inside Blanket





Prototype Quick-Release Fastener

High Temperature Flexible Ceramic Blanket



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

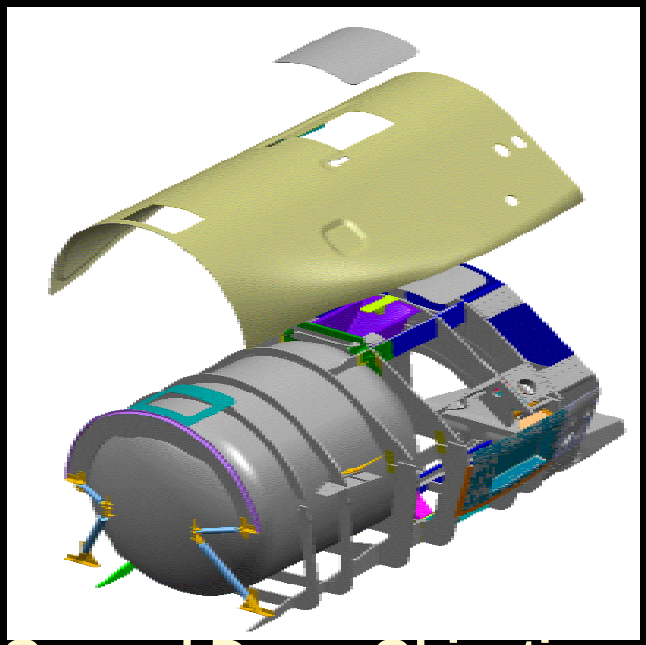
TPS: R&R 500X Faster

Integrated Structures

TPS

Tanks

IVHM

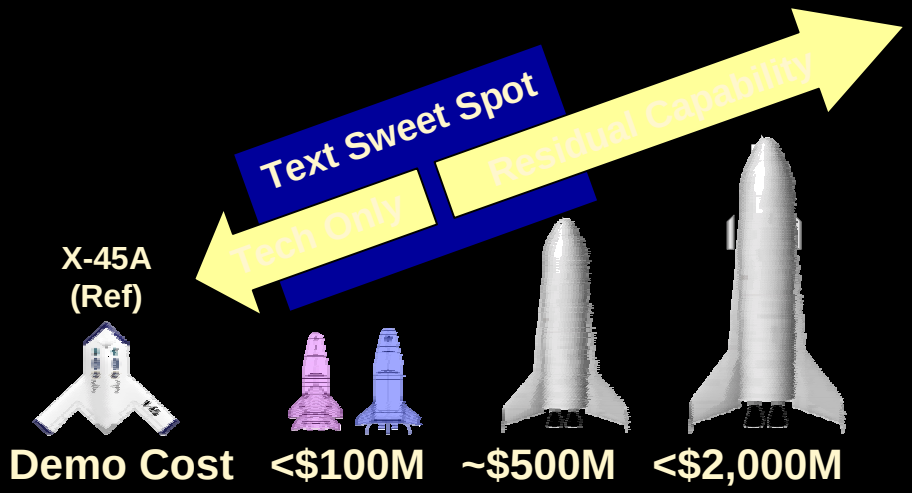


Ground Demo Objectives

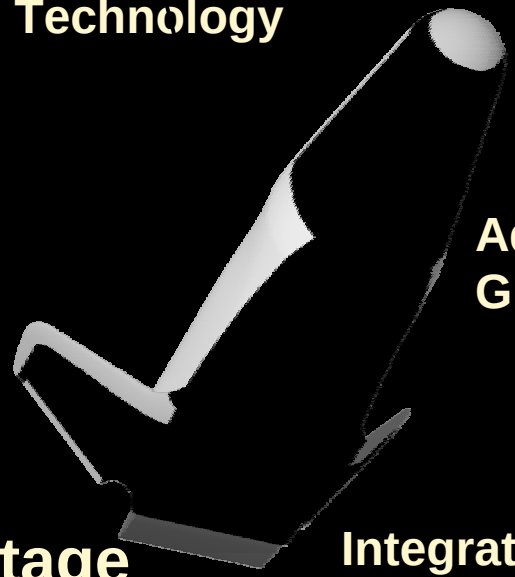
- Conduct large scale thermal, acoustic, & mech load tests
- Validate structural design tools
- Refine weights, costs & rapid turn estimates
- Lower flight demo risk

Flight Demonstrator

Multiple Options



Cryogenic Tank Technology



Adaptive GN&C

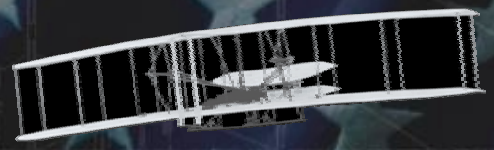
Integrated Structures

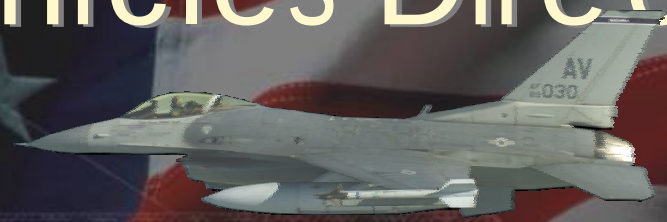
Thermal Protection Systems

Key Demo Objectives

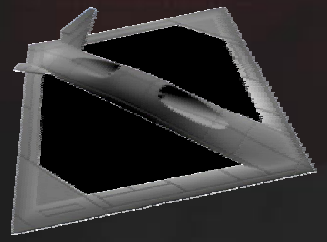
- Integration of fully reusable stage
- Responsive operations
- Mature technologies
- Scalability & traceability

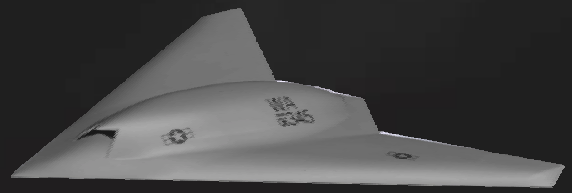
Air Vehicles Directorate





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





"We give the Air Force its Wings"