



# **The path forward from DC-X/XA**

***6th International Symposium for Personal and  
Commercial Spaceflight***

***OCTOBER 20, 2010***

**New Mexico Farm and Ranch Museum  
Las Cruces, New Mexico**



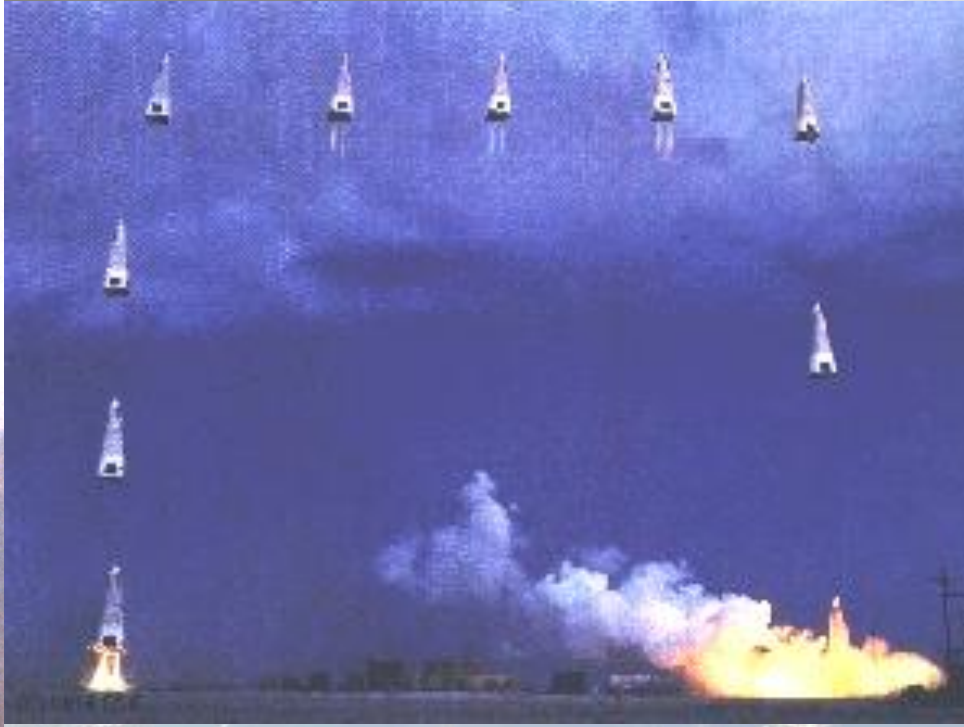
## **Co-Chairs:**

- **Bill Gaubatz, President, SpaceAvailable**
- **Jess Sponable, Technical Advisor Air Vehicles Directorate, Air Force Research Laboratory**

## **Distinguished Panel:**

- **Nino Polizzi, Vice President, Customer Integration Universal Space Network**
- **James Ball, Senior Manager, Flight Engineering, The Boeing Company**
- **Fredrick Bachtel, Director Strategic Planning & Initiatives, Pratt & Whitney Rocketdyne**
- **Yoshifumi Inatani, Institute of Space and Astronautical Science (ISAS), Japan Aerospace Exploration Agency (JAXA)**
- **David Masten, President and CEO, Masten Space Systems**
- **Neil Milburn, VP Program Management, Armadillo Aerospace, LLC**

# A Quick Look At DC-X/XA



## **DC-X (Delta *Clipper*-Experimental)**

**A 1/3 Scale Technology Demonstrator Developed Under SDIO/BMDO  
Single Stage Rocket Technology Program (SSRT)**

### **GOAL:**

- **Demonstrate technologies Supporting Aircraft-Like Operations for Spaceplanes**
  - **Safety, Maintainability, Availability, Low Cost per Flight**

**DC-X Was An “Iron-Bird” Ops Laboratory**

# Validated Aircraft-Like Flight and Ground Operations



QuickTime™ and a  
decompressor  
are needed to see this picture.

# DC-X Became Flying Test Bed for New Technol- ogies DC-XA



Aft Aeroshell  
New Access Panels



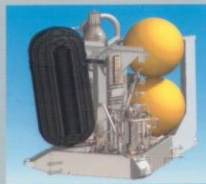
Aluminum-Lithium  
Liquid Oxygen Tank



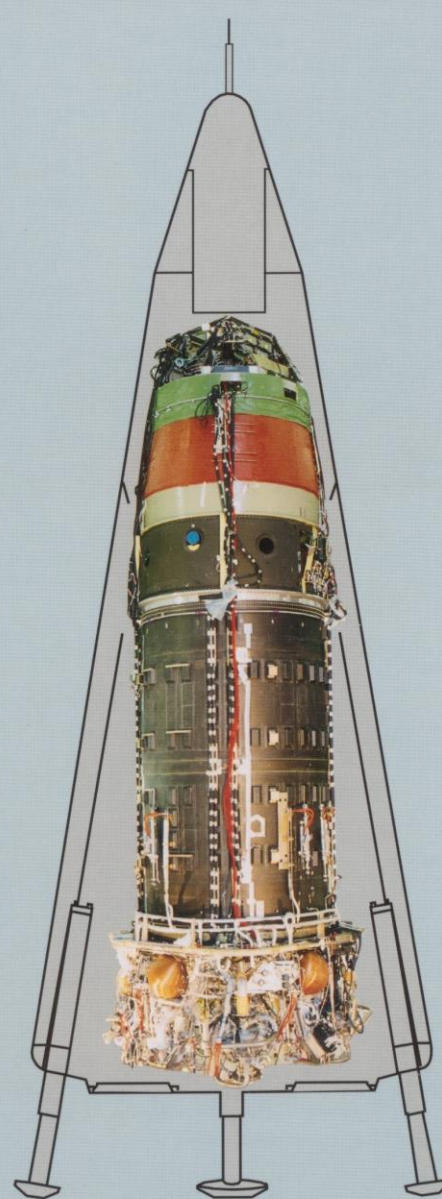
Composite Intertank



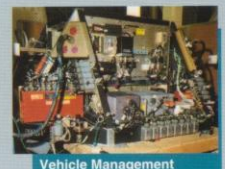
Landing Gear



Integrated GH<sub>2</sub>/GO<sub>2</sub>APU  
and Liquid Gas Converter



Forward Section of  
the Aeroshell



Vehicle Management  
Diagnostics, Telemetry



Composite Liquid  
Hydrogen Tank



Throttling LO<sub>2</sub>/LH<sub>2</sub>  
RL-10 Engines



Base Heat Shield



Composite Feed Lines

# Incremental Flight Steps to DC-1

1993



**DC-X**  
Proving VTVL  
Concept and  
Low-Cost  
Operations

1995



**DC-XA-XB**  
RLV Technology  
Components  
in a Flight  
Environment

1997



**X-33**  
A Balance of  
Flight and  
Ground Based  
RLV Technology

1999

2005



**RLV**  
A SSTO System That  
Meets Market Demand  
A Viable Commercial  
Business Plan



# **DC-X/XA Learning and Residual Issues**

- **Program and Technology - Jess Sponable**
- **Operations - Nino Polizzi**



# **DC-X/XA Learning and Residual Issues**

- **Program and Technology - Jess Sponable**
- **Operations - Nino Polizzi**
- **Panel Response to Resolving Residual Issues**
  - **Current and Planned Activities**





**Summary**  
**– All –**

# Some Key Next Steps

- **Validate high-alpha flight**
  - **Flight tests**
  - **Stability and control**
  - **Thermal environment**
  - **Explore Operations Boundaries**
- **Design for Safety**
  - **Certification**
    - **Type/Production/Airworthiness/Operator License**
- **Design for High Propellant Mass fraction**
  - **Durability / Maintainability**
  - **Incremental Development - Two Stage / Single Stage**
    - **Propellants**



**30**

# DC-X

## Physical Characteristics

- **Height – 42 feet**
- **Base Width – 13.5 feet**
- **Gross Weight – 41,630 pounds**
- **Empty Weight – 21,760 pounds**
- **Propulsion – (4) Pratt&Whitney RL-10A gimbaled Engines**
- **Thrust – 13,500 lbs each @ WSMR 3,000 foot altitude**
- **Propellant – LH2 / LO2**
- **Total Flights – DC-X (8) DC-XA (4)**

**DC-X Was An “Iron-Bird” Ops Laboratory**

**Aircraft-like Flight  
Envelop Expansion**