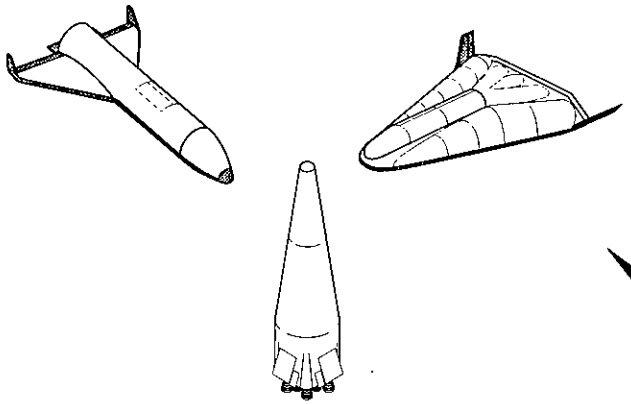
# Traceability / Scalability to SSTO



SSTO Rocket

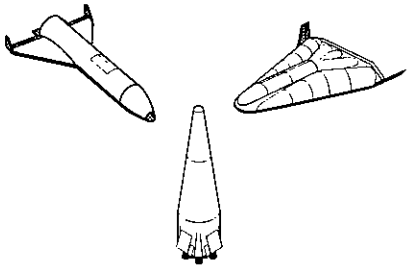
**Traceability:** Technology and General Design Similarity

**Scalability:** Directly Scalable Design Parameters

Requirements Flowdown

**Critical Characteristics**

- Operations Concept
  - RM&S
  - Ground and Flight
  - Cost
- Flight Stability and Control
- Airframe, Tanks, TPS
- Loads
- Weights (Mass Fraction)
- Ascent/ Reentry Environments
- Fabrication Methods
- Testing Approaches
- Etc.



X-33

*X-33 MUST Prove the Concept of SSTO Rocket*

# X-33 Concept Definition Studies

**Industry Partners**

- LMSW
- MDA/Boeing
- RI

**Task 1. Business Plan Development**

- Phase 2 Plan
  - X-33
  - Government Participation
- Phase 3 Plan
  - RLV Preliminary
  - Government

**Task 2. Operations Plan Development**

- RM&S Plan
- Flight Operations
- Logistics
- Vehicle Turnaround
- Ops & Maintenance

**Task 3. Concept Design**

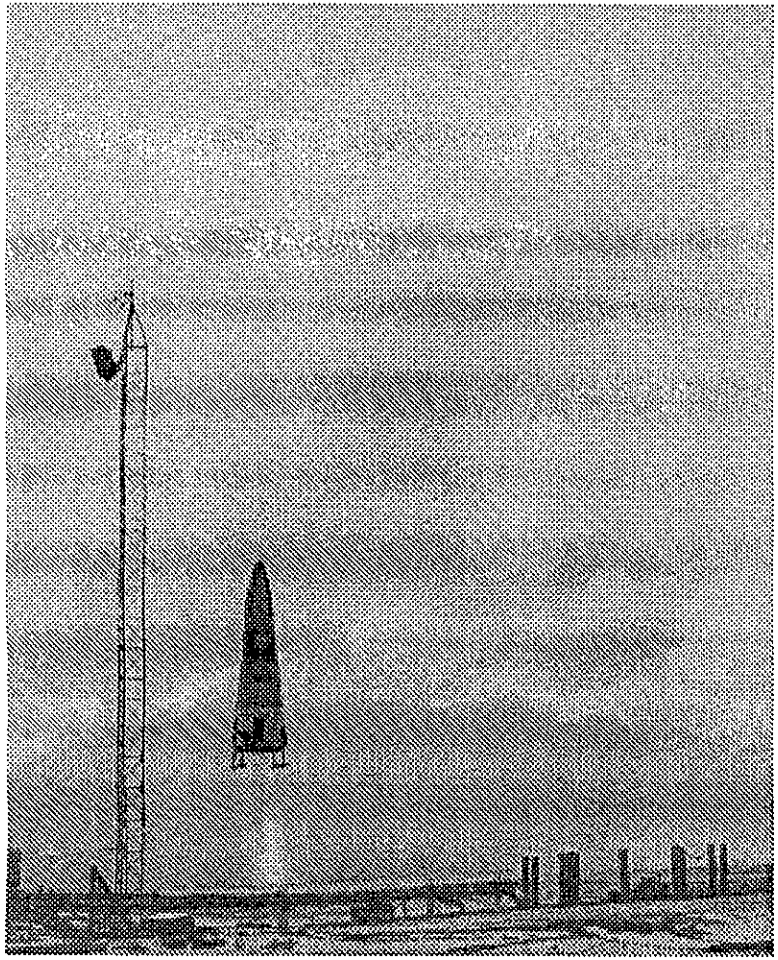
- X-33 And SSTO Concept Baselines
- Design to Cost Methodology
- Test Program
- Phase II Technology

**Task 4. Complementary Technologies Demonstration**

- Operations
- Reusable Cryogenic Tank System
- Thermal Protection Systems

# DC-XA PROGRAM OVERVIEW

DC-XA



## GOALS & OBJECTIVES

- MATURE TECHNOLOGY COMPONENTS VIA FLIGHT VEHICLE INTEGRATION
- DEMONSTRATE OPERABILITY, SUPPORTABILITY, & PERFORMANCE IN "REAL-WORLD" ENVIRONMENT
- DEMONSTRATE RAPID PROTOTYPING AND NEW GOVERNMENT / INDUSTRY PARTNERSHIP
- DEMONSTRATE ,MINIMUM GROUND (15 TOUCH LABOR) AND OPERATIONS (3 PERSON FLIGHT OPS.) CREW

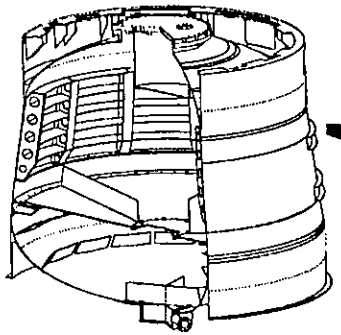
## ROLES & RESPONSIBILITIES

MCDONNELL DOUGLAS
- DESIGN & VEHICLE INTEGRATION
- OPERABILITY ENHANCEMENTS
- VEHCILE CHECKOUT
- GROUND & FLIGHT TESTING

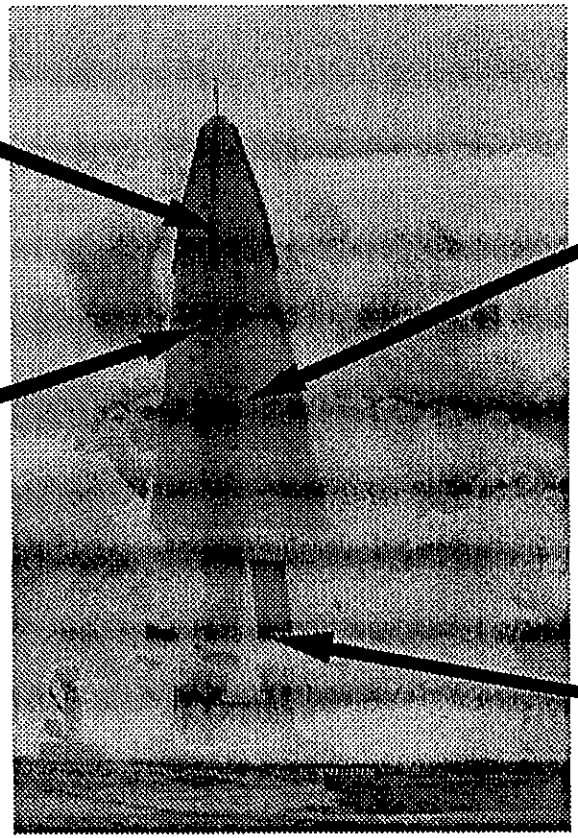
NASA / PHILLIPS LAB
- AID RESOLUTION OF INTEG. ISSUES
- FLIGHT TEST TELEMTRY SYSTEM
- STRUCTURES DESIGN SUPPORT
- WHITE SANDS COORDINATION

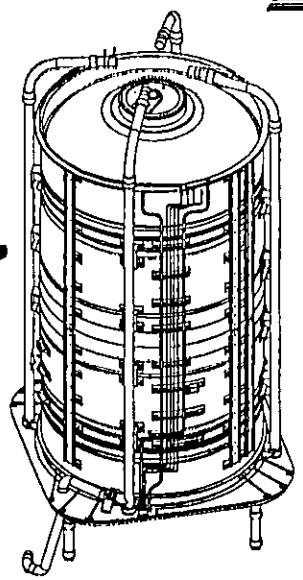
DC-XA

# DC-XA TECHNOLOGY COMPONENTS

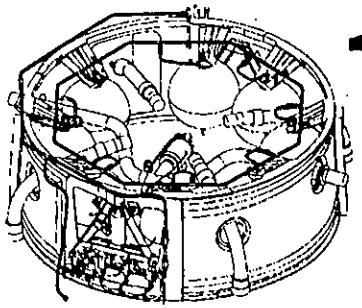


Al-Li $LO_2$ Tank





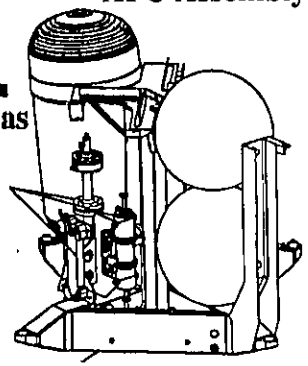
Composite $LH_2$ Tank



Composite Intertank

APU Assembly

Liquid to Gas Converter Assembly



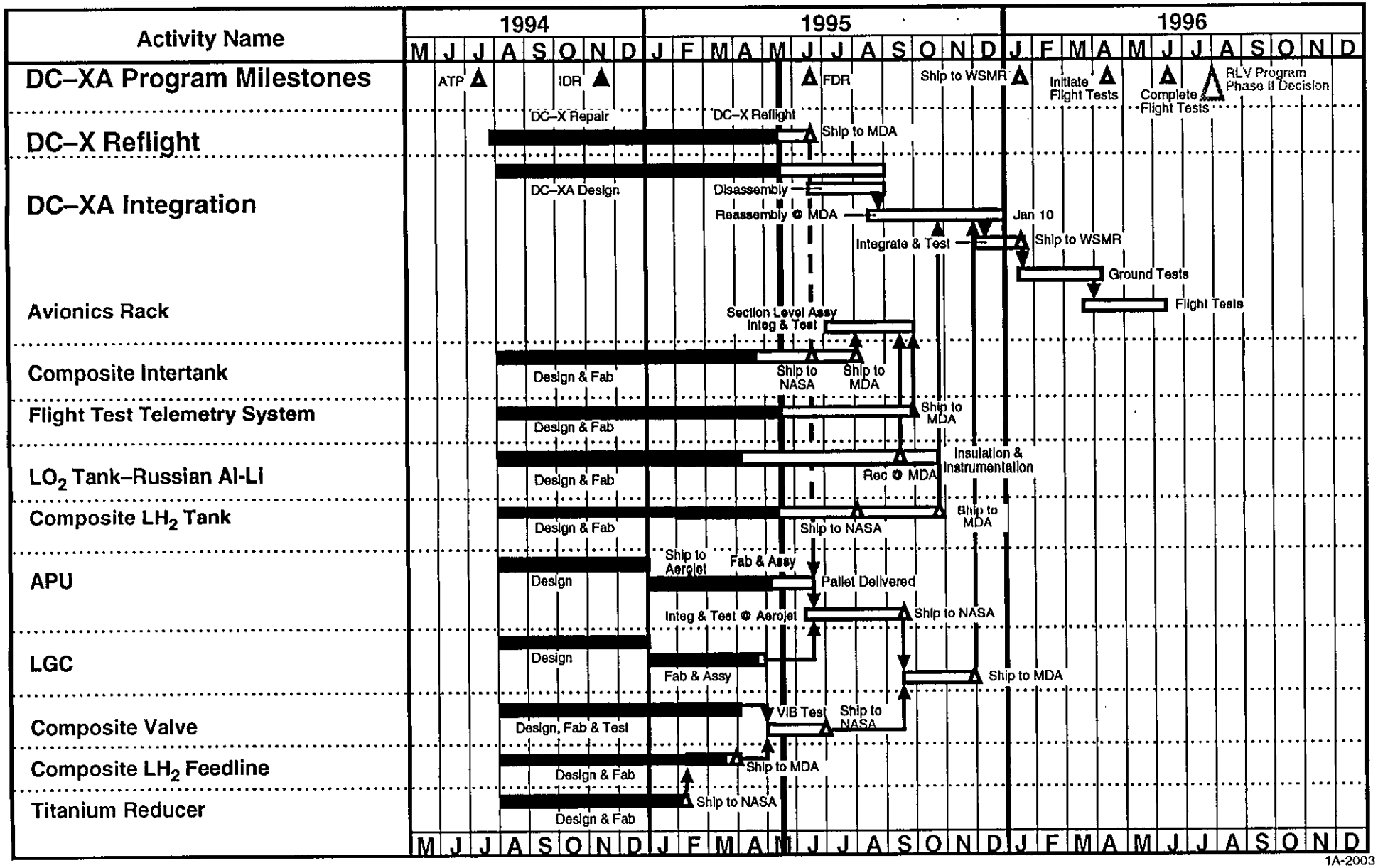
Composite line / Valve

**OPERABILITY ENHANCEMENTS**

- AUTOMATED MISSION PLANNING
- REDUNDANCY MANAGEMENT
  - DIFFERENTIAL THROTTLING
  - AUTOTRANSLATE

DC-XA

# SCHEDULE




1A-2003

DC-XA

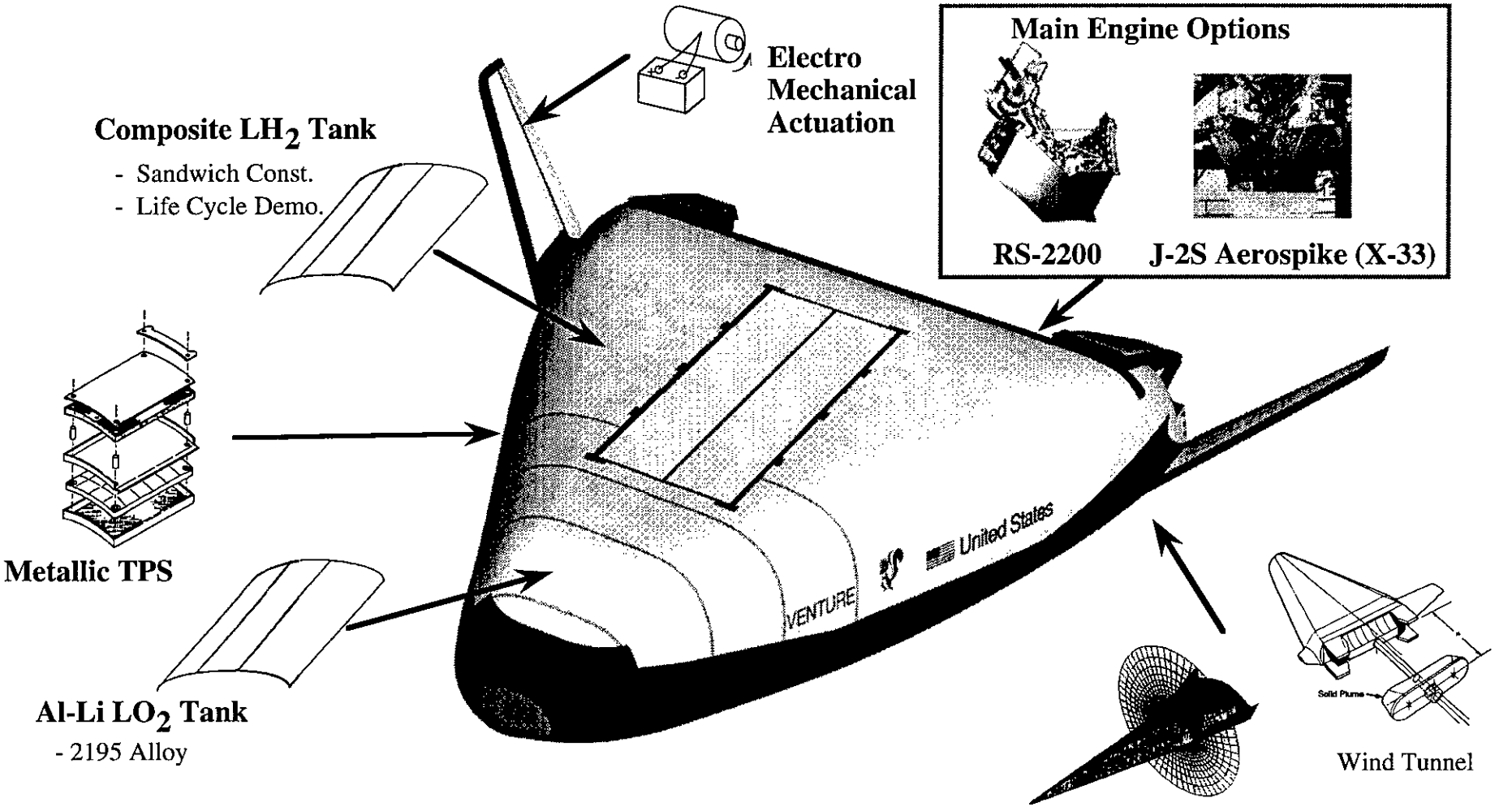
# PROGRAM STATUS

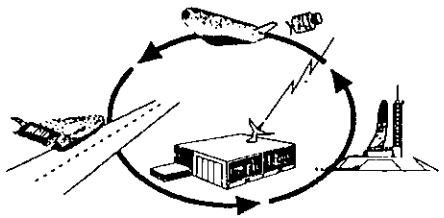
- DC-X REFLIGHT PROGRAM 1 MONTH BEHIND ORIGINAL SCHEDULE
  - REPAIRS COMPLETED AND VEHICLE AT WHITE SANDS MISSILE RANGE
  - BURP TEST SUCCESSFULLY COMPLETED MAY 3, 1995
  - FLIGHT #6 SUCCESSFULLY COMPLETED MAY 16, 1995
  - FLIGHT # 7 PLANNED FOR JUNE 2, 1995
- DC-XA MILESTONES COMPLETED SINCE OCTOBER
  - INITIAL DESIGN REVIEW
  - ELECTRONIC DEVELOPMENT FIXTURE
  - LONG - LEAD PURCHASE ORDERS IN PLACE
  - BASELINED INTEGRATION PLAN / DRAFT GROUND TEST PLAN DEVELOPED
- PREPARING FOR DC-XA FINAL DESIGN REVIEW JUNE 12 - 13
- ADJUSTING DC-XA MILESTONE COMPLETION SCHEDULE TO ACCOMODATE DC-X REFLIGHT AND COMPONENT DELIVERY

# RLV TECHNOLOGY OVERVIEW

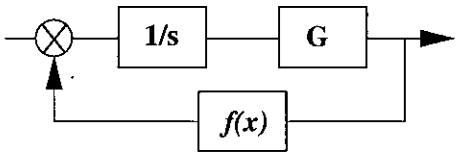
# X 33 Lockheed Martin Technology Demonstrations

*Phase I*

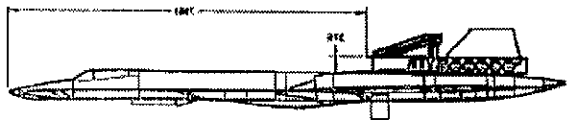


**Integrated Health Management**

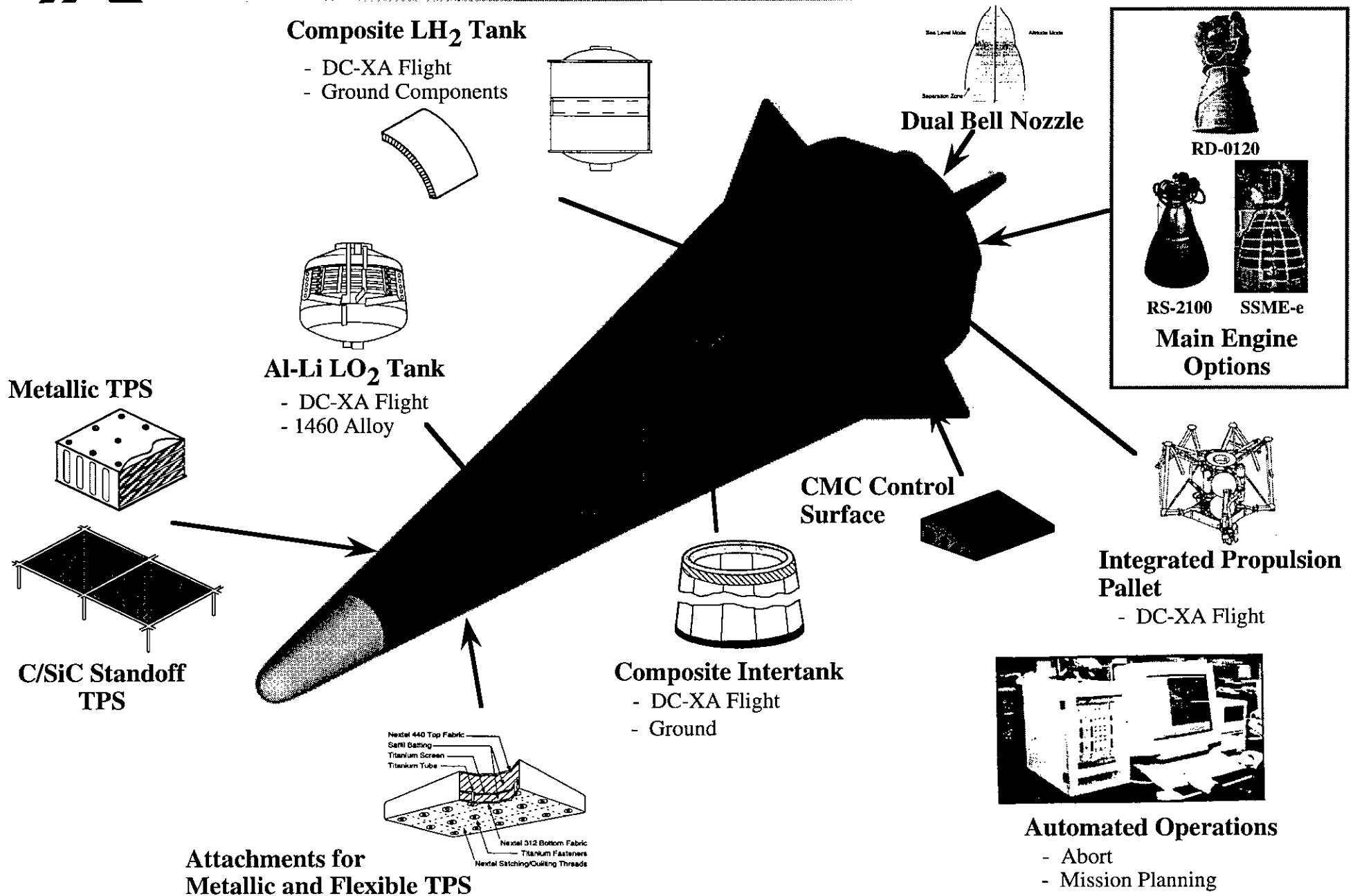



**Adaptive GN&C**



SR-71 Hot Fire Flight Test

**Integrated Aerospike / Lifting Body**

# Douglas/Boeing Technology Demonstrations

*Phase I*