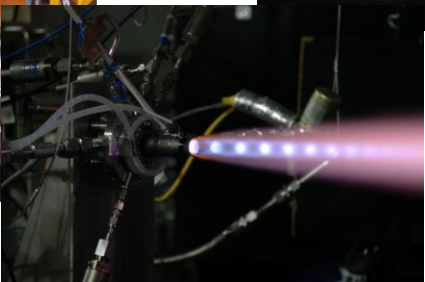
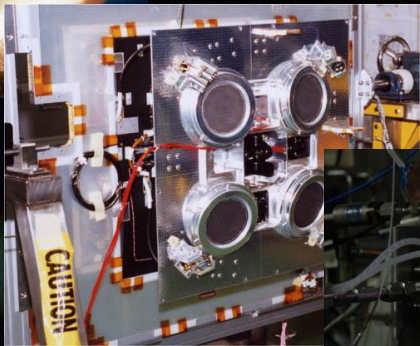
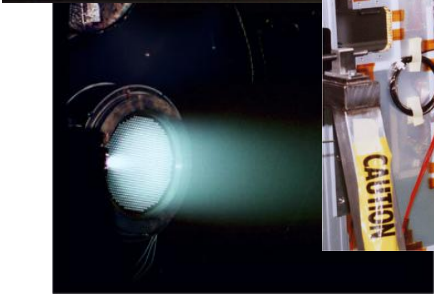
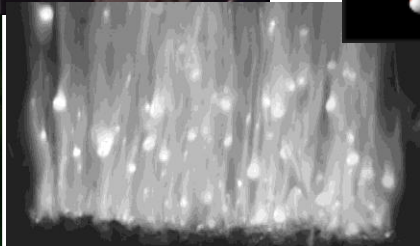
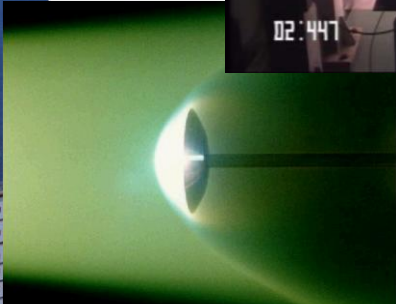
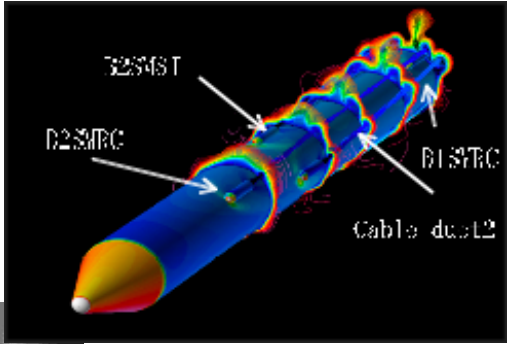
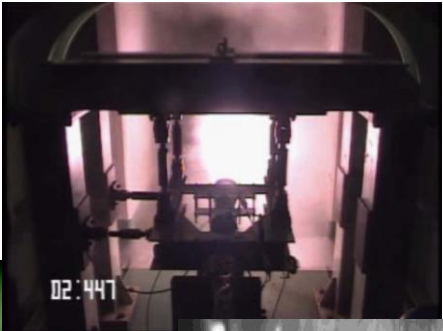


Progress Toward Operational & Reusable Rocket Vehicle

**ISPCS 2010
Las Cruces**

Yoshifumi INATANI

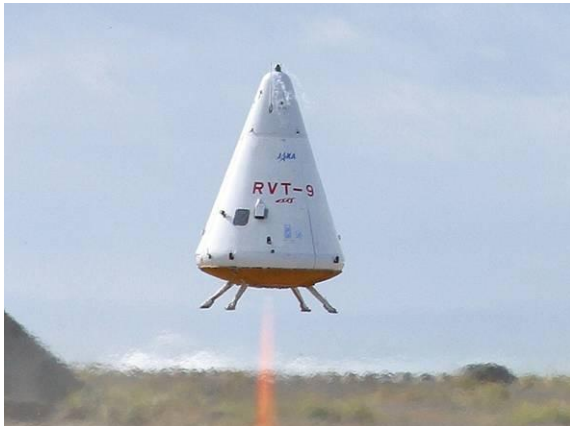
**Institute of Space and Astronautical Science
Japan Aerospace Exploration Agency**



ISAS Transportation / Propulsion Research Activities & Flight Projects

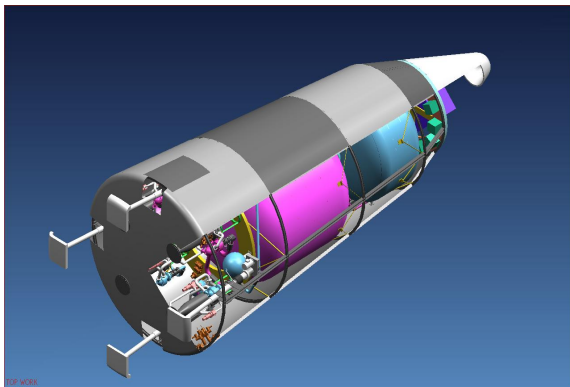
Studies of Reusable Rocket and Vehicles

System Architecture and Elementary Subsystem Studies by RVT

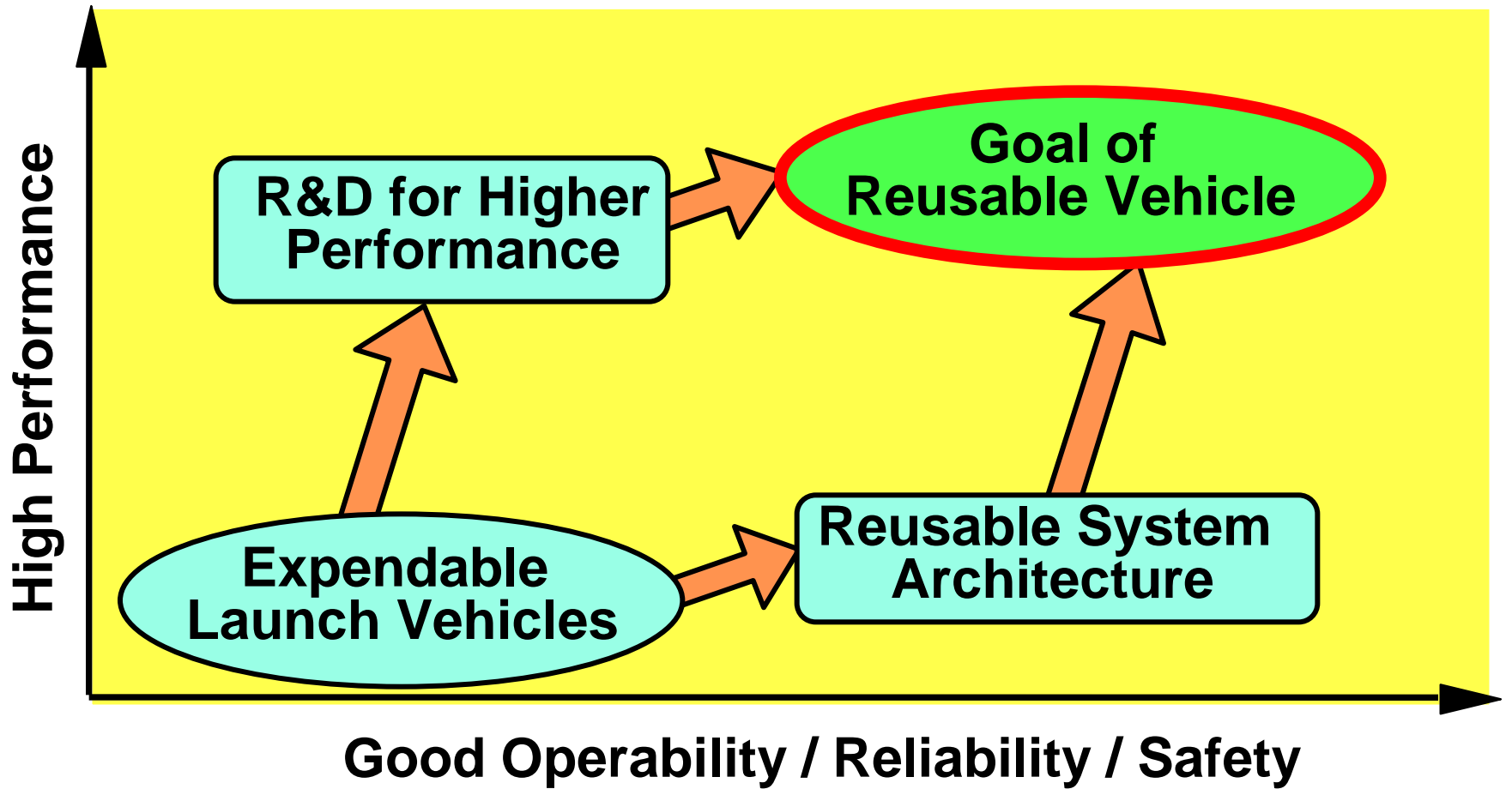


Repeated Flight & Turnaround Lessons
Life-Controlled Engine Studies
Landing Guidance Studies for Returning Flight
Integrated Propulsion/Power System Studies

Reusable Sounding Rocket System Studies



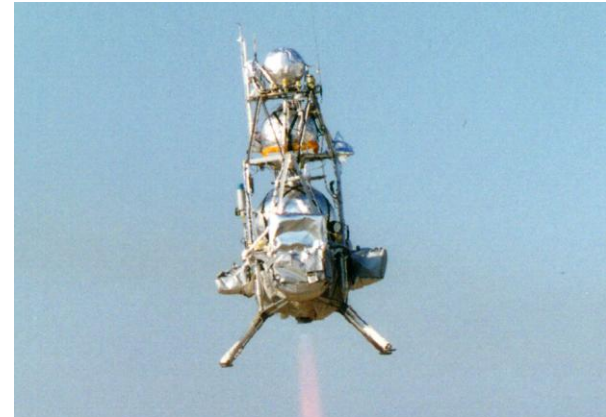
Fault Tolerant System Architecture
Vehicle and Propulsion Systems Studies
Aero-flight Mechanics of Returning Flight
Encouragement of Users



Reusable Vehicle Testing Campaign (1999-2003)

RVT#1 (1999)

Repeated Flight of LOX/LH2 Rocket



RVT#2 (2001)

Flight Envelope Extension
Streamlined Guidance
Life-Controlled Thrust Chamber

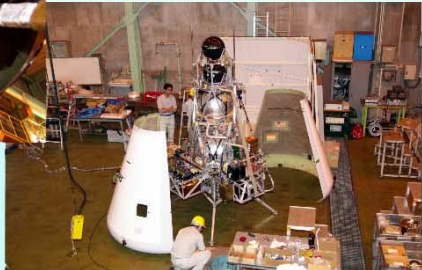


RVT#3 (2003)

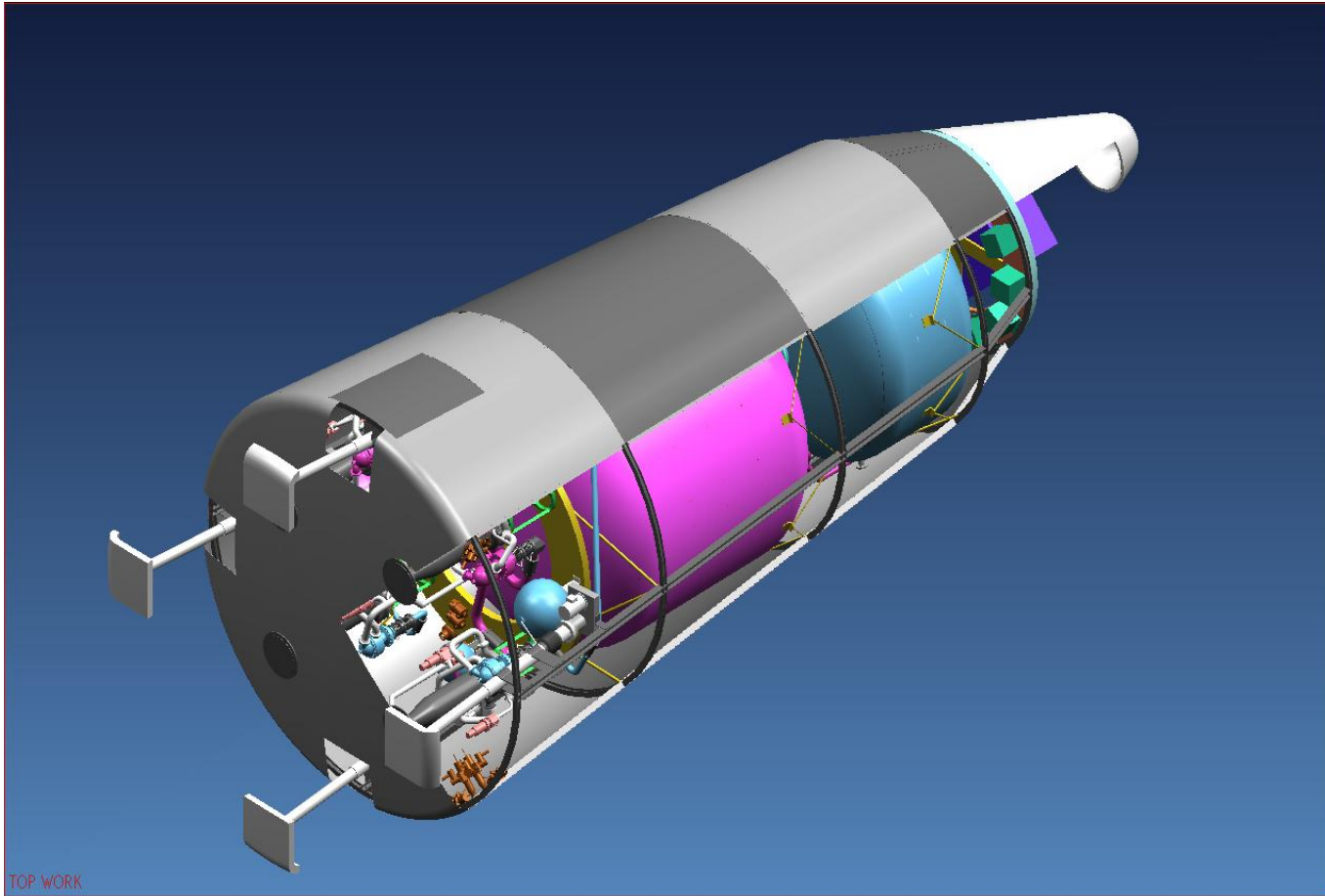
Composite Cryogenic Tank
Electroforming Injector
Flight Envelope Extension



Streamlined Turnaround Lessons



Status of Reusable Sounding Rocket Study and Development

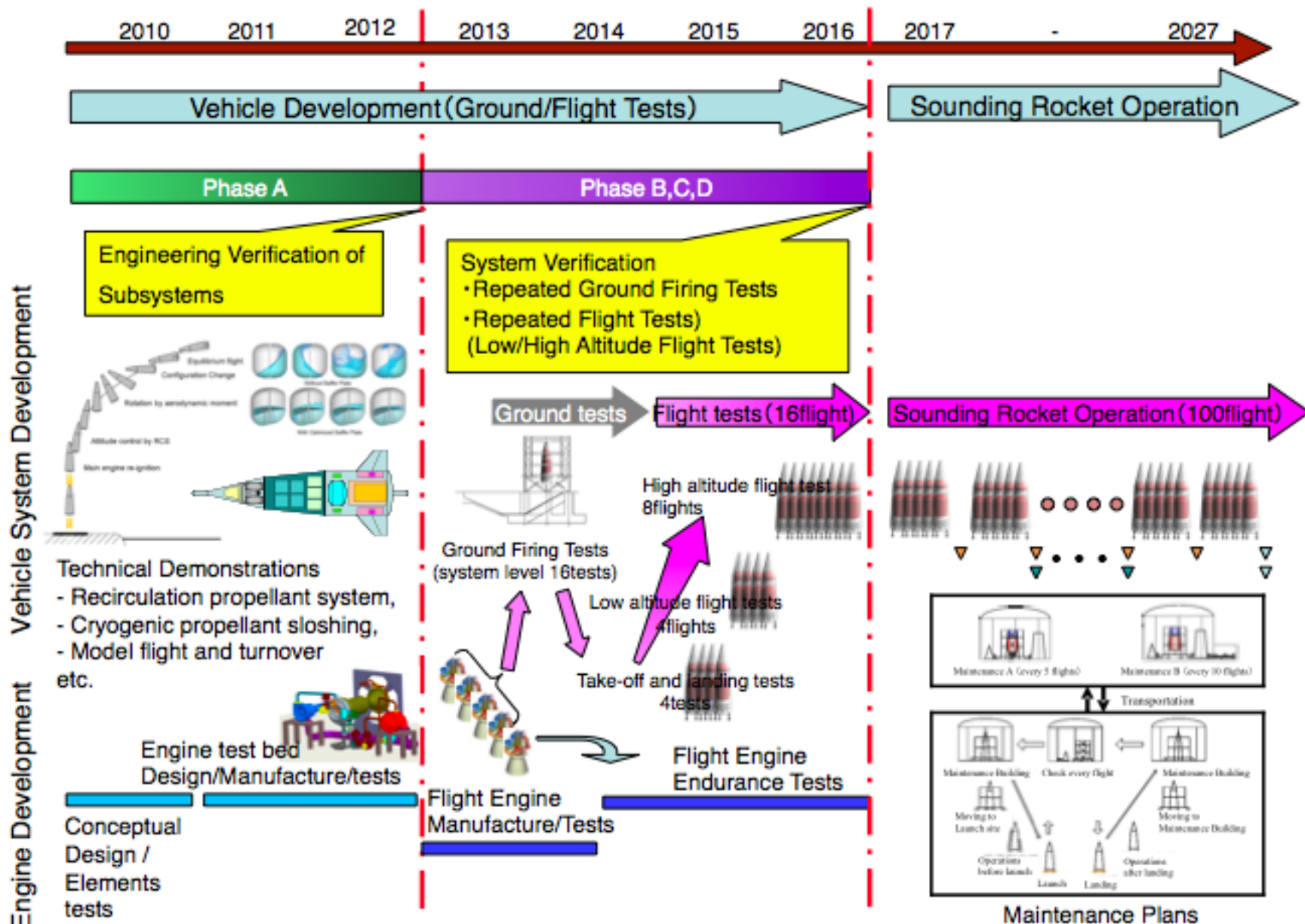


Reusable Sounding Rocket

Mission Definition and System Requirement Summary

- 1. To achieve 120km in altitude and returns/lands at the launch site**
- 2. Flight frequency is higher than 5 times in two-month launch season, and two seasons per year**
- 3. The minimum flight interval for the turnaround capability is one day**
- 4. 100 Times of Life and Reuse**
- 5. Operational flight cost should be an order of magnitude less than the existing ISAS sounding rocket**

Proposed Reusable Sounding Rocket Project Phasing



Technology Maturation Phase Studies Underway as phase-A of Reusable Sounding Rocket Development

**Proto-Model Engine Development and Repeated Operation
Demonstration**

**Fuel / Oxidizer Management Demonstration through Planned
Flight, In-Flight Restart and Turnaround Ground Operation**

**Detailed Aerodynamic Design and Model Flight Demonstration
of Returning / Turnover Maneuver**

Health Monitoring Subsystem Demonstration

**Comprehensive Preliminary System Design of “Flyable Vehicle”
including Repeated Flight Operation Architecture**

GOAL OF “OUR” REUSABLE VEHICLE STUDIES

- **SYSTEM ARCHITECTURE STUDIES FOR “TRUE” RLV**
- **MAXIMUM USE OF FREQUENT / REPEATED FLIGHT OPPORTUNITES & TECHNOLOGY MATURATION**
- **ACCEPTANCE OF BENEFIT OF RLV AND TO ACCELERATE FURTHER STUDIES**