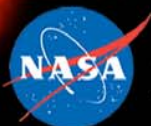


GENESIS

SEARCH FOR ORIGINS

<http://genesismission.jpl.nasa.gov/>



National Aeronautics and
Space Administration
Jet Propulsion Laboratory
Pasadena, California

Genesis - Launch



Genesis

Search for Origins

NASA Sample Return Mission

**NASA's first sample return mission since Apollo
First Sample Return from beyond the Moon**

5th "Discovery Class" mission

- 1. Mars Pathfinder**
- 2. Near Earth Asteriod Rendezvous**
- 3. Lunar Prospector**
- 4. Stardust**
- 5. Genesis**

Characterized by Focused Science Objectives, Low Cost, Short Development Time

Conceived in early eighties; Selected in 1997 after a competition with 35 other mission proposals

A partnership of Academic, Industrial and NASA space:

- Principal Investigator: Dr. Don Burnett / Caltech**
- Project Management: Jet Propulsion Laboratory (JPL)**
- Payload: Los Alamos National Laboratory (LANL) and JPL**
- Spacecraft: Lockheed Martin Space Systems, Denver, CO**
- Mission Ops: JPL, LMA, LANL**
- Sample Curation: Johnson Center Space (JSC)**
- Outreach: JPL & McREL**

Science Objectives

- **To Collect Samples of the Solar Wind and Return them to Earth**
- **To accurately determine the Composition of the Sun and then Address the Processes Involved in the Origins of the Solar System.**

..... i.e., What's the Data Used For?

Examples of Major Science Questions for Which Genesis Will Provide Information

- 1) What Is the Sun Made Of?**
- 2) Are we made of the same stuff?**
- 3) How Can We Explain the Great Diversity of Planetary Objects?**
- 4) What Makes Earth Different From Its Planetary Neighbors?**

**But Don't We Already Know the Composition
of the Solar Wind?**

Essentially Little Is Known About SOLAR ISOTOPIC Composition

- 1) Apollo Foils Provided Precise Solar Wind He and Ne Isotope Ratio
With $^{20}\text{Ne}/^{22}\text{Ne}$ Ratio a Surprising 38% Greater Than The Terrestrial Atmosphere**
- 2) The Only Practical Source Of Solar Isotopic Abundances is the Solar Wind;**
- 3) No Solar-Terrestrial Differences Can Be Seen for C, O, Mg Isotopes,
but Uncertainty in the data is 5 - 40%**

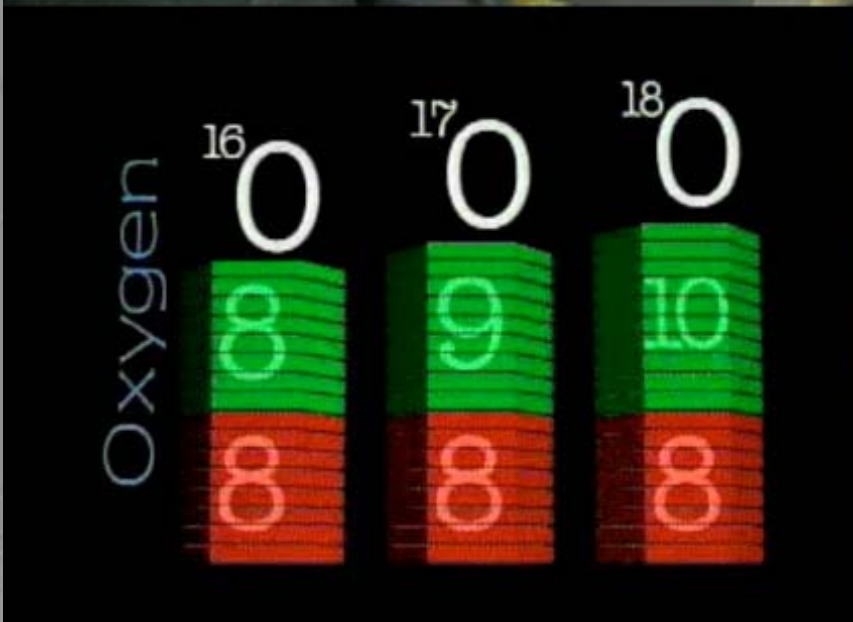
Best Source of Data:

**There Is No Data For A Significant Number Of Elements Since They Cannot Be
Measured At All**

**A Small Number of Elements Have Quoted Errors of $\pm 10\%$ But Overall, There Are
Large Uncertainties**

Meteorite Analysis Depend On Knowledge Of Its “Background Noise”

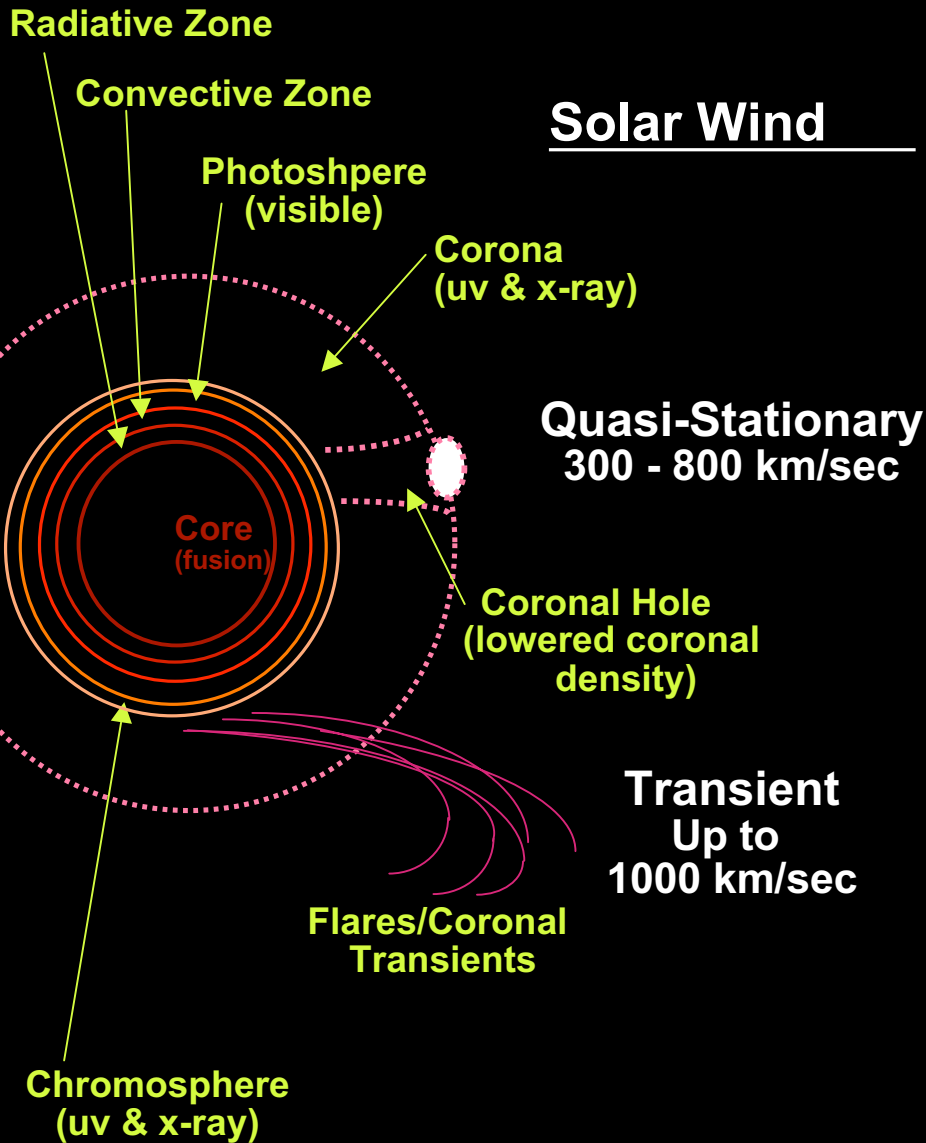
Genesis – Ion Recipe



Science Collection/Measurement

- **Measure Elemental & Isotopic Abundances of Solar Wind Ions.**
- **Collect Separate Samples for Each of 3 Solar-Wind Regimes: Low Speed, Coronal Hole, and Coronal Mass Ejections**
- **Provide a Reservoir of Solar Matter for Future Analysis**

Collecting Solar Wind



Solar Wind

Wind Regimes

IS = Interstream 60%
(Slow Wind)

CH = Coronal Holes 25%
(Fast Wind)

CME = Coronal Mass Ejection 15%
(Low or High Speed)

Science Devices

GEM & GIM Monitors

Select Regime & Grid Voltage

Collectors Arrays

2 Bulk Collectors

IS Bottom (L) #3

CH Middle (H) #2

CME Top (E) #1

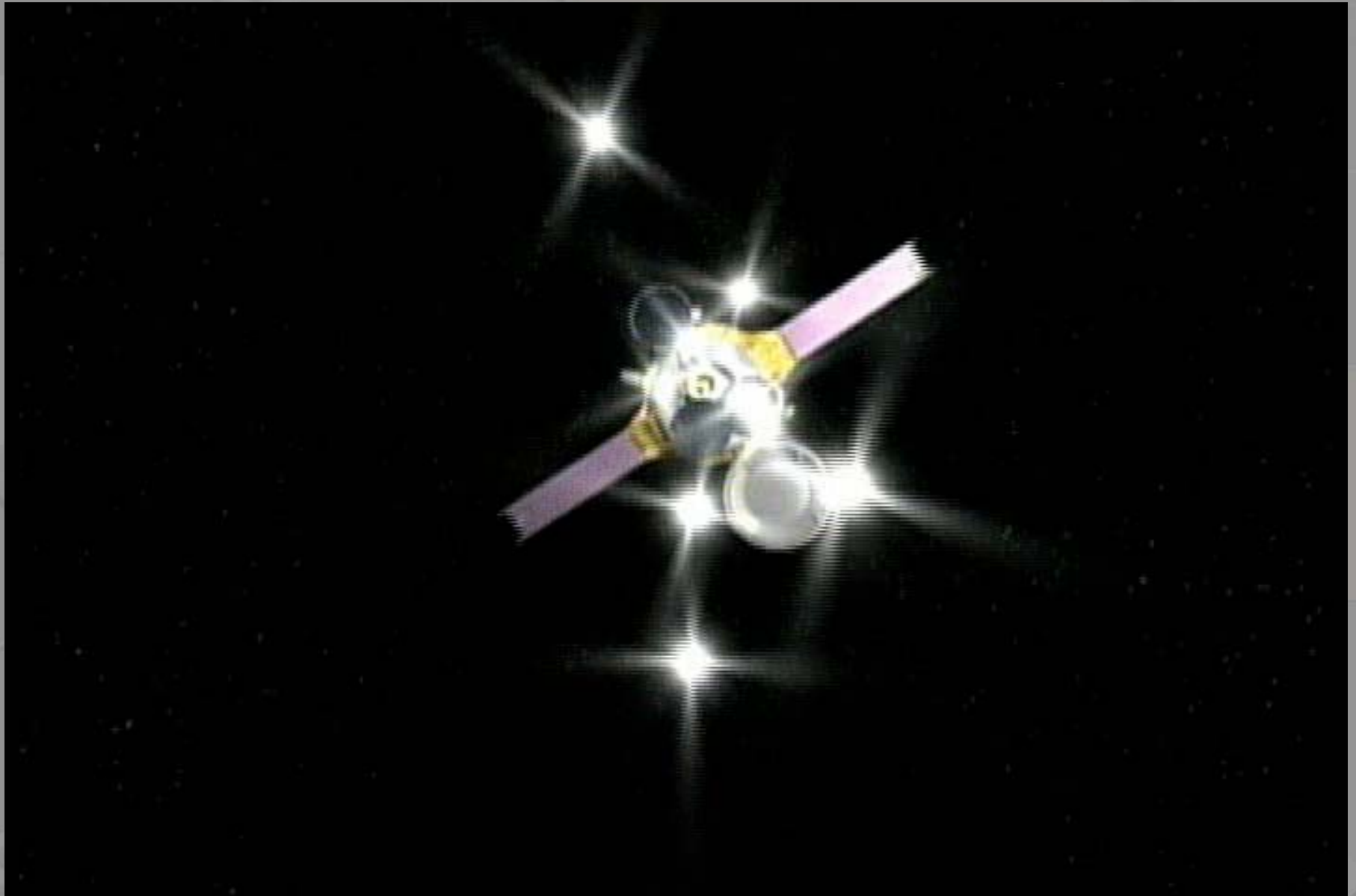
Concentrator

Mass 6-22 Primary - Oxygen

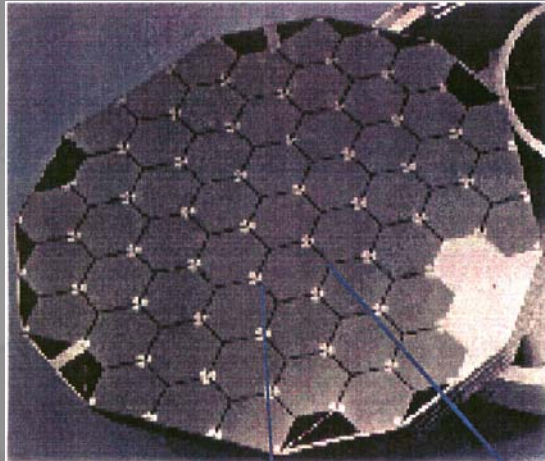
Secondary Collector

Radioactive Nuclei

Genesis – Flying Ions



Collector Array Design

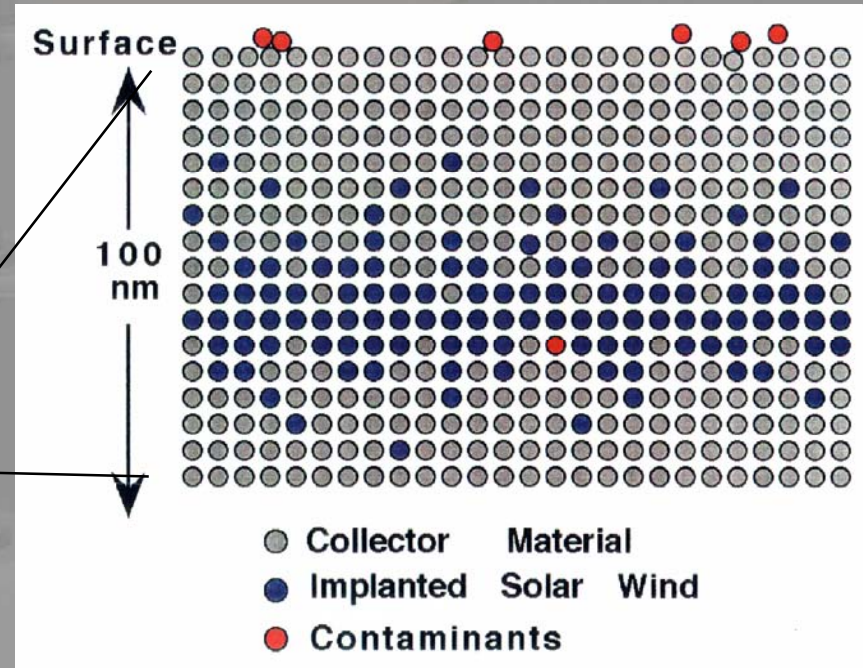


Array

- 55 Standard
- 6 Partial

Wafer

Schematic View of Top 100 nm



Requirements on Collectors:

- Bulk Solar-Wind Collector Area, $> 0.6 \text{ m}^2$
- Each of 3 Special-Regime Collector Areas, $> 0.3 \text{ m}^2$
- Material From Each Array Shall Be Uniquely Identifiable In Case Material is Dislodged.
- Radioactive Nuclei Collectors Exposed in Lid of SRC.

Collecting Solar Wind Ions

	Green = SNR > 100
	Blue = SNR > 10
	Blank = SNR < 10 expected

H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg 7											Al	Si	P	S	Cl	Ar
K	Ca 7	Sc	Ti 7	V	Cr 7	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo		Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba 7	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi			
		Ce	Pr	Nd		Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu		
		Th		U													

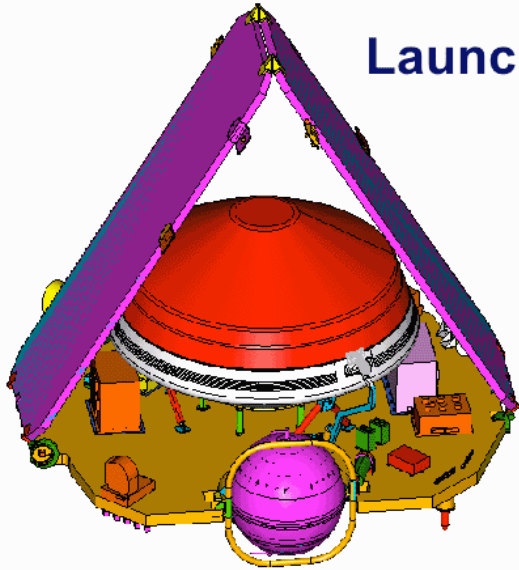
Completed Flight H-Array in Clean Room



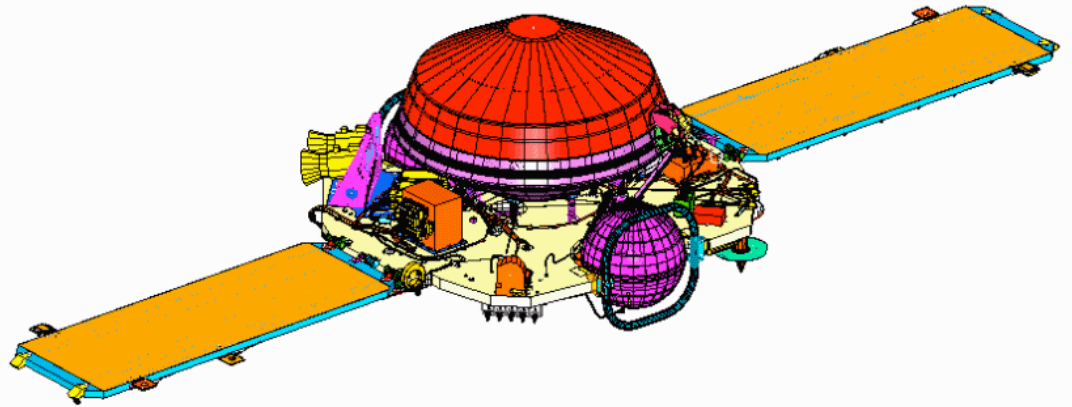
6/2/2000

Spacecraft Configurations

Launch



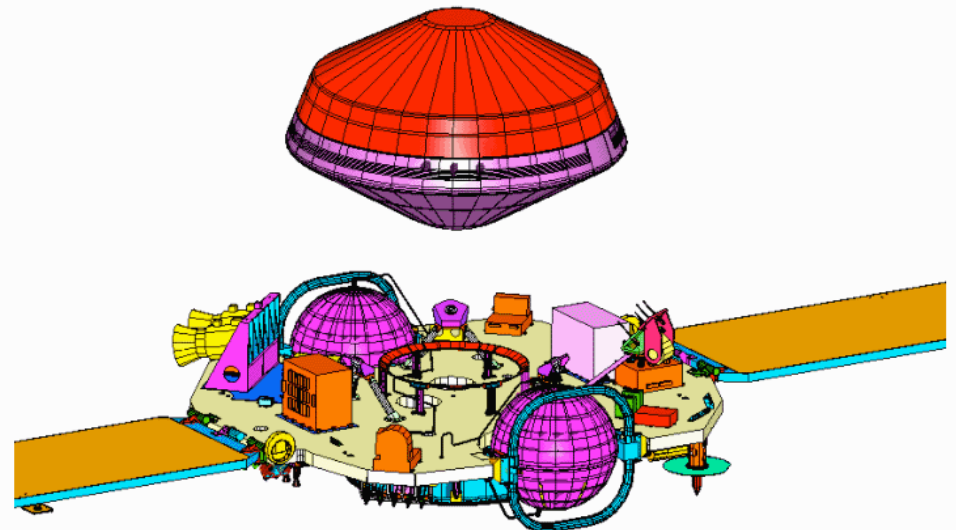
Cruise



Science Collection



Separation @ Earth



Spacecraft on Launch Vehicle



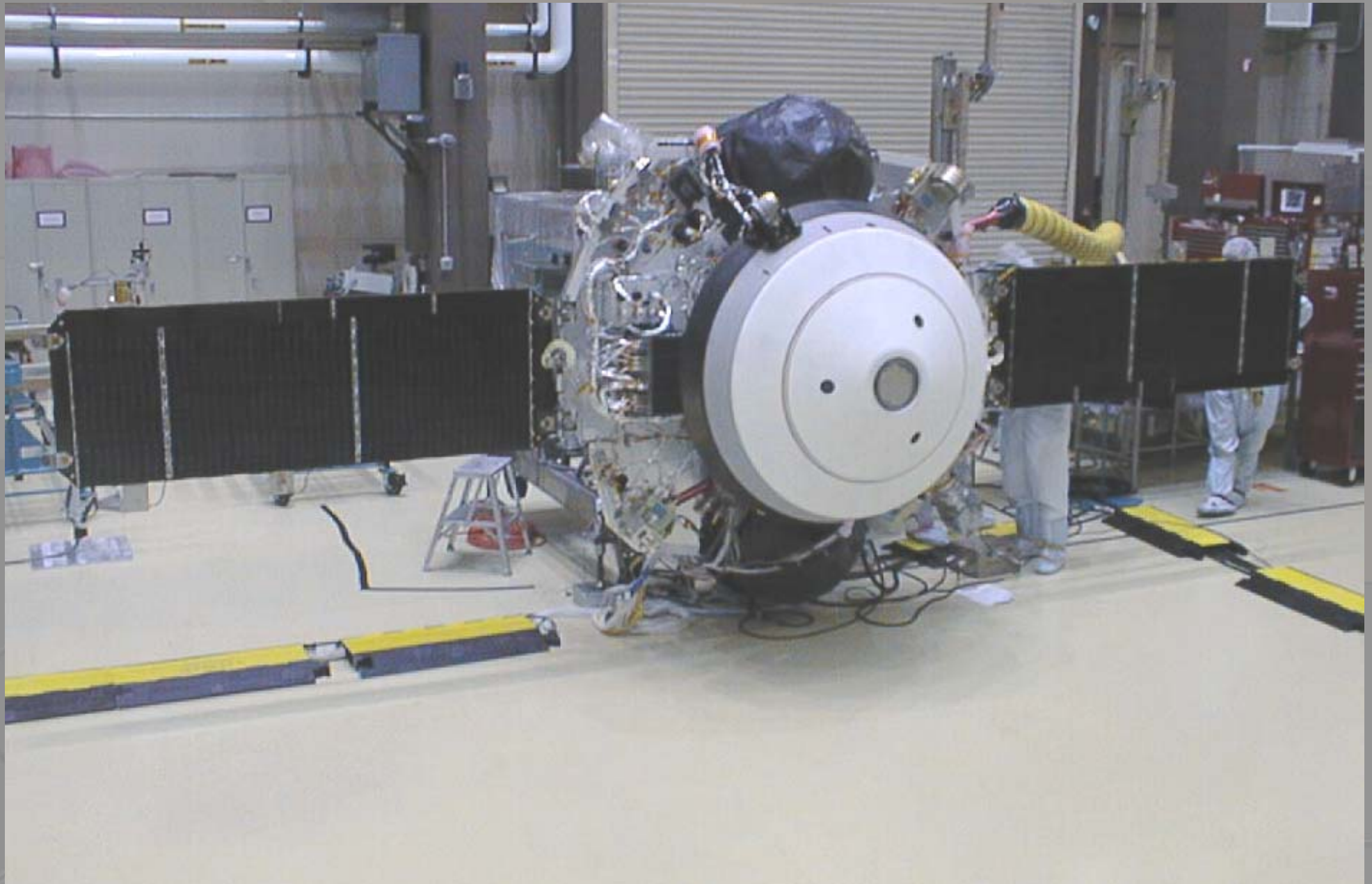
Spacecraft in Launch Vehicle Faring



Spacecraft on Launch Pad at KSC



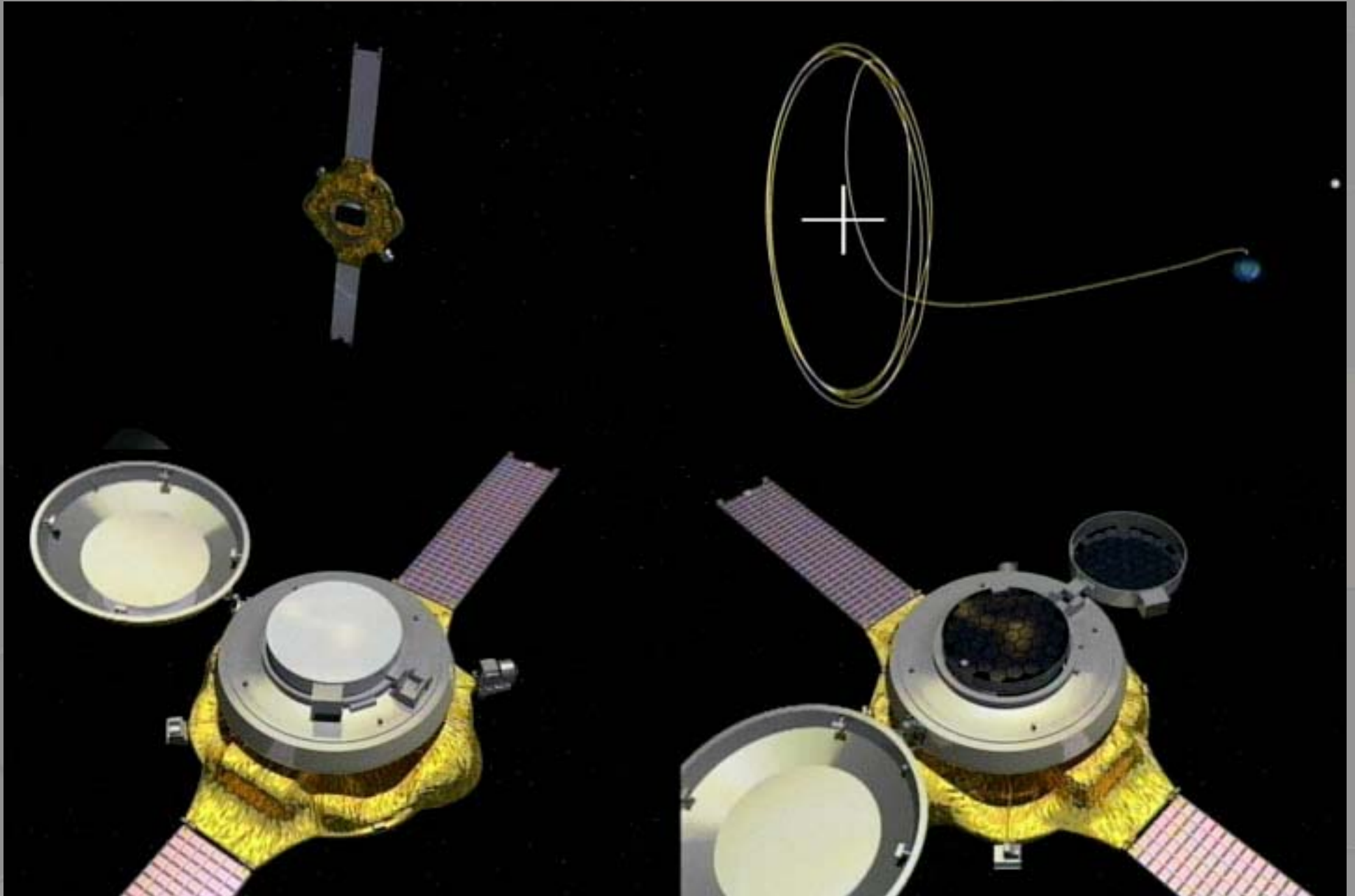
Spacecraft in Clean Room



The *GENESIS* Payload

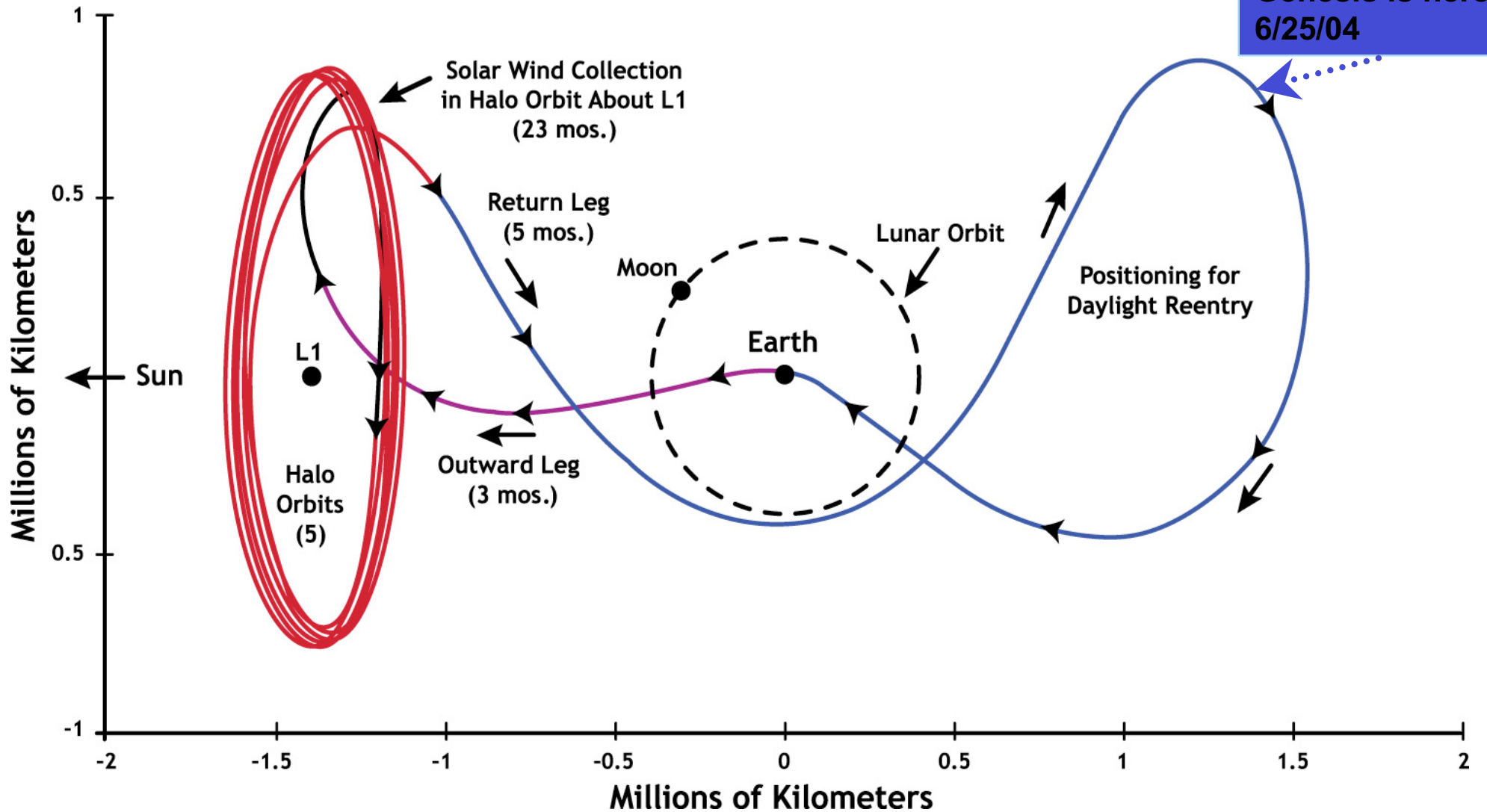


Genesis



Mission Trajectory

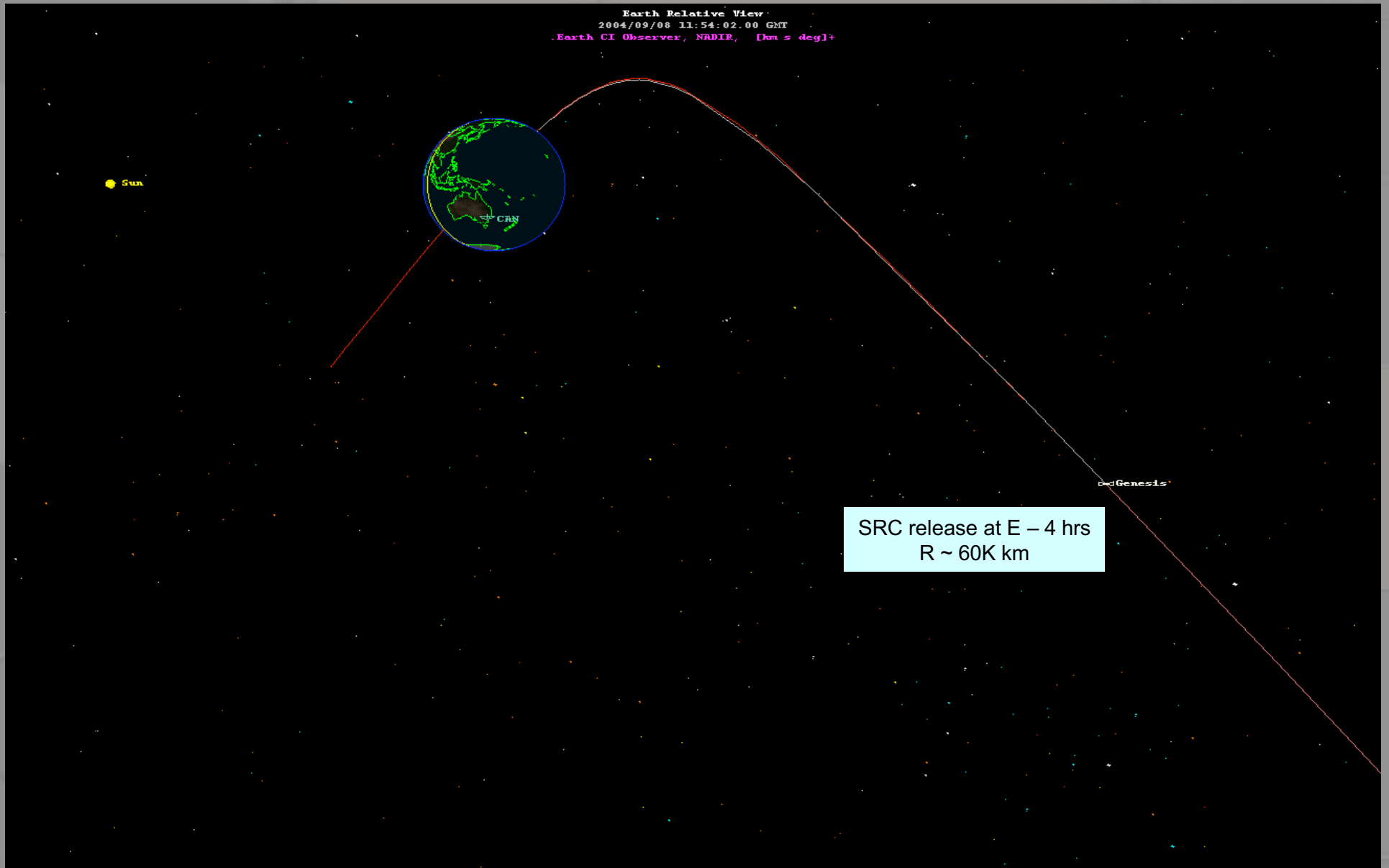
GENESIS MISSION TRAJECTORY: 2001 — 2004



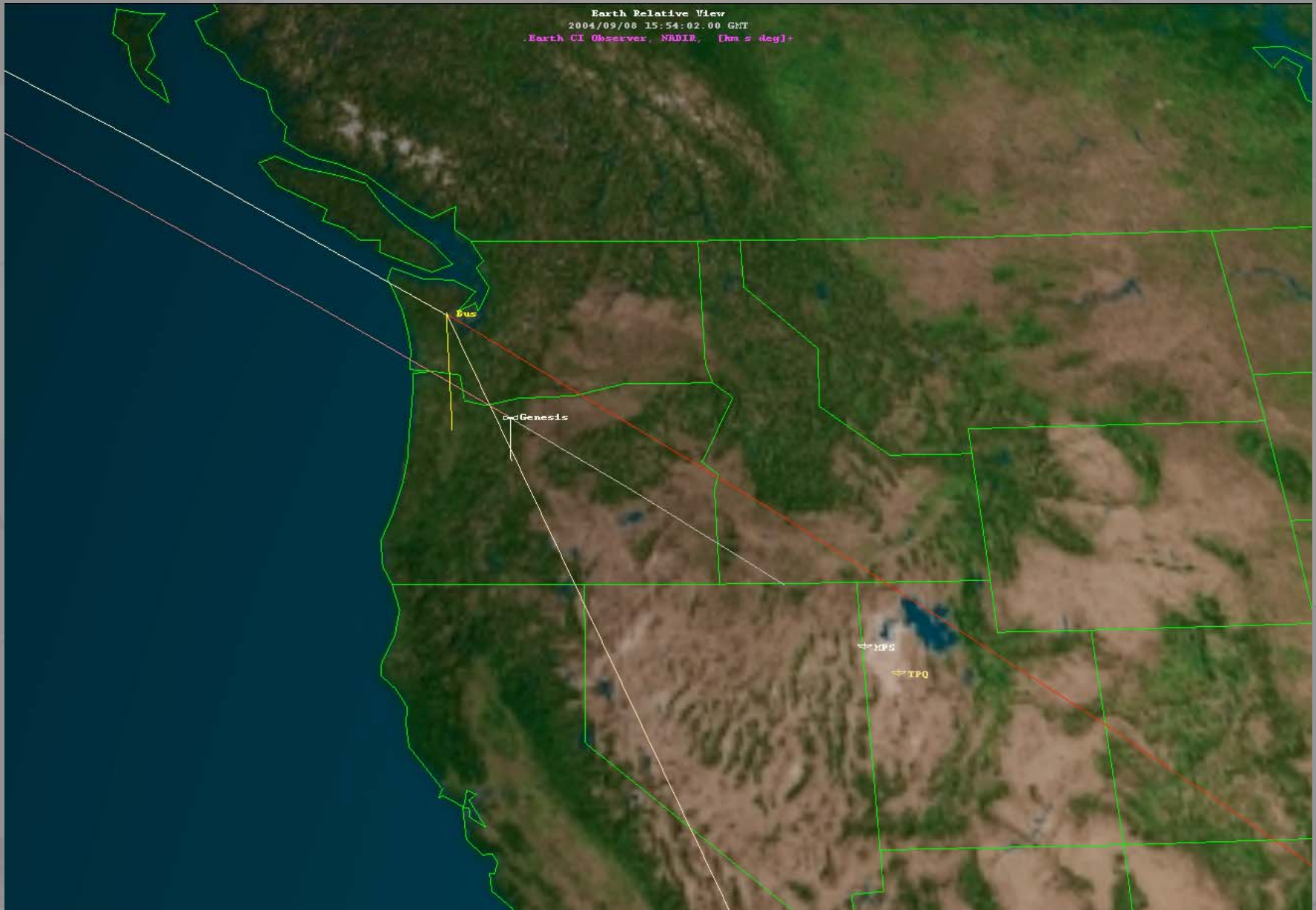
Mission Events

- **Launch** **8/8/2001**
- **Start of Sample Collection** **10/21/2001**
- **Halo Orbit Insertion** **11/16/2001**
- **Completion of Sample Collection** **4/2/2004**
 - **Sample material collected**
~10²⁰ ions
~0.5 milligrams
- **Earth “Flyby” on way to L2** **5/2/2004**
- **Sample Capsule Return to Earth** **9/8/2004**

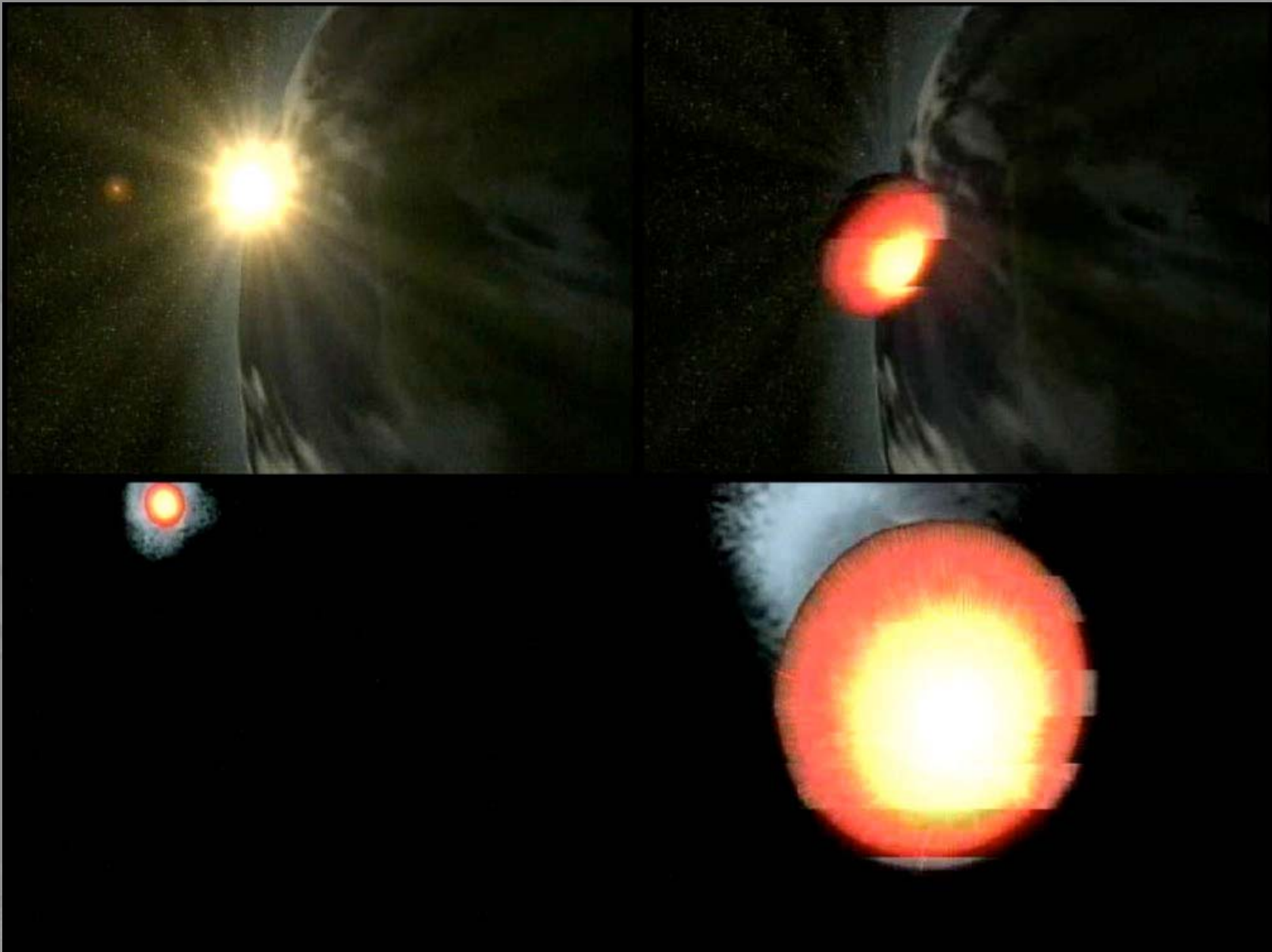
SRC Separation



Entry



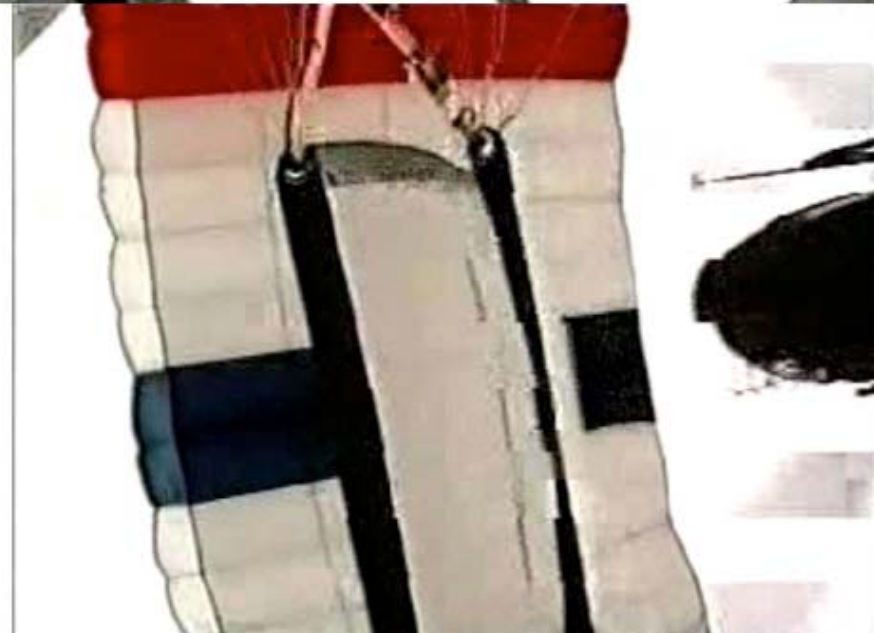
Genesis – Atmospheric Entry



Genesis Safe Arrival Zone Utah Test & Training Range



Genesis – Drogue & Parafoil & view from SRC



Genesis Mid-Air Capture - View from Helo



Genesis Search for Origins

40° 09.223' North 113° 21.920' West



2003/09/10