Jet Propulsion Laboratory
California Institute of Technology

Genesis Sample Return Capsule Overview

August 25, 2004

Bill Willcockson

Entry Systems
Lockheed Martin Space Systems

LOCKHEED MARTIN

Genesis SRC, Entry System

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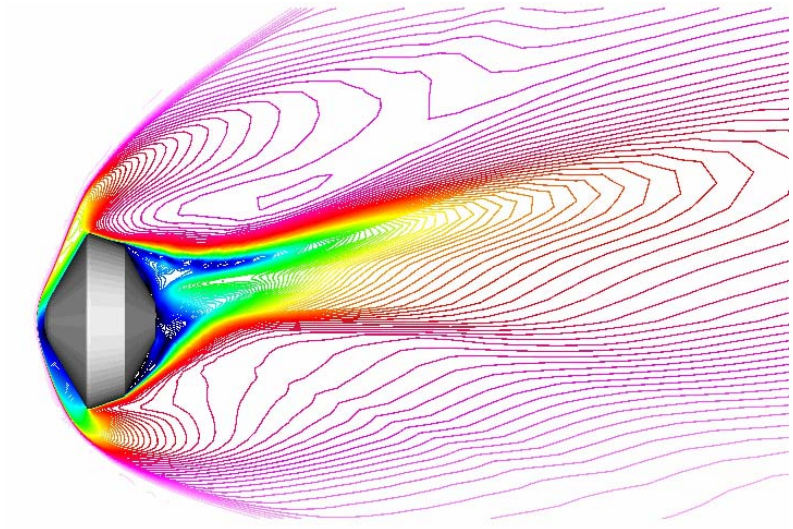
- **Simple Entry Capsule Concept**
  - Spin-Stabilized / No Active Control Systems
  - Ballistic Entry for 11.04 km/sec Velocity
  - No Heatshield Separation During Entry
  - Parachute Deploy via g-Switch + Timer
    - Baroswitch Backup
- **Stardust Design Inheritance**
  - Forebody Shape
  - Seal Concepts
  - Parachute Deploy Control
  - Utah Landing Site (UTTR)



- **TPS Systems**
  - Heatshield - Carbon-Carbon – First Planetary Entry
  - Backshell - SLA-561V - Flight Heritage from Pathfinder, MER
  - **Forebody Structural Penetrations**
- **Aerothermal & TPS Design Process**
  - **Same Methodology as Used for Pathfinder, MER Flight Vehicles**

Genesis Entry System

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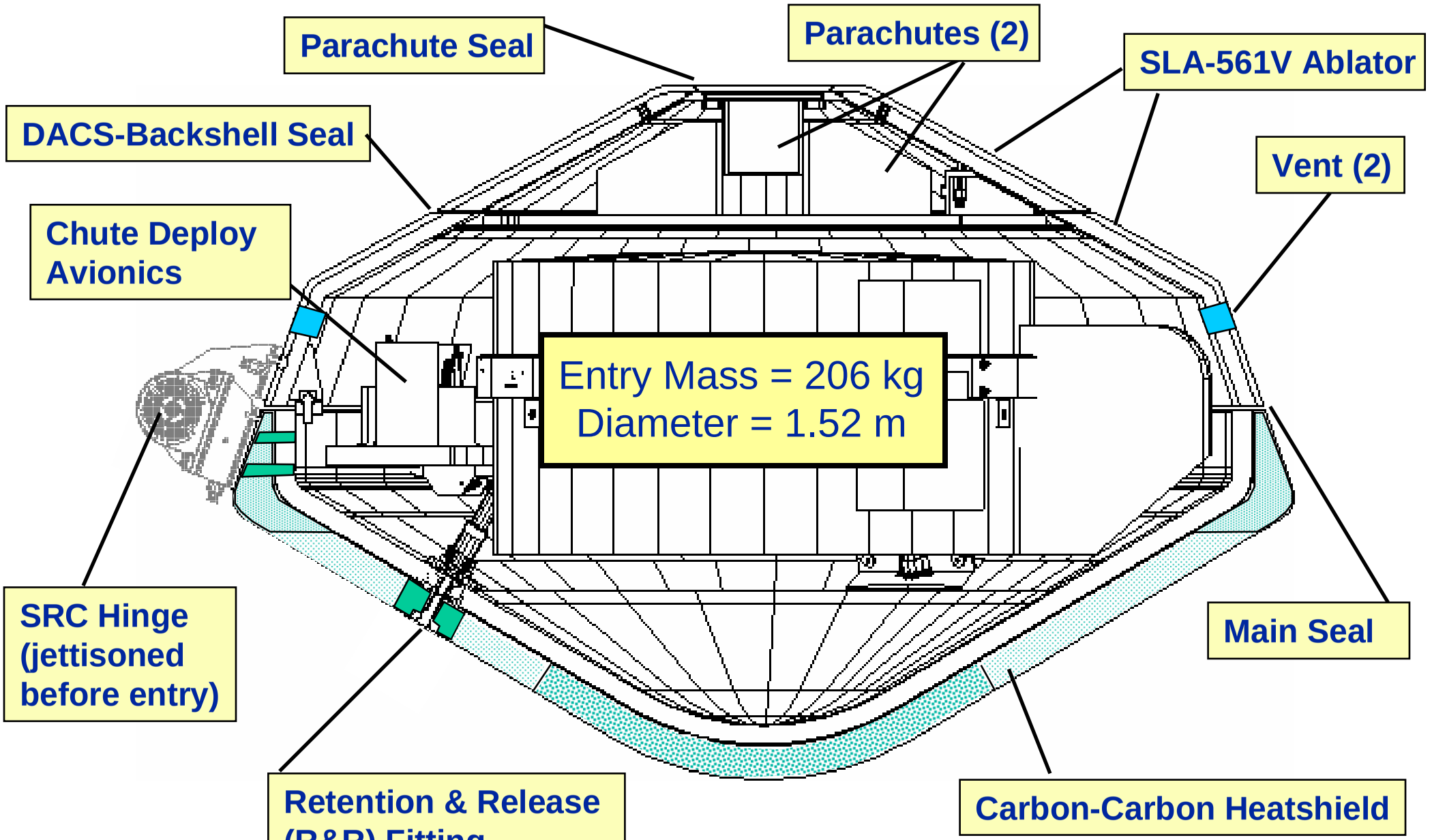

Nominal EDL Timeline

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Event	*Entry Time* (mm:ss)	*Altitude* (MSL, km)	*Comments*
Entry Interface (EI)	00:00	135	125 km ref altitude (wrt Equator) 11.04 kps, -8.00° Flight Path
Sensible Atmosphere	00:23	102	0.03 g's
3-g Point (Increasing)	00:45	75	
Peak Heating	00:59	60	470 W/cm2
Peak Loads	01:10	52	27.3 g's
3-g Trigger Point	02:01	35	Chute Timer Begin
Drogue Chute Deploy	02:06	33	Mach 1.8
Mach 1.0	02:20	30	
Main Chute Deploy	06:20	7.4	24,400 ft MSL
Air Snatch	22:07	2.4	8,000 ft MSL
Touchdown (Backup)	26:22	1.3	4.5 mps, 4200 ft MSL

Entry Trajectories

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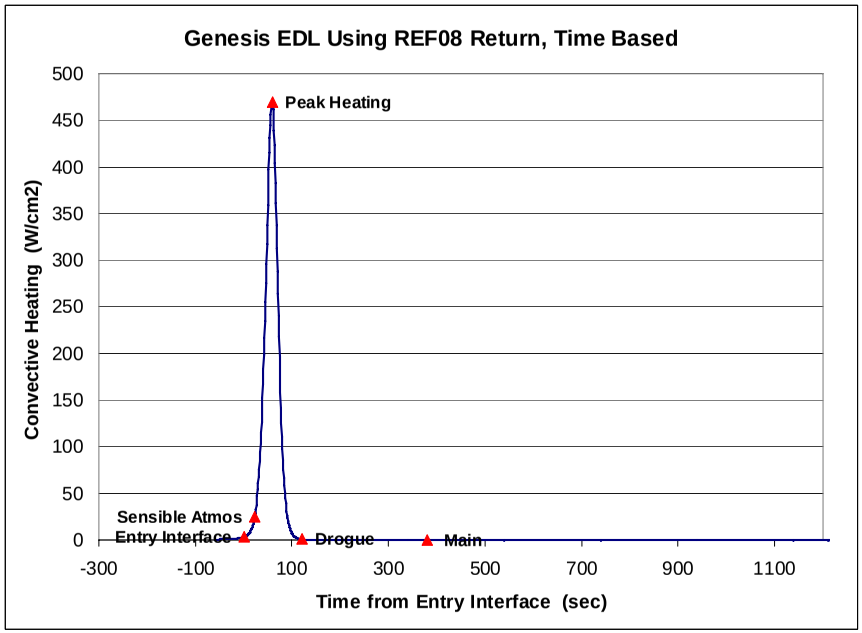

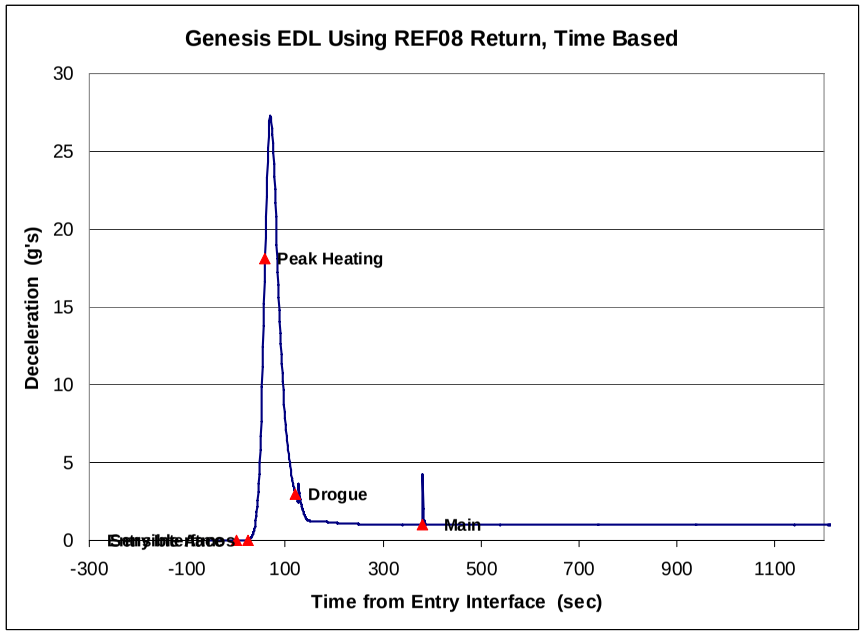

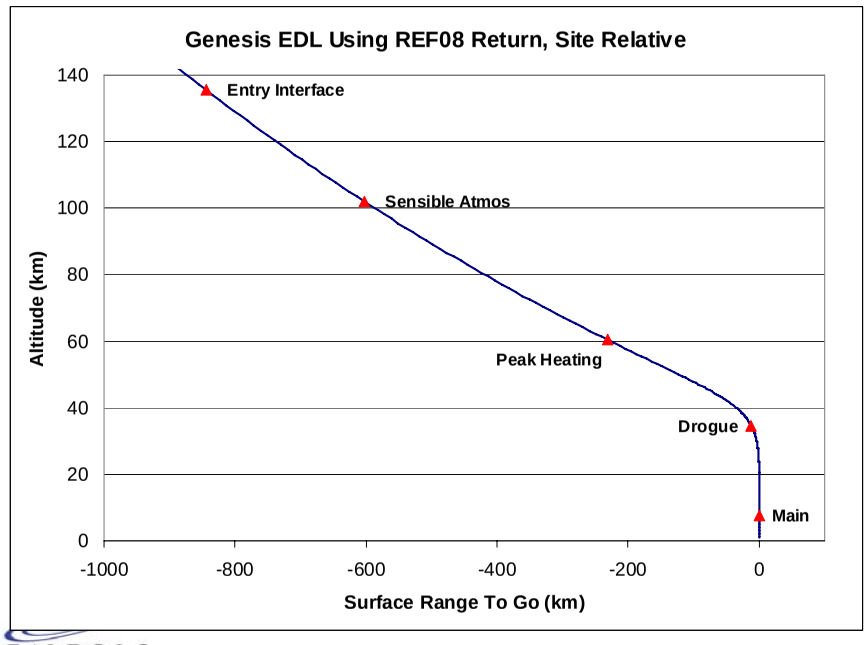

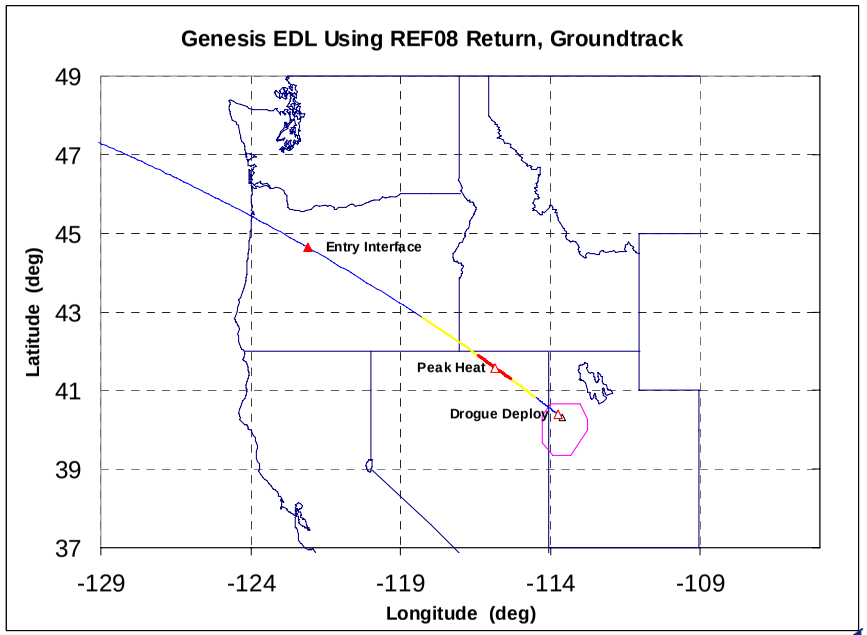

UTTR Nominal Footprint

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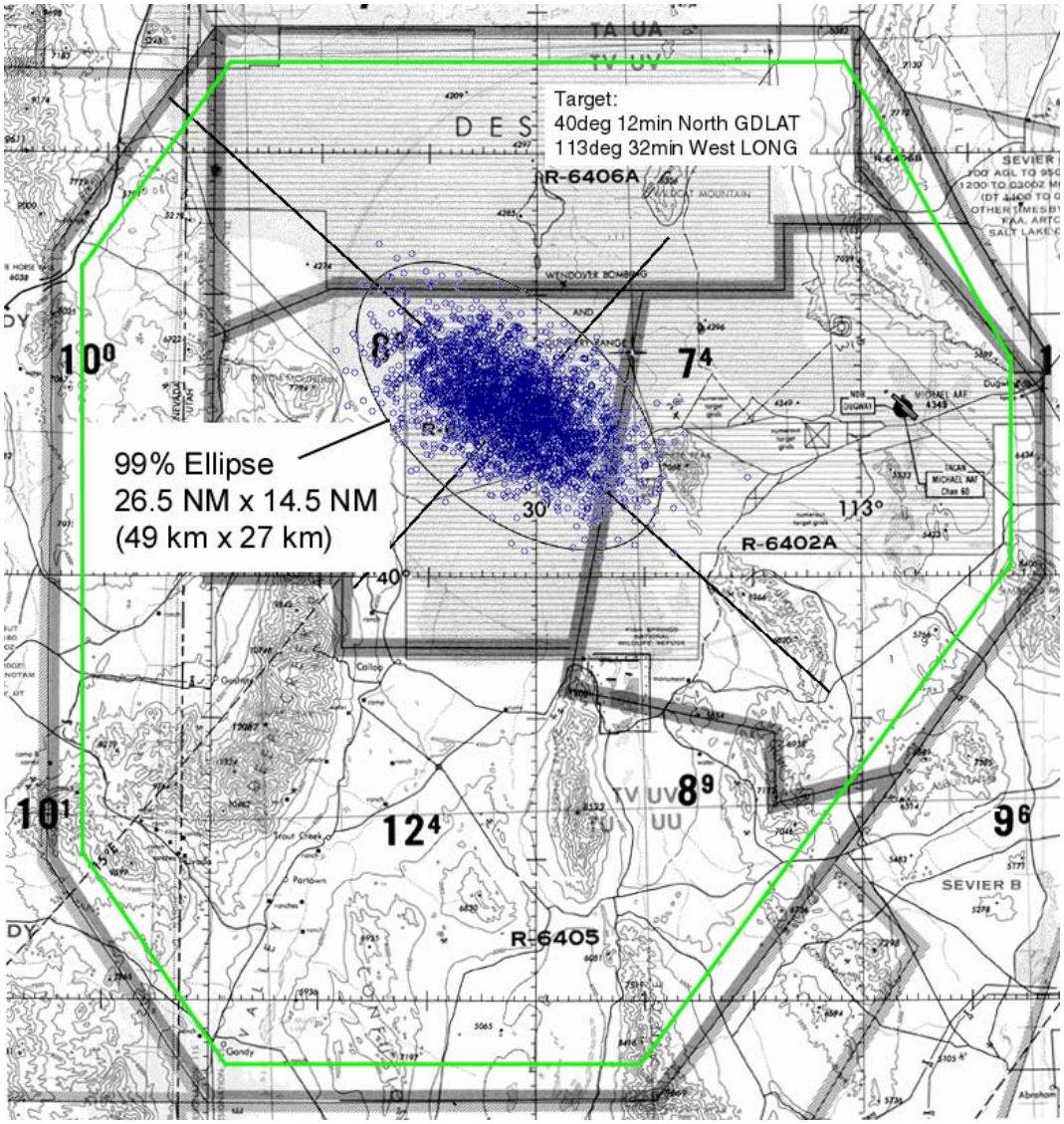
Footprint for 0.047 deg Flight Path Angle Error, Current Nav Capability Estimate

Landed Points via Langley Hi-Fidelity 6-DOF Monte Carlo



Genesis TPS Systems

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- **Genesis TPS Combines New & Old Systems**

- **Backshell – 24 W/cm2 Nom Convect Heating**
  - SLA-561V “Mars” Ablator
  - Aluminum-Honeycomb (Al-Hc) Substructure
  - System Confirmation via Single Arcjet Series
  - Previous Entries: Viking-76, Pathfinder, MER

SLA-561V System

- **Heatshield – 500 W/cm2 Nom Convect Heating**
  - Carbon-Carbon Skin
    - Continuous Surface (multi-layer fabric layup)
  - Forebody Attach Penetrations (3)
  - Carbon Foam insulation + Al-Hc Substructure
  - System Confirmation via 5 Arcjet Test Series
  - First Application to Entry Probe

Carbon-Carbon System