NASA
Mars 2001 Mars Odyssey Mission

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EUROPEAN GEOPHYSICAL SOCIETY
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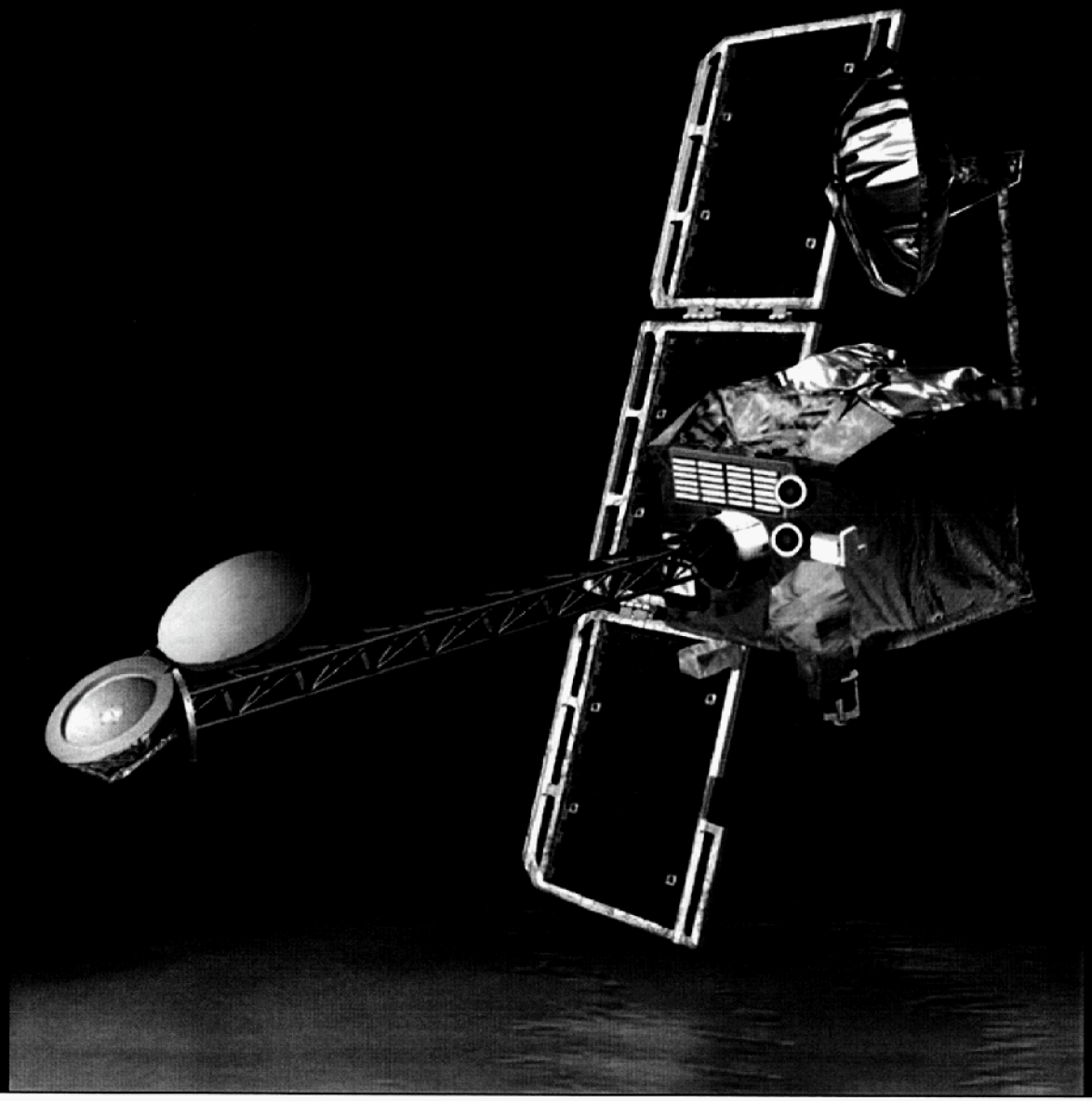
2001 Mars Odyssey



Mars

4TH PLANET FROM SUN - LAST TERRESTRIAL PLANET

Radius - 3390 km - (0.53 of Earth)

Density -3.93 grams per cubic cm - (71% of Earth)

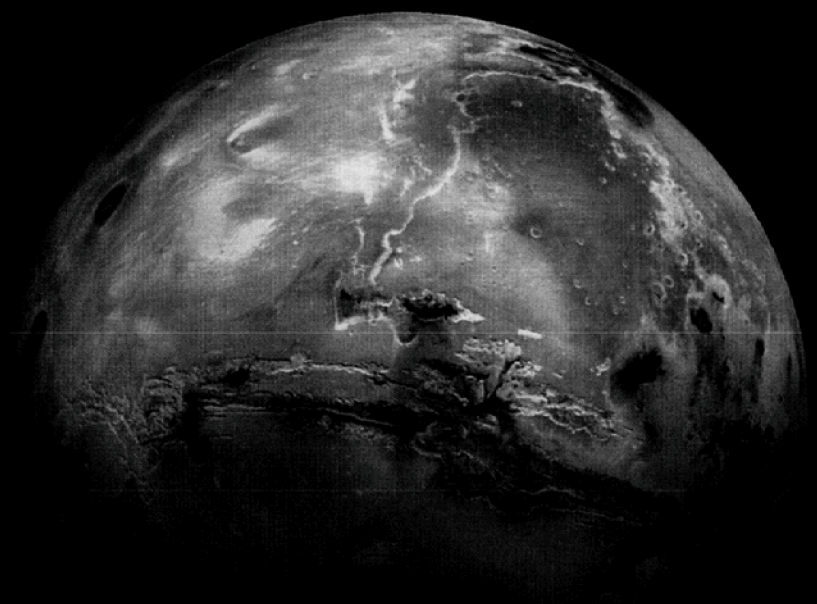
Gravity - 0.38 of Earth

Mass - 0.1 of Earth

Surface Temperature -225°F to 63°F

Two small satellites - Phobos and Deimos

Polar caps of water and carbon-dioxide ice



ORBIT AND ROTATION

Elliptical Orbit 1.38 to 1.67 AU (Earth 1 AU)

Mars Year - 687 days (Earth 365.25 days)

Rotates - 24 hr 37.5 min (Earth 24 hr)

Axis Inclined 25° (Earth 23.5°)

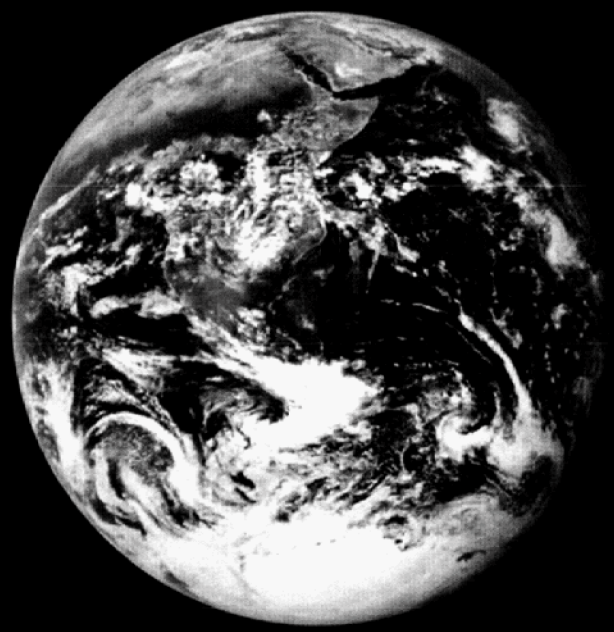
CLIMATIC CHANGES

Thin Atmosphere (1% of Earth) composed primarily of carbon dioxide

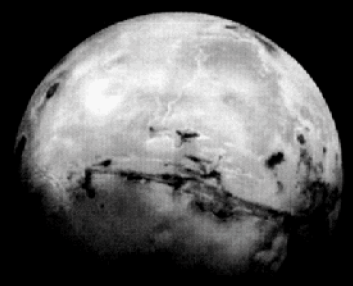
Strong Winds - Driven by Seasonal Heating and Cooling of Hemispheres

Great Dust Storms - Occur Near Perihelion (Southern Summer)

Comparison of Earth and Mars



12,756 km
Diameter



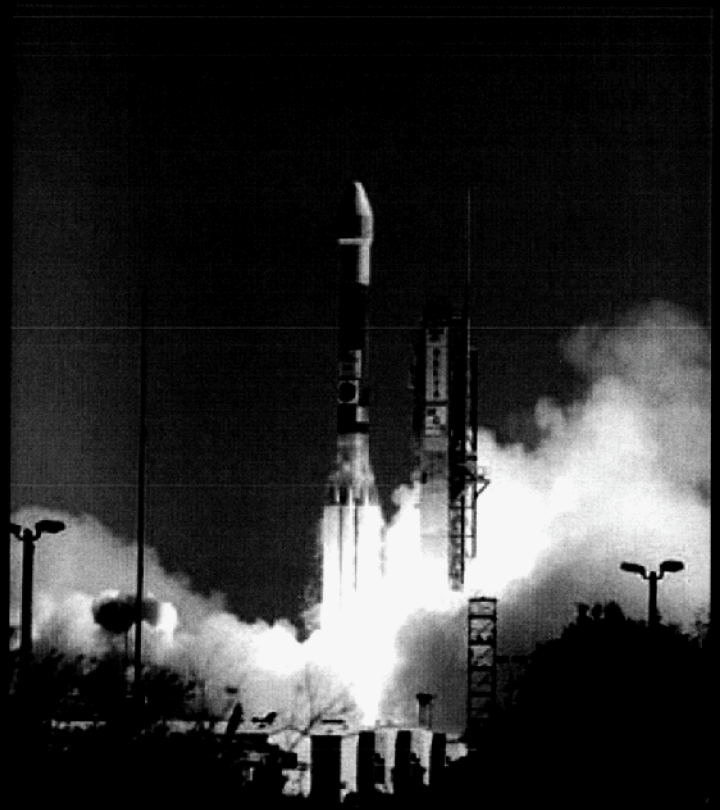
6,794 km
Diameter

Why Mars?

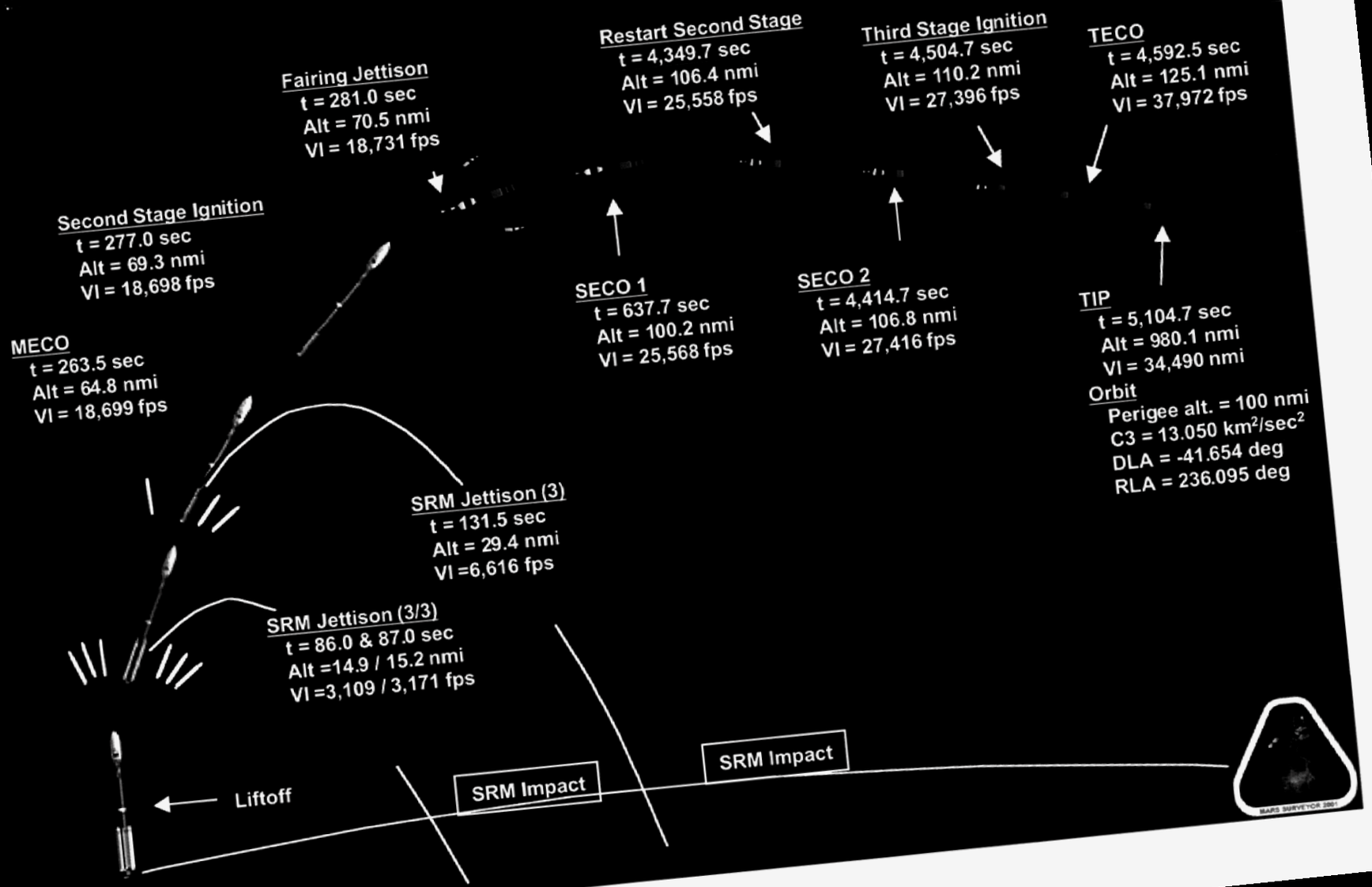
- MOST EARTH-LIKE OF TERRESTRIAL PLANETS
  - First planet (other than Earth) humans will visit
- ONLY PLANET THAT COULD SUPPORT LIFE IN FUTURE
  - Everything necessary to support life is present
  - Only terrestrial planet (besides Earth) with abundant water
- ONLY PLANET WHERE EVIDENCE INDICATES EARLY CONDITIONS WERE CONDUCIVE TO FORMATION OF LIFE
  - Early Mars may have been like early Earth:
  - Warmer, wetter, thicker atmosphere
  - Did life develop on early Mars? If not why not? If life did develop - What was its fate? Are we alone in the Universe?
- MARS IS A UNIQUE TERRESTRIAL PLANET
  - Evidence Indicates it has undergone major climatic fluctuations
    - What triggered these changes?
      - What do they tell us about Earth climate change?
  - Geologic activity produced rocks of all ages present on surface
    - Record entire history of Solar System including climate change

Launch Information

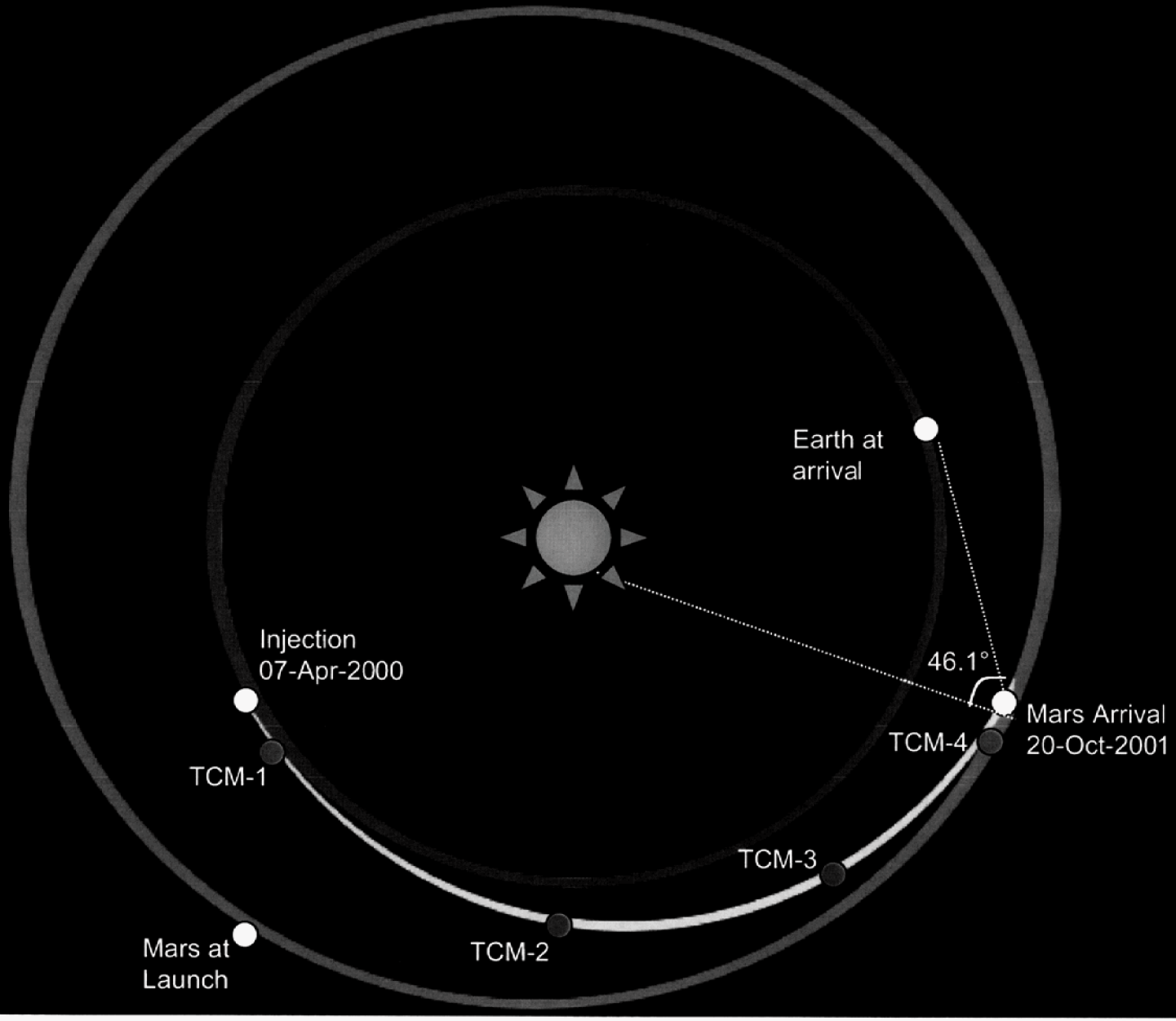
- Launch Date
  - April 07, 2001
- Arrival Date
  - October 21, 2001
- Launch Vehicle
  - Boeing Delta II 7925



Launch Ascent Schematic



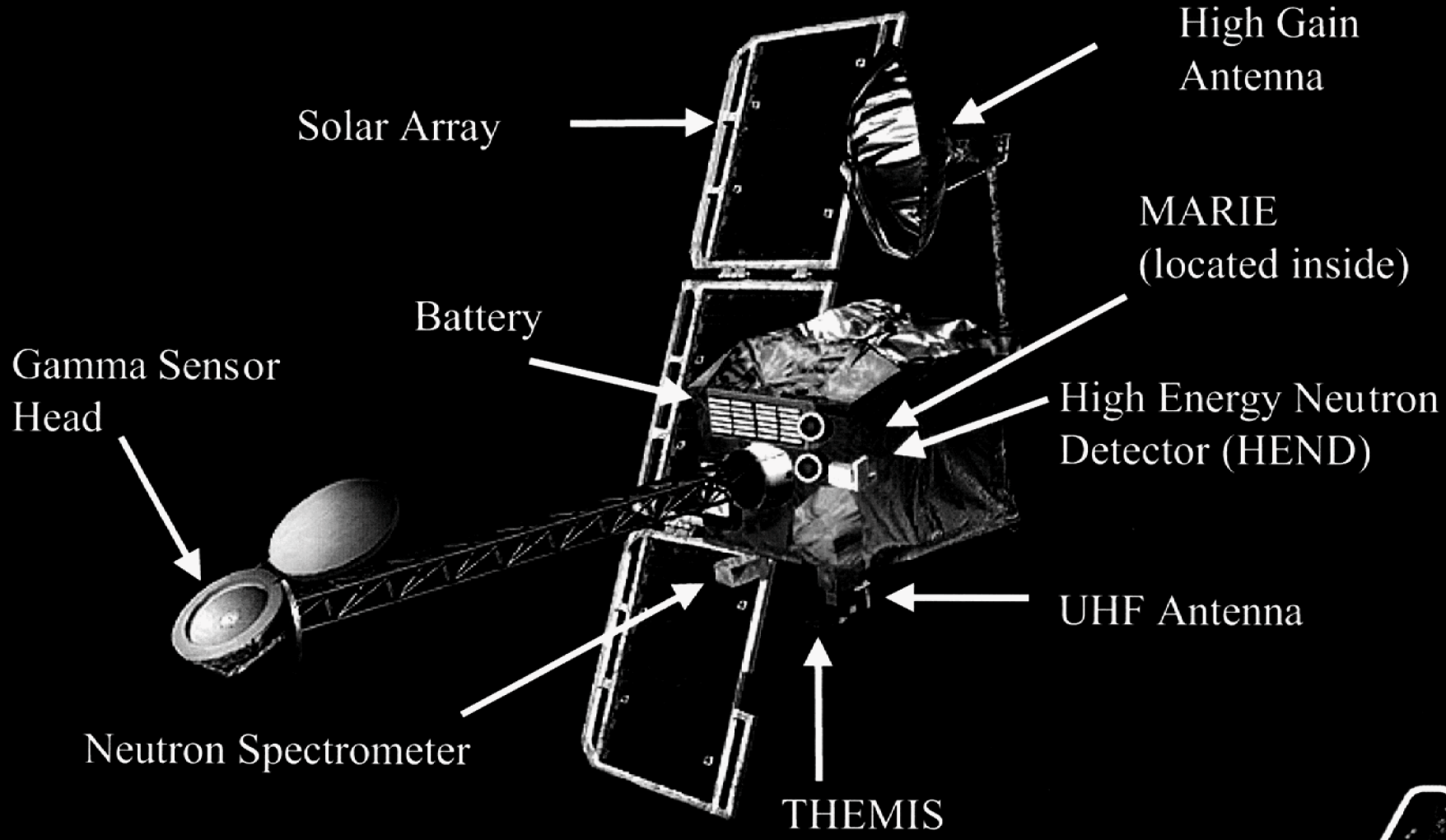
2001 Orbiter Interplanetary Trajectory

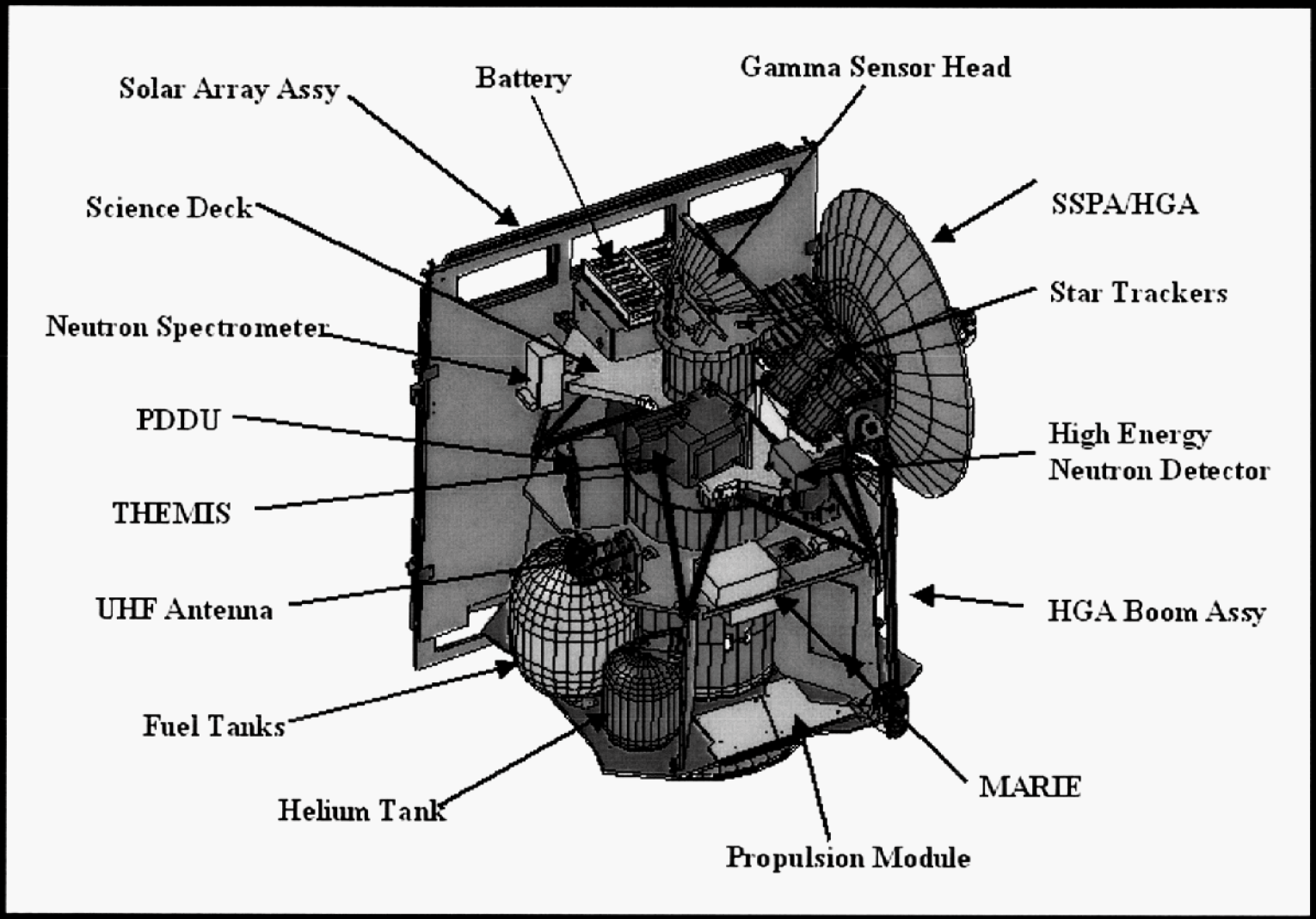


Science Objectives

- Globally map the elemental composition of the surface.
- Determine the abundance of hydrogen in the shallow subsurface.
- Acquire high spatial and spectral resolution of the surface mineralogy.
- Provide information on the morphology of the Martian surface.
- Determine the nature of local surface geologic processes from surface morphology.
- Characterize the Martian surface radiation environment as related to radiation-induced risk to human explorers.

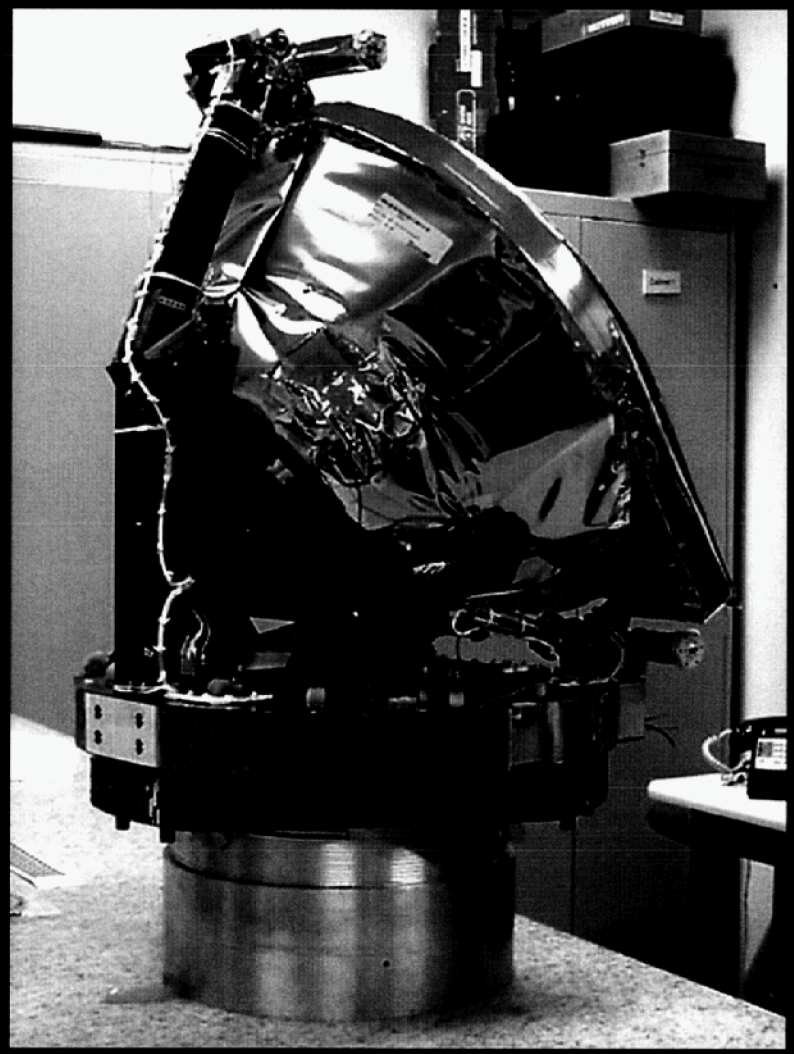
Mars 2001
Science Orbit Configuration




Solar Array Assy
Battery
Gamma Sensor Head
Science Deck
SSPA/HGA
Star Trackers
Neutron Spectrometer
PDDU
High Energy
Neutron Detector
THEMIS
UHF Antenna
HGA Boom Assy
Fuel Tanks
MARIE
Helium Tank
Propulsion Module

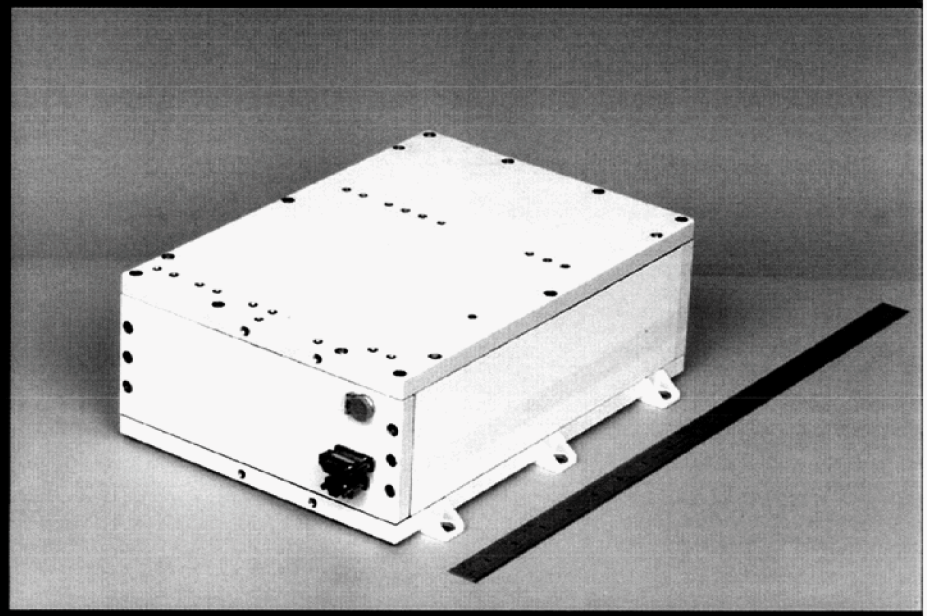
Gamma Ray Spectrometer (GRS)

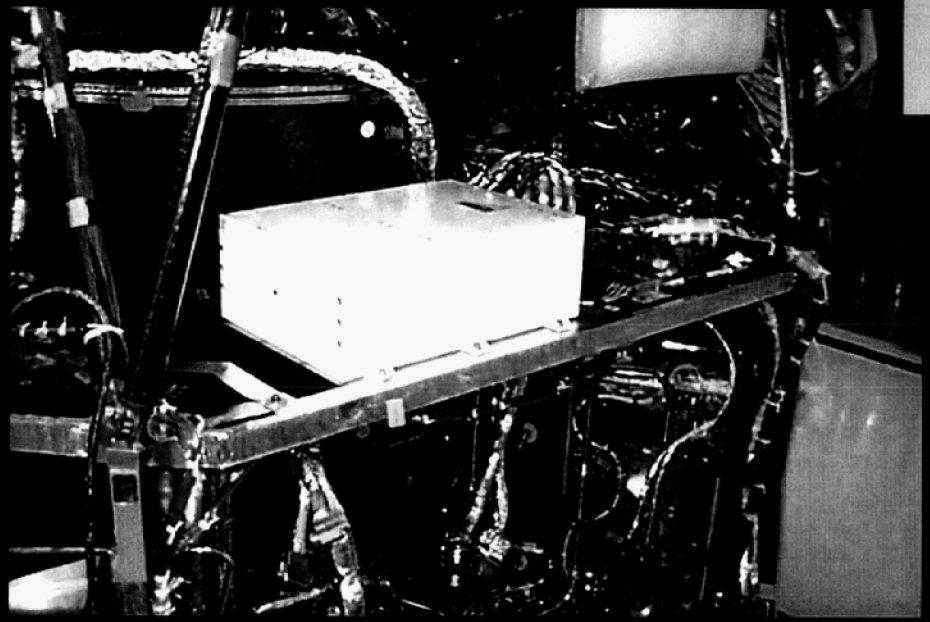
- To quantitatively determine the elemental abundances of the Martian surface - Including composition of the permanent polar caps
- To map the distribution of water and to determine its near-surface stratigraphy
- To determine the thickness of the seasonal polar caps and their variation with time To study the nature of cosmic gamma-ray bursts



Martian Radiation Environment Experiment (MARIE)

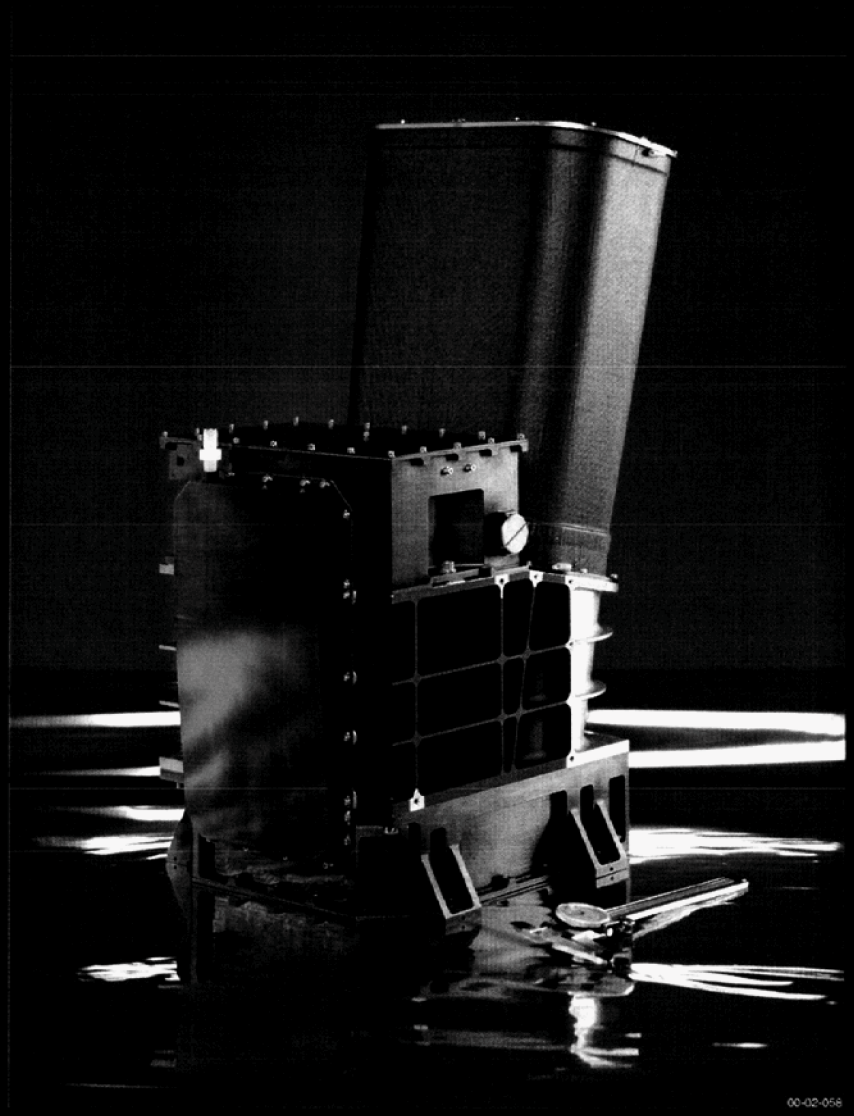
- Characterize specific aspects of near-space radiation environment
- Characterize the surface radiation environment as related to radiation-induced risk to human exploration





•Determine and model effects of the atmosphere in an attempt to predict anticipated doses and assess its radiobiological effectiveness.

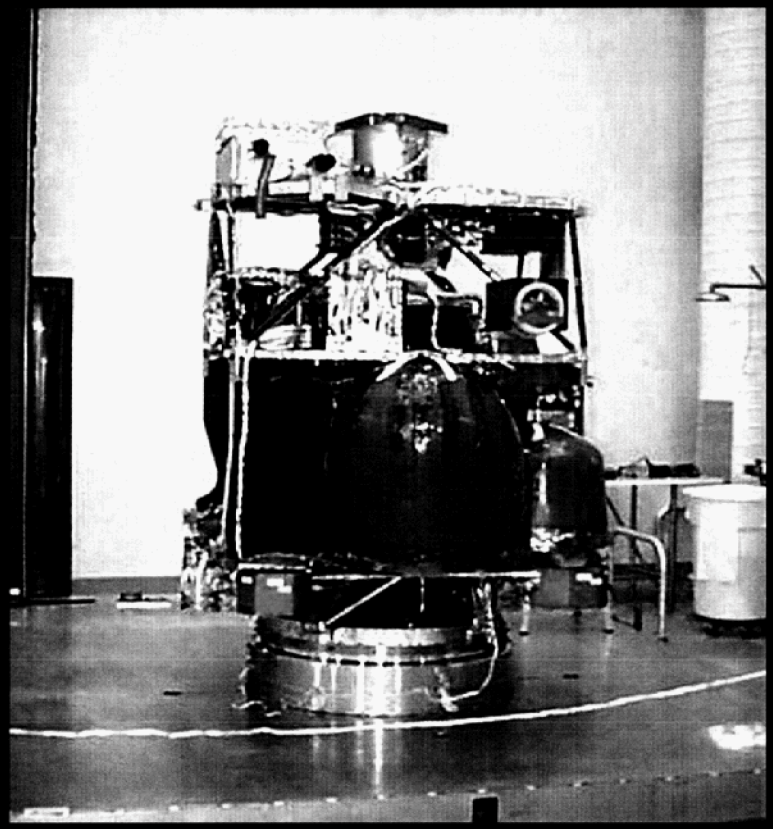
Thermal Emission Imaging System (THEMIS)



- Infrared Imaging
  - Multispectral, thermal infrared images that have 10 spectral bands between 6.5 and 14.5 micrometers.
  - The entire planet will be mapped in the infrared at 100 meters per pixel resolution.
- Visible Imaging
  - Visible-light images with 20 meters per pixel resolution.
  - Images can be monochrome (black-and-white) or color.
  - Up to 15,000 visible images will obtained; each will cover an area 20 km by 20 km on the surface of Mars.

Spacecraft Images

Orbiter
Main
Engine



Solar
Array
Testing

Getting Images Back From Mars

- Spacecraft transmit signals in various frequencies back to Earth. These signals are received by the antennas of the Deep Space Network (DSN).
- The DSN currently consists of three deep-space communications facilities placed approximately 120 degrees apart around the world: at Goldstone, in California's Mojave Desert; near Madrid, Spain; and near Canberra, Australia.
- Information is then relayed to JPL, where the signal is converted back into the original image.