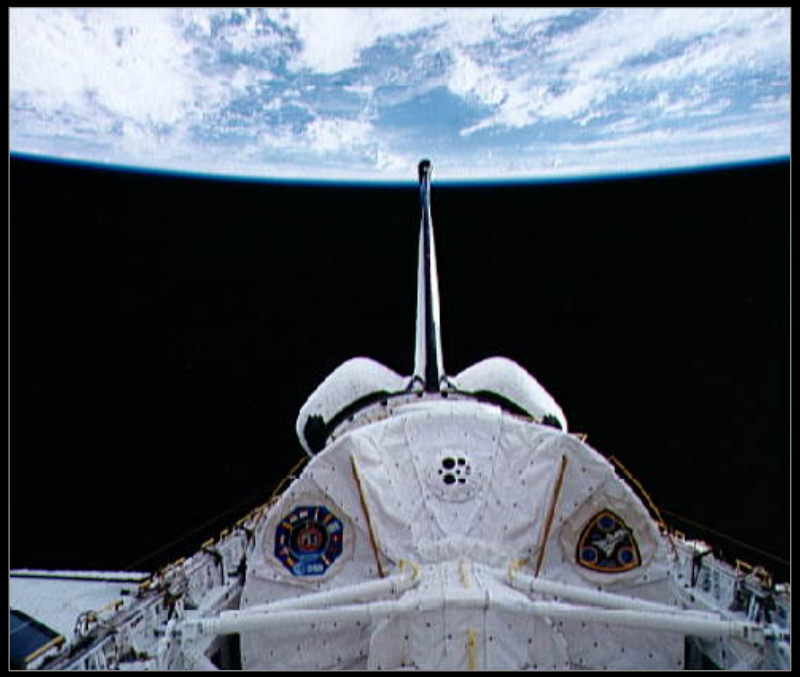
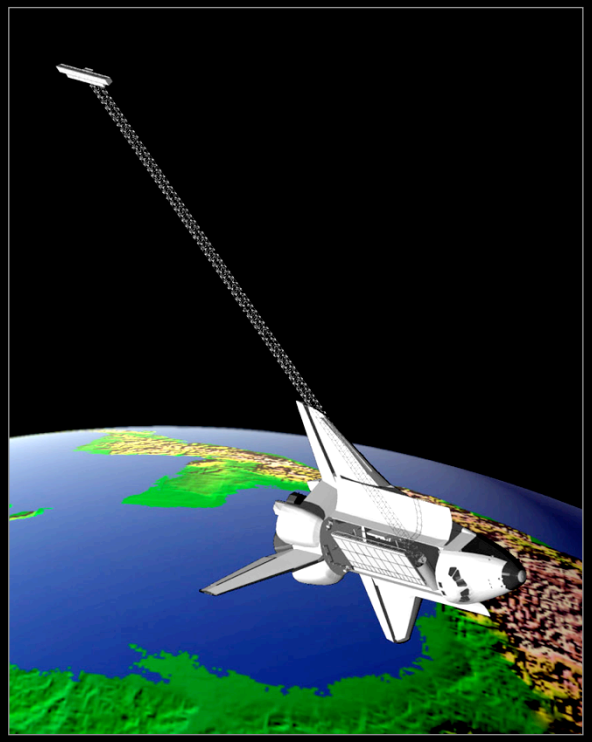
National Aeronautics and Space Administration
Jet Propulsion Laboratory
California Institute of Technology

Spacelab, Science, and Human Space Flight – *Retrospective Observations*





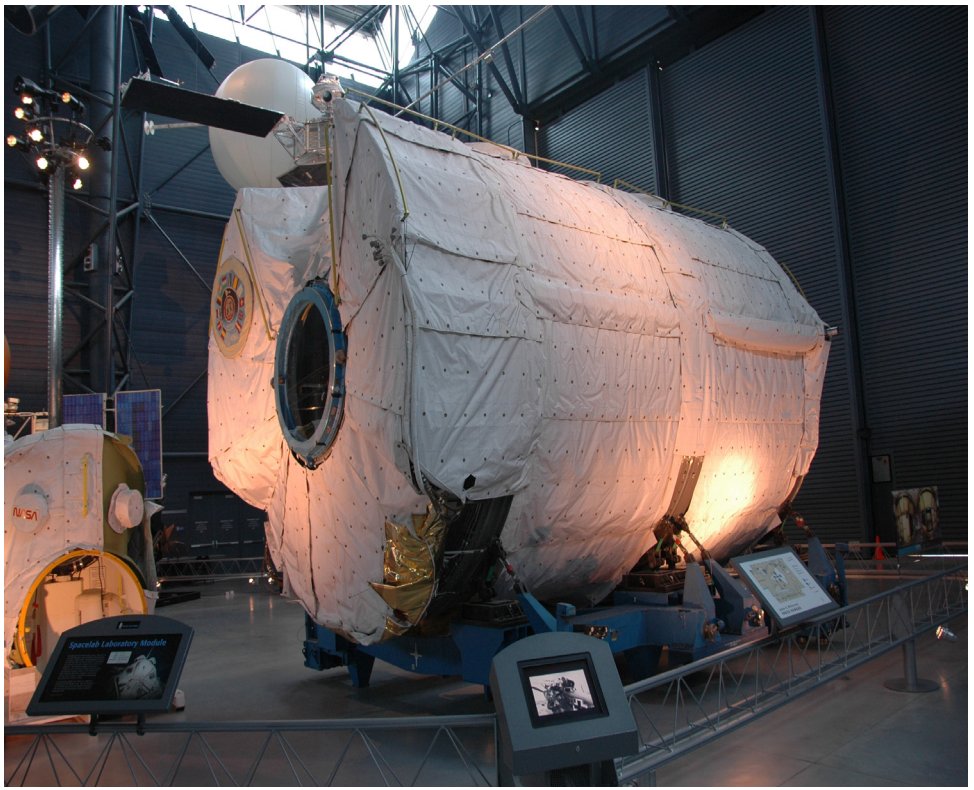
M. Sander
May 13, 2009

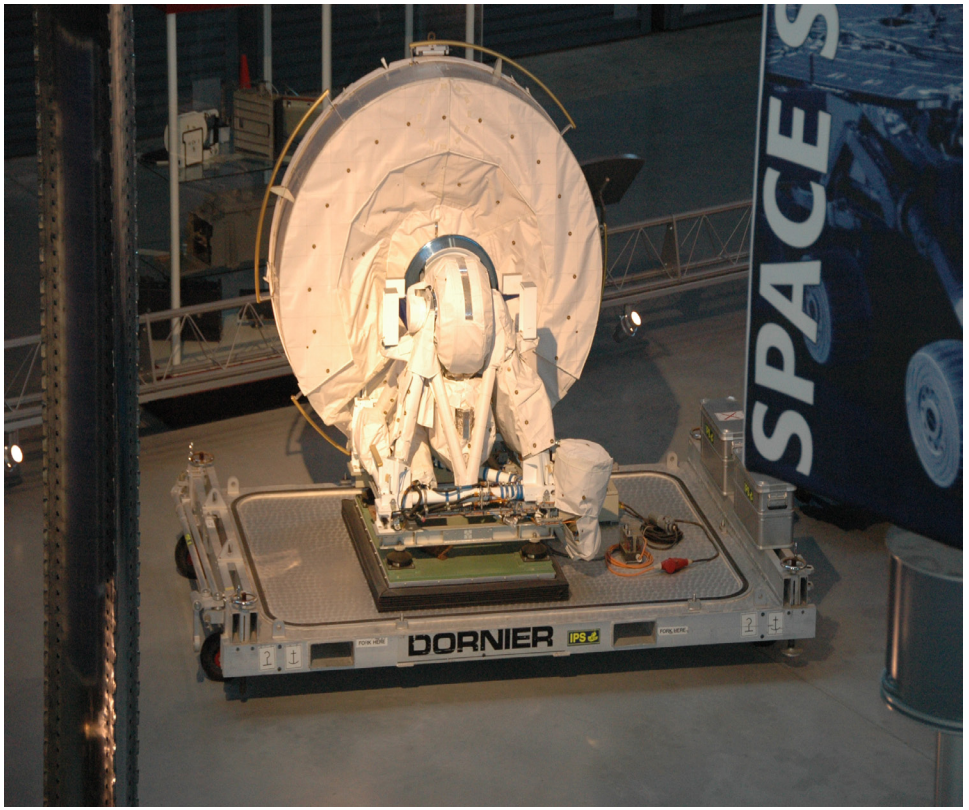
(With thanks to Tony Freeman / Scott Hensley)

Spacelab Scenario – 1970's to 1980's

- Nixon administration approved Shuttle, but…
- ESA agreed to participate – two agendas (sales and experience)
- Early expectations for :
  - flight rate vs. later realities
  - utilization practices vs. later realities
  - flight program start vs. later realities
- Learning how to use Spacelab
  - Too much, too early?
  - Finding the balance between force fitting and exploiting
- Finding the balance between protecting the infrastructure and flying experiments
  - Helping the PI be successful vs. protecting the "system" from the PI
- Funding the infrastructure vs funding the "payoff"

Spacelab in the Smithsonian





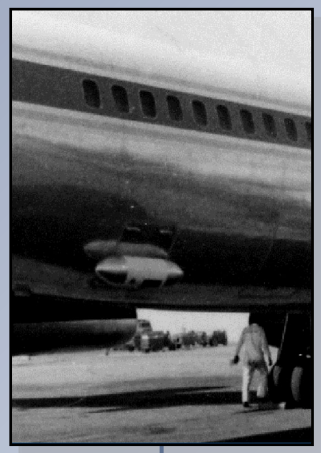
Shuttle Radar Laboratory

- Spaceborne Imaging Radar – A (SIR-A) on STS-2 Nov, 1981
- SIR-B on STS-41G Oct, 1984
- SIR-C / X-SAR on STS-59 and STS-68 April/Oct, 1994
- Shuttle Topography Radar Mission (SRTM) on STS-99 Feb, 2000

National Aeronautics and Space Administration
Jet Propulsion Laboratory
California Institute of Technology

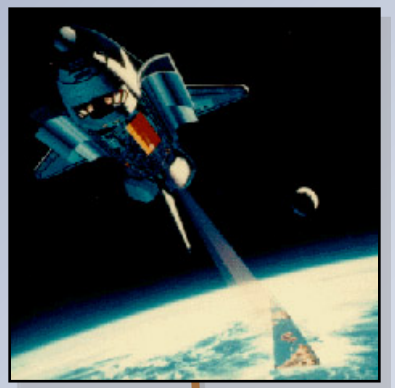
Coupled Airborne and Spaceborne Radar Programs

Rocket Radar mounted on NASA CV-990. (L-band only)

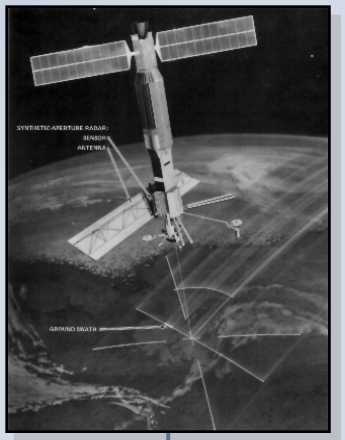


Rocket Radar

SIR-A



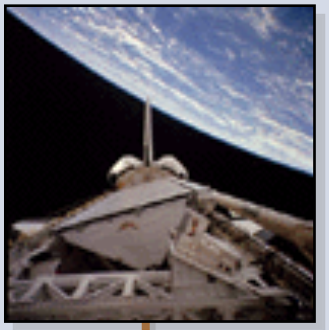
SeaSAT



SIR-B

AIRSAR re-built on DC-8

SIRC/XSAR



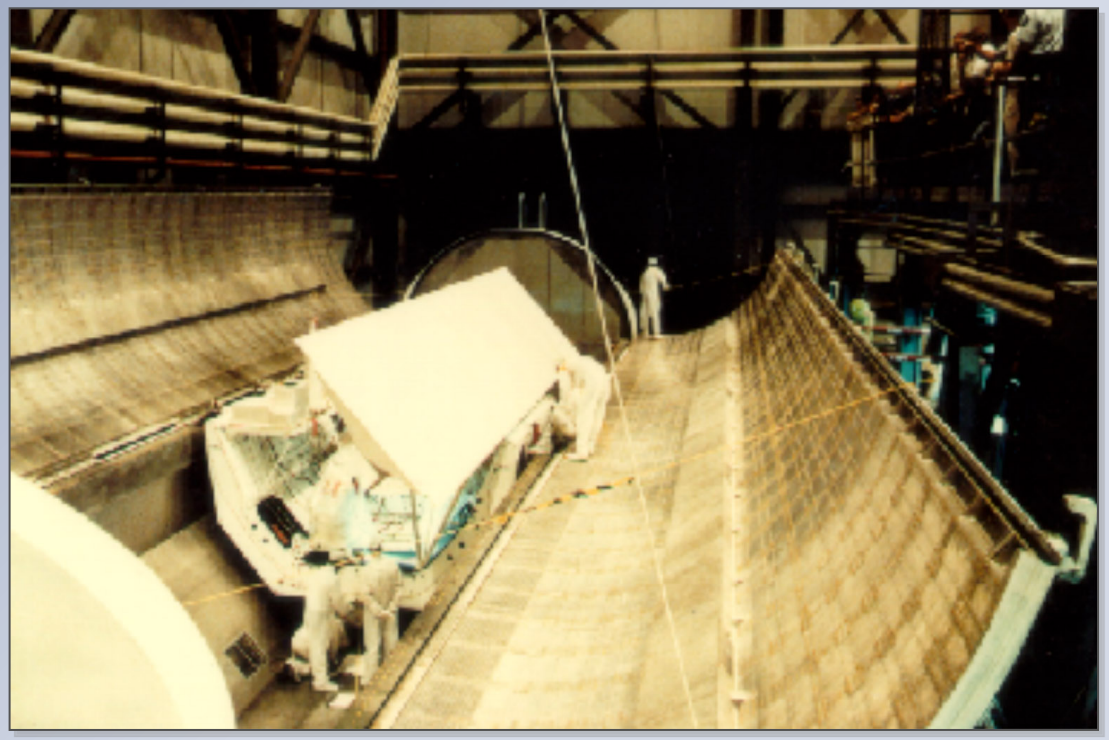
IFSARE/*3I

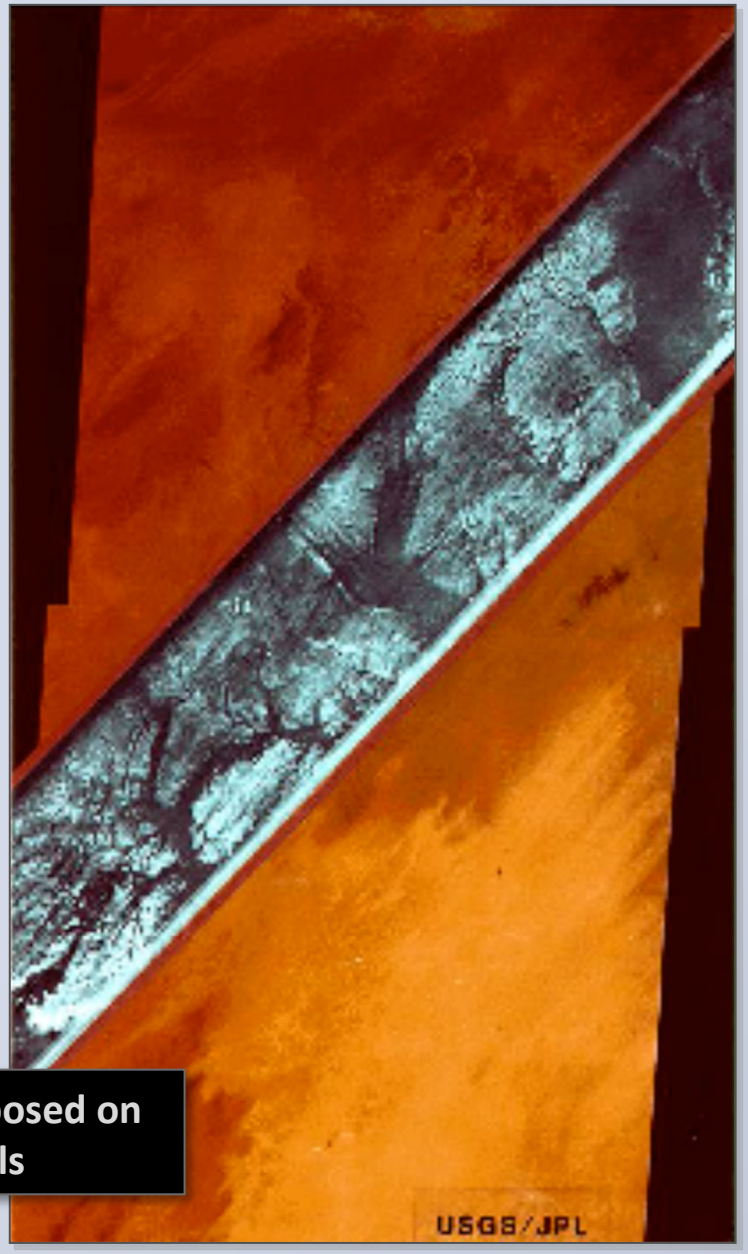
SRTM

GeoSAR

1965 1970 1975 1980 1985 1990 1995 2000 2005

Shuttle Imaging Radar-A (SIR-A), 1981





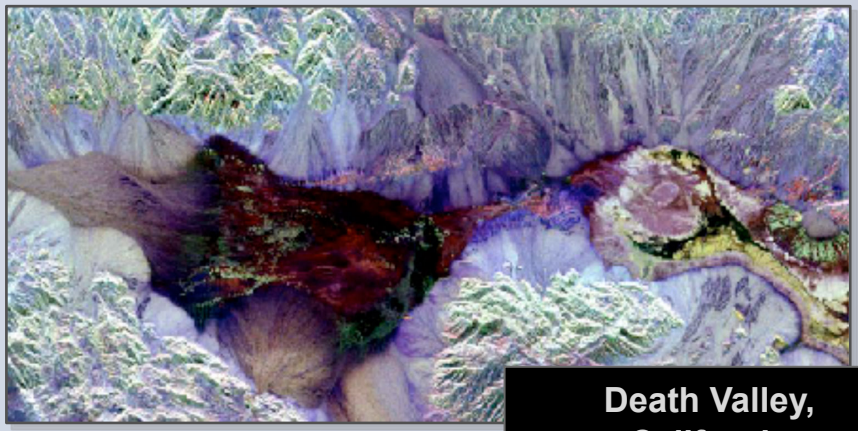
SIR-A image of Sudanese desert superimposed on visual image showing buried river channels

National Aeronautics and Space Administration
Jet Propulsion Laboratory
California Institute of Technology

Shuttle Imaging Radar-C / X-band Synthetic Aperture Radar (SIR-C/X-SAR)

Flew on two shuttle flights in 1994

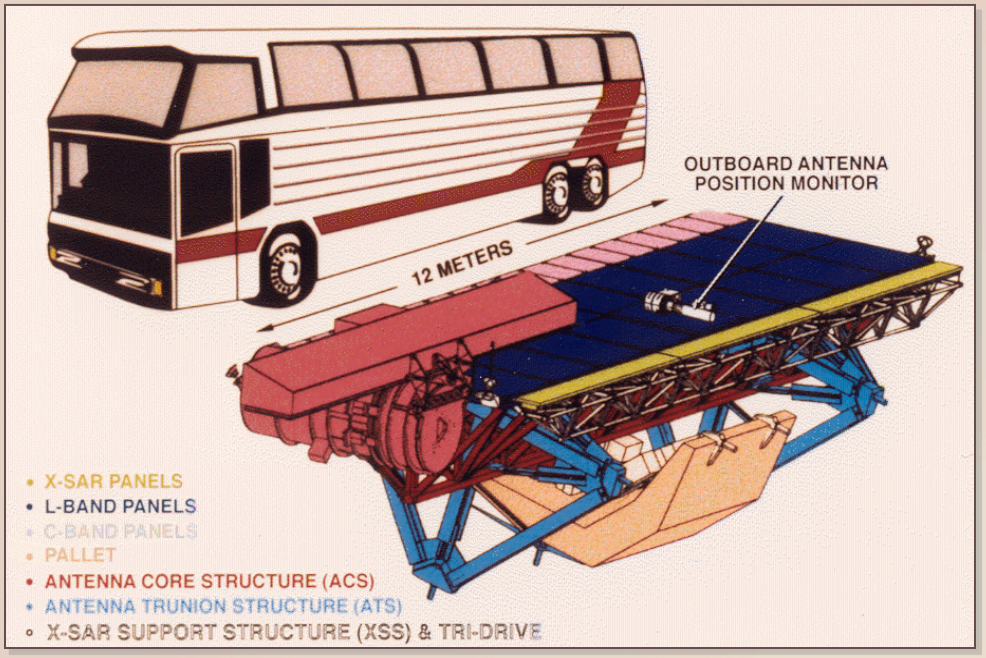
Forest cover and geology of Lozere Department, France with Gorges du Tarn. Composite of two X-band images from different seasons.



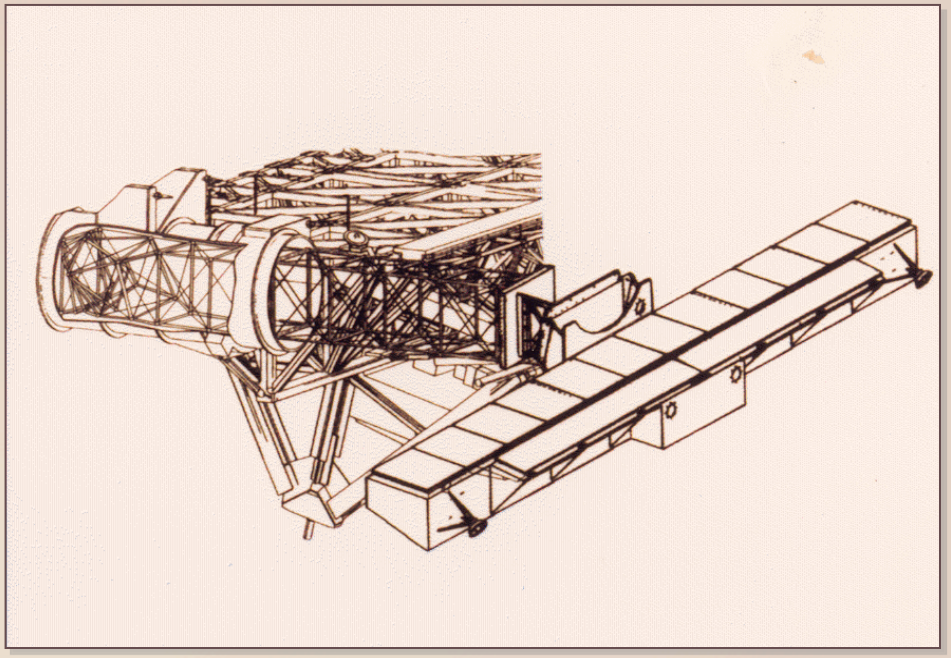
Death Valley, California

National Aeronautics and Space Administration
Jet Propulsion Laboratory
California Institute of Technology

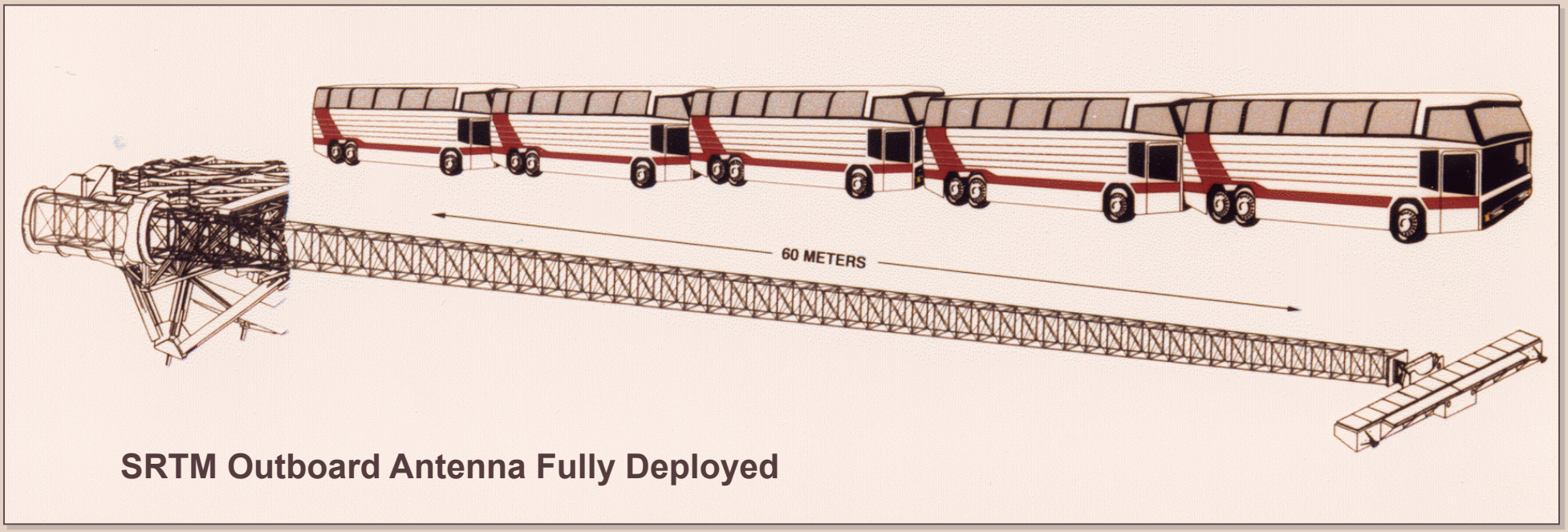
SRTM Hardware



SRTM Outboard Antenna Stowed



SRTM Outboard Antenna Partially Deployed

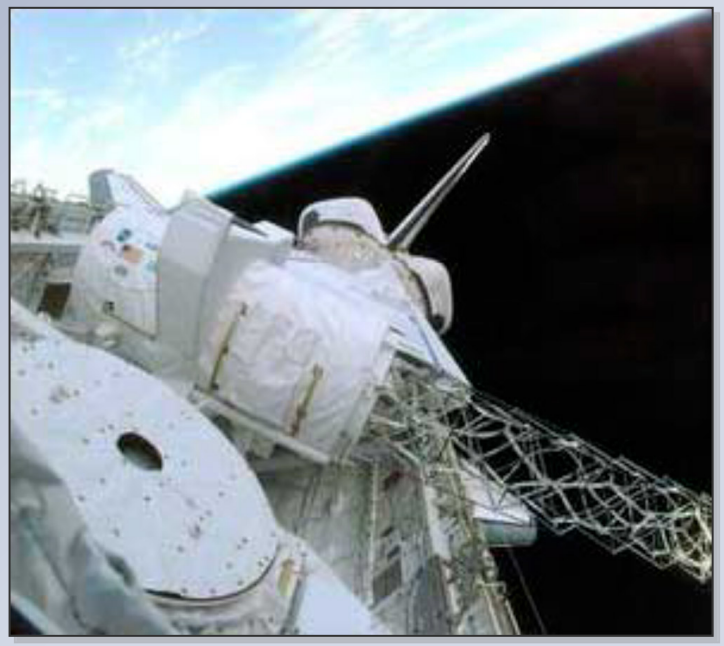


SRTM Outboard Antenna Fully Deployed

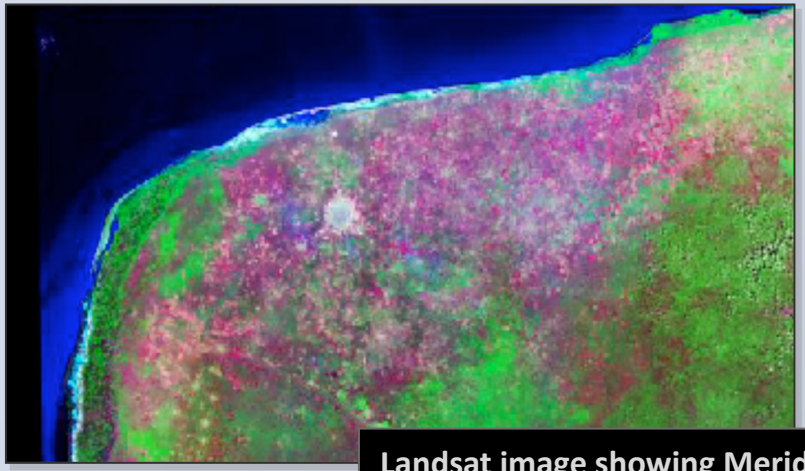
National Aeronautics and Space Administration
Jet Propulsion Laboratory
California Institute of Technology

Shuttle Radar Topography Mission (SRTM)

- Mapped 80% of Earth
- 30 m horizontal data points
- 10 m vertical accuracy



SRTM image of Yucatan showing Chicxulub Crater, site of K-T extinction impact

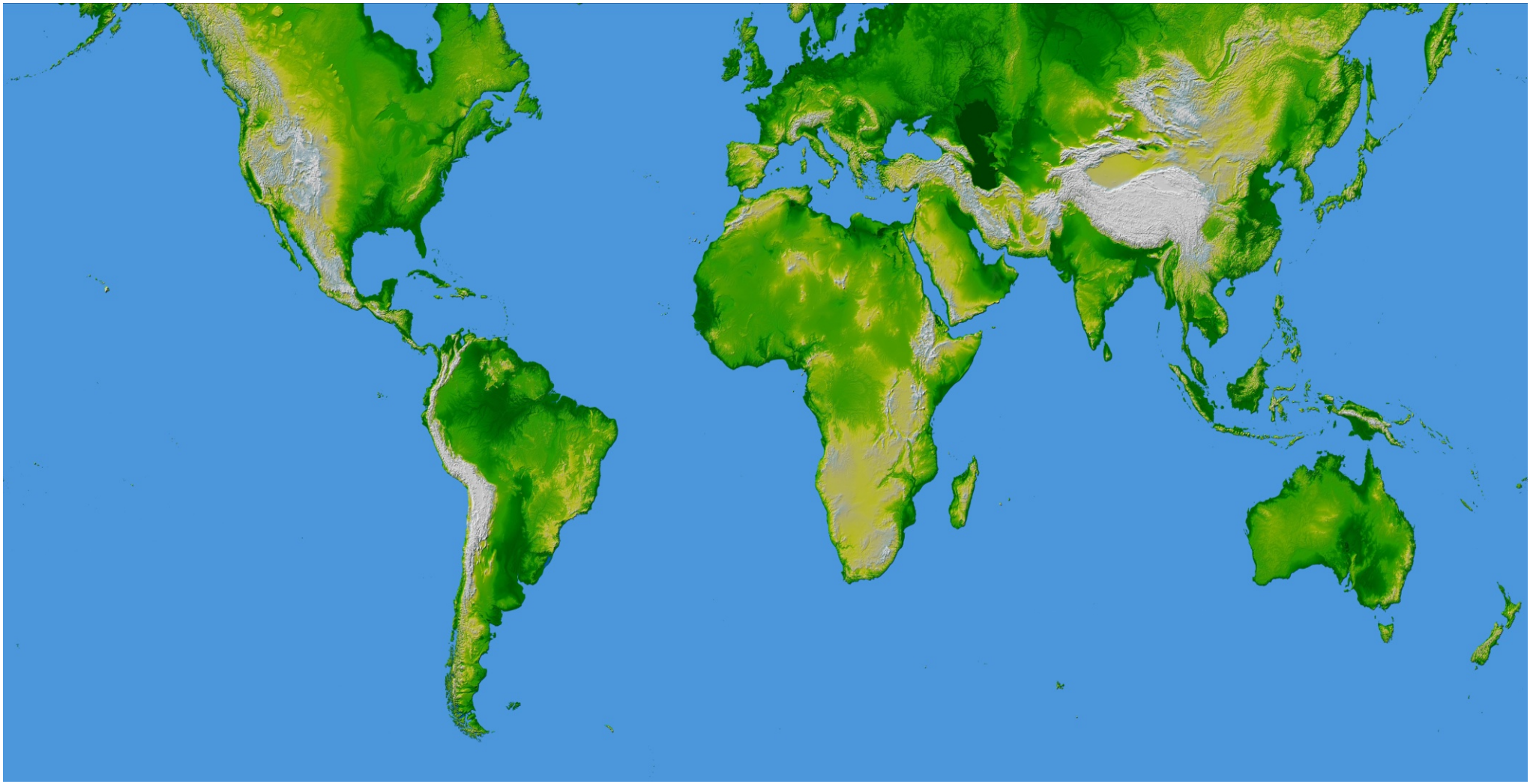


Landsat image showing Merida

3-dimensional SRTM view of Los Angeles (with Landsat data) showing San Andreas fault

SRTM Outboard Antenna in the Smithsonian

SRTM Global Production



• Map showing topographic data generated by the SRTM mission.

1.5 tera points of topographic reference elements

So What Do We Learn From This?

- Early expectations can be misleading
- Those who are successful using the elements of Human Space Flight Systems:
  - Understand the systems technically and socially
  - Develop systems that:
    - Are maximally self-reliant
    - Leverage and respect the presence of humans
    - Leverage the capabilities of the HSF transportation Infrastructure
- Exploiting the HSF capabilities requires timing, tenacity and agility
  - Let the systems mature before dipping in too deeply
  - Most elements are highly schedule and functionally interdependent
- Potential for payoff is huge