ENGINEERING

- A Noble Profession

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Who Am I?

- Education: Aeronautical Engineering and Business Management degrees from CU Boulder - 1964
- Retired from Lockheed Martin in 1999 after 36+ year career
- Career Highlights:
  - Intern with Martin Marietta for Six Summers During High School & College
  - Launch Vehicle and Spacecraft Propulsion Engineer – Analysis, Design, Test, Hardware Development
  - Vehicle Systems Engineer
  - Chief Systems Engineer on Robotic Program
  - Chief Engineer on SICBM Post Boost Vehicle
  - Principal Investigator on Many Independent Research &Development Projects
  - Program Manager
  - New Business Development
  - Competitive Proposal Creation and Management
  - Personnel Management
  - Subcontract Management and Procurement

Engineering Definition

- The creative application of scientific principles and mathematics to design or develop structures, machines, apparatus, or manufacturing processes, or works utilizing them singly or in combination; or to construct or operate the same with full cognizance of their design; or to forecast their behavior under specific operating conditions; all with respect to an intended function, economics of operation, and safety for life and property.

  American Engineers' Council for Professional Development

  Or, Simply Stated

- **THE APPLICATION OF SCIENTIFIC, ECONOMIC, SOCIAL, AND PRACTICAL KNOWLEDGE IN ORDER TO INVENT, DESIGN, BUILD, TEST, OPERATE, MAINTAIN, AND IMPROVE EVERYTHING.**

ENGINEERING Recipe

- S - Scientist
- T - Technician
- E - Eager/Energetic
- M - Mathematician

Necessary ATTRIBUTES To Be An ENGINEER

- CURIOSITY – how do things work?
  - INQUISITIVE
  - INTERESTED
- CALCULATING – must like math, numbers
- CAREFUL – don't make mistakes
- CONSERVATIVE – calculated "safe" risks
- CHALLENGED – want to improve
- CONSCIENTIOUS – really care
- COMMITMENT – make it happen
- COOPERATIVE – be a TEAM player

Educational Requirements

- Science and Mathematics Throughout Primary and Secondary Schools
- Sample Available Courses in Different Engineering Fields
  - Architecture
  - Aeronautics/Aerospace
  - Chemical
  - Civil
  - Computer Sciences/Software
  - Electrical/Electronics
  - Mechanical
  - Systems Engineering
- Attend Special Classes and Camps that are Available (e.g. Shades of Blue)
- Take Advantage of Available Internships – WE CAN HELP YOU
- Use the Internet – It is All There
  - http://en.wikipedia.org/wiki/Engineering is a good start
- Attend a College/University with Excellent Engineering Credentials

Career Avenues

- Analysis – determine the item's requirements
- Design – define the item
- Development – determine that it works
- Test – verify its performance, reliability, etc.
- Manufacturing – build the final product
- Operations – run it
- Research – find new, better ways to do it
- All of the above

Some Representative Results of First-Class Engineering

The Titans

Titan I ICBM

Titan II ICBM & Gemini LV

Titan IIIC SLV

Titan III Centaur Viking Launch

Titan IV Centaur – near the end

The Last Titan IV Ending 50 Years of Excellence

Gemini Launch Vehicle - A Man-Rated Titan II ICBM

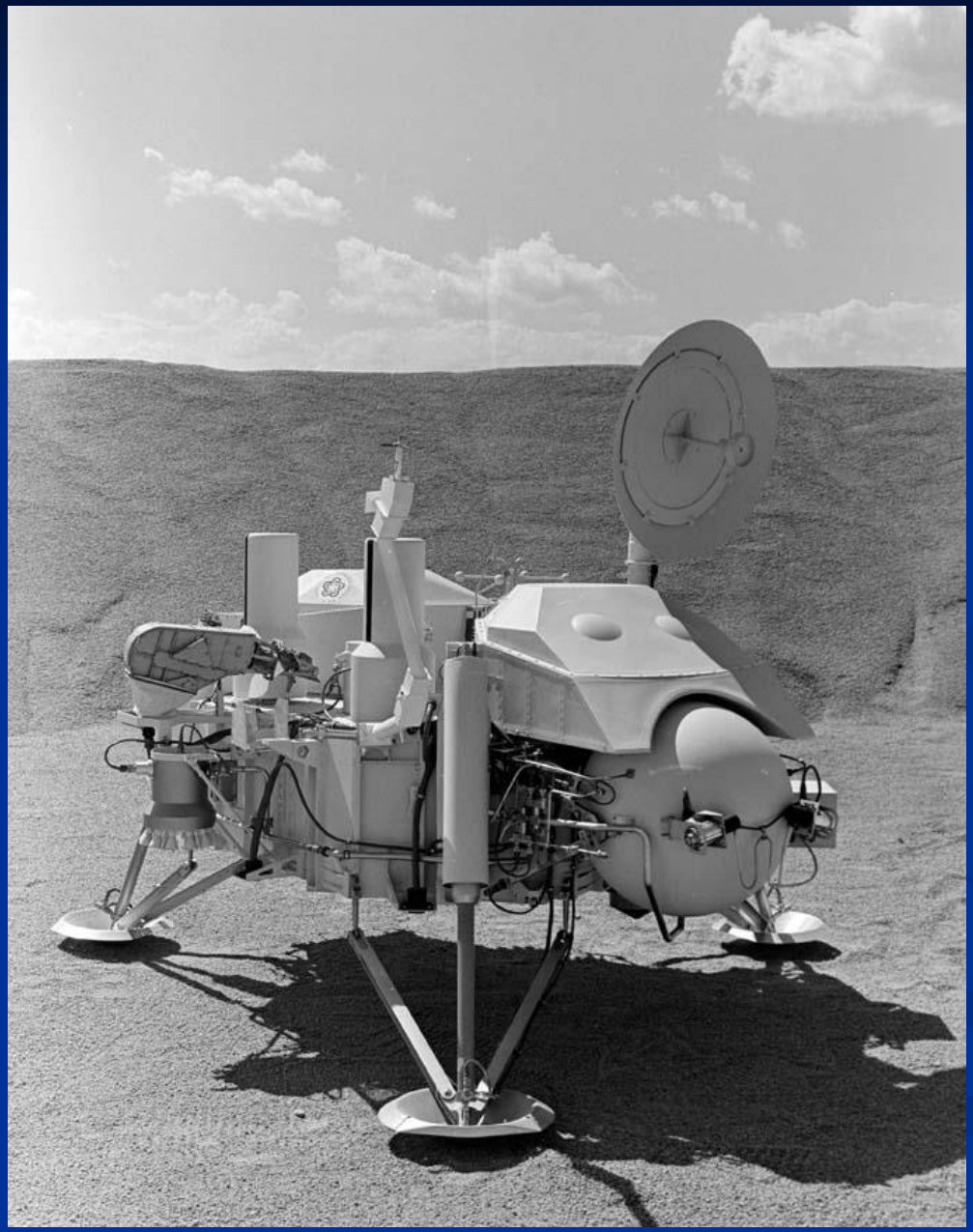
The Atlas and Delta Launch Vehicle Families
(The Current Generation)

Atlas V - New Horizons Mission to Pluto

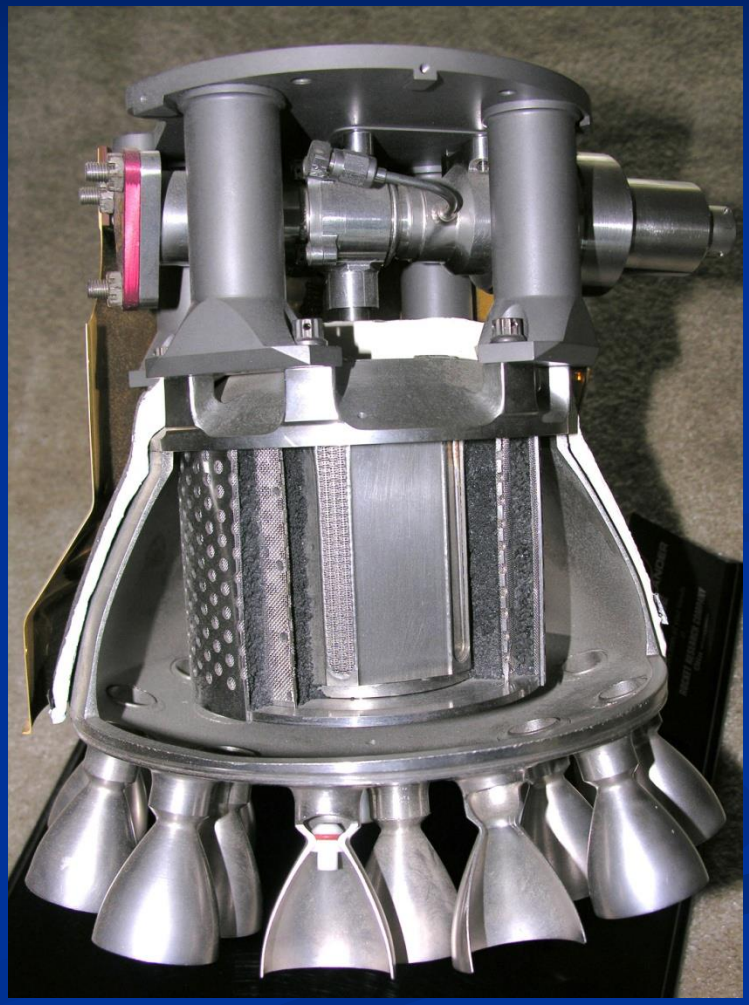
Athena Launch Vehicle – leaving Kodiak Island

Uses Minuteman III ICBM
Solid Motor Stages

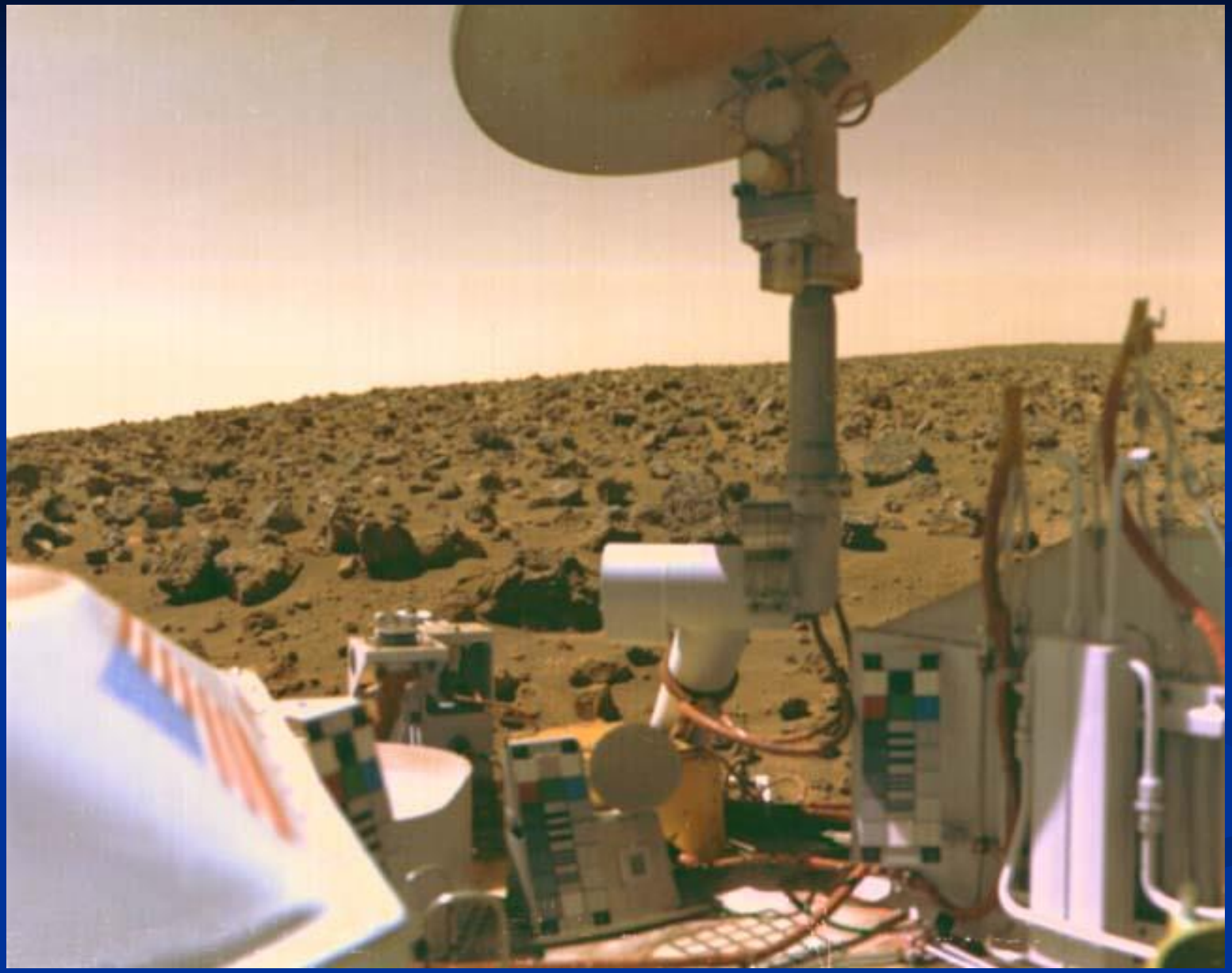
The Viking Lander – Two Landed on Mars July 1976



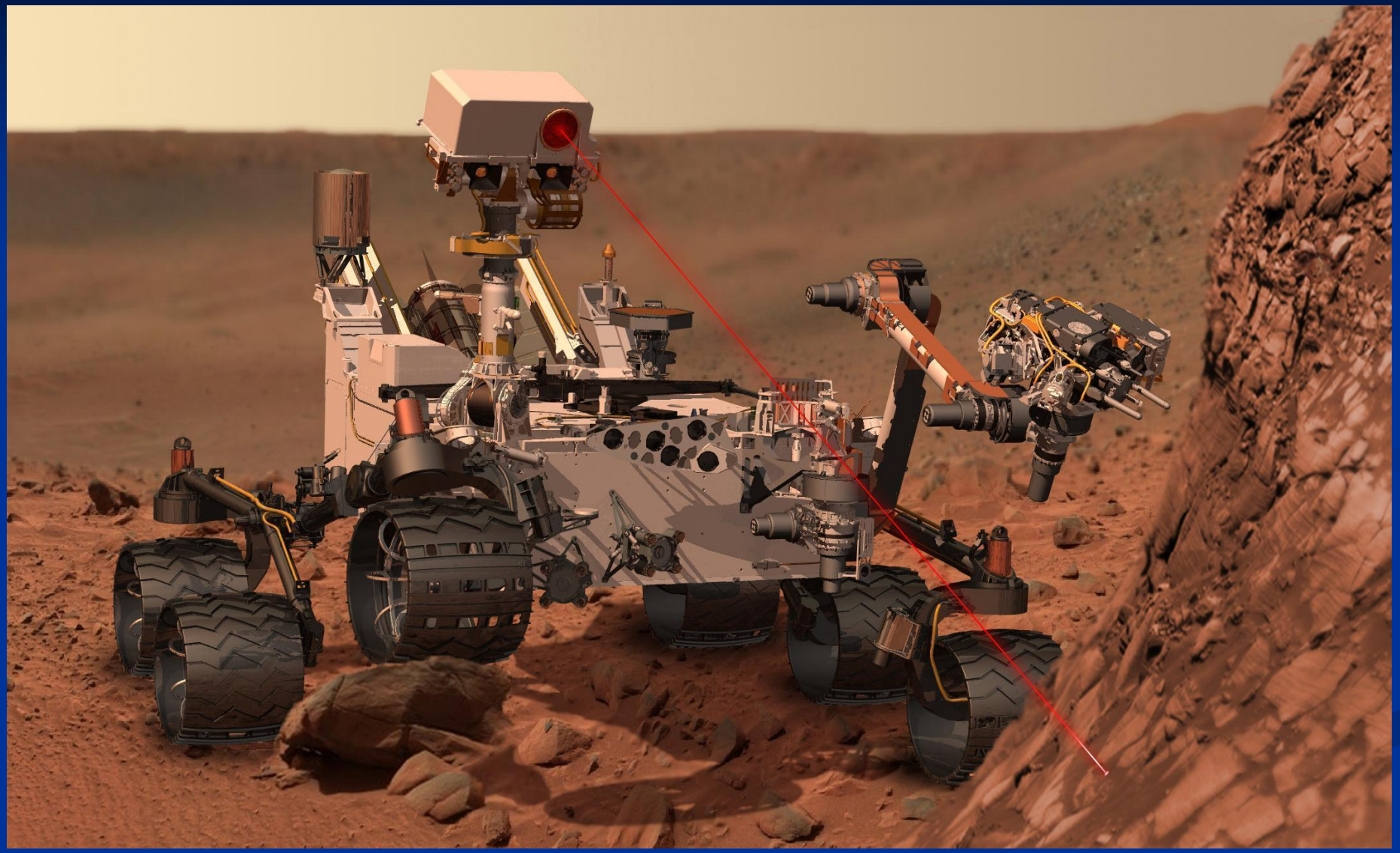
The Viking Lander Terminal Descent Rocket Engine



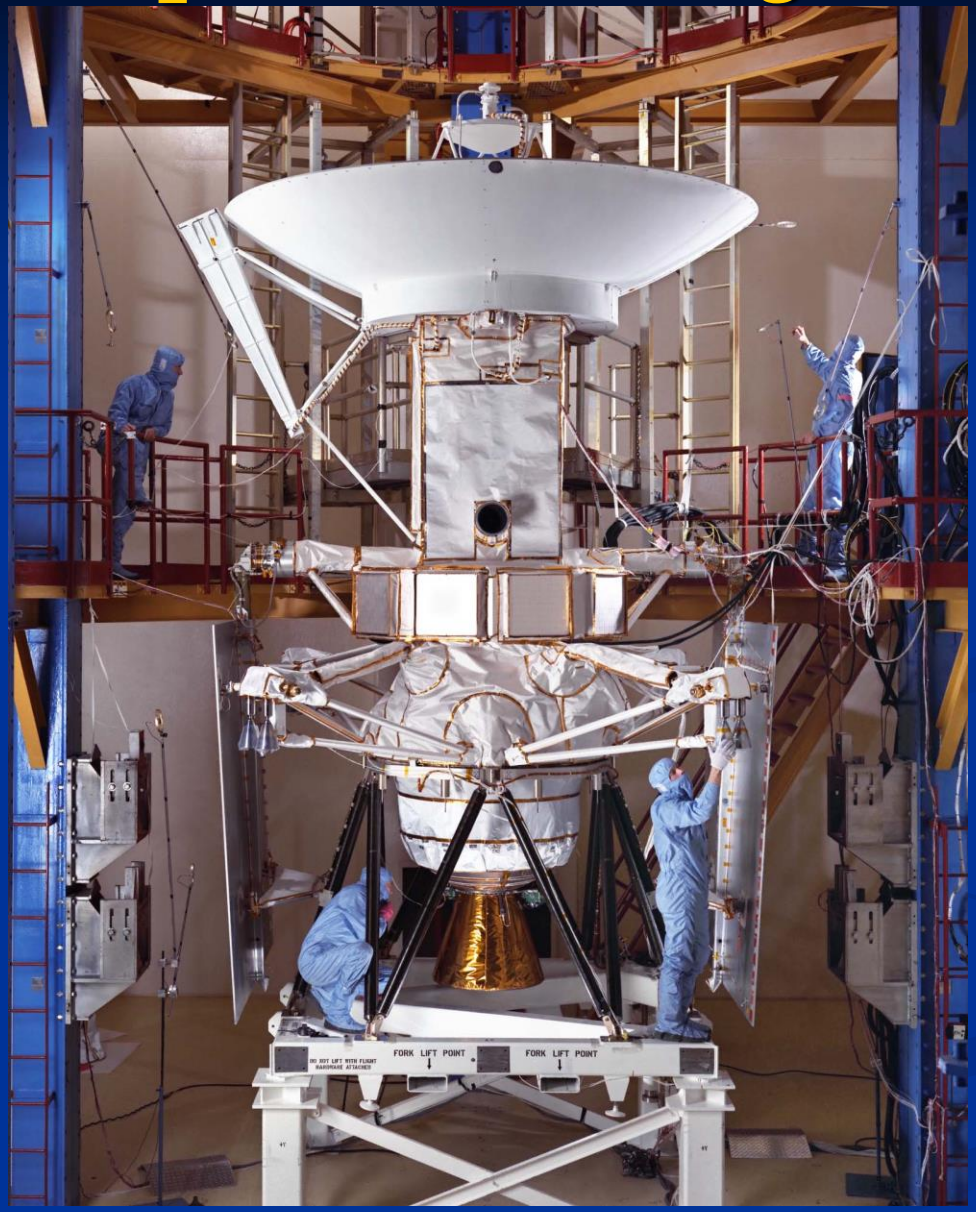
A Nice Day on Mars



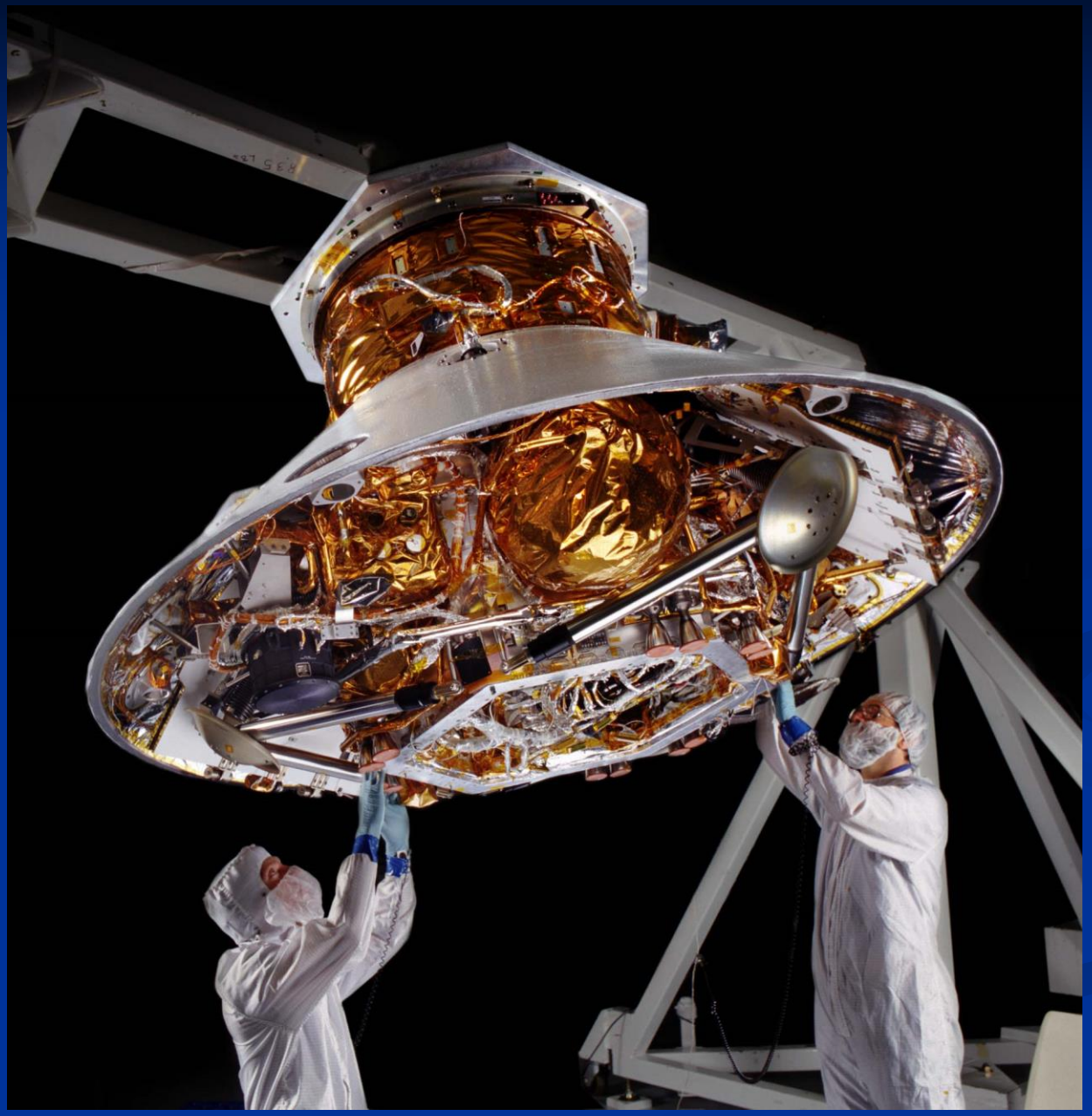
Curiosity on Mars



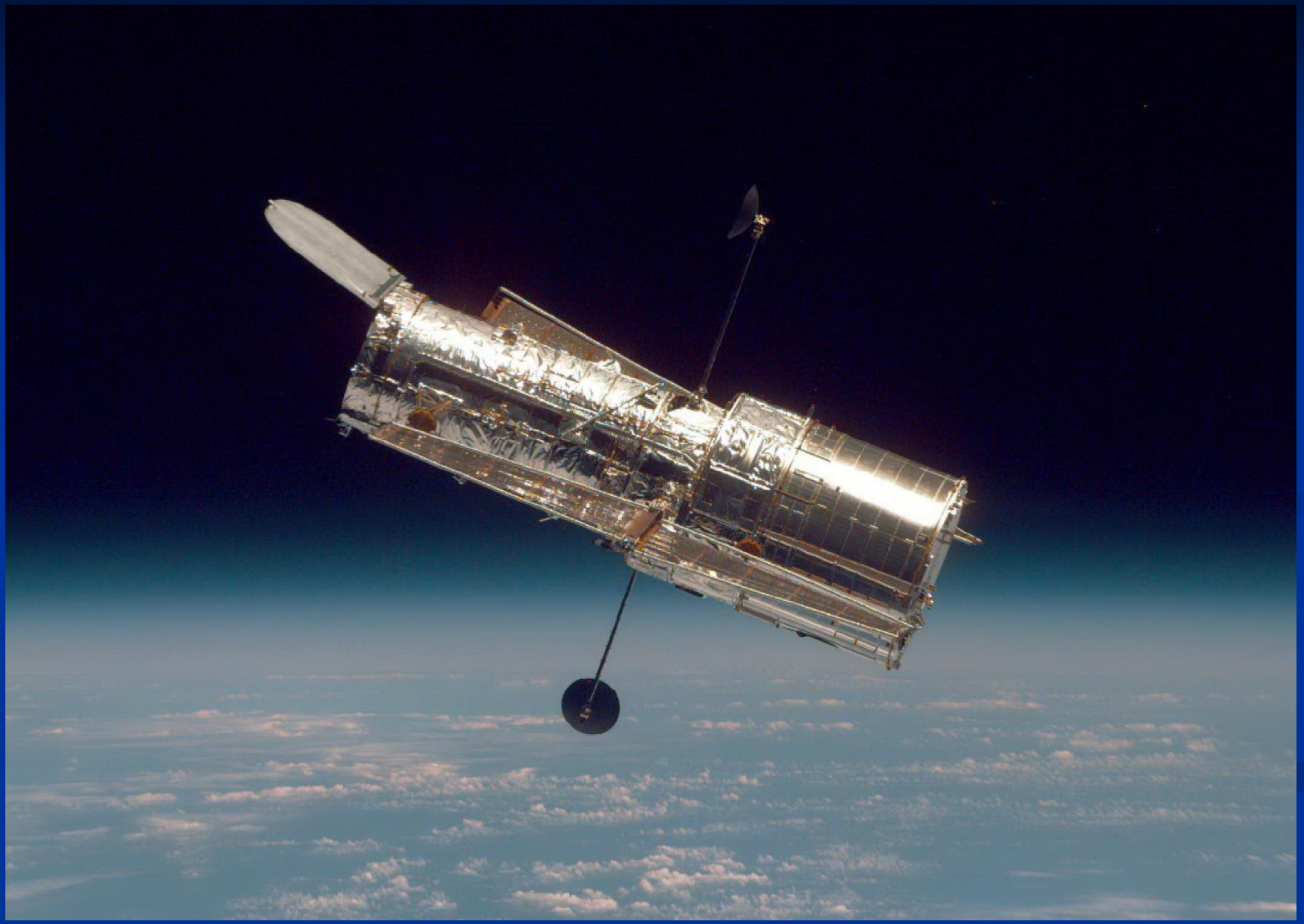
Magellan Spacecraft Getting Ready for Venus



Phoenix – A Recent Successful Mars Lander

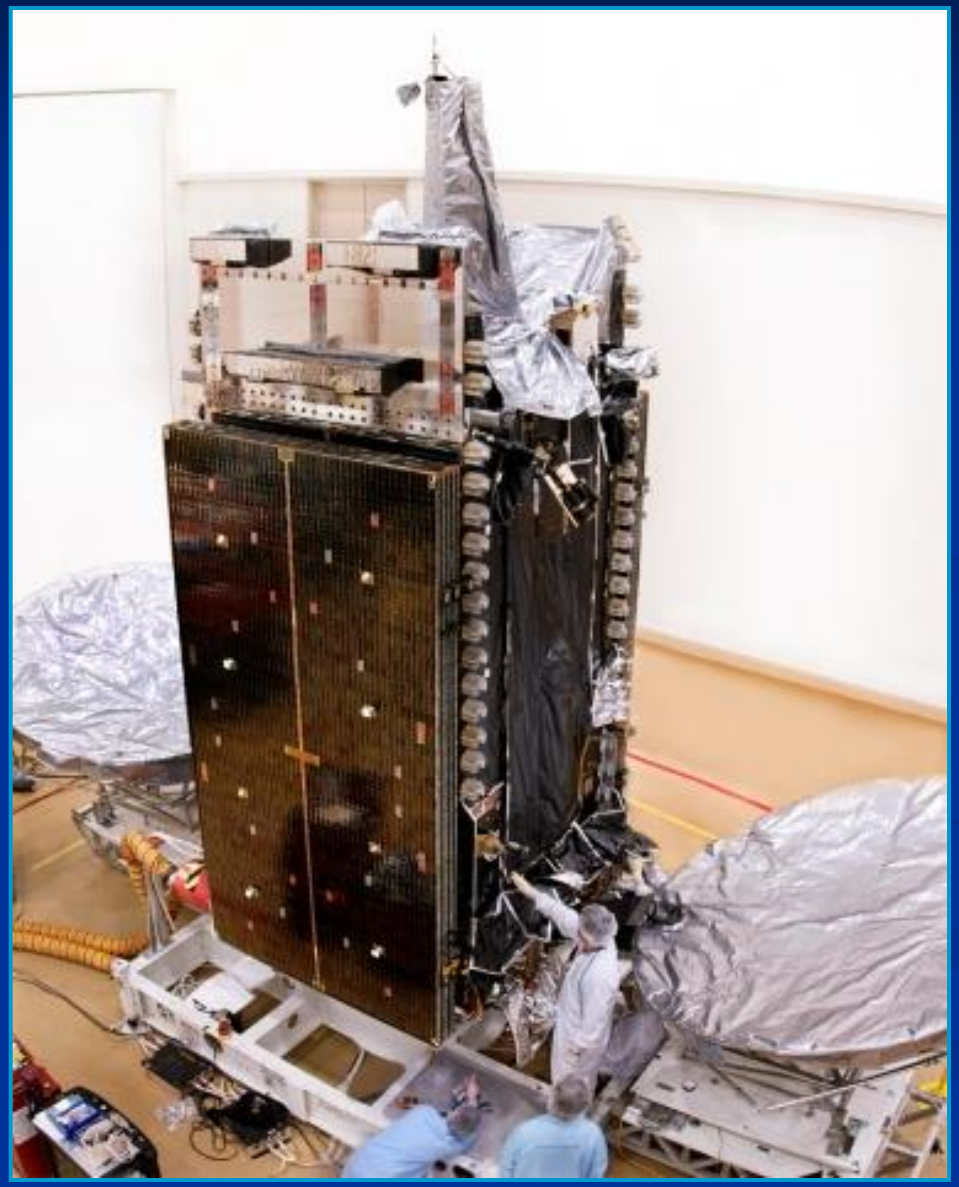


The Hubble Space Telescope

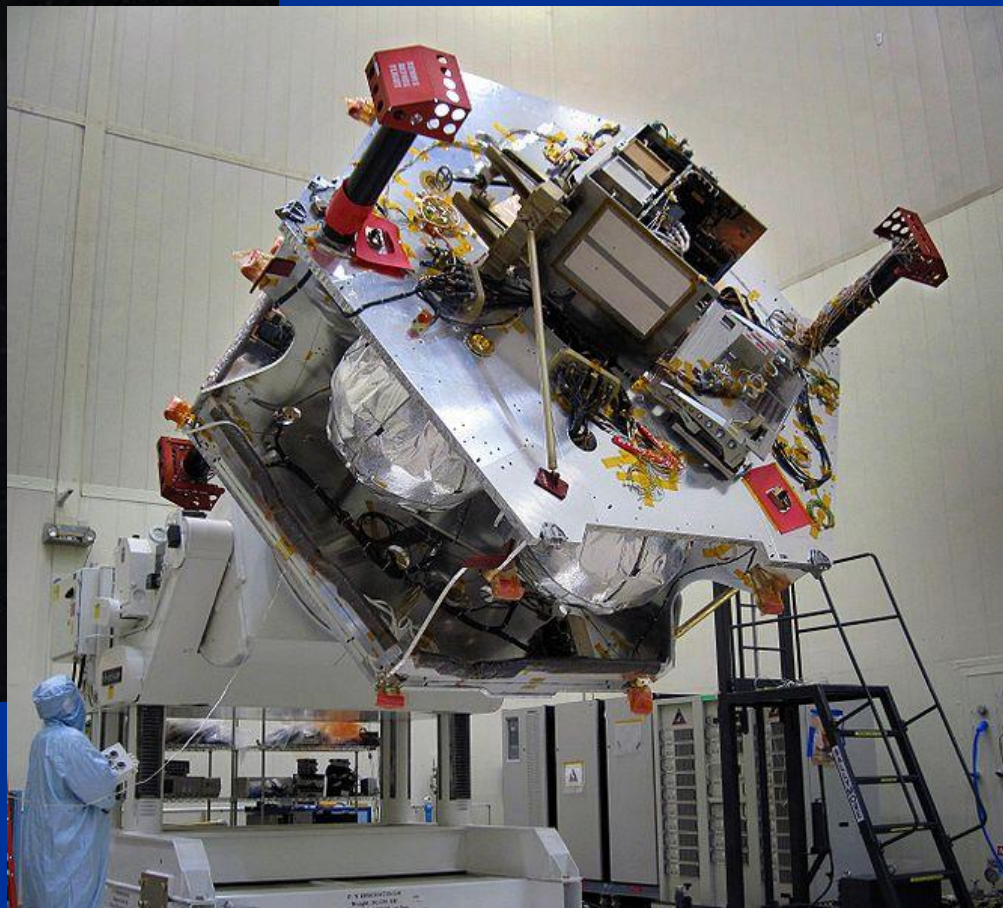


Global Positioning Satellite – Third Generation

Commercial Communications Satellite

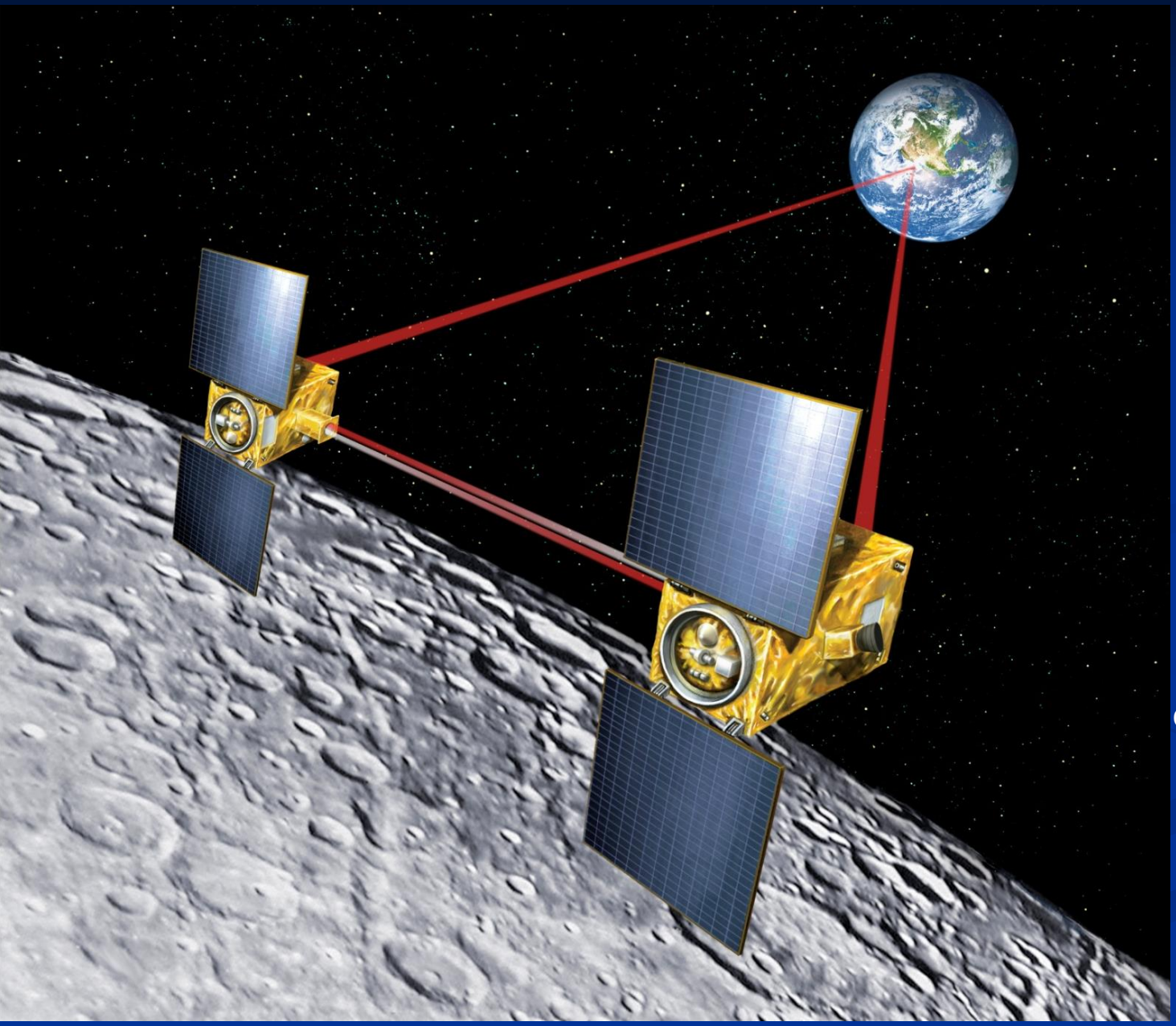


JUNO – Jupiter Orbiter



Launched: 8/5/11
Jupiter Arrival: 7/4/16

Gravity Recovery And Interior Laboratory (GRAIL)



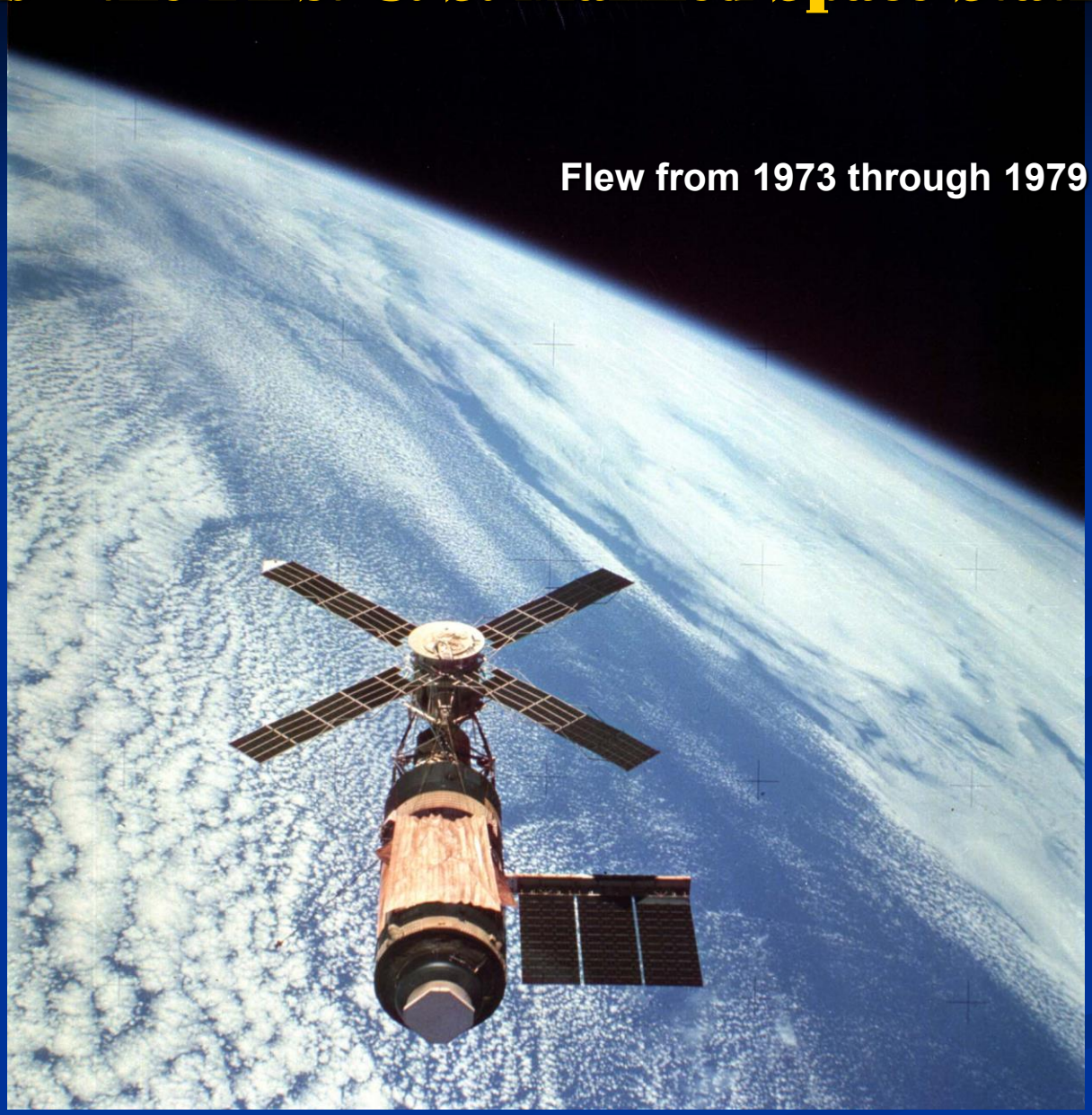
NASA JPL MIT GSFC LMSSC SRS

GRAIL

GRAVITY RECOVERY AND INTERIOR LABORATORY

Launch: Sept 10, 2011
to study the Moon
Mission successfully completed in late 2012

Skylab – the First U. S. Manned Space Station



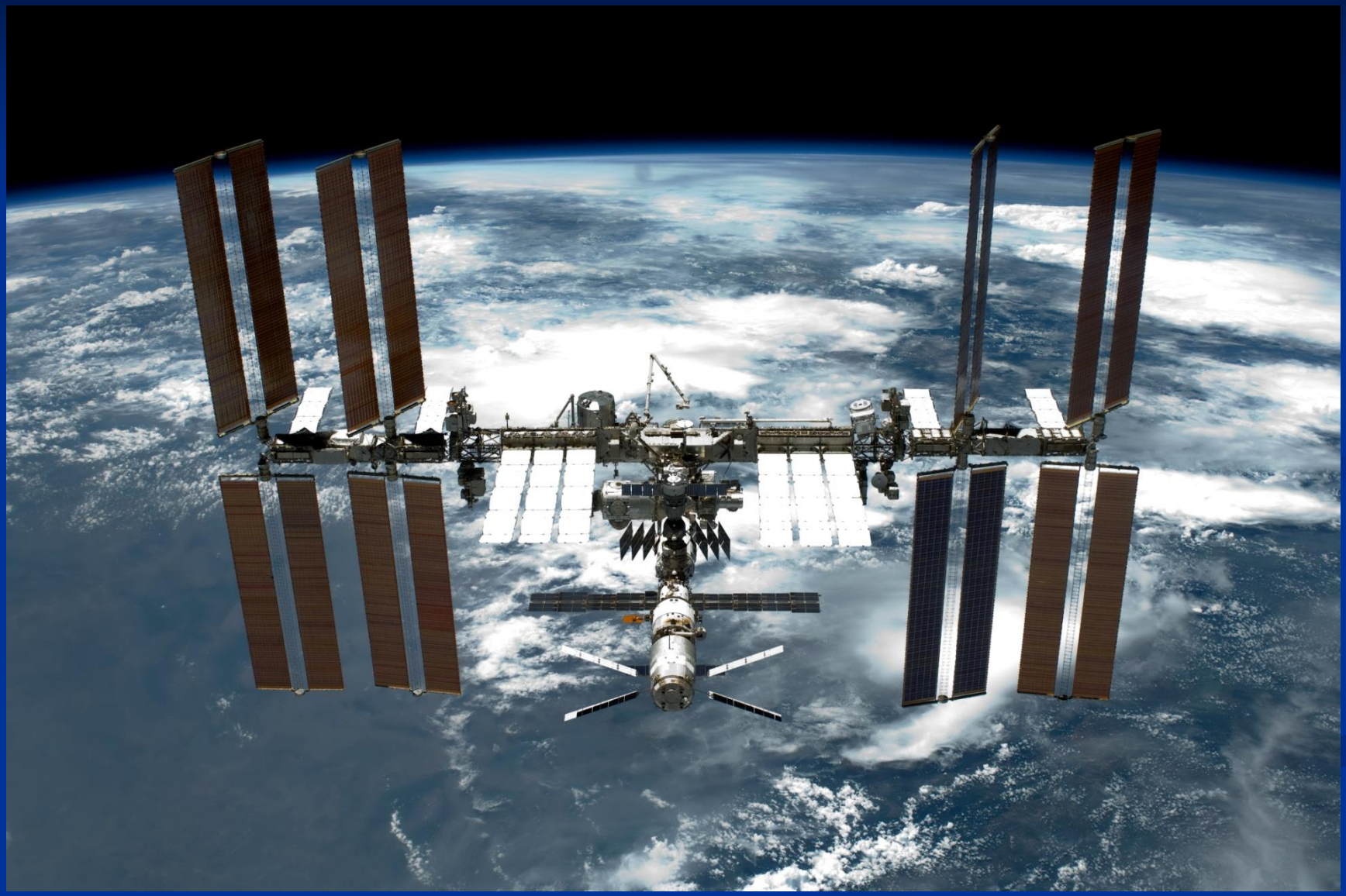
Flew from 1973 through 1979

The Manned Maneuvering Unit (MMU)

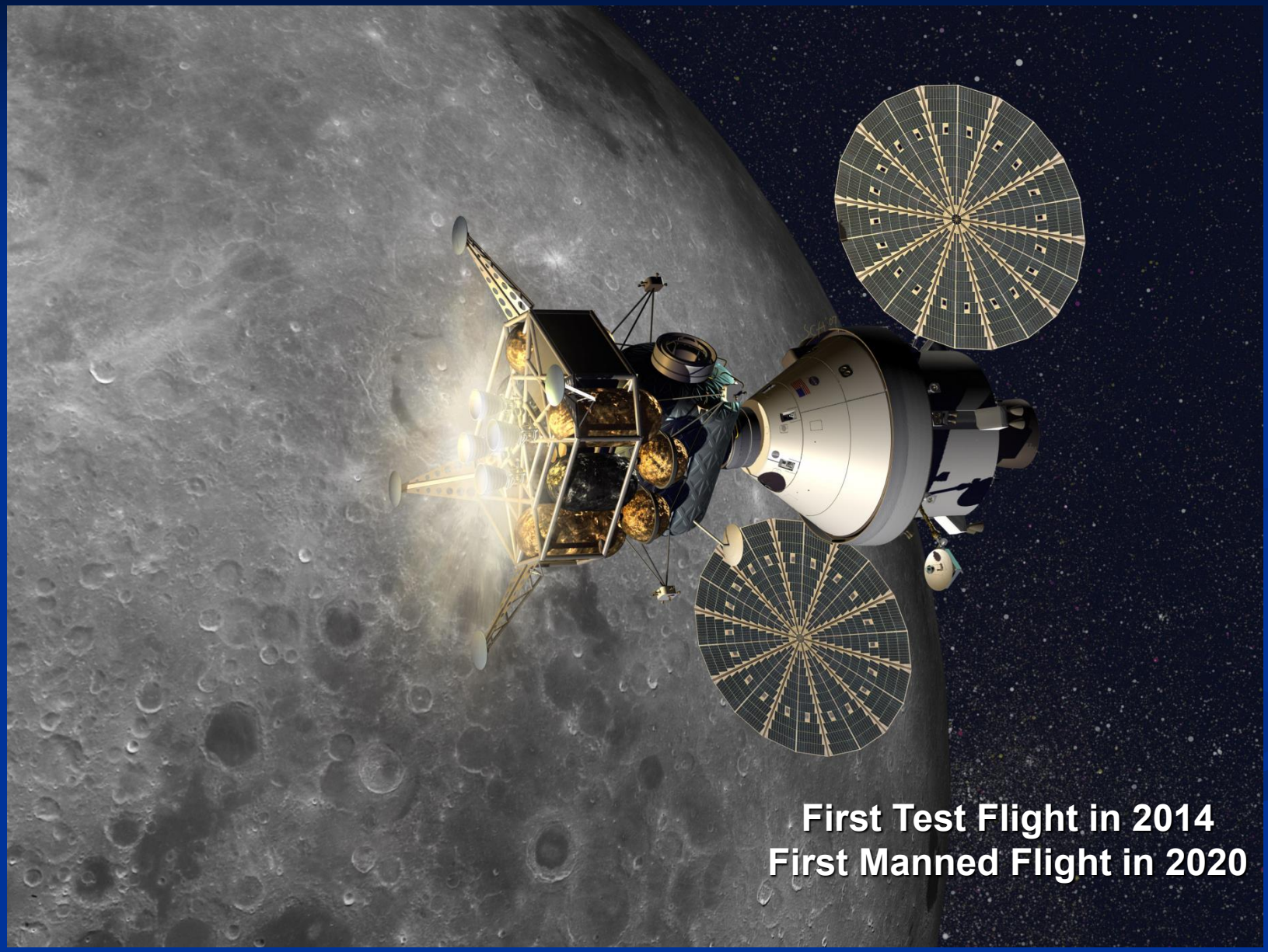
The Space Shuttle

135 Missions from
1981 to 2011

International Space Station



Orion – Manned Flight to the Moon and Mars



The Wonderful 747 – Still Going Strong

The 787 Dreamliner

AH64D – Apache Longbow – WOW!

F-35 Joint Strike Fighter

C-17- Workhorse for Our Troops

Airborne Warning and Control System

High Definition TV Spacecraft

Earth-Bound Transportation

Structures – Old and New












Around the House

The Bottom Line

- Everything Must to be “Engineered”
- Start Now
- Focus
- Learn All You Can
- Make the World a Better Place

Above all, Have Fun!