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Jet Propulsion Laboratory
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Small business opportunities at NASA's Jet Propulsion Laboratory

for

Sixteenth Annual High-Tech Small Business Conference
March 2, 2004

Gen. Eugene Tattini
Deputy Director, Jet Propulsion Laboratory
California Institute of Technology

Overview

- **Introduction to NASA and JPL**
- **JPL view of small business subcontracting**
- **Mars Exploration Rover landing video**

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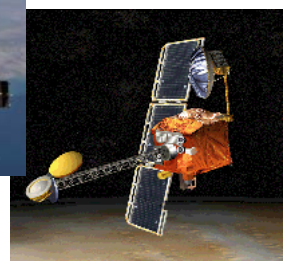
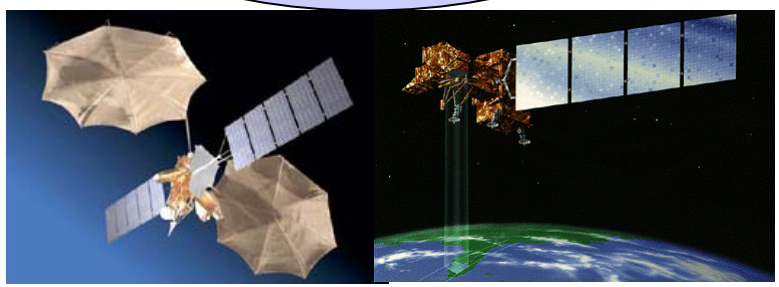
Extensive uses of space in the half century of the Space Age

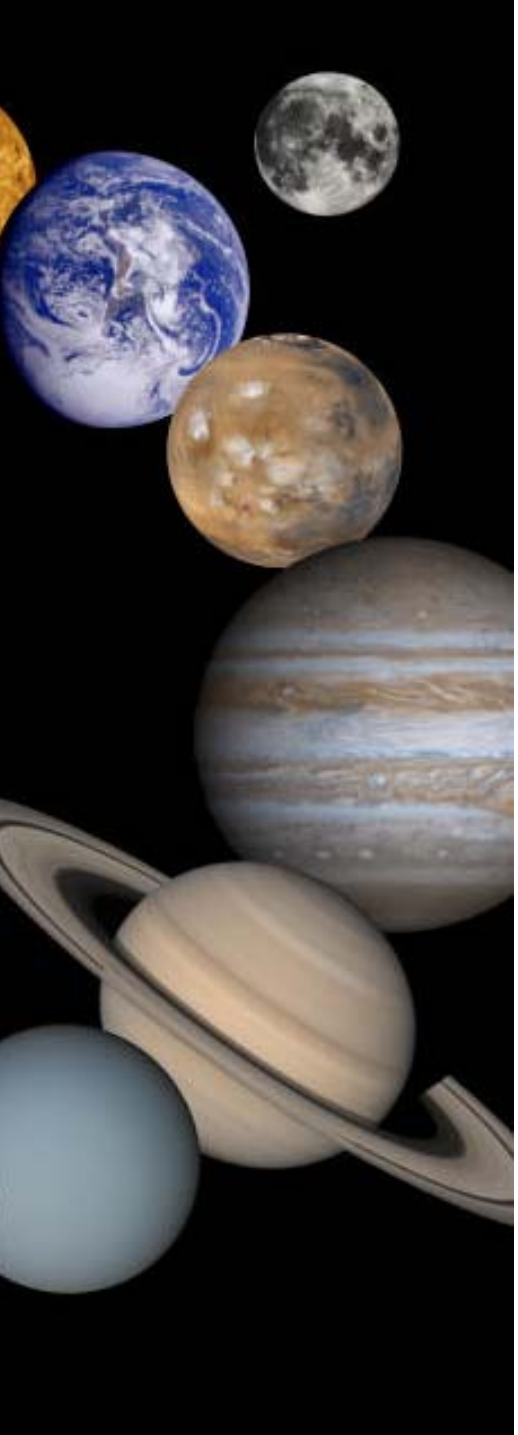
Civil space ↔ **Military space**

Civil space ↔ **Commercial space**

Military space ↔ **Commercial space**







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Solar system distance scales

- **To reach Voyager 1 at 12.5 billion km, it would take:**
  - **Lewis & Clark: 3.8 million years**
  - **JPL Director's 260Z: 14 thousand years**
  - **Chuck Yeager's X-1: 1500 years**
  - **John Glenn in the ISS: 54 years**
- **For Columbus to have reached Mars by today, he should have left Spain when it was populated by Neanderthals (60,000 years BP).**
- **Alternatively, if Earth were the size of a golf ball (and humans were the size of large protein molecules), distances to other objects would be:**
  - **Sun: 1600 feet (and 16 feet in diameter)**
  - **Mars from Sun: 2600 feet**
  - **Jupiter: 1.6 miles**
  - **Neptune: 10 miles**
  - **Voyager 1: 26 miles**

Teeing off in Los Angeles and……
sinking it for a birdie in St. Andrews, Scotland? Impossible!!

Yet, interplanetary navigation demands this kind of accuracy!

After traveling 450 million km, the Odyssey spacecraft arrived at Mars within 750 m of its target – a virtual tap in for a birdie.

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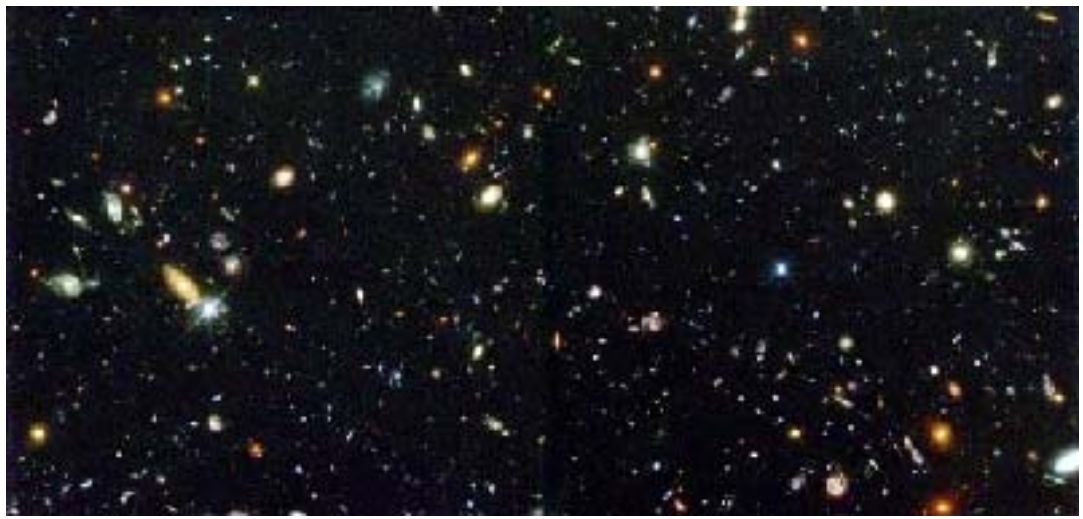
Hubble Deep Field size comparisons

- **Image:**
  - Image is of a sky region the size of Roosevelt's eye on a dime held at arm's length.
- **Galaxies in image:**
  - The smallest galaxies in the Hubble Deep Field image have a diameter seen from Earth of 1/200th the width of a hair held at arm's length.
  - Galaxies (the dots in the Hubble Deep Field image) have:
    - ~400 billion stars
    - Mass of ~1 trillion solar masses
    - Diameters of ~1 billion billion miles
    - Distances from Earth of ~1 hundred billion trillion miles



Understanding the Universe Using Fundamental Physics Studies in Space

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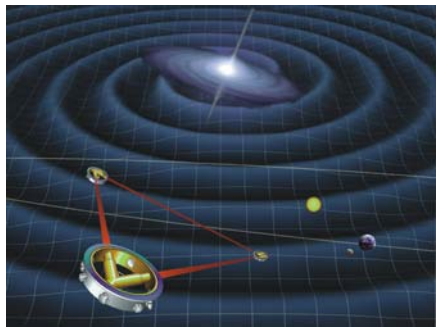
Curvature of Space-Time

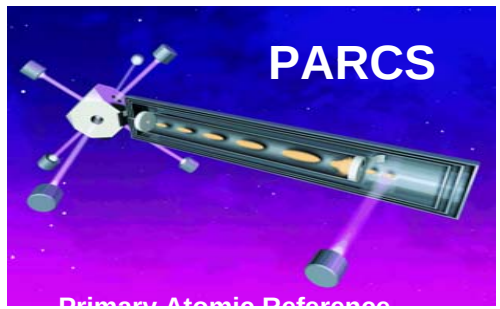
- **Observe gravitational waves from massive black hole binaries and early universe**
- **Test theories of gravity in strong fields near super-massive black holes**
- **Use laser interferometry to measure distance between spacecraft (separated by millions of kilometers) with picometer precision**



“”. . like measuring the distance to moon to one-hundredth of the size of an atom. . .”

Atomic Clocks in Space

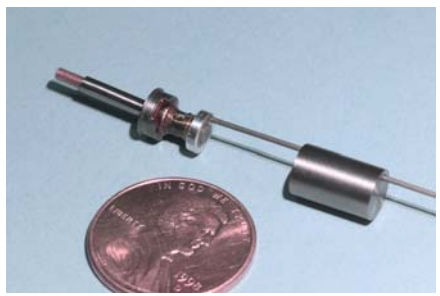
- **Test fundamental tenets of Einstein’s theory of general relativity**
- **Study cesium atoms cooled to a millionth of a degree above absolute zero**
- **Resolving the second to five parts in 10^{17}**



“… less than one second’s error in 100 million years, or about 2.5 minutes in the 15 billion year life of the universe …”

Low Temperature Physics Experiments in Space

- **Studying properties of matter cooled to very low temperatures**
- **Utilizing superconducting quantum Interference technology**
- **Temperature resolution of 10^{-10} Kelvin**



“…like observing the temperature drop in a pond after dropping one ice cube into it….”

NASA Vision and Mission

- ***NASA Vision:***
  - **To improve life here;**
  - **To extend life to there;**
  - **To find life beyond.**
- ***NASA Mission:***
  - **To understand and protect our home planet;**
  - **To explore the universe and search for life;**
  - **To inspire the next generation of explorers as only NASA can.**

JPL history mosaic

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1936

JPL today

1940s

1958

1950s

JPL business summary

- A federal (NASA) laboratory
- University (Caltech)-operated
- $1.4 billion business base
- 5400 employees and contractors
- 177 acres
- 134 buildings and 57 trailers
- 670,000 net square feet of office space
- 860,000 net square feet of non-office space (e.g., labs)

JPL funding distributions for FY03
$1.441 billion business base

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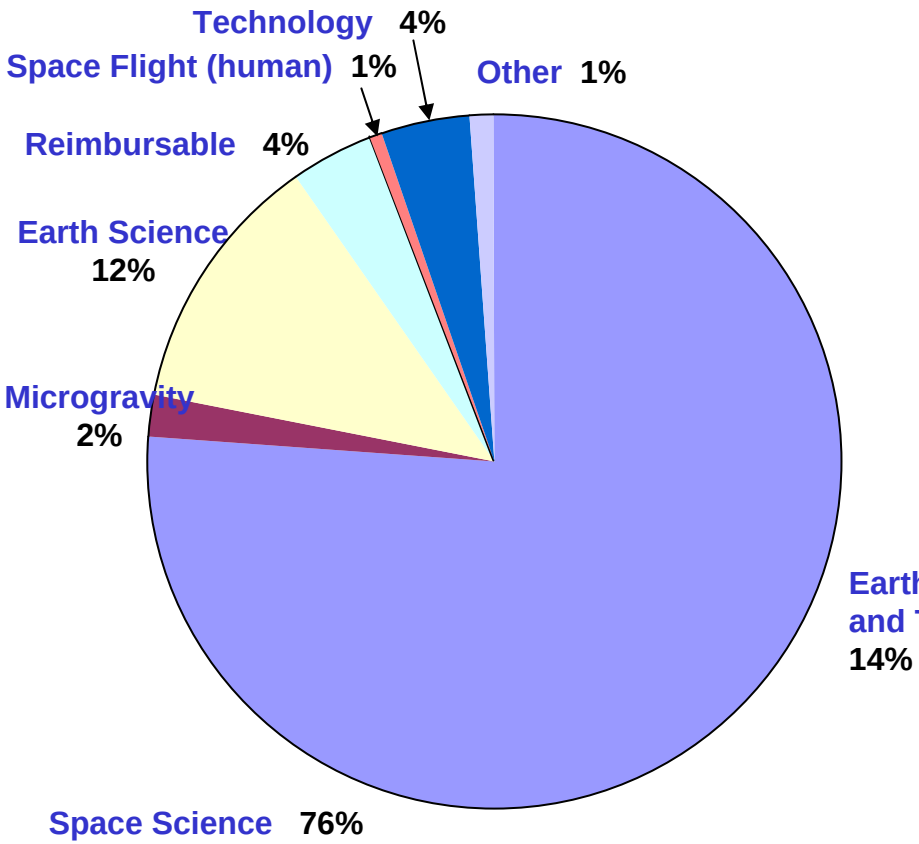
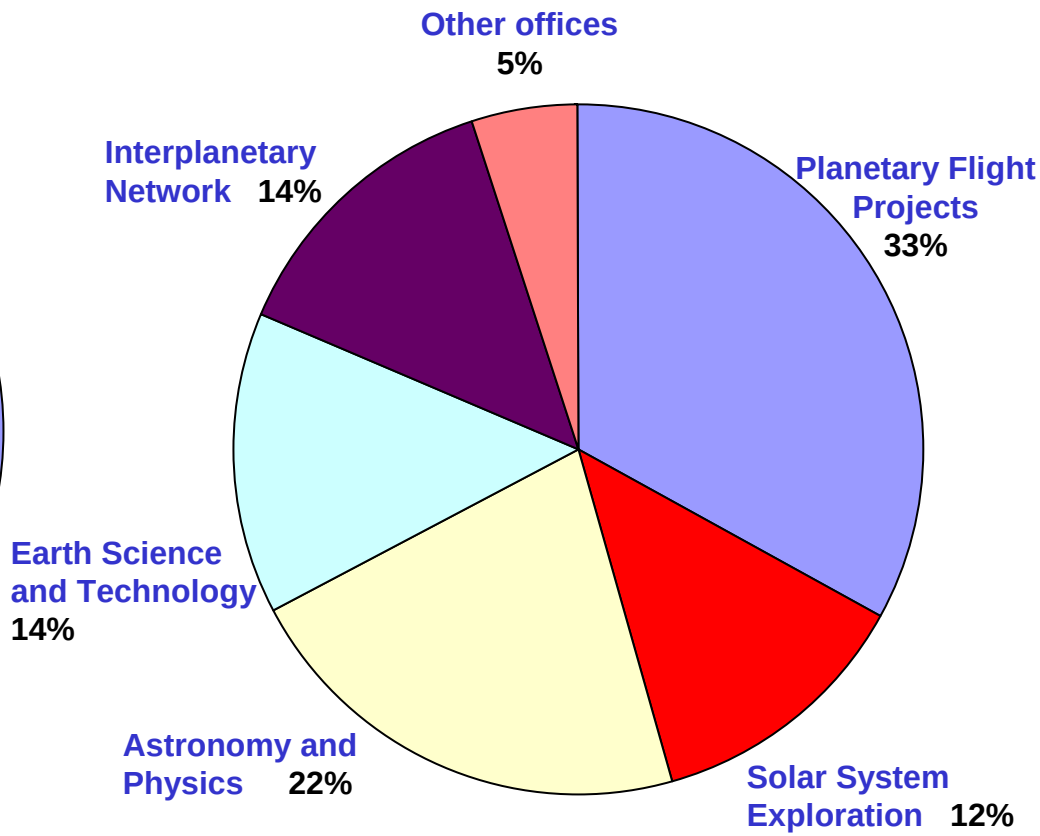
- **By NASA office or other sponsor**



- **By implementing JPL directorate**



JPL staff composition by job classification and academic degree in FY2003

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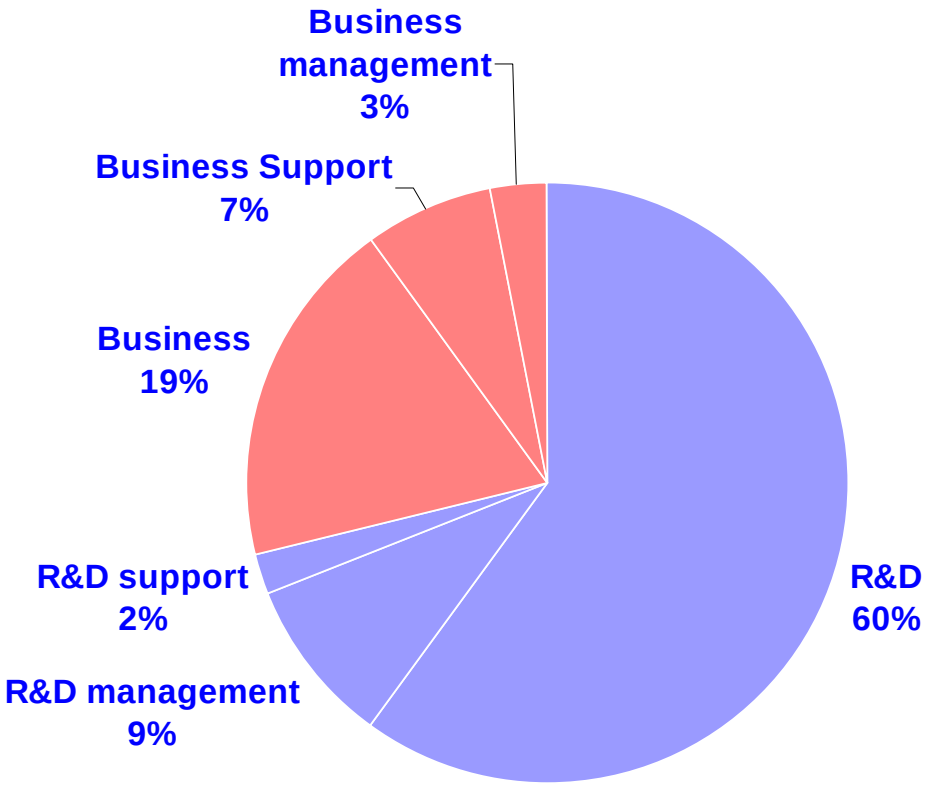
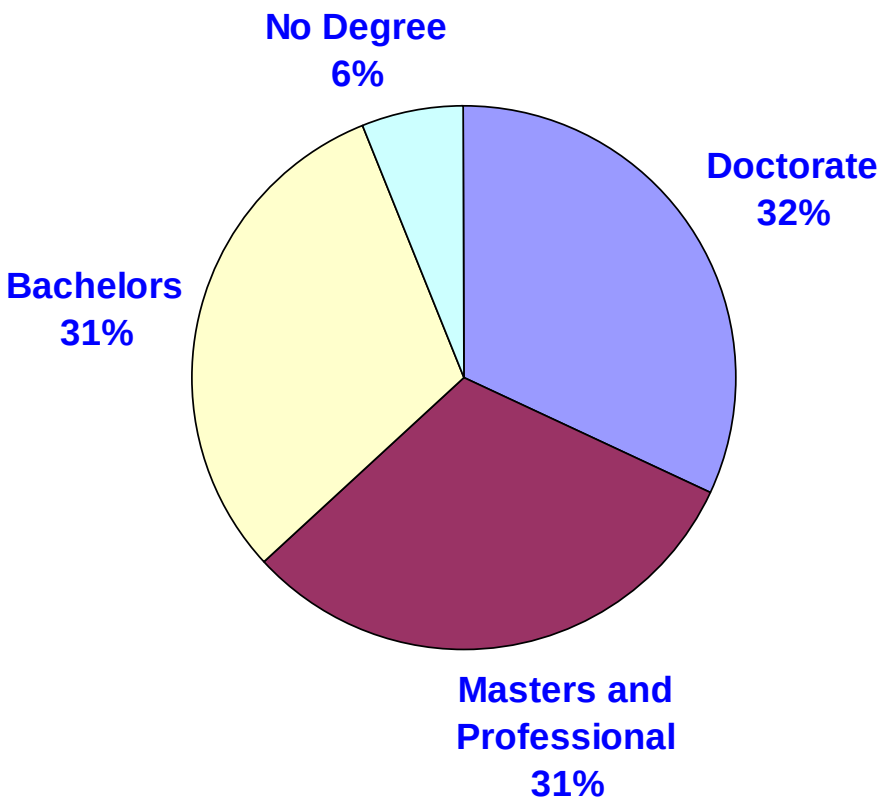
- **Staff composition by job classification for 5189 employees**



- **R&D staff distribution by academic degree for 3144 employees**



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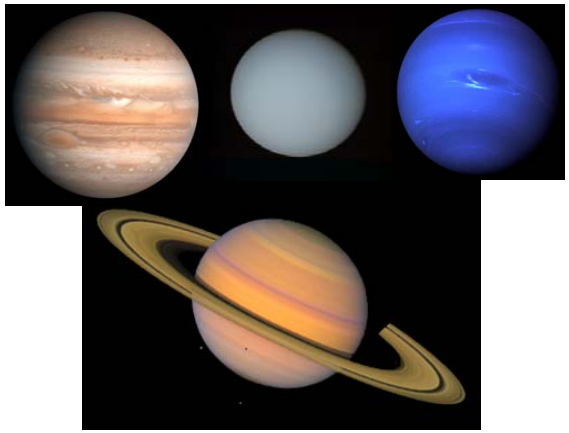
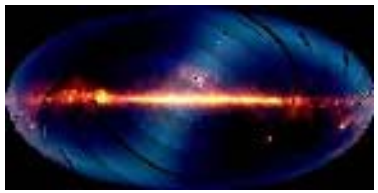
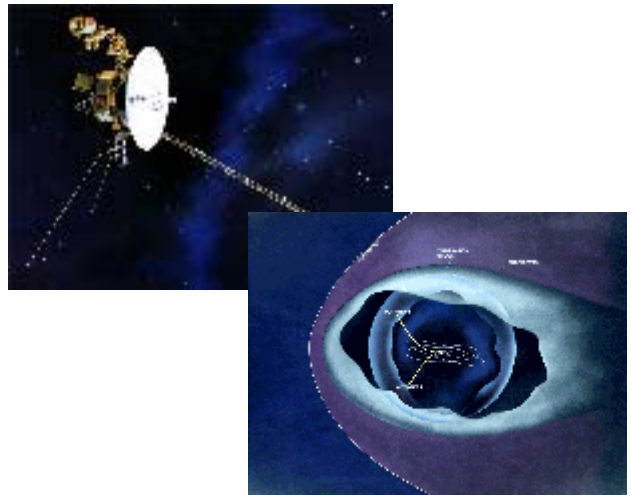
Forty-six years of exploration



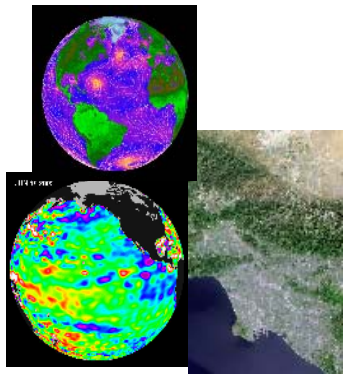
Giant Planets



Astrophysics

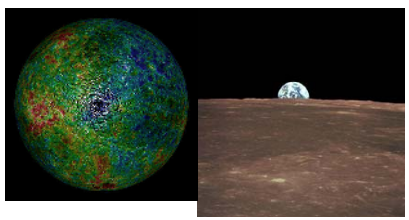


Interstellar space

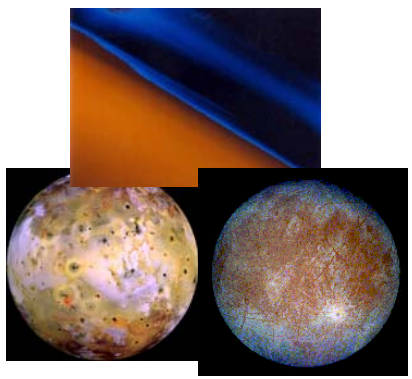


Earth

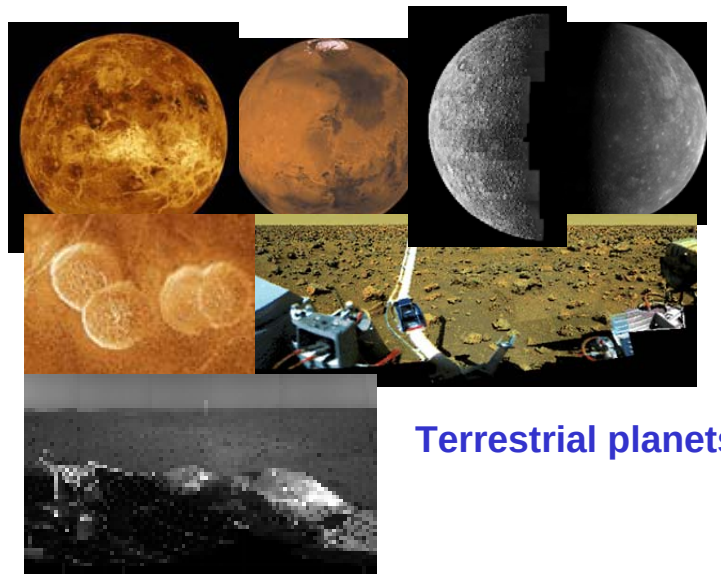
Small bodies



Earth's moon



Planetary satellites



Terrestrial planets

Seventeen JPL spacecraft, and three major instruments, now operating across the solar system

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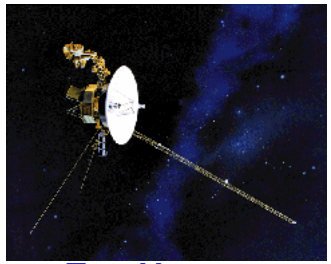
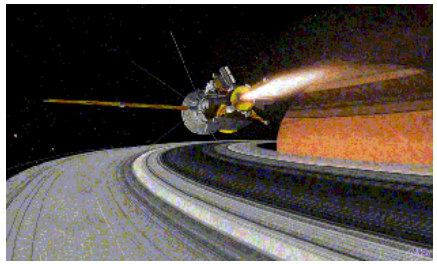
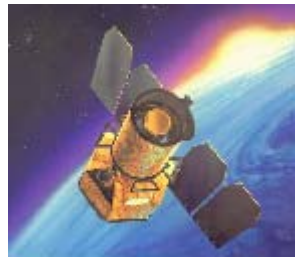
Spitzer studying stars and galaxies in the infrared



Two Voyagers on an interstellar mission

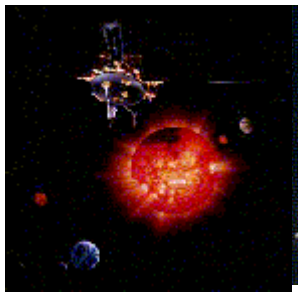
Cassini studying Saturn

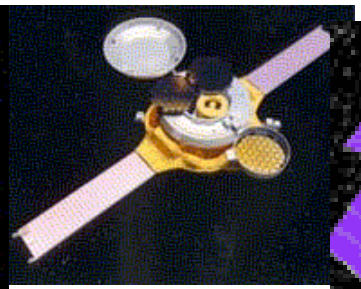


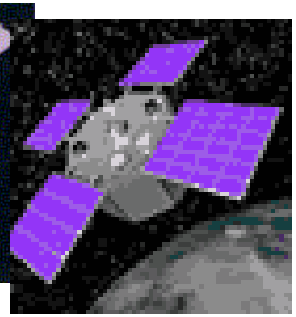


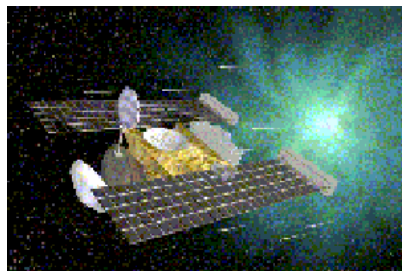
GALEX studying UV universe

Ulysses, Genesis, and ACRIMSAT studying the sun

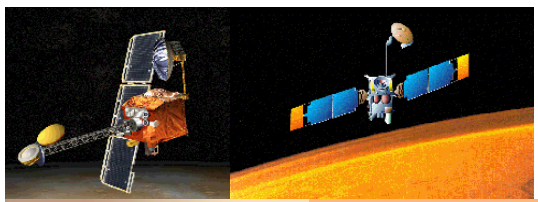


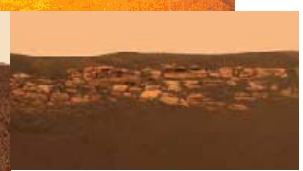




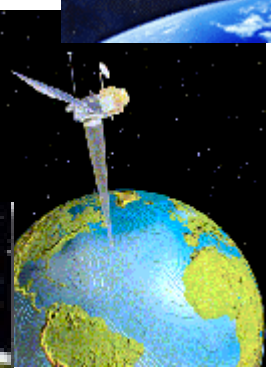


Stardust returning comet dust





Mars Global Surveyor and Mars Odyssey orbiters; "Spirit" and "Opportunity" on Mars



Topex/Poseidon, QuikSCAT, Jason 1, and GRACE (plus ASTER, MISR, and AIRS instruments) monitoring Earth

Mars program goal: study Mars' geology and biology with a permanent presence.

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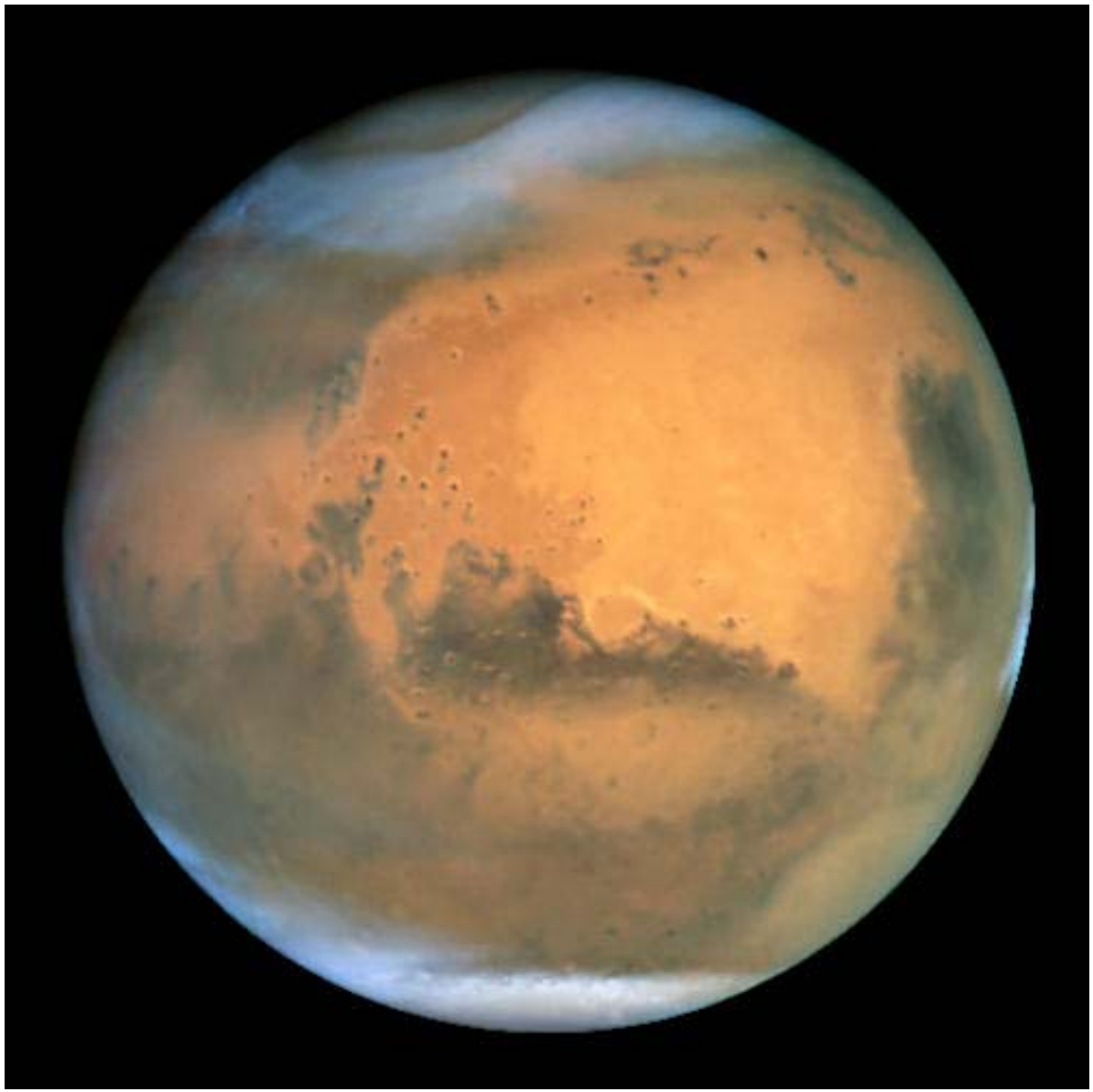

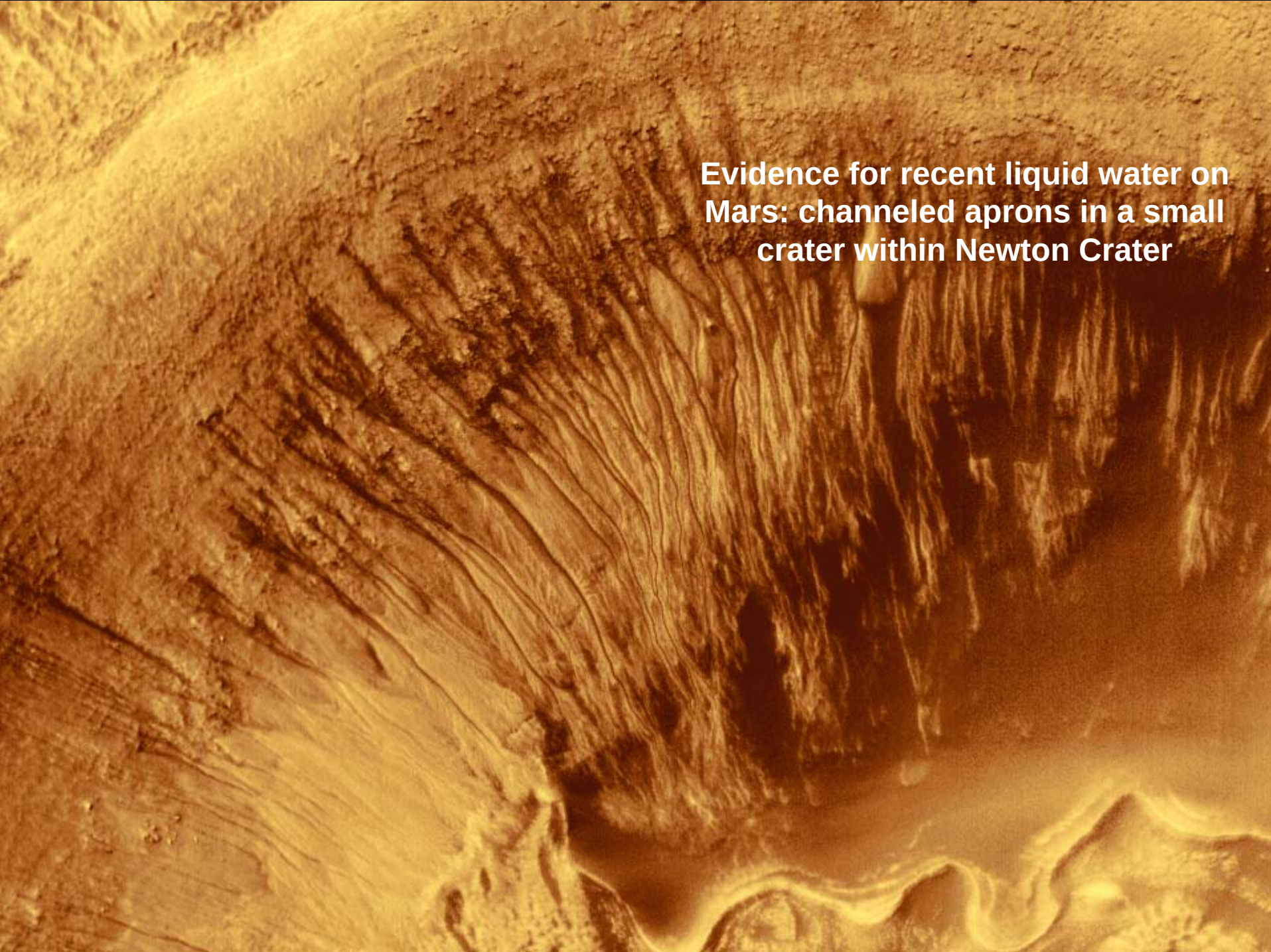
Evidence for recent liquid water on Mars: channeled aprons in a small crater within Newton Crater

Mars Exploration Rover (MER) “Spirit” and “Opportunity” landing sites relative to other landers

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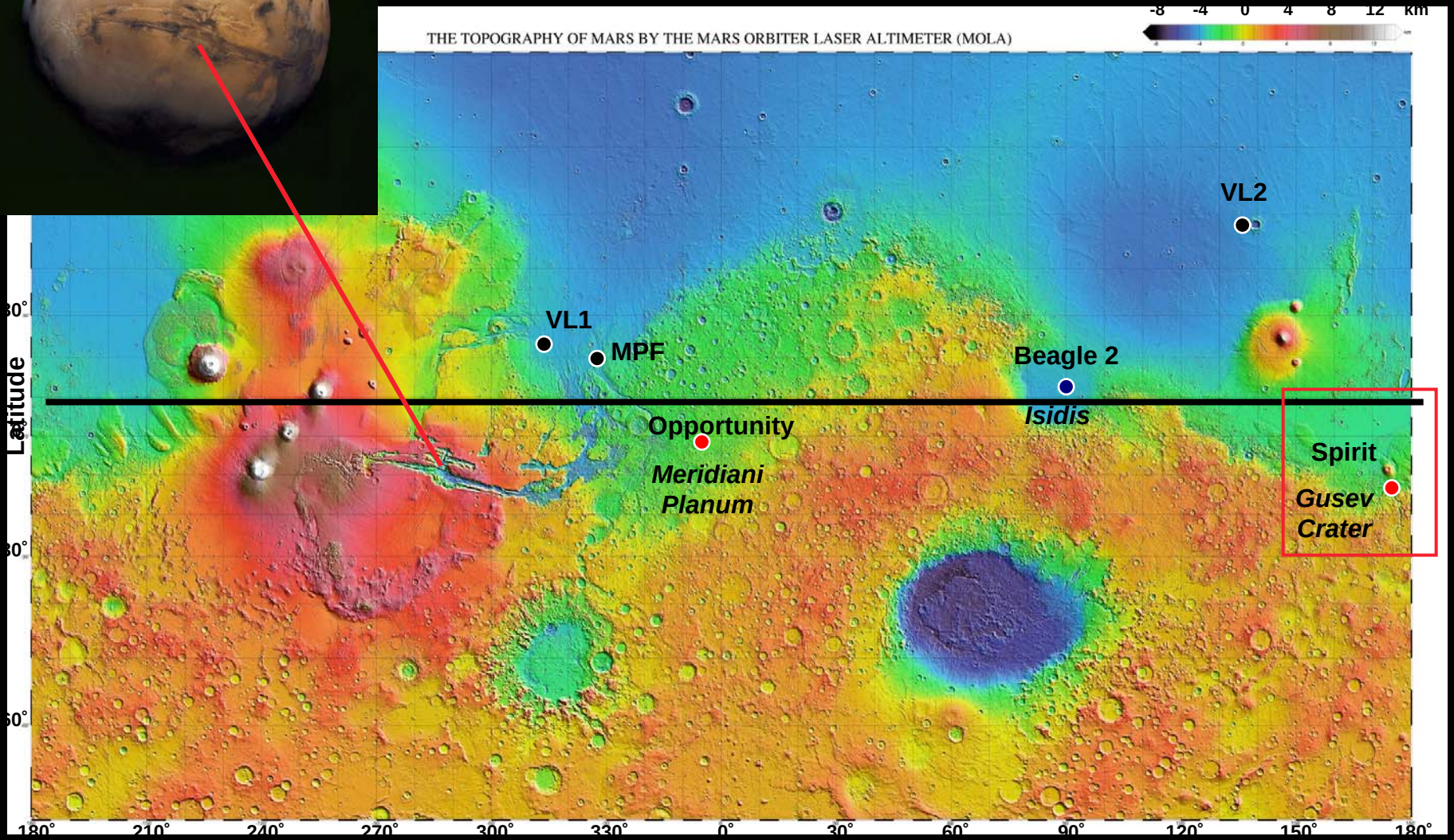

Gusev crater (Spirit landing site) dust devil trails and context

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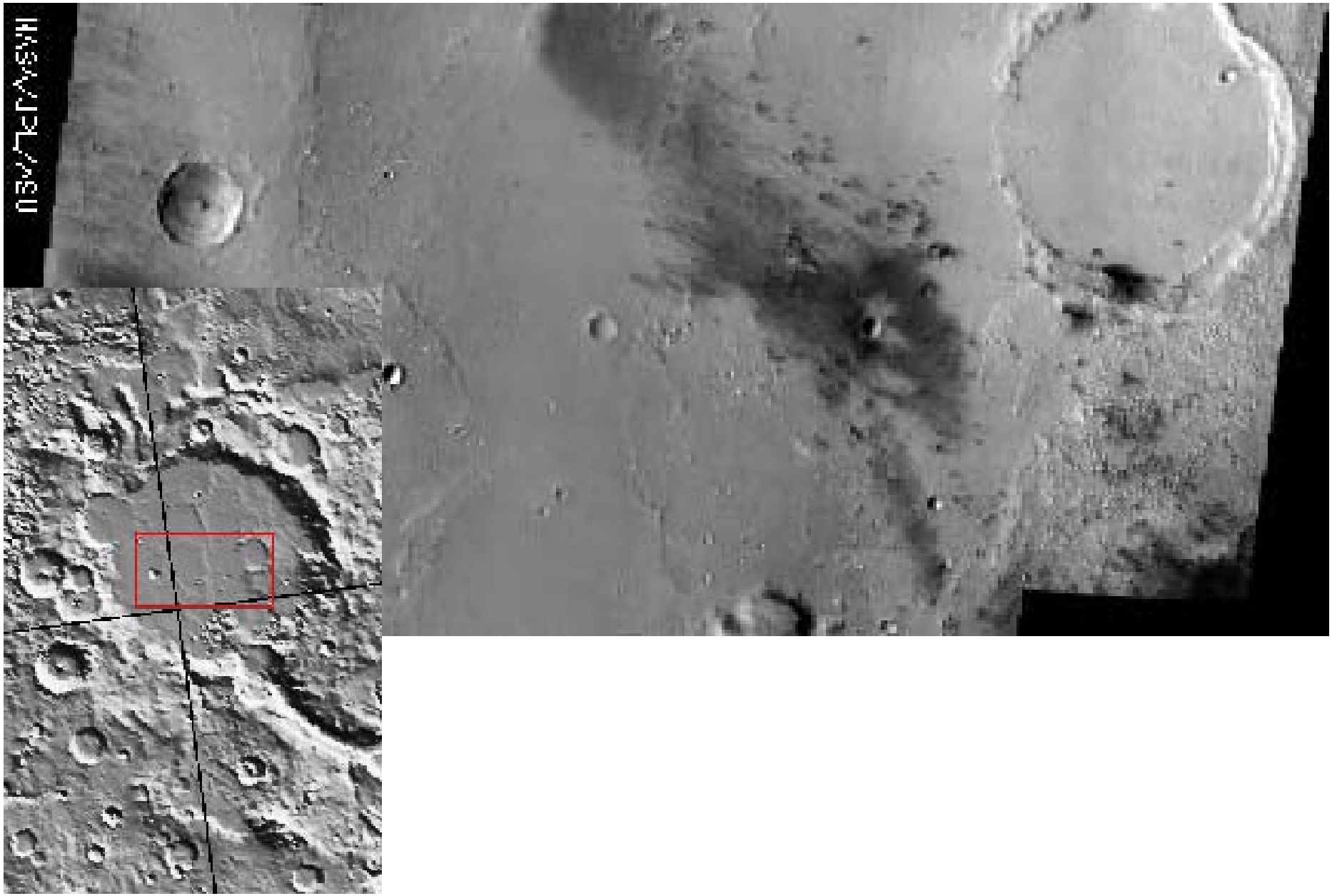

Mars Exploration Rover *Spirit* and components in Gusev crater from Mars Global Surveyor

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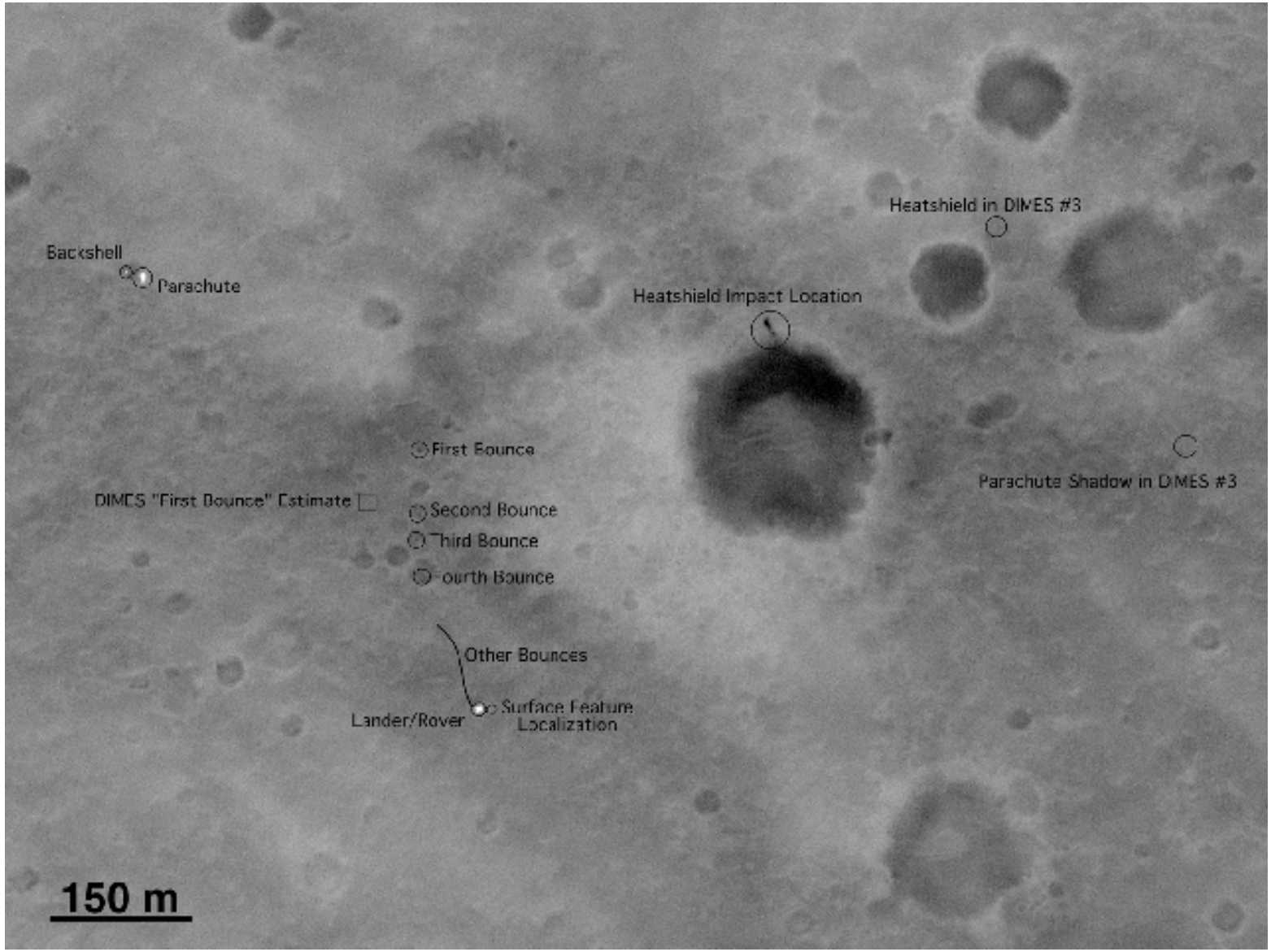

Seven Hills from Spirit

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White Boat rock studied by *Spirit*

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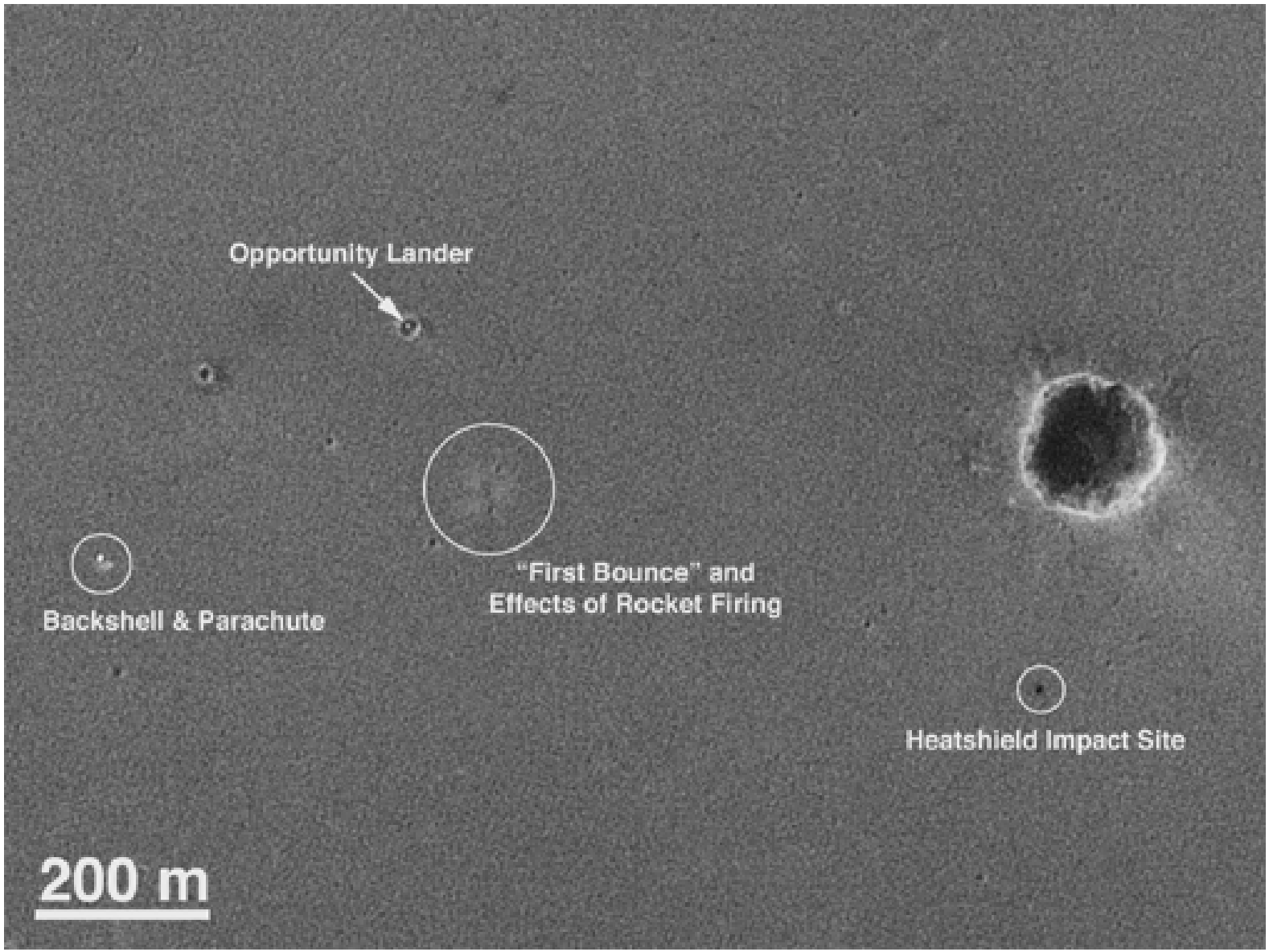
Mars Exploration Rover *Opportunity* and components in Meridiani Planum from Mars Global Surveyor



Bedrock outcrops at Meridiani Planum from Mars Exploration Rover *Odyssey*

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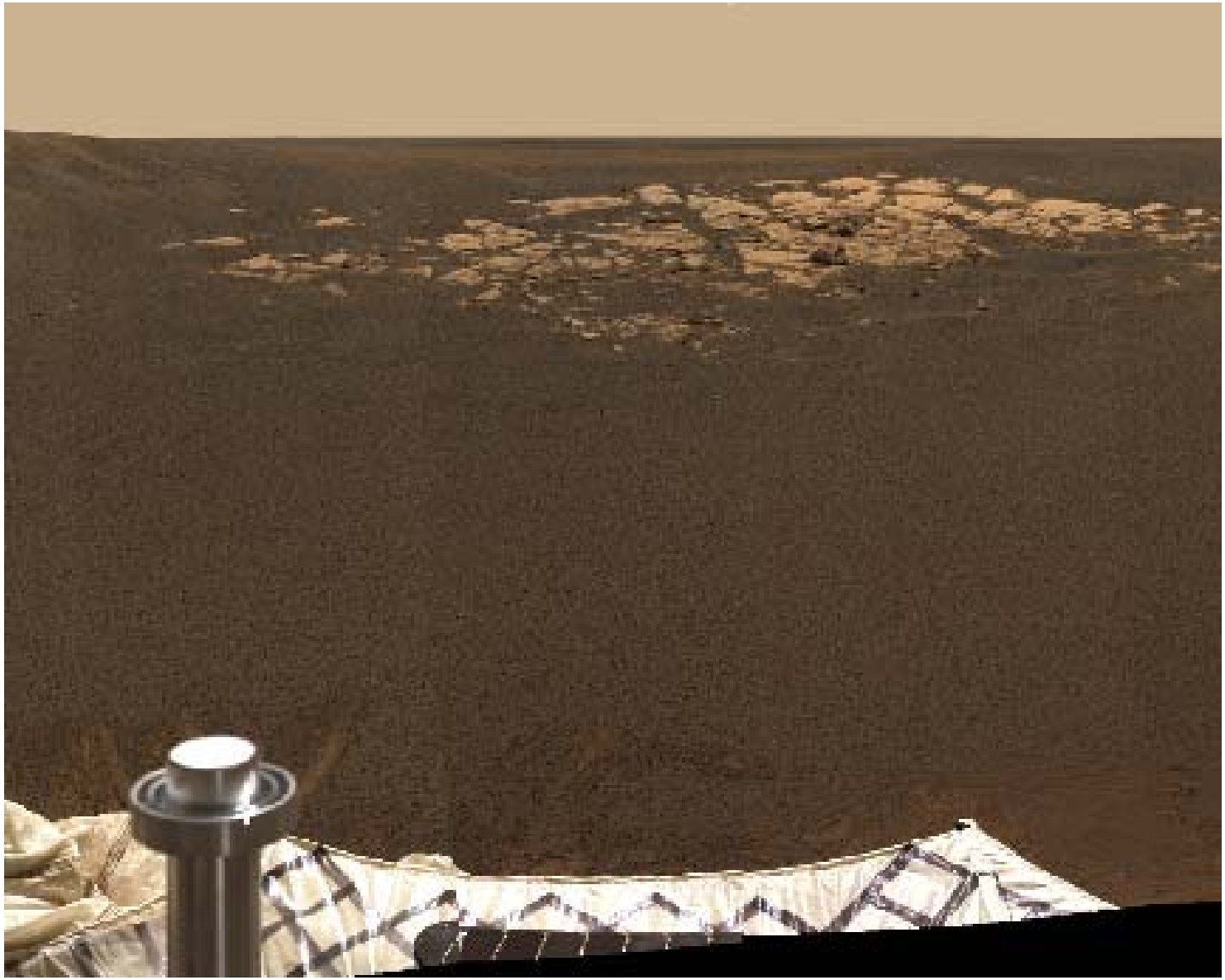

Odyssey sees its parachute and backshell from its crater's rim

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Layered beds in Meridiani Planum near Mars rover *Opportunity*

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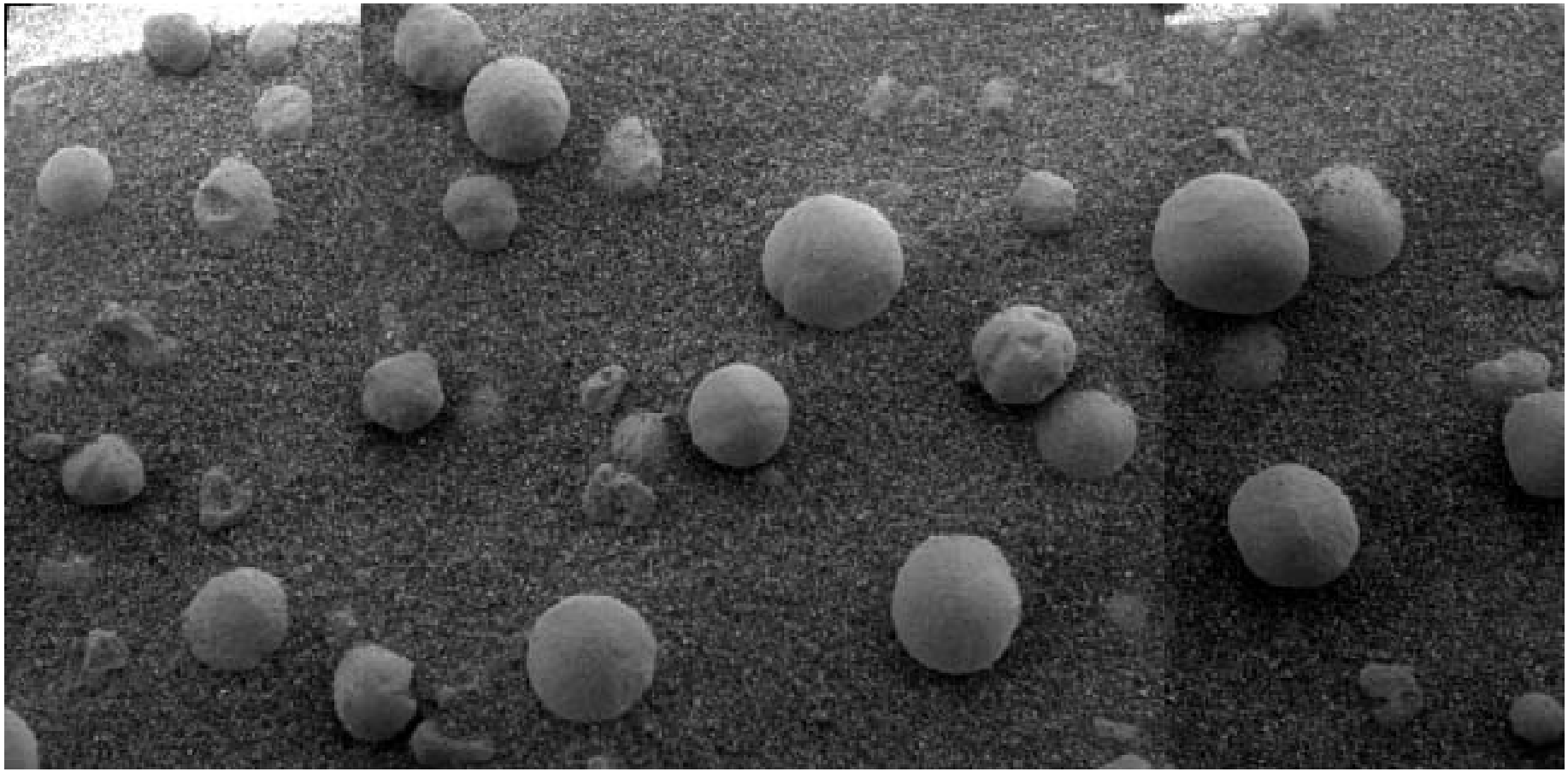
Mars “berries” in Meridiani Planum near Mars rover *Opportunity*



International recognition of JPL Mars Exploration Rover meeting Martians

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“Push it harder. Maybe it’ll go home.”

"Sure it can shoot, but can it play defense?"

Emergent Mars Exploration Rover skills

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Mars exploration in the President's vision

President Bush congratulates MER team on *Spirit* landing

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+ ROVER EVENTS ON NASA TV/WEBCAST
Subject to change

Jan. 8, 2004
+ Spirit rover briefing (9:00 am PST)

Jan. 9, 2004
+ Spirit rover briefing (12:00 pm PST)

Jan. 24, 2004 PST (Jan. 25 EST)
+ Opportunity rover lands on Mars

+ LATEST IMAGES FROM SPIRIT
(updated Jan 7, 9:30am PST)
+ Mars in 3-D
+ Airbag trails
+ Columbia memorial
+ All of latest images

President Commends Mars Exploration Rover Team

Jubilant faces filled a mission support conference room at NASA's Jet Propulsion Laboratory as President George W. Bush and NASA Administrator Sean O'Keefe called 8 a.m. Tuesday to congratulate the Mars Exploration Rover team. The president was highly complimentary of the team, calling their efforts a "reconfirmation of the American spirit of exploration." Team members said it meant a great deal to know the country was behind them on the mission. (Jan. 7)

Galileo's end of mission plunge into Jupiter's atmosphere on September 21, 2003

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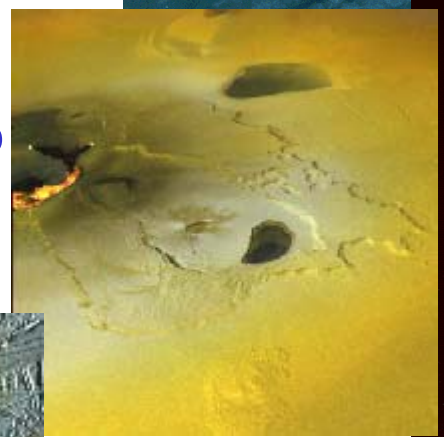
- Volcanic processes on Io
- Ice rafts on Europa's ocean
- Asteroids Gaspara and Ida
- Shoemaker-Levy collision
- Water layers on Ganymede and Callisto
- Magnetic field on Ganymede



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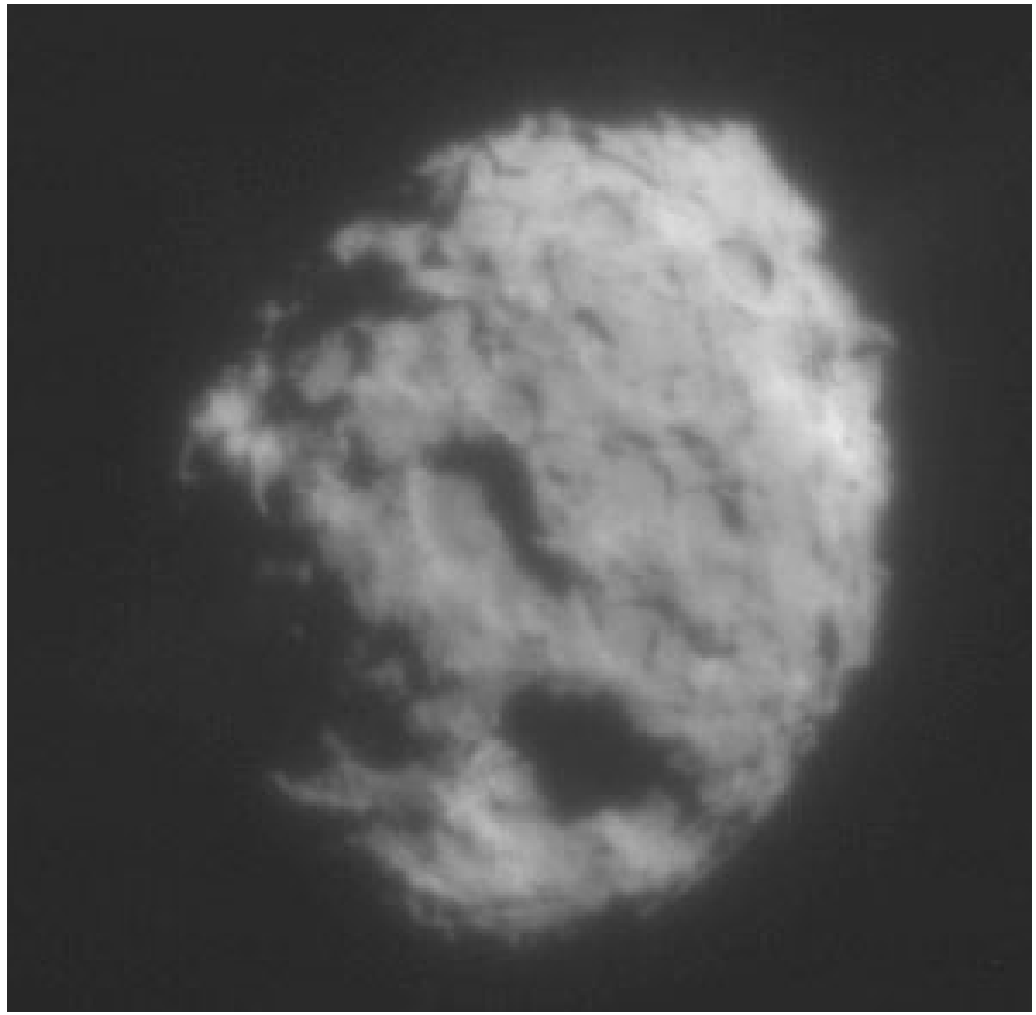
Successful Stardust encounter with comet Wild-2, January 2, 2004

- Discovery class mission.
- Launched February 1999.
- Three orbits of sun, traveling 2 billion miles.
- Flew through tail of comet Wild-2, 200 miles from nucleus.
- Return micrograms to milligrams of comet dust and interstellar dust to Earth in January 2006.



Studying other solar system bodies for possible life

- **A possible sub-surface ocean on Europa and other Galilean satellites**
  - **Jupiter Icy Moons Orbiter mission**
- **Studying Saturn's moon Titan for life-friendly conditions**
  - **Cassini Saturn orbiter and Huygens Titan probe launched 1997.**
  - **Cassini Arrives at Saturn July 1, 2004.**
  - **Cassini images Titan's surface October 2004.**
  - **Cassini orbiter drops Huygens probe into Titan's atmosphere January 14, 2005.**
- **Comets may have delivered carbon-based molecules and water to early Earth; Life's building blocks?**
  - **Stardust: Return first cometary material to Earth, and determine roles of comets in the evolution of Earth:**
    - **Comet Wild-2 flyby on January 2, 2004**
    - **Return sample on January 15, 2006**
  - **Deep Impact: Determine the differences between interior of comet nucleus and its surface**
    - **Impact on July 4, 2005**

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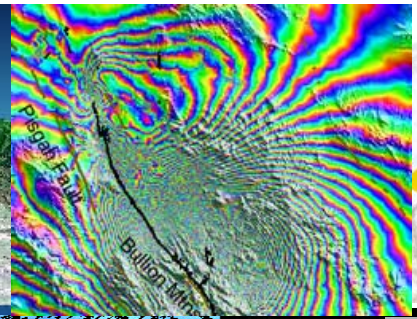
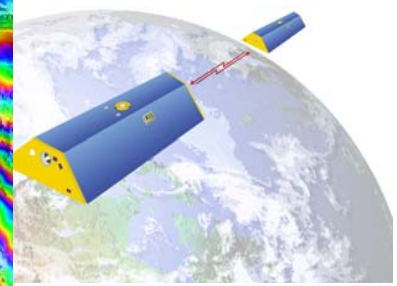
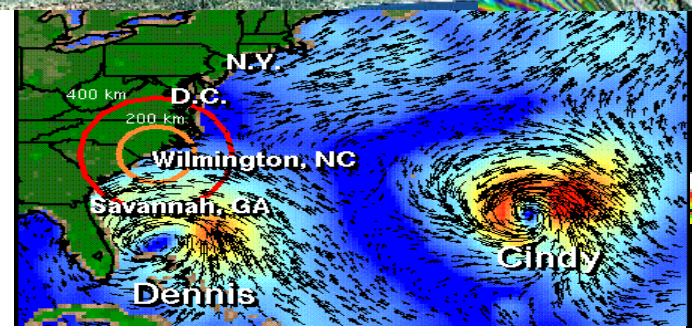
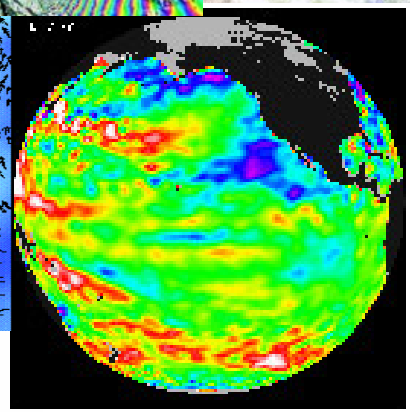
JPL global Earth monitoring missions

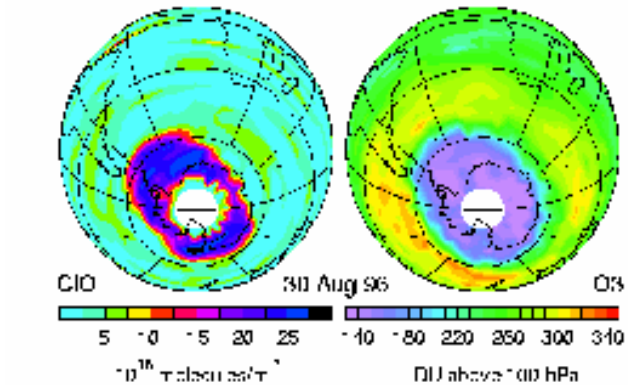
- **Solid Earth observation:**
  - **Plate motion**
  - **Gravity field**
  - **Topography**
- **Ocean circulation:**
  - **Wind field**
  - **Currents**
- **Atmospheric chemistry:**
  - **Stratosphere**
  - **Troposphere**











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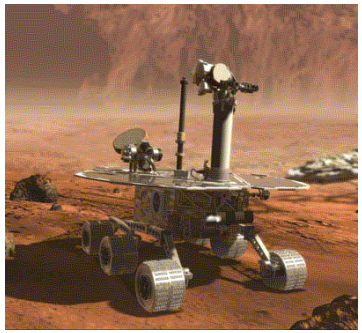
Technology and Engineering

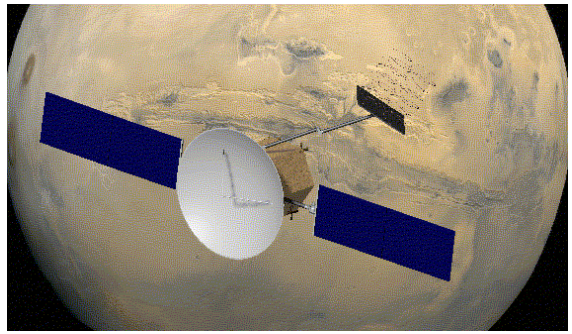
JPL is a world leader in key areas critical to deep space exploration

End-to-end system engineering and project management



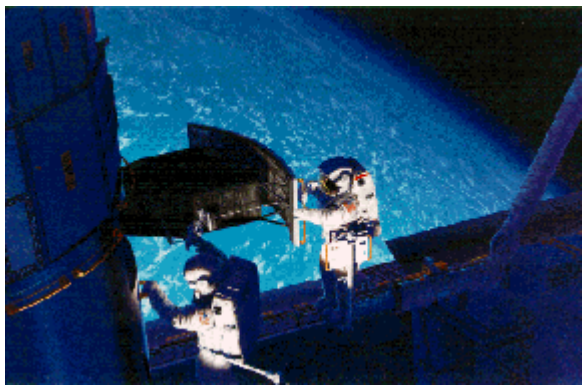
Autonomous mobility

Deep space communications

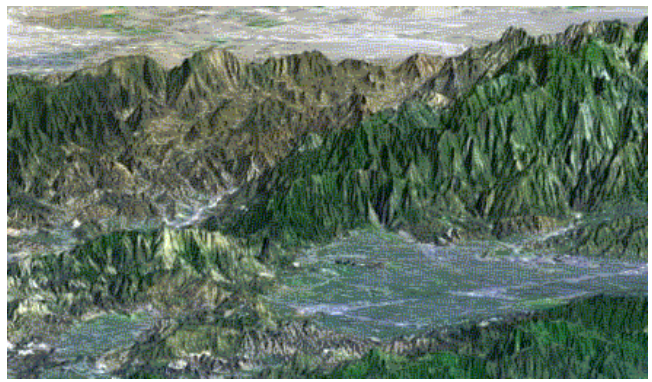


Deep space navigation and highly stable clocks

Extreme precision formation flying for science and rendezvous



High precision spaceborne systems in optical to sub-millimeter, including interferometry



Active sensors for mapping and positioning (SAR, altimeters, GPS)

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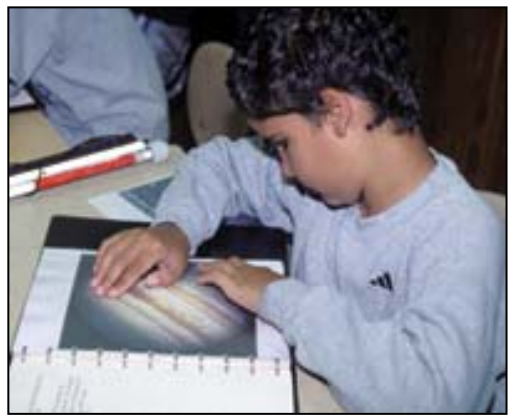
Jet Propulsion Laboratory
California Institute of Technology

Education and Public Outreach: Getting Results

Share the excitement with the public . . .

Voyage: A scale model solar system on the national capitol mall



Enhance the quality of education . . .

A Braille book of astronomy

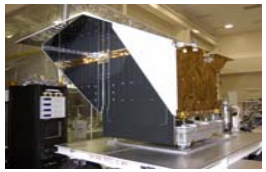
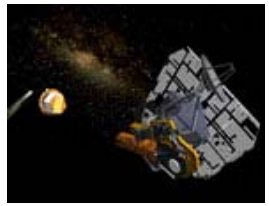
. . . Help create the 21st century workforce.

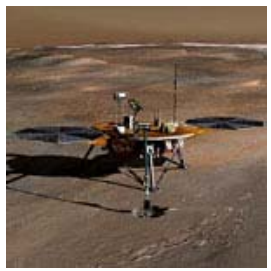
Space Science bachelor's degree program at CUNY

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

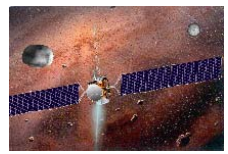
JPL missions and major instrument launches in the next decade

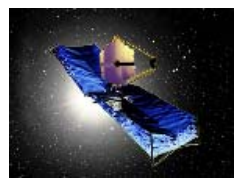
- MLS/TES on EOS-AURA (6/04)
- Deep Impact (12/04): comet material analysis
- Cloudsat (4/05): cloud monitoring
- Mars Reconnaissance Orbiter (MRO) (8/05)
- Actuated Hybrid Mirror/X-Sat with NRO (2/06)
- Dawn (5/06): study asteroids Ceres and Vesta
- ST7 Disturbance Reduction System(7/06)
- Herschel/Planck (4/07)
- Orbiting Carbon Observatory (8/07)
- Phoenix polar lander (9/07)
- Ocean Surface Topography Mission (10/07)
- Kepler (10/07): Extra-solar planet transits
- Primary Atomic Clocks in Space (PARCS)(1/08)



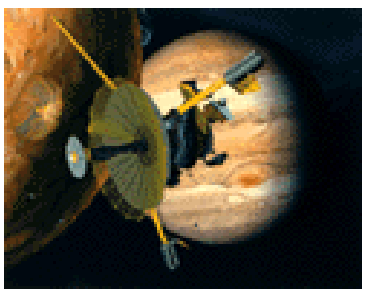
- Wide-field Infrared Explorer (WISE) (4/08)
- Aquarius (9/08): Ocean salt for heat transfer
- Mars Telesat (10/09)
- Mars Science Laboratory (MSL) (10/09)
- Space Interferometry Mission (SIM) (12/09)
- Hydros (09): Soil moisture
- Lunar lander (09)
- New Frontier I (09)
- Mars lander (11)
- Mid-infrared instrument (MIRI) on the James Webb Space Telescope payload (6/11)
- New Frontier II (12)
- Mars sample return (13)
- Jupiter Icy Moons Orbiter (13)
- Laser Interferometer Space Antenna (LISA) (13)
- Terrestrial Planet Finder (15)





“We Mean Business For Small Business”

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



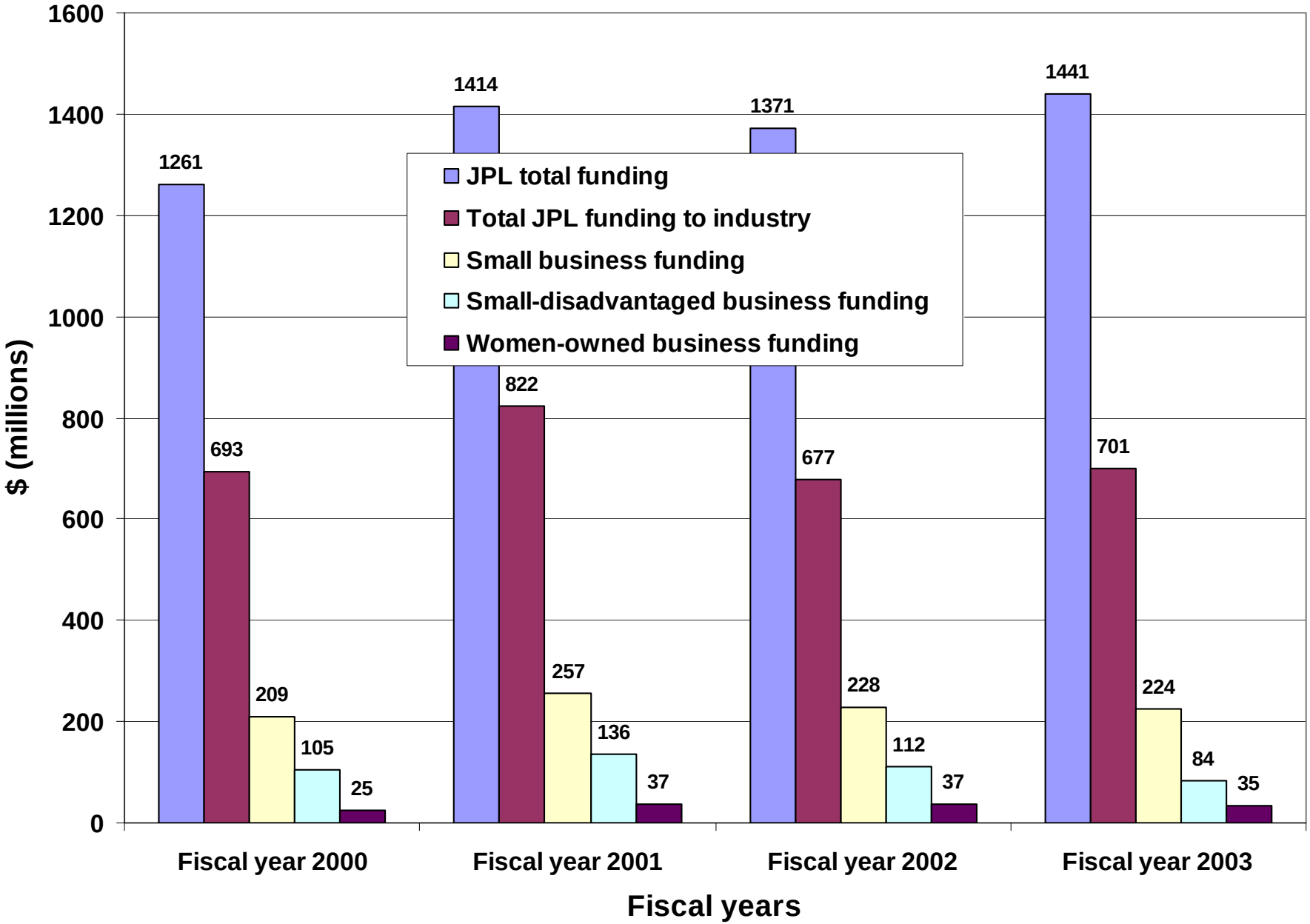
- ***The overall objective of the JPL Small Business Program is to ensure small businesses, small disadvantaged businesses, woman-owned businesses, HUBZone business and Historically Black Universities and Colleges have equitable opportunities to compete for subcontracts***

- ***Outreach is an important part of JPL’s small business program***
  - ***16 High-Tech Conferences***
  - ***8 Space Science Symposia***
  - ***6 Small Business Round Tables***
  - ***8 Science Forums***

- ***1995 - 2003 Awards to Small Businesses:***
  - ***Small Businesses: $2,277,000,000***
  - ***Small Disadvantaged Businesses: $872,000,000***
  - ***Women-owned Businesses: $258,000,000***

JPL funding categories

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



Proposing to JPL (or anyone else)

- Analyze the request for proposal (RFP)
  - Identify minimum, mandatory requirements.
  - Identify requirements that are hard for you to meet.
    - If you can't meet the minimum requirements, ***don't bid.***
  - Identify areas that offer you a competitive advantage.
  - Verify that you can meet the delivery schedule.
  - Understand the evaluation factors and their relative importance:
    - Technical
    - Management
    - Cost or price
    - Financial capability
    - Past performance

Proposal preparation

- Review proposal instructions ***carefully.***
- Identify critical requirements and brainstorm cost-effective solutions.
- Decide whether to bid.
- Establish a proposal team:
  - Accountable leader
  - Specialists for evaluation factors and compliance topics
- Create a "compliance matrix" listing every requirement in statement of work and specification. Assess your ability to meet every one.
- Create a proposal theme: e.g.; "high reliability," or "innovative."
- Format the proposal to match the proposal instructions.
- Respond to every instruction and requirement.
- Support your assertions.
- Ask questions, but only of contracting officer/negotiator.
- Consult legal counsel if RFP restricts competition.

How to lose a competition

- **Fail to understand what the customer wants**
- **Take exception to requirements, or fail to comply with the requirements. You *must* have:**
  - **Best *cost/price*, or**
  - **Best *value* with a reasonable price.**
- **Fail to provide all requested information.**
- **Fail to substantiate you assertions.**
- **Put responses where evaluators can't find them.**
- **Unrealistic schedules, pricing or technological advances.**
- **Deliver proposal late.**

Connecting with the JPL Business Opportunities Office

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

- ***The JPL Business Opportunities Office is responsible for:***
  - ***Small Business Programs***
  - ***Small Disadvantaged Business Programs***
  - ***Woman-Owned Business Programs***
  - ***Historically Black Colleges and Universities Programs***
  - ***HUBZone Businesses Programs***

Tom May
Manager
(818) 354-2121

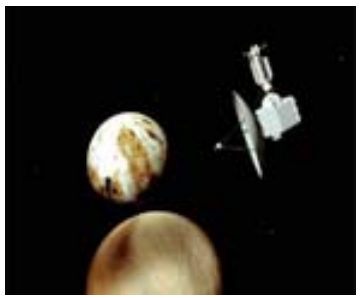
- ***JPL uses the Small Business Administration's (SBA) internet database, PRONet, to identify small businesses***
  - ***http://pro-net.sba.gov***

How to contact JPL

- Jet Propulsion Laboratory
  - Phone: (818) 354-4321

- Business Opportunities Office
  - Thomas May, Manager (818) 354-2121
    thomas.h.may@jpl.nasa.gov
  - Art Duran (818) 354-7531
    arthur.a.duran@jpl.nasa.gov
  - Margo Kuhn (818) 354-5722
    margo.p.kuhn@jpl.nasa.gov
  - Martin Ramirez (818) 354-6093
    martin.m.ramirez@jpl.nasa.gov
  - Mary Helen Ruiz (818) 354-7532
    maryhelen.ruiz@jpl.nasa.gov

Getting to Know the NASA and JPL Families Better



- ***Find out more about NASA and JPL, and their wide range of missions and discoveries***

  Jet Propulsion Laboratory
  http://www.jpl.nasa.gov

  JPL Acquisition Division
  http://acquisition.jpl.nasa.gov/default.htm

  JPL Business Opportunities Office
  http://acquisition.jpl.nasa.gov/boo

  NASA
  http://www.nasa.gov

  Small Business Administration
  http://www.sbaonline.sba.gov