8TH BRIEFING FOR INDUSTRY

JPL Status and Plans

Gen. Eugene Tattini, Deputy Director

Deputy Director

Jet Propulsion Laboratory
California Institute of Technology

Explore the Possibilities

JPL status and plans
for
Industry Day 2006
April 18, 2006

Gen. Eugene Tattini, Deputy Director

Jet Propulsion Laboratory

California Institute of Technology

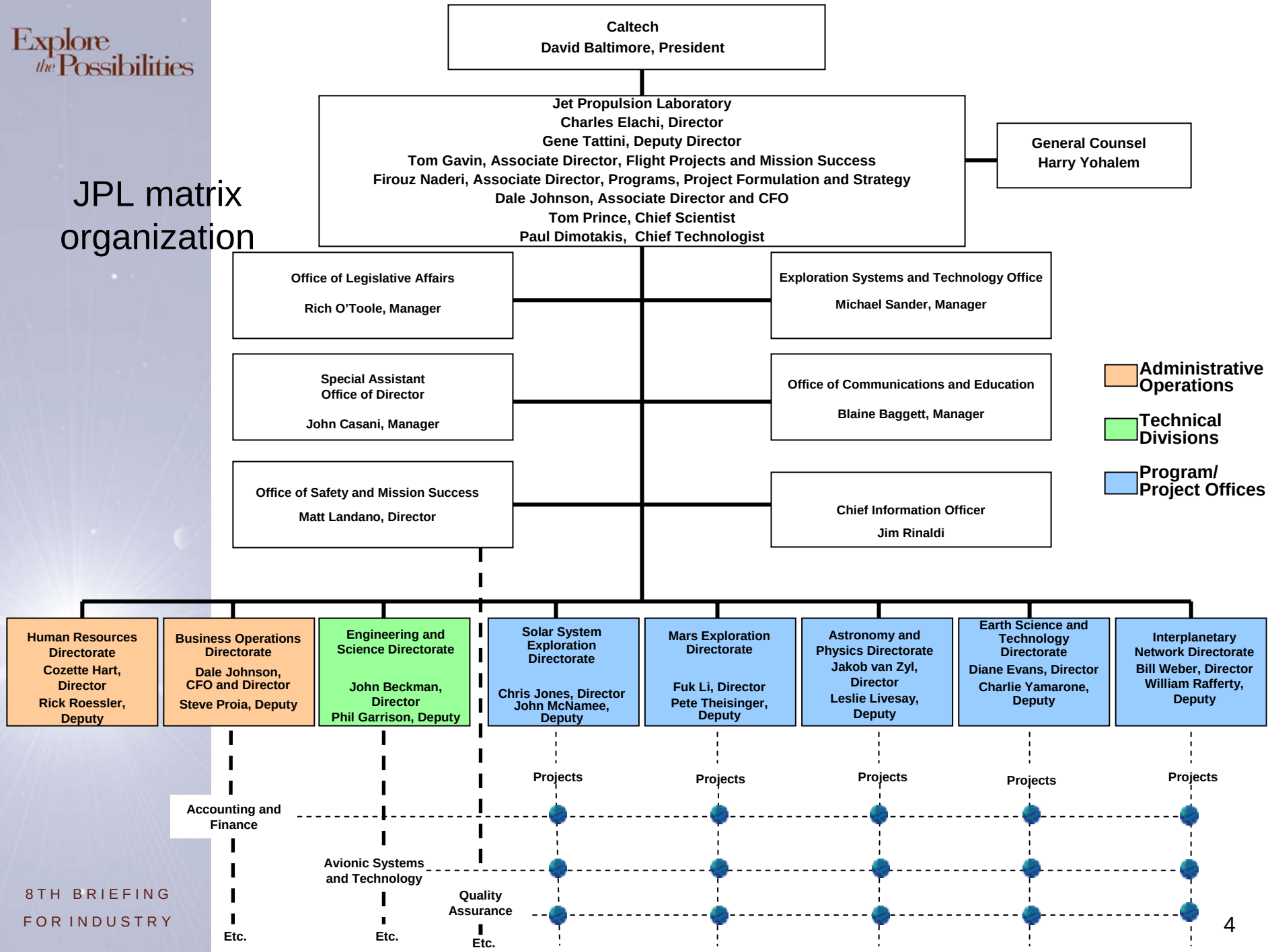
Explore the Possibilities

JPL is part of NASA and Caltech

- Federally (NASA)-owned “Federally-Funded Research and Development Center” (FFRDC)
- University (Caltech)-operated
- $1.5 billion business base
- 5000 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)

Explore the Possibilities

JPL matrix organization

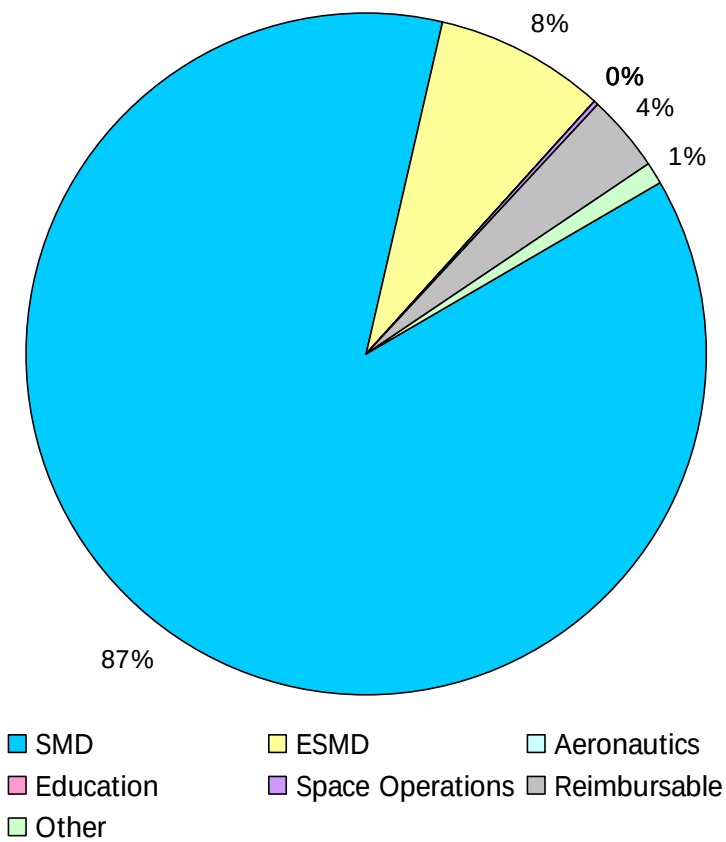


Explore the Possibilities

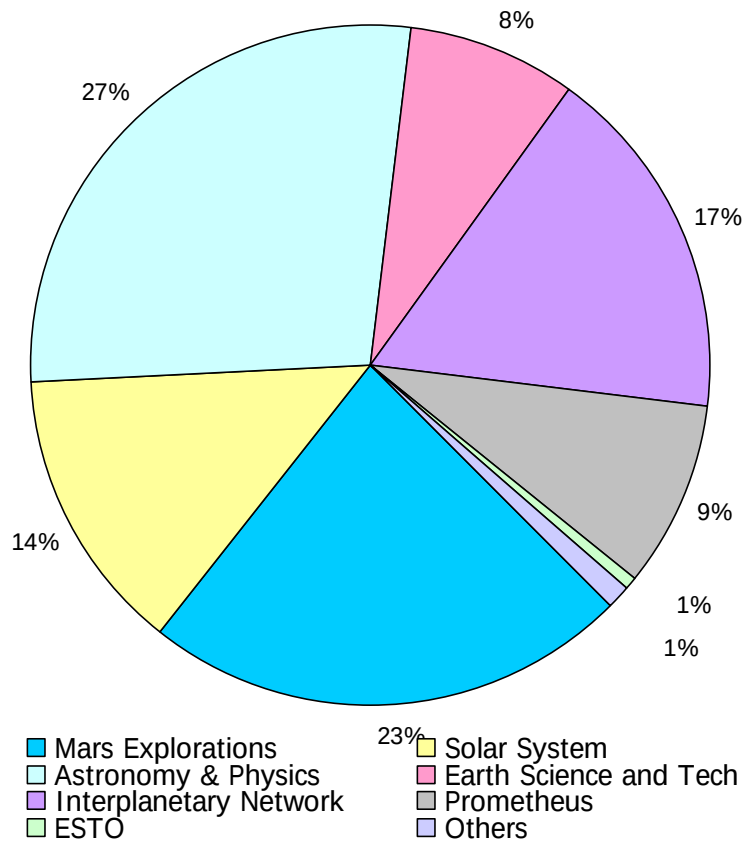
JPL funding distribution for FY05

$1.675 billion business base

By NASA Office or Other Sponsor



By Implementing JPL Directorates



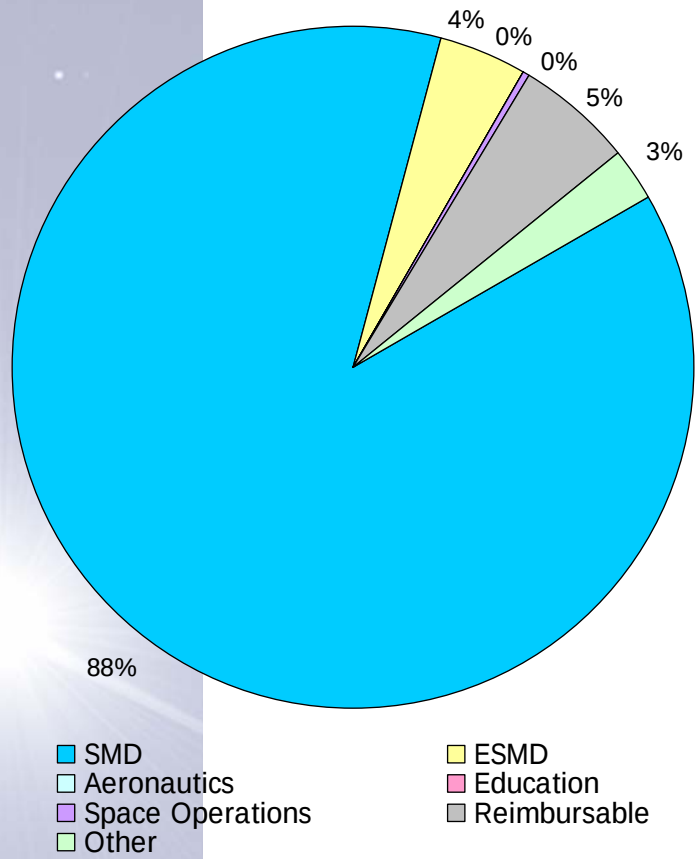
Percentages based on actual funding received through February 2005

Explore the Possibilities

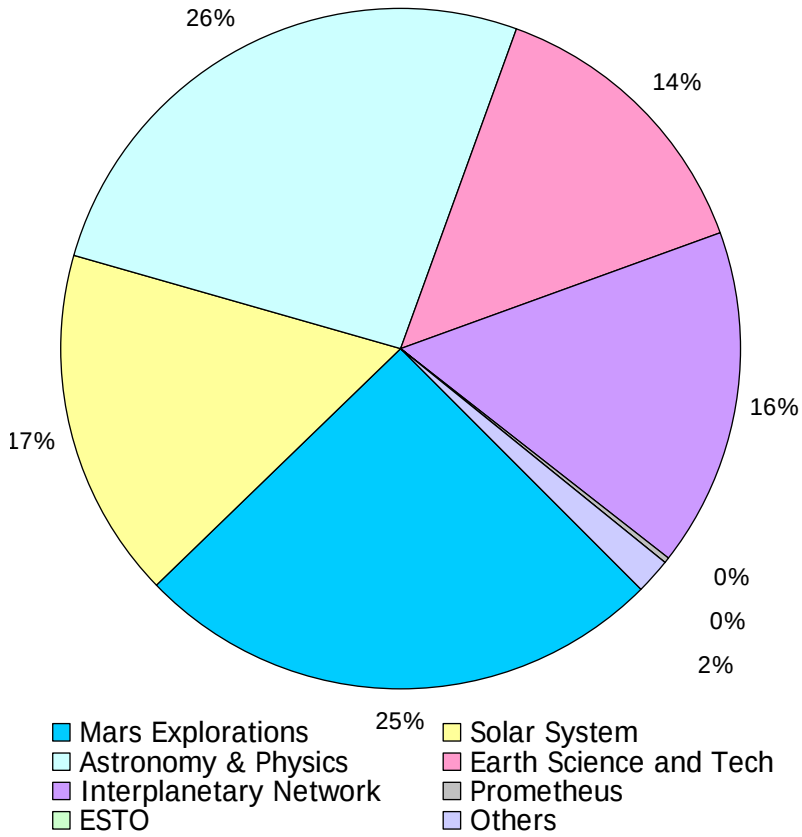
JPL funding distribution for FY06

$1.550 billion business base

By NASA Office or Other Sponsor



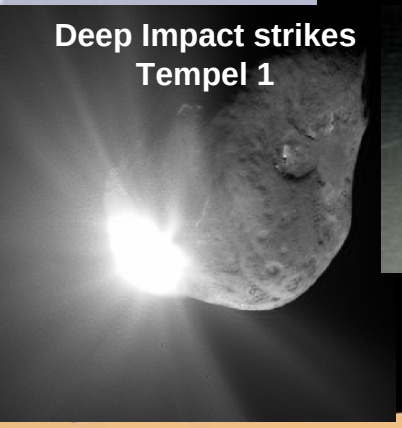
By Implementing JPL Directorates



Percentages based on actual funding received through February 2006

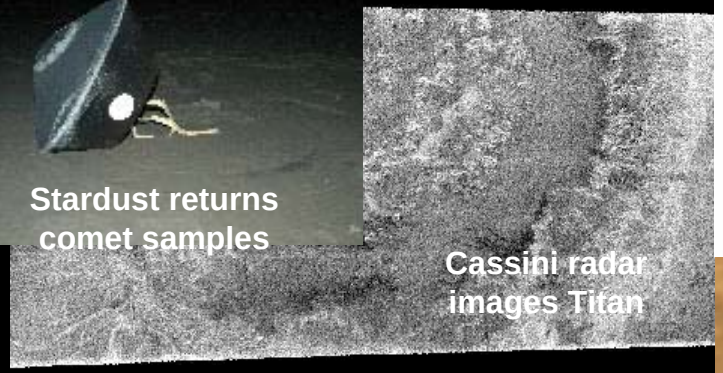
Explore the Possibilities

Recent accomplishments

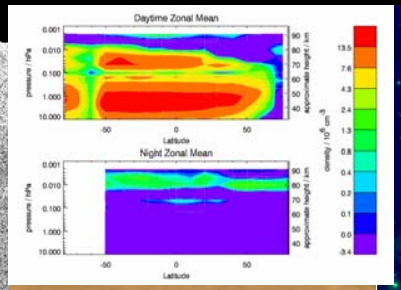


Deep Impact strikes Tempel 1

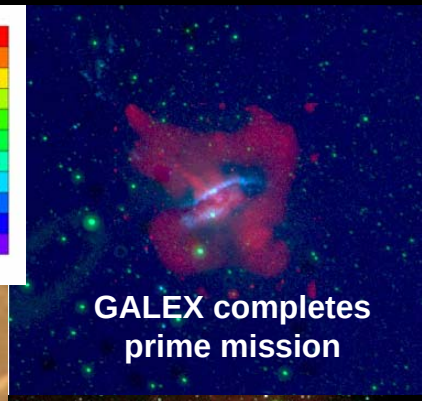
Stardust returns comet samples



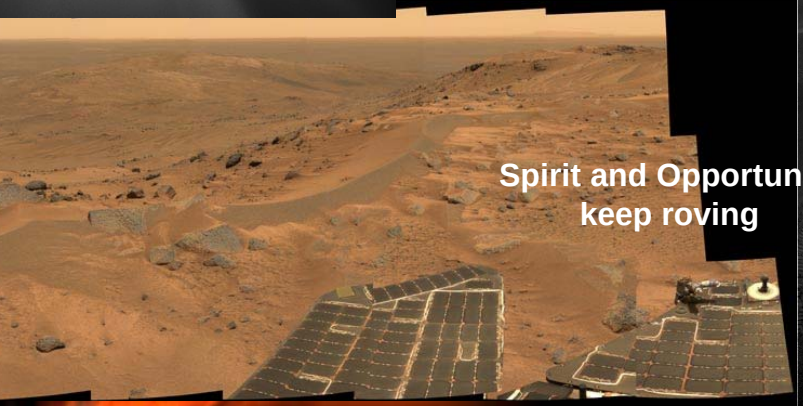
Cassini radar images Titan



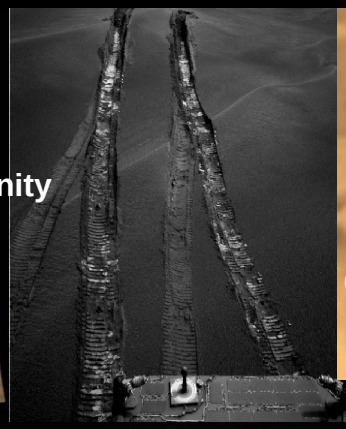
MLS monitors stratospheric compounds



GALEX completes prime mission



Spirit and Opportunity keep roving

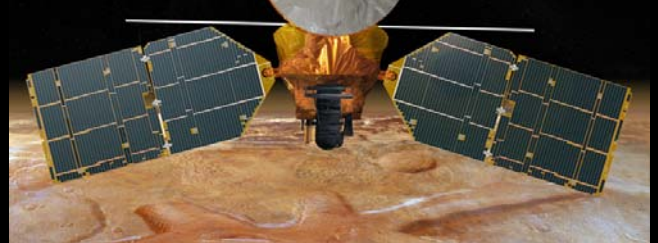


Cassini carries Huygens Titan lander

Spitzer spies early hydrocarbons

Voyager senses heliosheath

Mars Reconnaissance Orbiter in orbit around Mars

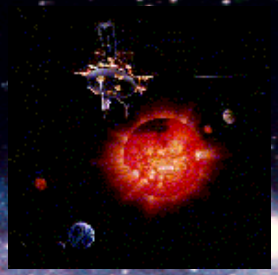


Cloudsat prepares to launch

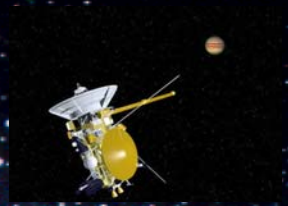
Explore the Possibilities

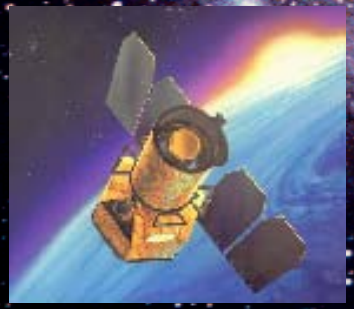
Seventeen spacecraft and five instruments across the solar system (and beyond).

Spitzer studying stars and galaxies in the infrared

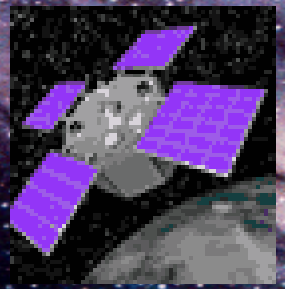


Cassini studying Saturn

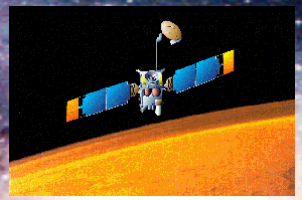




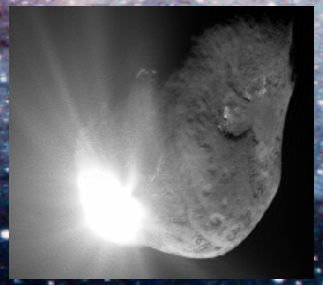
GALEX surveying galaxies in the ultraviolet



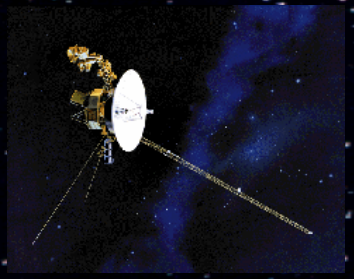
Ulysses and ACRIMSAT studying the sun



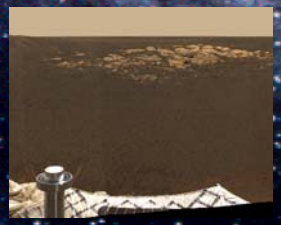
Stardust carrier continuing after sample return



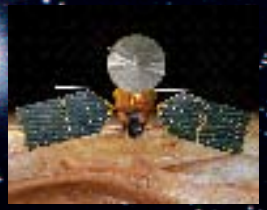
Deep Impact carrier continuing after hitting comet Tempel 1



Two Voyagers on an interstellar mission



QuikScat, Jason 1, and GRACE (plus ASTER, MISR, AIRS, MLS and TES instruments) monitoring Earth.

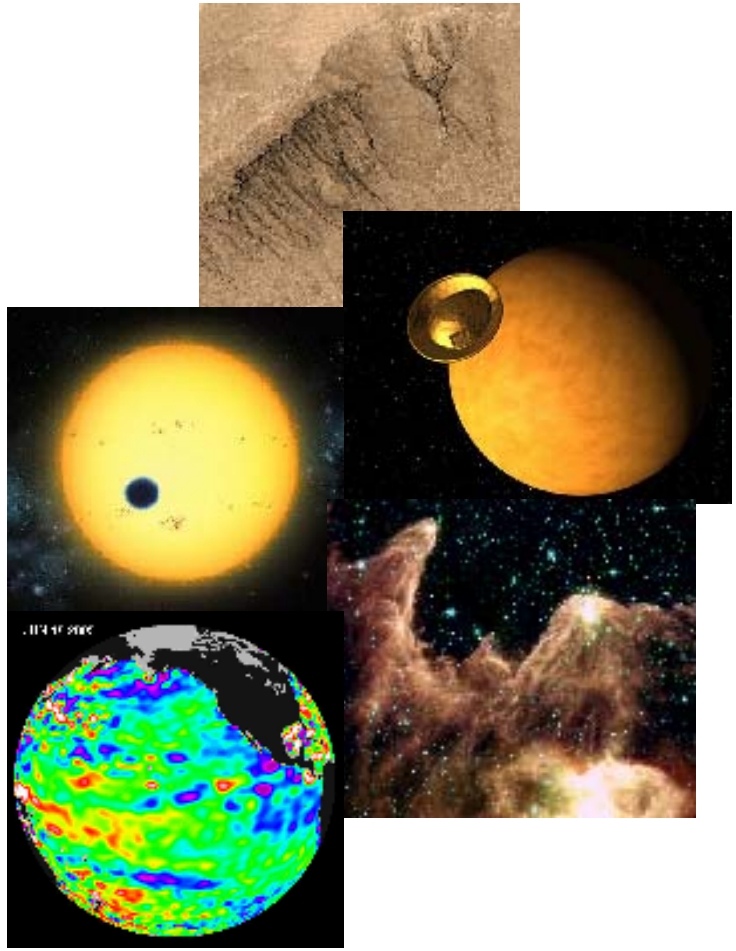


Mars Global Surveyor, Mars Odyssey, and MRO in orbit around Mars. "Spirit" and "Opportunity" in extended missions.

Explore the Possibilities

Realizing the potential of Space Science in five themes

1. **Mars exploration: Follow the water**
2. **Life-friendly sites in the solar system**
3. **Extra-solar planets**
4. **Origins of galaxies and the universe**
5. **Our home planet, Earth**



Explore the Possibilities

Mars Exploration Rovers in “eighth lifetime”

- *Spirit* finding water-altered rocks in Gusev crater

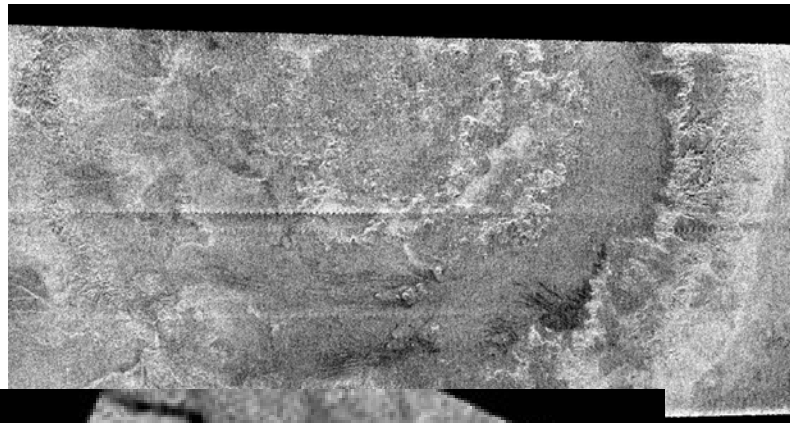
Dust devils as seen by *Spirit*, and *Spirit* surface before and after a “cleaning” event

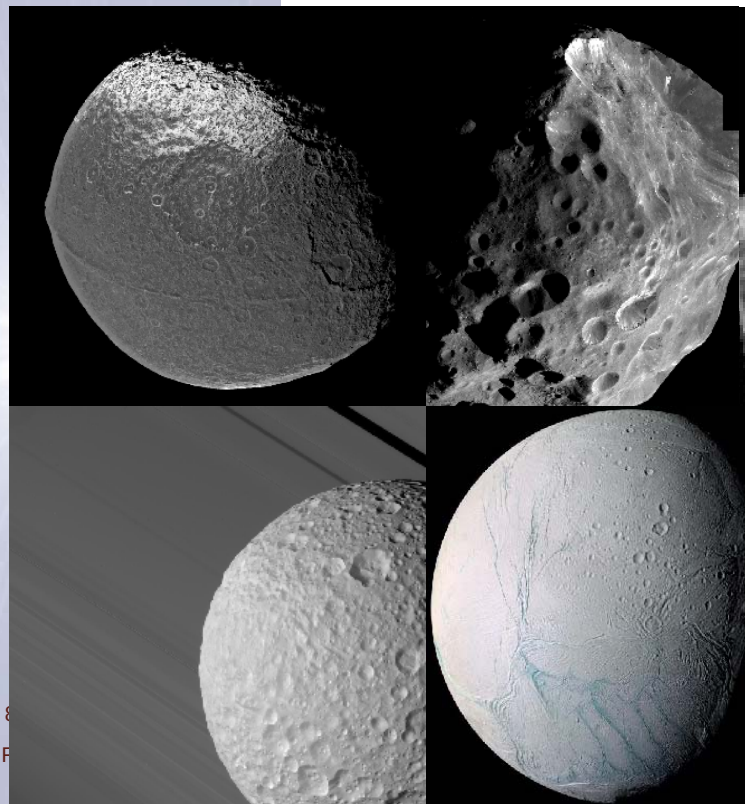
- *Opportunity* studying bedrock in Meridiani Planum after freeing itself from sand trap.

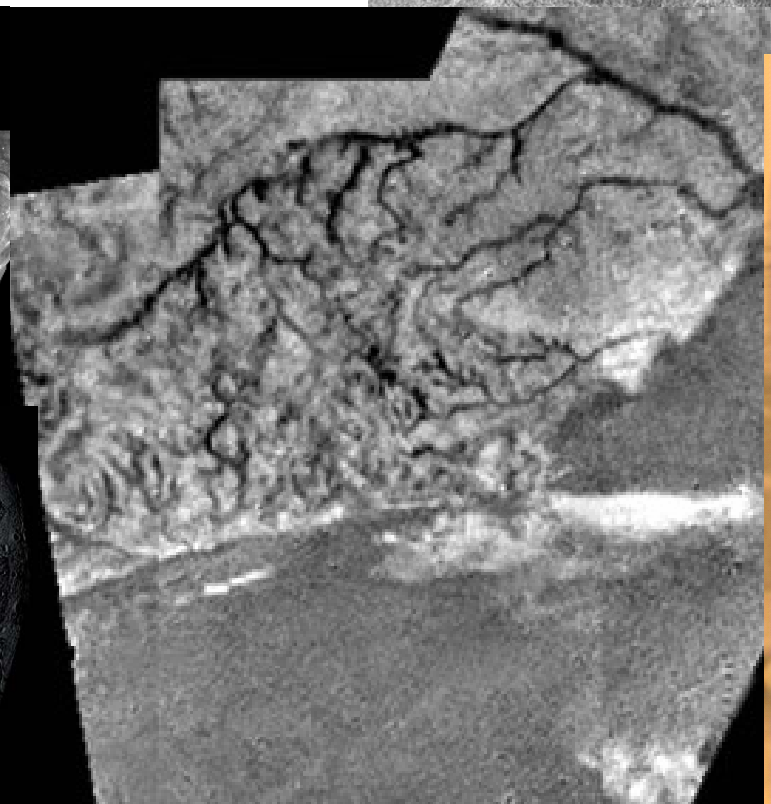
Explore the Possibilities

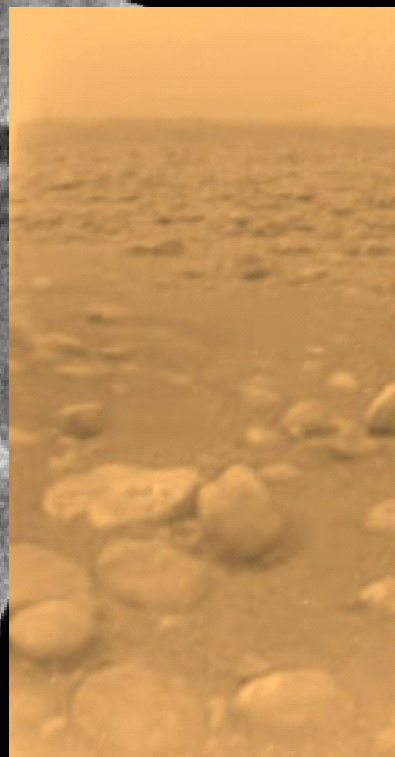
Cassini

- Carried Huygens, and communicated with it during Titan landing.
- Studying Titan with radar and multispectral imaging.
- Studying Saturn and its moons until 2008 and beyond.
- 12 targeted flybys of Saturn's moons in FY05







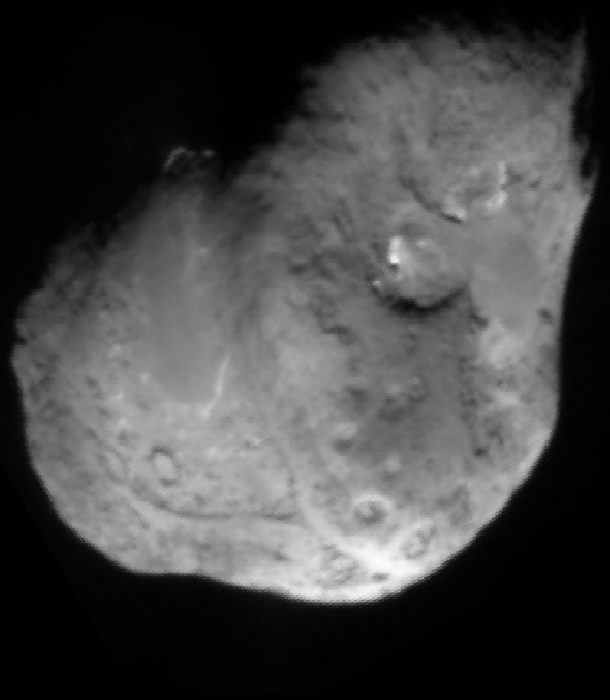


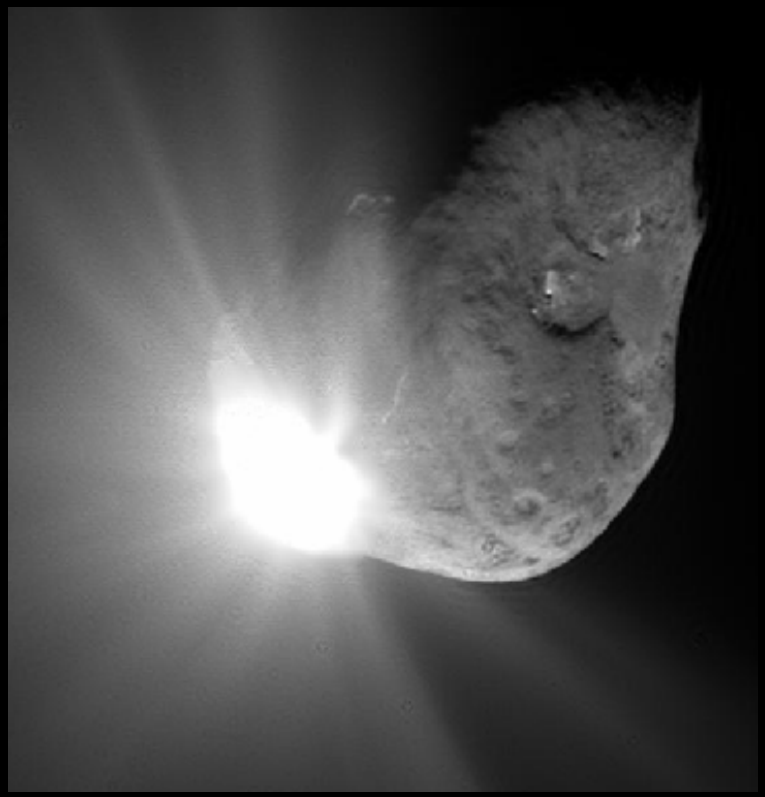
Science recognizes Cassini's recent results

Explore the Possibilities

Ouch!

Comet Tempel 1 before and after Deep Impact



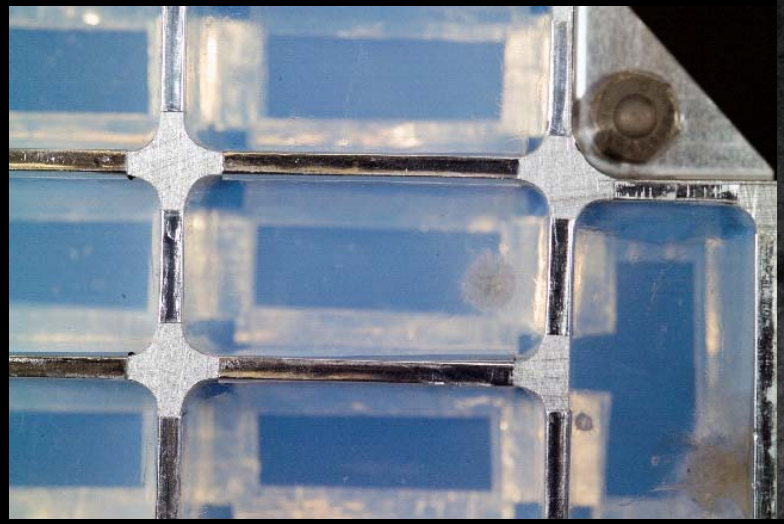


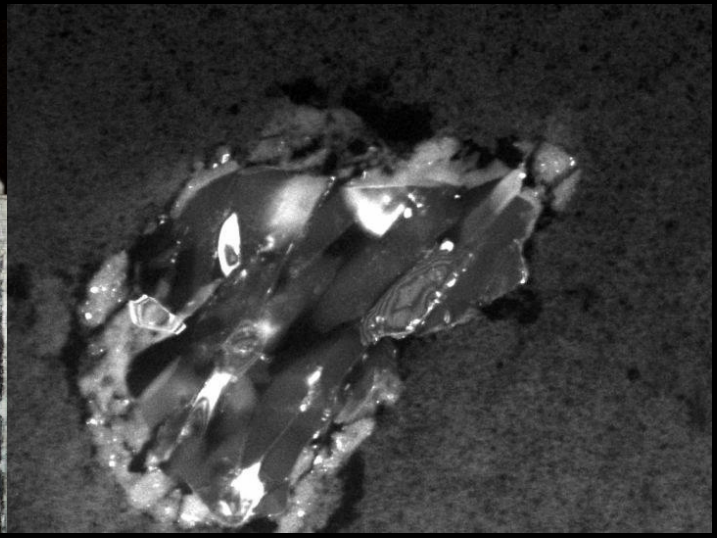
Explore the Possibilities

Stardust returns

Explore the Possibilities

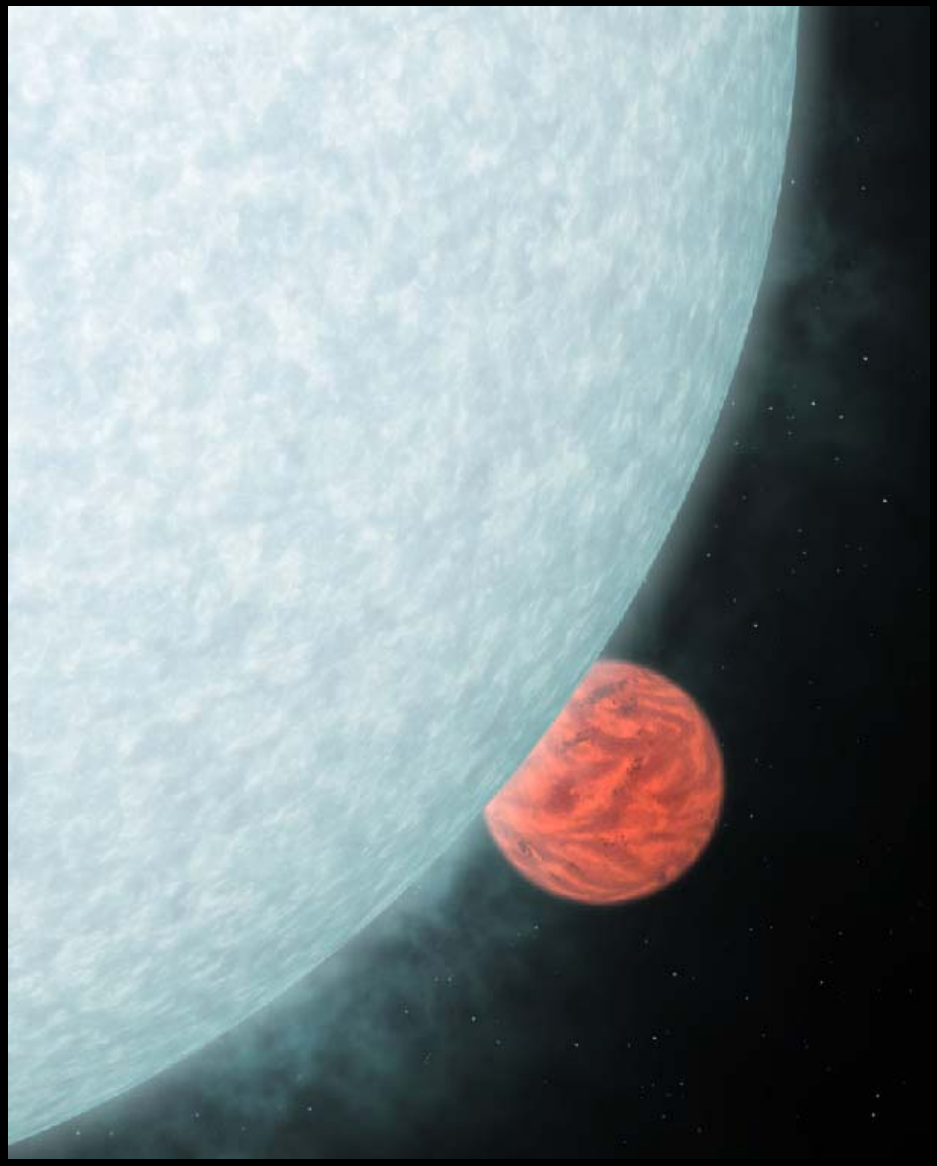
Comet particle in aerojel, and 2 micron particle extracted from aerojel





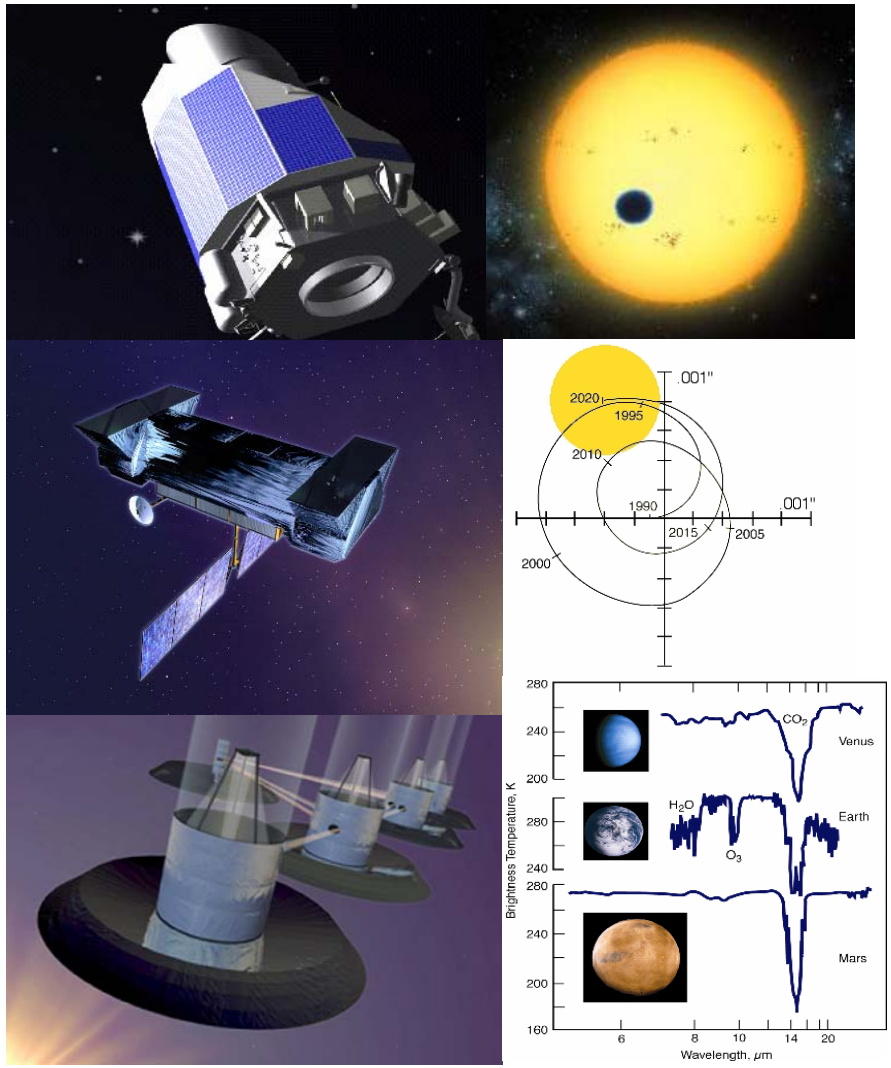
Explore the Possibilities

Studying extra-solar planets with Spitzer Space Telescope



8TH BRIEFING FOR INDUSTRY

Future exploration of extrasolar planetary systems



- Kepler Discovery mission in 2008 to observe transits of Earth-sized planets across stars.
- Space Interferometry Mission (SIM), to launch in 2015, performs astrometry of extra-solar planets.
- Terrestrial Planet Finder (TPF), to launch in 2015-2020, performs spectroscopy of extra-solar planets.

Explore the Possibilities

Spitzer sees center of our Milky Way galaxy

The Center of the Milky Way Galaxy

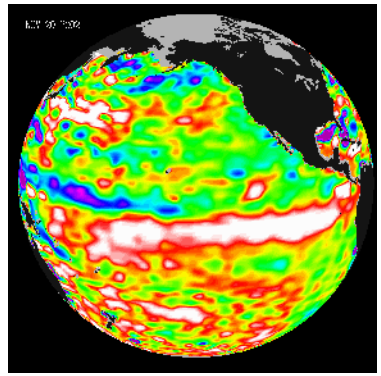
NASA / JPL-Caltech / S. Stolovy (Spitzer Science Center/Caltech)

Spitzer Space Telescope • IRAC

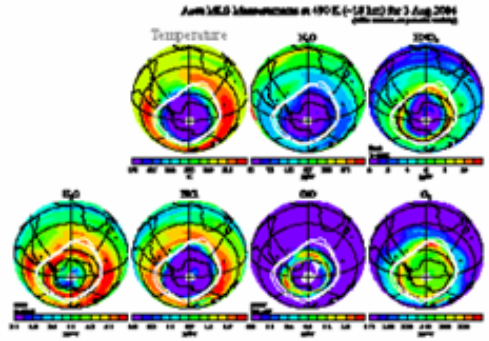
ssc2006-02a

Examples of NASA/JPL spacecraft improving life on our own planet

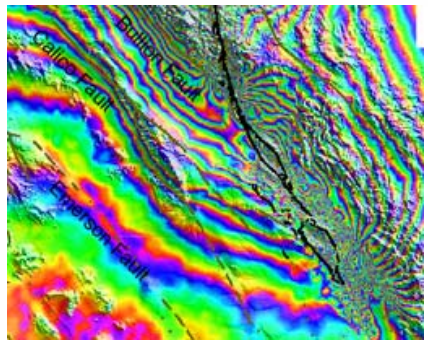
- Ocean studies support long-term weather prediction.



- Atmospheric ozone studies monitor human-caused pollution.



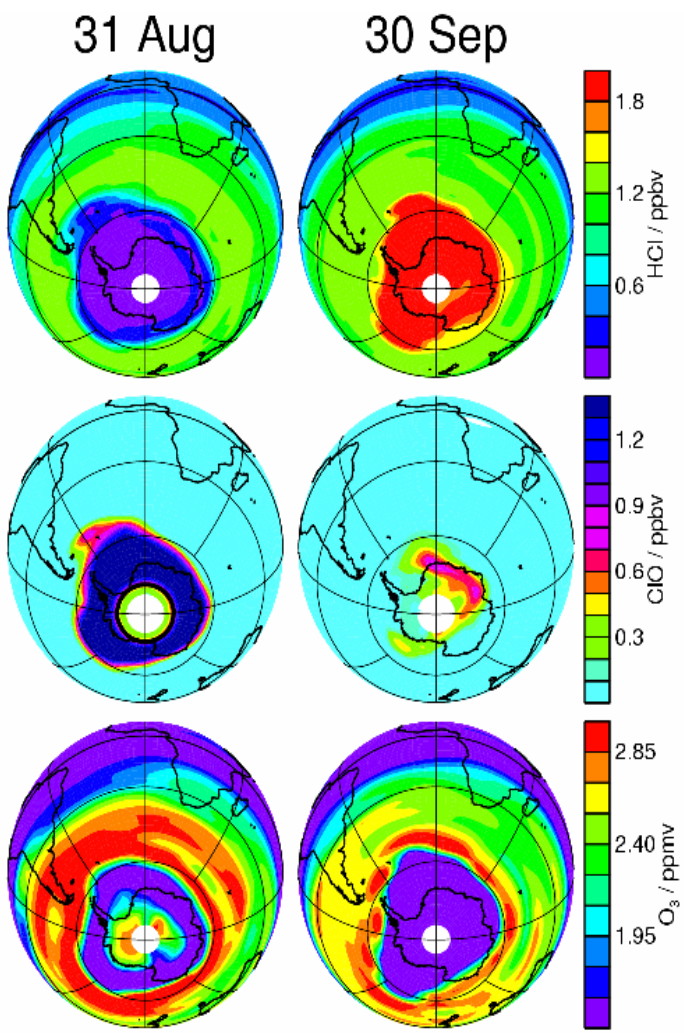
- Solid Earth studies will aid in future earthquake prediction.

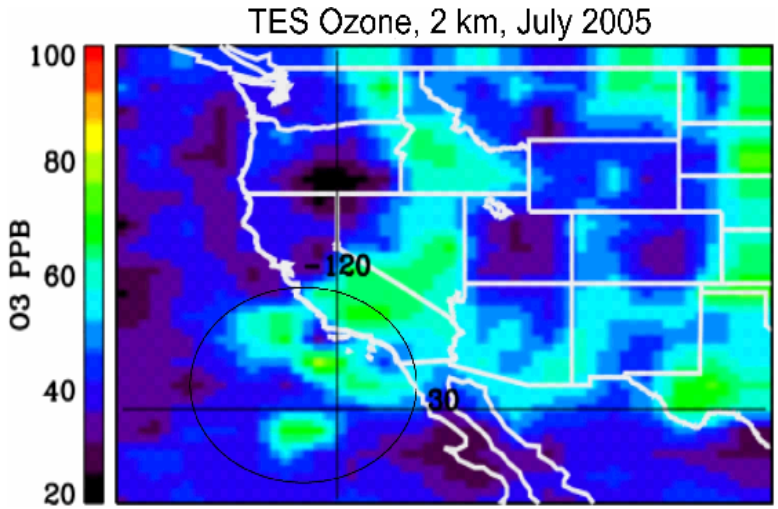


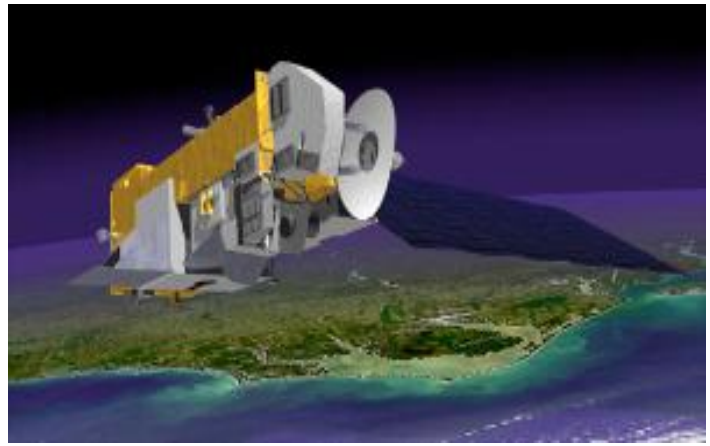
Explore the Possibilities

MLS and TES on Aura: Monitoring stratospheric and surface ozone

The 2005 Antarctic ozone hole

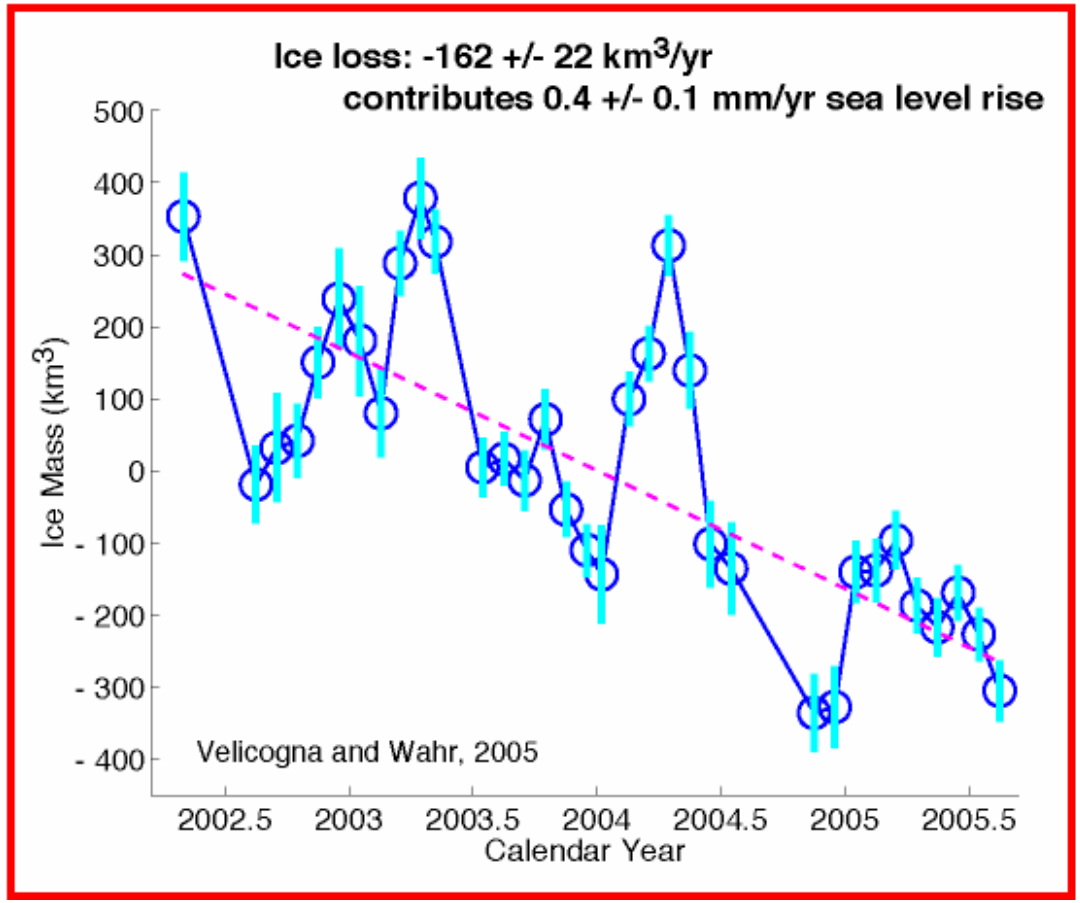




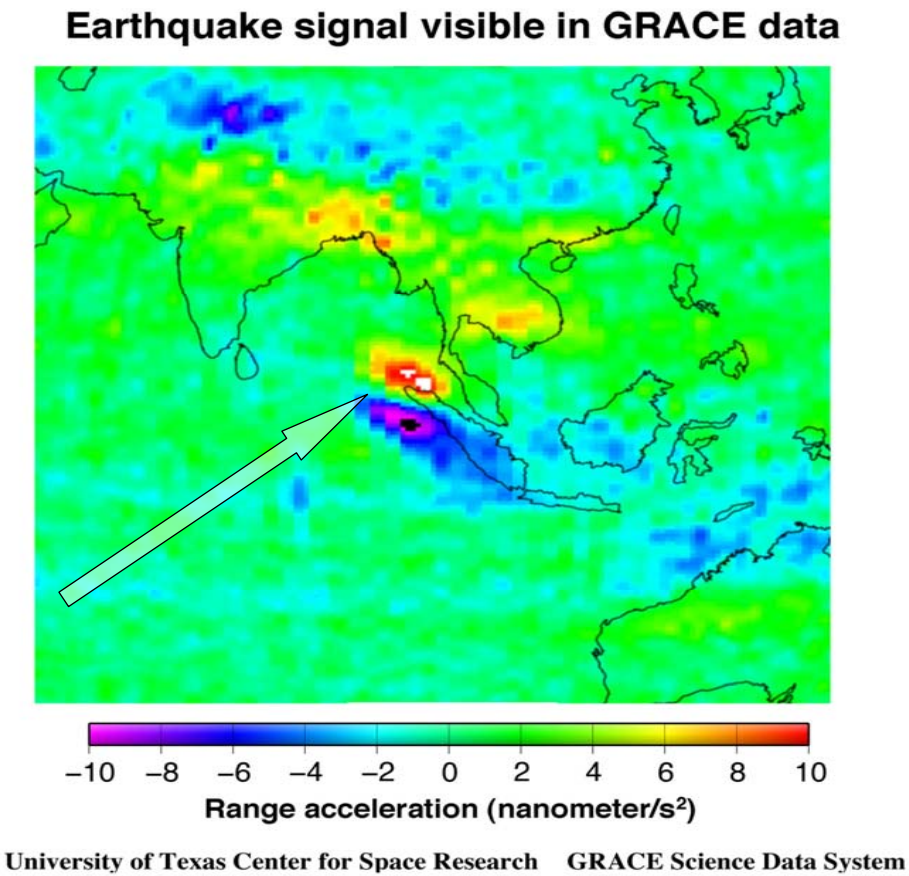


Greenland mass loss from GRACE: An update

- GRACE measurements show mass loss in Greenland



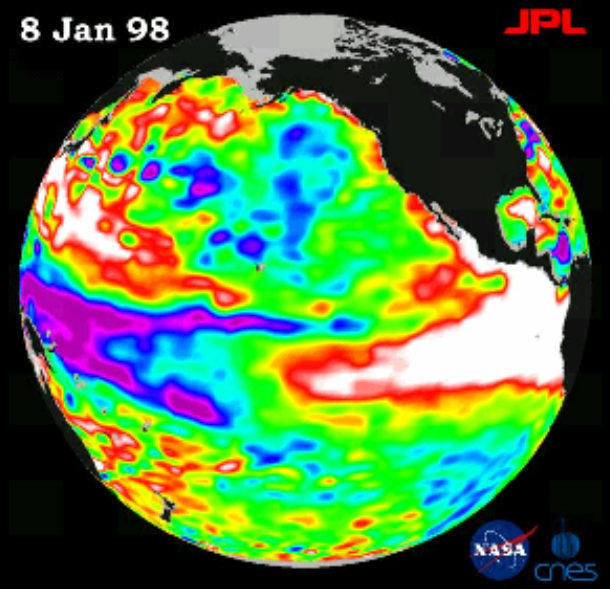
GRACE samples Sumatra earthquake impact

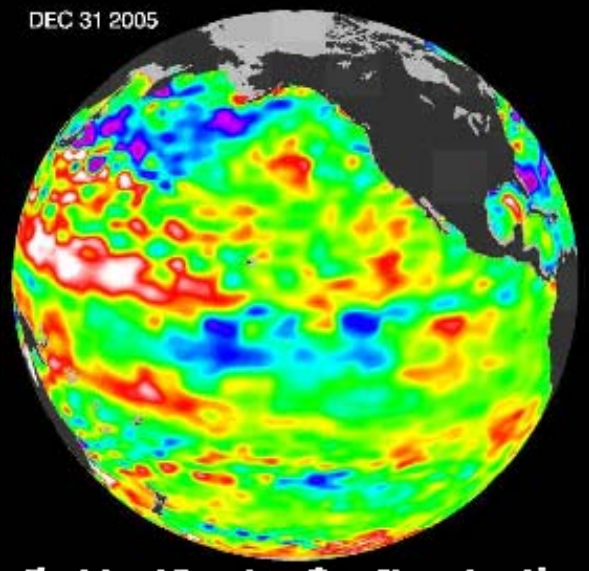


Effect of December 2004 great Sumatra earthquake on the Earth's gravity field as observed by GRACE. The signal is expressed in terms of the relative acceleration of the two GRACE satellites, in this case a few nanometers per second squared, or about 1 billionth of the acceleration we experience everyday at the Earth's surface.

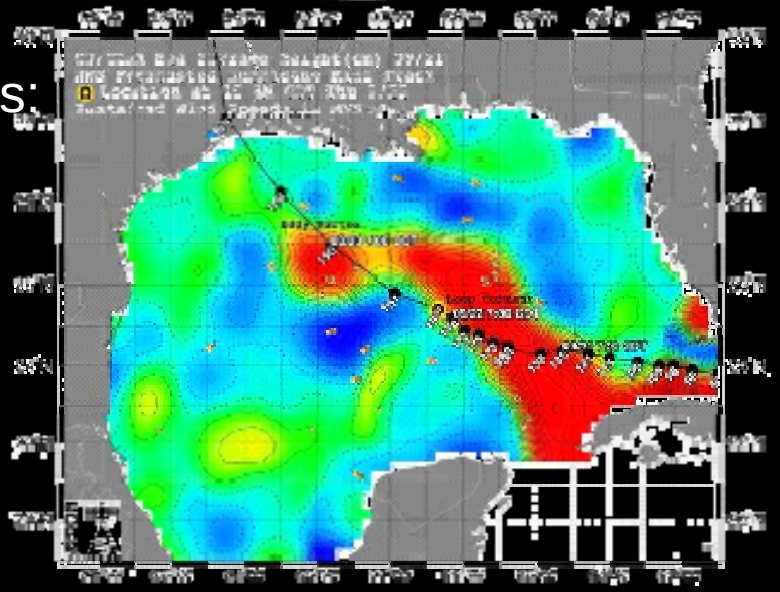
Explore the Possibilities

Topex/Poseidon: A job well done for 13 years





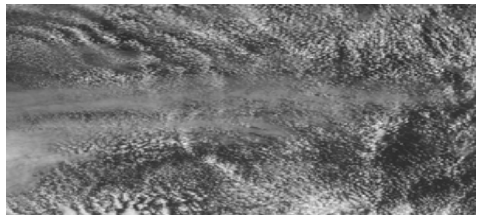
- Monitoring the Earth's oceans:
  - El Niño
  - La Niña
  - Hurricanes

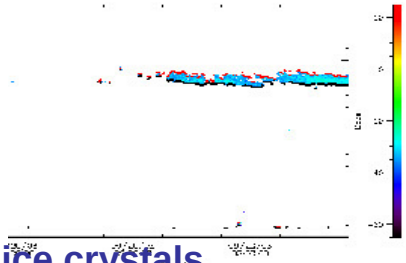


Explore the Possibilities

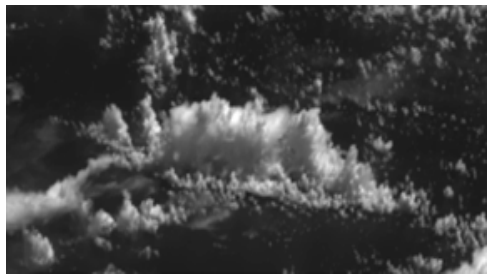
CloudSAT is ready for launch

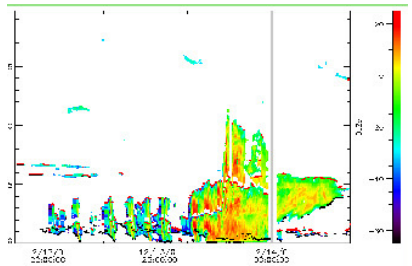
What we see | **What MISR sees (slant view)** | **What CloudSat sees**



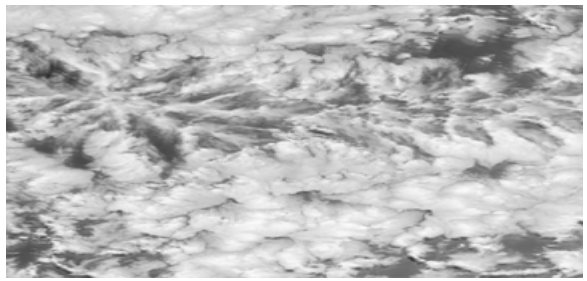


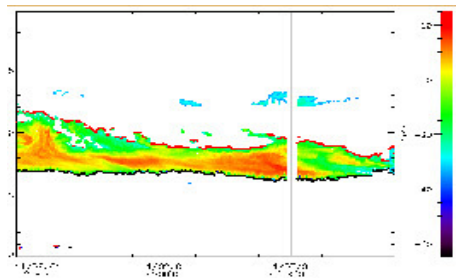
High level (6,000 meters) cirrus clouds are composed of ice crystals.





Vertically developed cumulonimbus clouds grow to heights in excess of 12,000 meters, and are a mixture of water droplets and ice crystals.

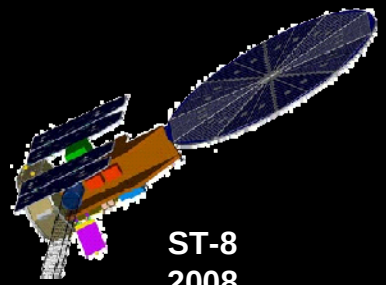


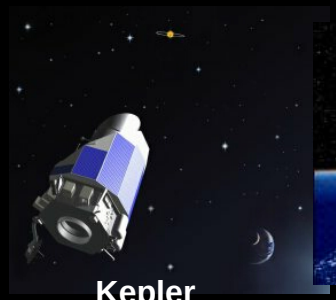


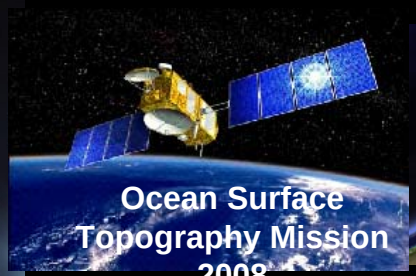
Low-level—2,000 meters—stratus clouds can be accompanied by light to moderate precipitation.

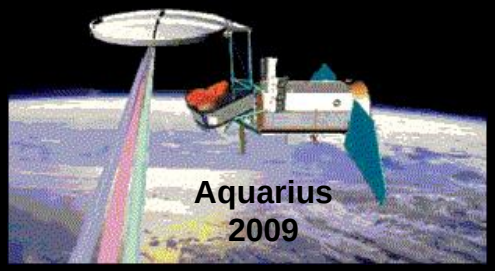
Explore the Possibilities

Looking Ahead : Missions under development



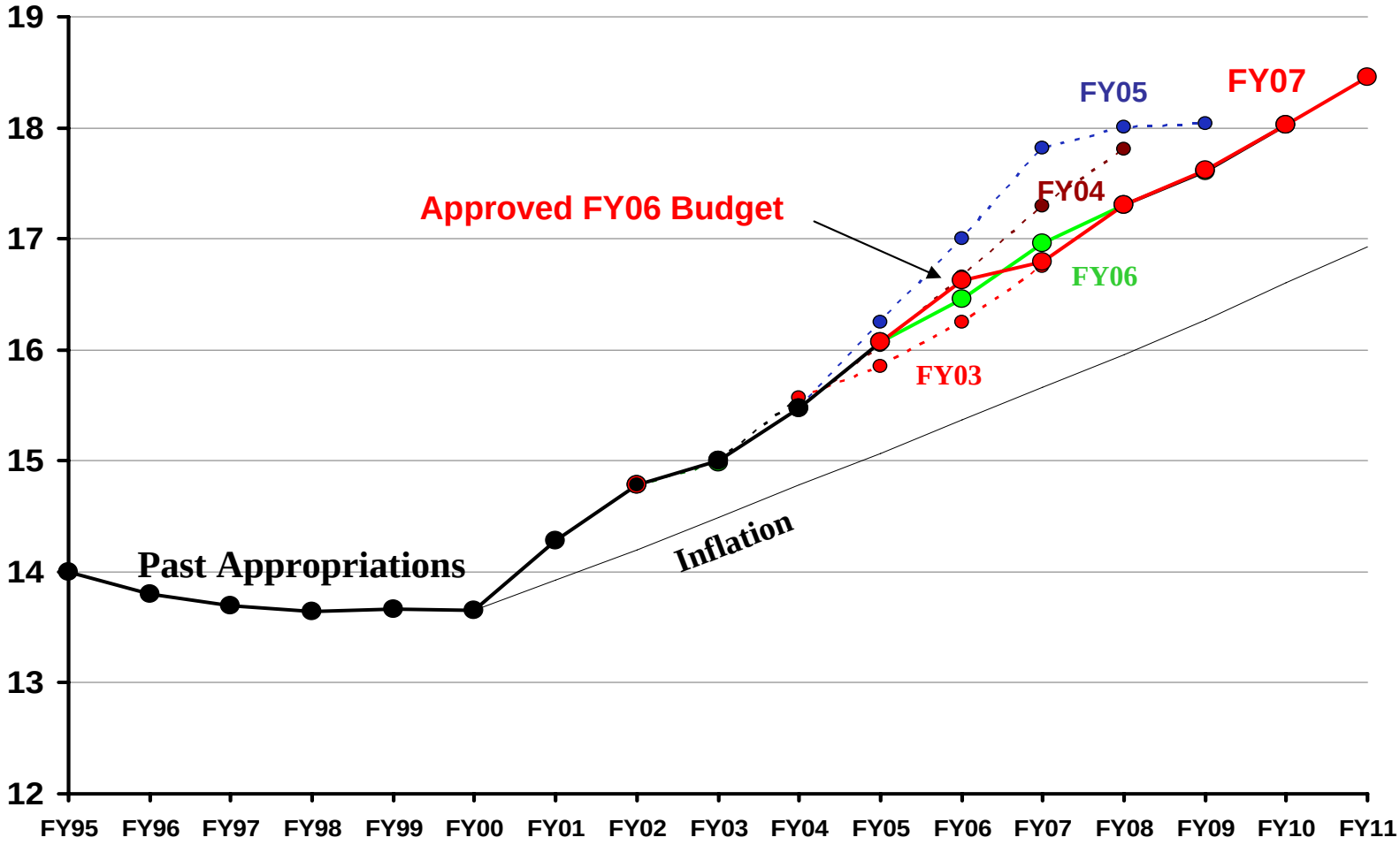






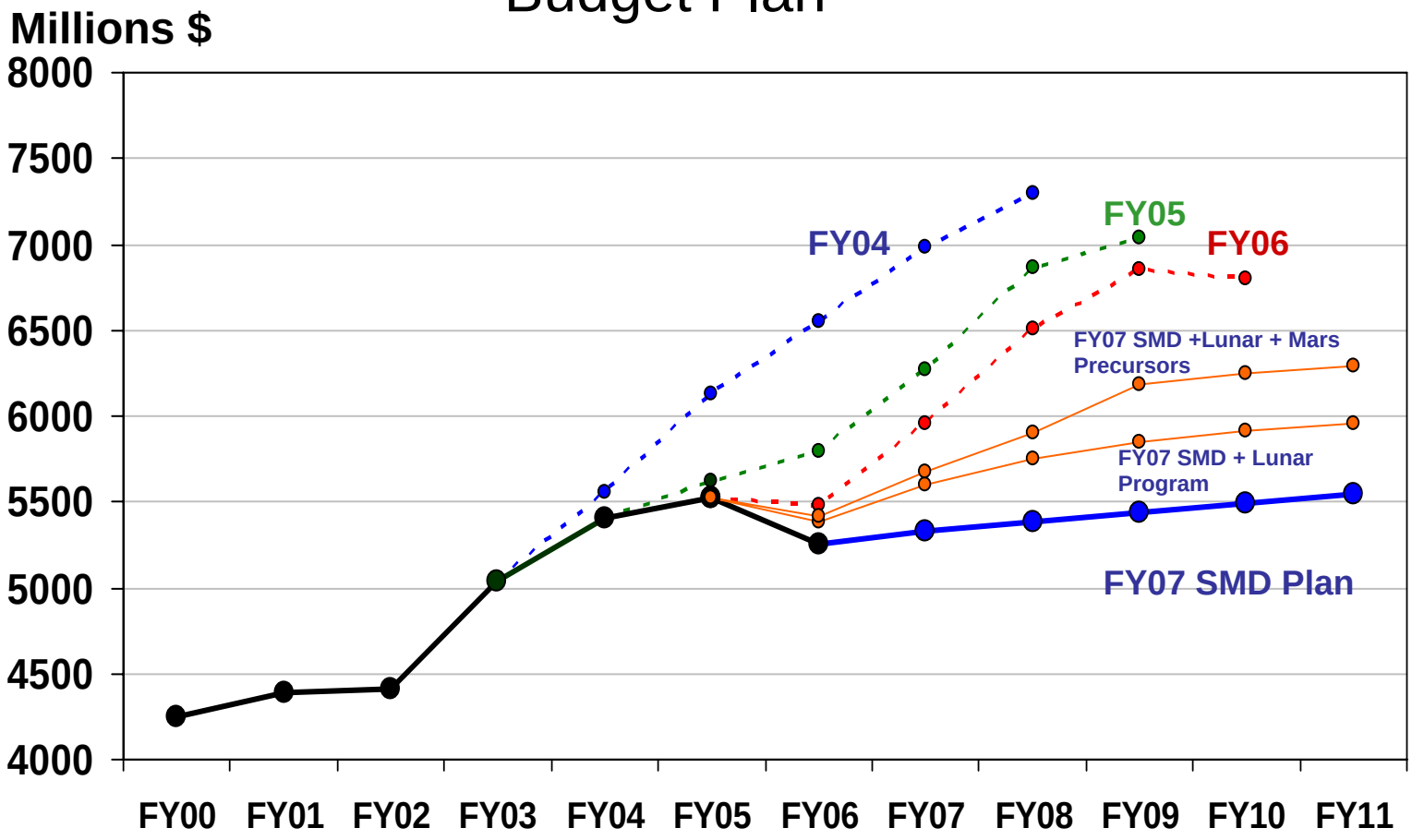
Explore the Possibilities

NASA FY07 Budget Plan
(Billions$)



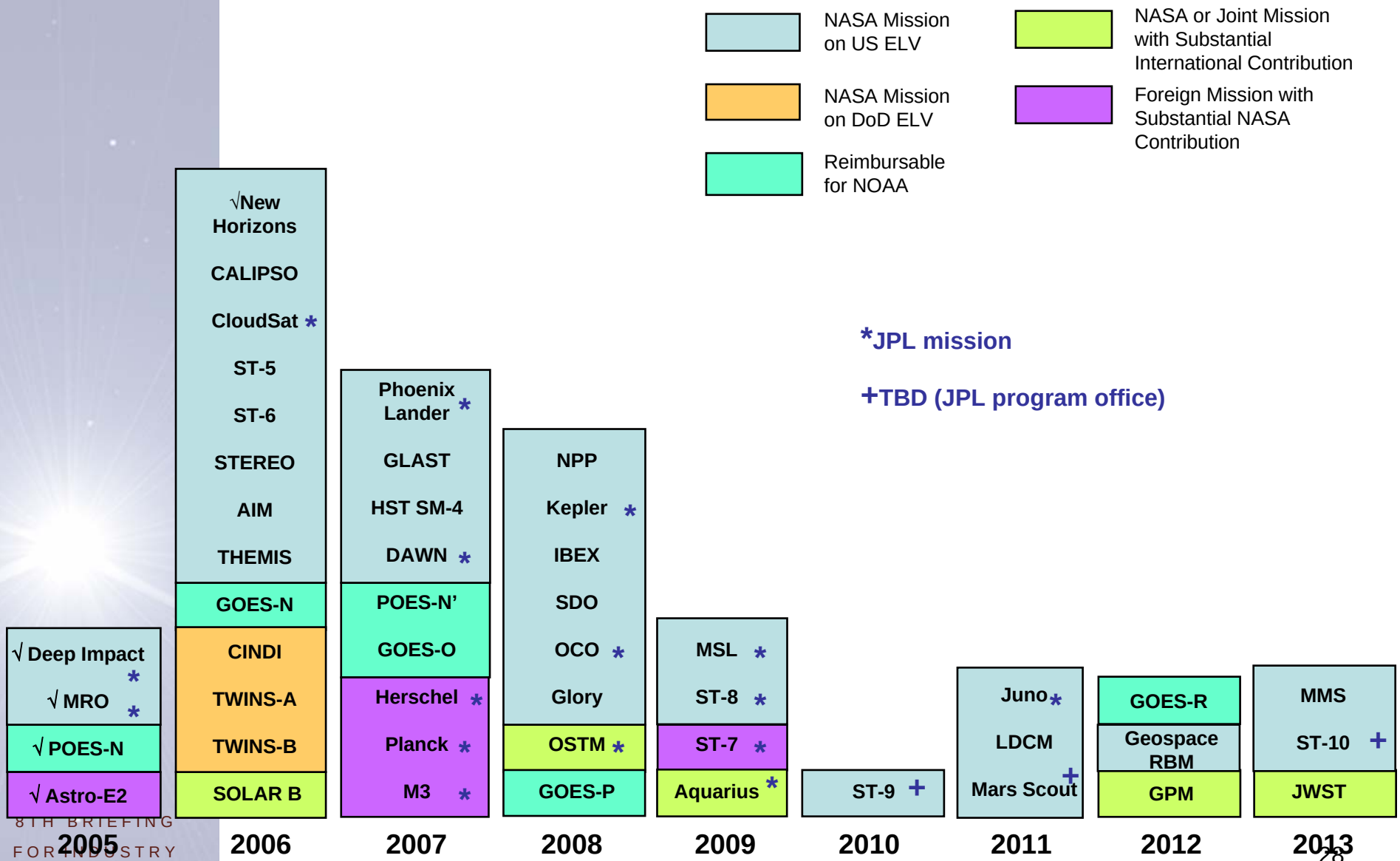
Explore the Possibilities

NASA Science Mission Directorate (SMD) Budget Plan



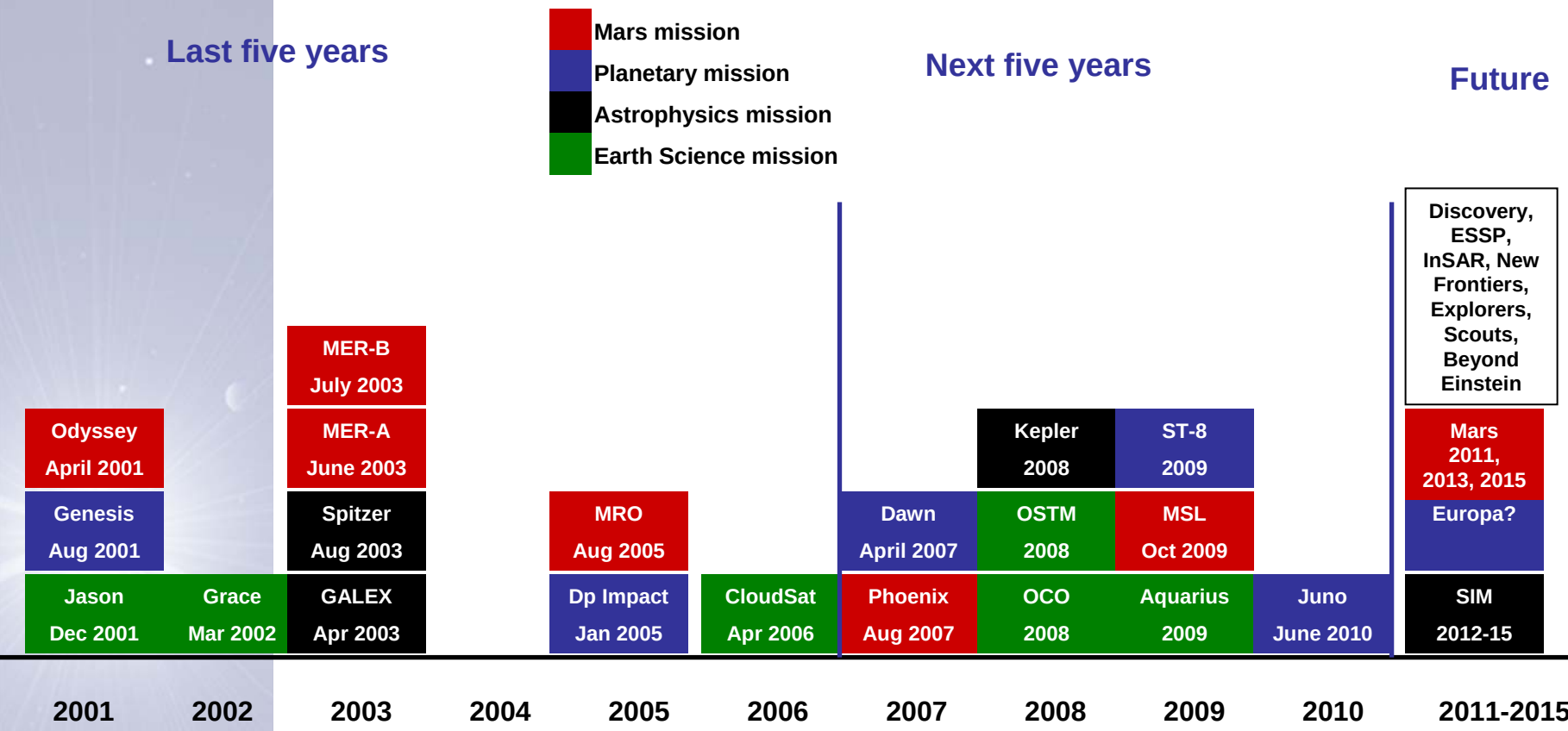
Explore the Possibilities

NASA Science Mission Launches (CY05-CY13)



Explore the Possibilities

Ten-year launches; actual and future opportunities



NASA budget effects on JPL programs and personnel

- Delayed:
  - PlanetQuest Space Interferometer Mission (SIM)
- Not continued:
  - Nuclear Spectroscopic Telescope Array (NuSTAR)
  - Hydros
- Deferred for re-planning:
  - Wide-field Infrared Survey Explorer (WISE)
  - Mars sample return
  - Laser Interferometer Space Antenna
  - Europa orbiter
  - Terrestrial Planet Finder (TPF)
- Workforce:
  - From 5400 in FY05 to 5000 in FY06; likely to remain stable.

JPL depends on US and international industrial, academic, and government partners

- MRO: LMA, JHU/APL, Malin SSS, U/A, BATC, ASI, Wash/U, Alenia Spazio, U/Rome, MIT, GSFC, GWU
- DI: BATC, U/Md
- MLS, TES: GSFC, NGST
- Spitzer: Caltech, LMSSC, BATC, Smithsonian AL, GSFC, Cornell, U/A
- MER: Cornell, Washington U/SL
- GALEX: Caltech, OSC, UCB, Yonsei U (Korea), JHU, LAM (France)
- AIRS: Lockheed Imaging Syst (now British Aerospace), GSFC
- GRACE: ROKOT L/V, DLR, Loral, Astrim GmbH, German SOC
- Jason-1: CNES
- Mars Odyssey: LMA, U/A, JSC, ASU
- Stardust: LMA, UW
- Cassini: ESA, ASI
- MGS: LMSS, Malin SS, GSFC, ASU, Stanford, CNSS (France)

JPL competes; and has proprietary programs

- Assigned missions:
  - Space Interferometry Mission
  - Mars Science Laboratory
  - Mars Reconnaissance Orbiter
  - Spitzer Space Telescope
  - Mars Exploration Rovers
  - Jason-1
  - QuikScat
  - Cassini
  - Mars Global Surveyor
  - Ulysses
  - Voyager
- Competed missions and instruments:
  - Dawn
  - Juno
  - Aquarius
  - Wide-field Infrared Survey Explorer (WISE)
  - Orbiting Carbon Observatory (OCO)
  - Ocean Surface Topography Mission (OSTM)
  - Kepler
  - Space Technology-8 (ST-8)
  - Cloudsat
  - Phoenix
  - Deep Impact
  - Microwave Limb Sounder
  - Tropospheric Emission Spectrometer
  - Galaxy Evolution Explorer (GALEX)
  - Atmospheric Infrared Sounder (AIRS)
  - Gravity Recovery and Climate Experiment (GRACE)
  - Active Cavity Irradiance Monitor Satellite (ACRIMSAT)
  - Wide Field/Planetary Camera (WF/PC)
  - Multi-angle Imaging Spectrometer (MISR)
  - Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER)
  - Stardust