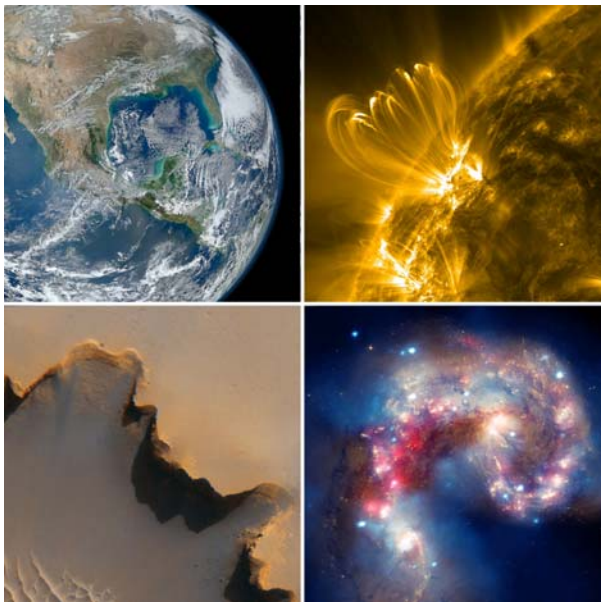
SCIENCE

FY 2013 BUDGET

Budget Authority (in $ millions)	Actual FY 2011	Estimate FY 2012	FY 2013	Notional FY 2014	FY 2015	FY 2016	FY 2017
FY 2013 President's Budget Request	**4,919.7**	**5,073.7**	**4,911.2**	**4,914.4**	**4,914.4**	**4,914.4**	**4,914.4**
Earth Science	1,721.9	1,760.5	**1,784.8**	1,775.6	1,835.5	1,826.2	1,772.8
Planetary Science	1,450.8	1,501.4	**1,192.3**	1,133.7	1,102.0	1,119.4	1,198.8
Astrophysics	631.1	672.7	**659.4**	703.0	693.7	708.9	710.2
James Webb Space Telescope	476.8	518.6	**627.6**	659.1	646.6	621.6	571.1
Heliophysics	639.2	620.5	**647.0**	643.0	636.7	638.3	661.6
Change From FY 2012 Estimate	--	--	**-162.5**				
Percent Change From FY 2012 Estimate	--	--	**-3.2%**				



From the vantage point of space NASA captures breath-taking images of our world and the universe. These images advance our scientific understanding in a multitude of disciplines, but they also have the power to inform policy, influence action, and inspire learning.

NASA's Science Mission Directorate (SMD) conducts scientific exploration enabled by the use of space observatories and space probes that view the Earth from space, observe and visit other bodies in the solar system, and gaze out into the galaxy and beyond. NASA's science program seeks answers to profound questions that touch us all:

- How and why are Earth's climate and the environment changing?
- How and why does the Sun vary and affect Earth and the rest of the solar system?
- How do planets and life originate?
- How does the universe work, and what are its origin and destiny?
- Are we alone?

EXPLANATION OF MAJOR CHANGES FOR FY 2013

As NASA continues to pursue a robust Mars exploration program, the Agency is adjusting the mission profile so that critical science objectives can be achieved in a lean fiscal environment. The Agency continues to work towards defining future missions that will build upon scientific discoveries from past missions and incorporate the lessons learned from previous mission successes and failures. NASA remains committed to an ongoing Mars Exploration program of robotic exploration missions in support of an integrated strategy of scientific and human exploration, and intends to work with the science community and our international partners in the formulation of new missions.

SCIENCE

Earth Science adjusted mission timelines and budgets to accommodate increasing launch vehicle costs (for Soil Moisture Active Passive (SMAP), now scheduled to launch in FY 2015). The Agency continues with the pre-formulation studies, formulation, and development of other decadal study and continuity missions; however, several of these projects will be delayed. The planned launch vehicle for the Orbiting Carbon Observatory (OCO)-2 satellite was the Taurus XL. Following the Taurus XL failure in March 2011 and the loss of NASA's Glory mission, the contract for the Taurus XL was put on hold pending the outcome of a failure investigation. As a result, the OCO-2 launch date will change.

NASA rebaselined the James Webb Space Telescope (JWST) project, making significant changes in the management of JWST in 2011, in response to the poor cost and schedule performance and the recommendations of the Independent Comprehensive Review Panel (ICRP) report.

ACHIEVEMENTS IN FY 2011

SMD launched three key missions in FY 2011: Aquarius, Juno, and Gravity Recovery and Interior Laboratory (GRAIL). Aquarius will deliver global ocean salinity measurements to advance climate studies. After its five-year journey, Juno will deliver data that will allow scientists to learn more about Jupiter's origins, structure, atmosphere and magnetosphere, and look for a potential solid planetary core. The GRAIL mission will help scientists determine the structure of the lunar interior from crust to core, and advance understanding of the thermal evolution of the Moon.

NASA also moved other critical missions on the path to launch, completing final preparations for the Suomi NPOESS Preparatory Project (NPP) mission and the Mars Science Laboratory (MSL), both of which were successfully launched in early FY 2012. Suomi NPP will provide for continuation of selected climate data records and will become an integral part of the Nation's operational meteorological satellite system for weather prediction. After landing on August 6, 2012, the MSL Curiosity rover will assess the habitability of Mars.

New evidence from the Mars Reconnaissance Orbiter (MRO) suggests flowing water on Mars. A new sequence of images taken by MRO show "lineae," narrow, dark streaks on steep slopes that appear and incrementally grow during warm seasons and fade in cold seasons, indicating that they are formed by liquid water moving down-slope whose origin is from a layer near the surface.

Science discoveries and applications of NASA-provided data are numerous and are detailed in programmatic and project sections of this document.

KEY ACHIEVEMENTS PLANNED FOR FY 2013

NASA is planning to launch several missions in FY 2013. The Landsat Data Continuity Mission (LDCM), scheduled to launch in December 2012, will be the eighth in the series of Landsat satellites and will observe and measure Earth's continental and coastal landscapes. The Lunar Atmosphere and Dust Environment Explorer (LADEE) will orbit the Moon to characterize the atmosphere and lunar dust environment that is believed to be lofted above the surface at the sunrise or sundown on the moon.

NASA will continue making discoveries that change the way we view the Earth, our Sun, and the universe. In FY 2013, NASA will begin obtaining data from 2011 Mars Science Laboratory (MSL). Operating under its own power, the Curiosity rover will use its ten instruments to analyze the

environment remotely, find targets of interest, take samples, and analyze them to assess whether or not Mars could have sustained life.

Themes

EARTH SCIENCE

From space, NASA satellites can view Earth as a planet and enable its study as a complex, dynamic system with diverse components: the oceans, atmosphere, continents, ice sheets, and life itself. The Nation's scientific community can thereby observe and track global-scale changes, connecting causes to effects. They can study regional changes in their global context, as well as observe the role that human civilization plays as a force of change. Through partnerships with agencies that maintain forecasting and decision support systems, NASA improves national capabilities to predict climate, weather, and natural hazards, manage resources, and craft environmental policy.

Budget Explanation

The FY 2013 request is $1,784.8 million. This represents a $24.3 million increase from the FY 2012 estimate ($1,760.5 million).

PLANETARY SCIENCE

NASA extends humankind's virtual presence throughout the solar system via robotic space probes to other planets and their moons, to asteroids and comets, and to the icy bodies of the outer solar system. SMD is completing humankind's first basic reconnaissance of the solar system by sending one mission to fly by Pluto and another that will visit two planet-sized asteroids, Ceres and Vesta. SMD is also in the midst of sustained investigation of Mars, launching a series of orbiters, landers, and rovers, with the long-term goal eventual human exploration. In addition, SMD is focusing on certain moons of the giant planets where current NASA missions see intriguing signs of surface activity and of liquid water within, knowing that on Earth, where there is water and an energy source, there is also life.

Budget Explanation

The FY 2013 request is $1,192.3 million. This represents a $309.1 million decrease from the FY 2012 estimate ($1,501.4 million).

ASTROPHYSICS

Some of the greatest minds of the last century discovered wondrous things about the physical universe: the Big Bang and black holes, dark matter and dark energy, and the interrelated nature of space and time. Their theories challenge scientists and NASA to use observations from space to test the limits of our understanding of fundamental physics. Having measured the age of the universe, the scientific community now seeks to explore its ultimate extremes: its birth, the edges of space and time near black holes, and the mysterious dark energy filling the entire universe. Scientists also seek to understand the relationship between the smallest of subatomic particles and the vast expanse of the cosmos. With hundreds of planets

around other stars now known, scientists are using current NASA missions in conjunction with ground-based telescopes to seek Earth-like planets in other solar systems.

Budget Explanation

The FY 2013 request is $659.4 million. This represents a $13.3 million decrease from the FY 2012 estimate ($672.7 million).

JAMES WEBB SPACE TELESCOPE

JWST is a large, deployable, space-based infrared astronomical observatory. The mission is a logical successor to the Hubble Space Telescope, extending beyond Hubble's discoveries by looking into the infrared spectrum, where the highly red-shifted early universe must be observed, where cool objects like protostars and protoplanetary disks emit infrared light strongly, and where dust obscures shorter wavelengths.

Budget Explanation

The FY 2013 request is $627.6 million. This represents a $109.0 million increase from the FY 2012 estimate ($518.6 million).

HELIOPHYSICS

The solar system is governed by the Sun, a main-sequence star midway through its life. The Sun's influence is wielded through its gravity, radiation, solar wind, and magnetic fields, all of which interact with the gravity, fields and atmospheres of Earth to produce space weather. Using a fleet of sensors on various spacecraft in Earth orbit and throughout the solar system, SMD seeks to understand how and why the Sun varies, how Earth responds, and how human activities are affected. The science of heliophysics enables the space weather predictions necessary to safeguard life and society on Earth and the outward journeys of human and robotic explorers.

Budget Explanation

The FY 2013 request is $647.0 million. This represents a $26.5 million increase from the FY 2012 estimate ($620.5 million).