COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

The National Aeronautics and Space Administration Fiscal Year 2012 Budget Request

Wednesday, March 2, 2011
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

Purpose

The purpose of the Committee hearing is to review the Administration's FY 2012 budget request for the National Aeronautics and Space Administration and examine its priorities and challenges.

National Aeronautics and Space Administration President's FY 2012 Budget Request Summary								
Budget Authority, $ in millions								
By Appropriation Account								
	FY2010 Actual	FY2011 Request	FY2012 Author.	FY2012 Request	FY2013 Notional	FY2014 Notional	FY2015 Notional	FY2016 Notional
Science	**4,497.6**	**5,005.6**	**5,248.6**	**5,016.8**	**5,016.8**	**5,016.8**	**5,016.8**	**5,016.8**
Earth Science	1,439.3	1,801.8	1,944.5	1,797.4	1,821.7	1,818.5	1,858.2	1,915.4
Planetary Science	1,364.4	1,485.7	1,547.2	1,540.7	1,429.3	1,394.7	1,344.2	1,256.8
Astrophysics	647.3	631.5	1,109.3	682.7	758.1	775.5	779.8	810.9
James Webb Space Tel.	438.7	444.8	--	373.7	375.0	375.0	375.0	375.0
Heliophysics	608.0	641.9	647.6	622.3	632.7	653.0	659.7	658.7
Aeronautics	**497.0**	**579.6**	**584.7**	**569.4**	**569.4**	**569.4**	**569.4**	**569.4**
Space Technology	**275.2**	**572.2**	**486.0**	**1,024.2**	**1,024.2**	**1,024.2**	**1,024.2**	**1,024.2**
Exploration	**3,625.8**	**4,263.4**	**5,252.3**	**3,948.7**	**3,948.7**	**3,948.7**	**3,948.7**	**3,948.7**
Human Exploration Cap.	3,287.5	1,900.0	4,050.0	2,810.2	2,810.2	2,810.2	2,810.2	2,810.2
Space Launch Syst	--	--	*2,650.0*	*1,800.0*	--	--	--	--
Multi-Purpose Crew Veh	--	--	*1,400.0*	*1,010.2*	--	--	--	--
Commercial Spaceflight	39.1	812.0	500.0	850.0	850.0	850.0	850.0	850.0
Exporation R&D	299.2	1,551.4	702.3	288.5	288.5	288.5	288.5	288.5
Space Operations	**6,141.8**	**4,887.8**	**4,141.5**	**4,346.9**	**4,346.9**	**4,346.9**	**4,346.9**	**4,346.9**
Space Shuttle	3,101.4	989.1	0.0	664.9	79.7	0.8	0.8	0.9
ISS	2,312.7	2,779.8	2,952.3	2,841.5	2,960.4	3,005.4	3,098.0	3,174.8
Space & Flight Support	727.7	1,119.0	1,189.3	840.6	1,306.8	1,340.7	1,248.1	1,171.2
Education	**180.1**	**145.8**	**145.8**	**138.4**	**138.4**	**138.4**	**138.4**	**138.4**
Cross-Agency Support	**3,017.6**	**3,111.4**	**3,189.6**	**3,192.0**	**3,192.0**	**3,192.0**	**3,192.0**	**3,192.0**
Construction & Envir. Compliance and Restoration	**452.8**	**397.3**	**363.8**	**450.4**	**450.4**	**450.4**	**450.4**	**450.4**
Construction of Facilities	389.4	335.2	--	397.9	384.0	359.5	362.9	360.0
Envir. Compliance	63.4	62.1	--	52.5	66.4	90.9	87.5	90.4
Inspector General	**36.4**	**37.0**	**37.8**	**37.5**	**37.5**	**37.5**	**37.5**	**37.5**
NASA TOTAL	**18,724.3**	**19,000.0**	**19,450.0**	**18,724.3**	**18,724.3**	**18,724.3**	**18,724.3**	**18,724.3**
(Numbers may not add due to rounding.)								

Witness

The Honorable Charles F. Bolden, Jr., Administrator, National Aeronautics and Space Administration

Background

Agency Overview

NASA is the nation's primary civilian space and aeronautics research and development agency, carrying out a diverse set of missions and projects designed to expand our understanding of Earth, the Solar System, and the universe. NASA operates the Space Shuttle fleet, the International Space Station, and a number of satellites in orbit around Earth and throughout the solar system. It also undertakes activities in technology development and transfer, education, outreach, and participates in a number of interagency initiatives such as nanotechnology, information technology, climate change research, and the Next Generation Air Transportation (NextGen) program.

NASA was established by the National Aeronautics and Space Act of 1958 (P.L. 85-568) and was formed by merging the National Advisory Committee on Aeronautics (NACA) with selected space and aeronautics research projects from the defense department. In its first year, President Eisenhower requested $125 million for NASA. Today, the agency's budget is more than $18.7 billion (less than half of one percent of the federal budget), with about 83 percent of the total budget paid to commercial entities on a contract basis. NASA employs about 18,300 full time equivalent civil servants and another 43,000 contractors. In addition to its headquarters office in Washington, DC, NASA has nine field centers:

- Ames Research Center, Mountain View, CA
- Dryden Flight Research Center, Edwards Air Force Base, CA
- Glenn Research Center, Cleveland, OH
- Goddard Space Flight Center, Greenbelt, MD
- Johnson Space Center, Houston, TX
- Kennedy Space Center, Merritt Island, FL
- Langley Research Center, Hampton, VA
- Marshall Space Flight Center, Huntsville, AL
- Stennis Space Center, Bay St. Louis, MS

The Jet Propulsion Laboratory, located in Pasadena, CA, is a NASA-sponsored federally funded research and development center. NASA also owns the Wallops Flight Facility in Wallops Island, Virginia and the Michoud Assembly Facility east of New Orleans, Louisiana.

FY2012 Budget Request

NASA's budget request for FY 2012 is $18.7 billion, the same amount appropriated by Congress for FY 2010 and continued thus far in FY 2011. The budget request also displays the succeeding four out-year budget assumptions (FY2013 – FY2016) to give Congress an indication of near-term spending plans for programs, projects and activities. The FY 2012 budget request assumes the same topline spending level through FY2016, but unlike previous budgets, NASA's FY2012 request qualified their out-year assumptions as 'notional.' However, NASA's 'notional' assumptions are significantly higher than those in OMB's FY2012 agency request (OMB's Blue Books) by an

aggregate of $2.33 Billion. In spite of this significant difference, NASA officials advised the Committee that they are using their higher out-year assumptions for planning purposes.

NASA is proposing to modify its current account structure in two ways: (1) to divide "Aeronautics and Space Technology" into separate accounts; and (2) merge the "Space Operations" and "Exploration Systems" Directorates into one account. The latter may occur by this summer.

Key Highlights and Programs from the FY2012 Budget Proposal

- *Earth Science.* NASA's Earth Science programs seek approaches for providing sustained, simultaneous spaceborne climate measurements to advance knowledge of the Earth's atmosphere, oceans, sea ice, land surfaces, and the interaction of these elements in the ecosystem, including the impact of humans. Key elements include flight programs to develop satellite observation missions; research analysis to understand the flight data; developing technologies for new measurement approaches; and advancing the use of Earth science measurements to inform environmental policy decisions.
    - Compared to last year's budget, the FY2012 Earth Sciences request – $1,797.4 million – is $4.4 million less, a decrease of 0.2%.
    - NASA operates 13 satellite missions making global observations and has seven missions in formulation or under development, with Glory, Aquarius, and NPOESS Preparatory Project (NPP) scheduled for launch in 2011.
    - Delays start of the DESDynI and CLARREO missions.

- *Astrophysics.* NASA's Astrophysics programs seek to discover how matter, energy, space and time behave under the extraordinary range of conditions within our universe; explore how the universe began and evolved; and characterize planetary systems orbiting other stars in a search for Earth-like planets. NASA operates 13 satellite missions including the Hubble Space Telescope, which has taken hundreds of thousands of astronomical images shedding light on many of the greatest mysteries of astronomy.
    - Compared to last year's budget, the FY2012 Astrophysics request – $682.7 million – is $51.2 million higher, an 8.1% increase.
    - NASA's successor to the Hubble Space Telescope is the James Webb Space Telescope (JWST). Last year, an external review panel determined that JWST will require up to $1.5 billion in additional funding and at least another year before it will be ready for launch. In an effort to get the cost and schedule growth under control, JWST's program and project management was moved out of the Astrophysics management structure. NASA is currently conducting a 'bottoms-up' review to establish a new cost and schedule baseline that will be reflected in next year's budget request. The FY2012 budget request reduces JWST funding, ensuring that it will not meet the current launch date of 2014.

- *Planetary Science*. NASA's Planetary Science program conducts robotic missions throughout our solar system to answer fundamental questions about its origins and evolution. Planetary science data supports NASA's longer term human exploration agenda including the use of robotic Mars rovers, (i.e. Spirit and Opportunity), and orbiters, (i.e., Odyssey and Mars Reconnaissance Orbiter) to map water and minerals on or near Mars surface. NASA's Near Earth Observation (NEO) program hunts for asteroids that are potential impact hazards to Earth.
    - Compared to last year's budget, the FY2012 Planetary Science request – $1540.7 million – is $55 million higher, a 3.7% increase.

- NASA and the European Space Agency have established a joint program office to coordinate future Mars missions beginning in 2016.
- Higher launch vehicle costs is severely impacting program, leading to reduced number of launches-per-decade unless lower-cost launchers become available.

- *Heliophysics.* Heliophysics seeks to understand the Sun and its impact on the Earth's magnetosphere, ionosphere, and atmosphere. The extended solar environment extends beyond the orbit of Pluto, but here on Earth solar particles and fields effect high-altitude winds, radio and radar transmissions, the electrical power grid, and spacecraft electronics. NASA operates 14 heliophysics missions using 26 spacecraft including the Solar and Heliospheric Observatory (SOHO) and the Solar Terrestrial Relations Observatory (STEREO). Many Heliophysics missions have been extended beyond their original lifetimes, including the Voyager spacecraft launched in August 1977.
  - Compared to last year's budget, the FY2012 Heliophysics request – $622.3 million – is 19.6 million less, a 3.1% decrease.
  - The United States may have to eliminate one or more instruments from the Solar Orbiter Collaboration – a joint mission with the European Space Agency – due to the high cost of a launch vehicle. Under the agreement, the US provides the launcher and several of the instruments. The mission is being led by the European Space Agency.

- *Aeronautics Research.* NASA's Aeronautics research programs provide direct and indirect benefit to the public. Fundamental research in traditional aeronautical disciplines and relevant emerging fields enable revolutionary changes which lead to a safer, more environmentally friendly and more efficient national air transportation system to benefit the flying public. Aeronautics research is conducted through five programs: Aviation Safety; Airspace Systems; Fundamental Aeronautics; Integrated Systems Research; and the Aeronautics Test Program. NASA's Aeronautics research is a significant contributor to the FAA's Next Generation Air Transportation System (NextGen) program.
  - Compared to last year's budget, the FY2012 Aeronautics request – $569.4 million – is $10.2 million less, a 1.8% decrease.

- *Space Technology.* For FY2012, NASA is proposing to create a new budget line for Space Technology (in last year's budget request, it was combined with Aeronautics Research). The program consists of technology development and innovation projects that are broadly applicable to the Agency's future missions in science and exploration while providing space technologies that can improve the capabilities and lower the cost of other government agencies and commercial space activities. It is managed by the Office of Chief Technologist, who reports directly to the Administrator. Space Technology has three programs: Early Stage Innovation; Game Changing Technology; and Crosscutting Capability Demonstrations.
  - Compared to last year's budget, the FY2012 Space Technology request – $1,024.2 million – is $452 million higher, a 79% increase. Note, however, that last year's request was never enacted.
  - The Space Technology program also absorbs existing programs, including the Innovative Partnership Program, portions of the Exploration Technology Program, and the Small Business Innovative Research (SBIR)/Small Business Technology Transfer (STTR) Programs.

- *Exploration Systems and Human Spaceflight.* See the section Human Space Flight and the NASA Authorization Act of 2010 below for a fuller explanation of changes and issues.

- *Space Operations.* The Space Operations Mission Directorate (SOMD) manages the Space Shuttle program; oversees the operation of the International Space Station, including payloads on the ISS; provides launch services for other NASA directorates, mainly for Space Science missions; manages the Space Communication and Navigation (SCaN) program, providing communications between Earth and missions in space (Shuttle, ISS, and deep space science missions); through the Human Space Flight Operations program, provides training for NASA astronauts and supports their health and safety; develops future space launch complex upgrades; and manages rocket testing capabilities through the Rocket Propulsion Test program.
    - Compared to last year's budget, the FY2012 Space Operations request – $4,346.9 million – is $540.9 million less, an 11.1% decrease. This largely reflects the pending retirement of Shuttle.
    - STS-133 Space Shuttle Discovery is currently at the International Space Station. NASA must safely fly the two remaining Space Shuttle missions while preparing for the Shuttle's retirement later this year.
    - NASA will support utilization of the International Space Station though at least 2020.
    - The FY2012 budget request includes $548 million in pension liability for the Shuttle's prime contractor United Space Alliance.

- *Education.* NASA's education programs are designed to increase the number of students who are proficient in, and choose to major in, and pursue careers in STEM fields. NASA works through mutually beneficial relationship s with over 500 colleges and universities, hundreds of K-12 schools and districts, and over 400 museums and science centers to provide education experiences.
    - Compared to last year's budget, the FY2012 Education request – $138.4 million – is $7.4 million less, a 5.1% decrease.

- *Cross Agency Support.* Cross Agency Support (CAS) is comprised of two themes, Center Management and Operations, and Agency Management and Operations. Together they manage all nine NASA centers and their personnel; agency acquisitions; financial management; maintenance and operation of facilities; ensure safety and mission success; sustain Agency-wide critical capabilities; and information technology.
    - Compared to last year's budget, the FY2012 CAS request – $3,192.0 million – is $80.6 million higher, a 2.6% increase.

- *Construction and Environmental Compliance and Restoration.* The Construction and Environmental Compliance and Restoration (CECR) account provides for design and execution of facility construction and revitalization projects, demolition projects, and environmental and restoration activities. The Environmental Compliance and Restoration program is to clean up pollutants from past activities.
    - Compared to last year's budget, the FY2012 request – $450.4 million – is $53.1 million higher, a 13.4% increase.
    - The FY2012 request supports cleanup of the Santa Susana Field Laboratory (CA), in preparation for dispositioning the property.

- *Inspector General.* Supports auditors, investigators, and analysts to prevent and detect fraud, waste and abuse and mismanagement.
    - Compared to last year's budget, the FY2012 request – $37.5 million – is $500 thousand higher, a 1.4% increase.

Human Space Flight and the NASA Authorization Act of 2010

Last year Congress passed the NASA Authorization Act of 2010, which was signed by the President on October 11th (P.L.111-267). The Act provided policy guidance and recommended funding levels agreed to by the Congress. Yet the Administration's FY2012 budget request diverges significantly from the Authorization Act in a number of ways in the area of human spaceflight. Much of the Act was in direct response to the Administration's FY2011 request to cancel development of the *Constellation* Program (consisting of a new launch system, Ares 1 and Ares 5; and the Orion crew capsule) as the successor to the Space Shuttle, which will be retired from service later this year.

In lieu of *Constellation*, the Administration's FY2011 budget sought $6 billion to fund development of multiple commercial crew transport services (three or four, according to NASA), arguing that emerging commercial companies had the capability to safely design, build and operate launch systems and crew capsules to carry astronauts to and from low-Earth orbit. Despite repeated requests by the Committee throughout 2010, NASA failed to provide a credible plan or the basis for its $6 billion estimate to Congress. As a result, Congress in its 2010 NASA Authorization Act strongly disagreed with the Administration's proposal.

Instead, the Act provided $10.8 billion (through 2013) for continued development of a Shuttle- and *Constellation*-derived launch system (newly designated the Space Launch System and Multi-Purpose Crew Vehicle) that would assure a backup capability to access the International Space Station for the U.S. and our international partners in case commercial proposals fail to materialize. The Act also directed NASA to proceed immediately with its development with the goal of making the system operational by 2016.

The Space Launch System (SLS) and Multi-Purpose Crew Vehicle (MPCV) were to continue to focus on developing the advanced human safety features of the Orion project, and be capable of evolving into a heavy lift launch system that could eventually carry 130 tons to orbit to enable human exploration missions beyond Earth orbit. Congress envisioned that the SLS and MPCV would get maximum benefit from the more than $10.3 billion that had previously been spent on the *Constellation* system. During the previous 18 months, major *Constellation* components achieved a number of milestones including successful flight tests of the Ares 1-X and the Orion launch abort systems, and a ground demonstration of a five-segment solid rocket motor that was to have powered the Ares 1.

In the area of commercial crew the Authorization Act provided $1.3 billion over three years to "*continue or expand activities and agreements initiated in FY2010 that reduce risk, develop technologies, and lead to other advancements that will help determine the most effective and efficient means of advancing the development of commercial crew services.*"

The following table compares the policy and funding guidance that Congress established in the NASA Authorization Act with the Administration's FY2012 budget request. Over the next two years (FY2012 – FY2013) the Administration's request underfunds development of the Multi-Purpose Crew Vehicle and Space Launch System/Heavy Lift Launch Vehicle by more than $2.4 billion, a 31 percent decline. In the area of Commercial Spaceflight the Administration significantly augmented amounts already authorized for commercial Cargo Resupply Services and Commercial Crew.

Although NASA is seeking to fund development of multiple commercial crew systems, NASA will not own the systems and will shoulder additional costs to "rent seats" on a per mission basis. NASA has inserted a new line in the FY2012 budget called Mission Operations Sustainment that will

be used to pay the per seat rental if and when a new commercial crew industry has been established. Despite repeated requests to NASA to provide the cost basis or assumptions used to estimate the future cost for commercial seat rental, NASA did not provide that information to the Committee. As a result the table below assumes that $415 million requested in FY2013 will be necessary for seat rentals, which is roughly similar to the cost to rent seats on the Russian Soyuz.

Comparing the NASA Authorization Act of 2010 (P.L. 111-267) with the FY2012 Budget Request

(millions of $)	FY10 enacted / FY11 C.R. *	Auth. FY12	Budget Request FY12	Request vs. Auth. FY12	Auth. FY13	Budget Request FY13	Request vs. Auth. FY13	Auth. Total FY12-13	Budget Request Total FY12-13	Request vs. Auth. FY12-13	Request vs. Auth. FY12-13
Human Exploration Capabilities	**3,287**	**4,050**	**2,810**	**(1,240)**	**4,050**	**2,810**	**(1,240)**	**8,100**	**5,620**	**(2,480)**	**--31%**
MPCV	*1,435*	*1,400*	*1,010*	*(390)*	*1,400*						
SLS/HLLV	*1,387*	*2,650*	*1,800*	*(850)*	*2,640*						
Integr'n & Ops	*465*										
Commercial Spaceflight Capabilities	**1,066**	**1,295**	**1,645**	**350**	**1,301**	**2,066**	**765**	**2,596**	**3,711**	**1,115**	**+43%**
COTS	*^300*										
CRS (Cargo)	*516*	*795*	*795*	*0*	*801*	*801*	*0*	*1,596*	*1,596*		
Comm Crew	***250*	*500*	*850*	*350*	*500*	*850*	*350*	*1,000*	*1,700*	*700*	
Mission Ops Sustainment					*0*	*415*	*415*	*0*	*415*	*415*	

*Values are reference only. Under the CR some numbers may vary slightly.

^ $39 million in FY2010 and $33 million in Q1 FY2011

** Senate Appropriations committee bill as reported (S.3636) and House-passed full year continuing resolution (H.R.3082 as amended), not enacted. Approx $50 million obligated for CCDev2

Last year NASA used $50 million from the American Recovery and Reinvestment Act to fund five study proposals called Commercial Crew Development (CCDev). NASA initiated a second request for proposals (CCDev 2) and plans to award funding once the FY2011 appropriation is finalized. CCDev 2 currently has no budget allocation so these funds will further reduce the amount available for Human Exploration Capabilities but is not reflected in the above chart.