**COMMITTEE ON SCIENCE AND TECHNOLOGY**
**U.S. HOUSE OF REPRESENTATIVES**

***NASA's Fiscal Year 2009 Budget Request***

Wednesday, February 13, 2008

10:00 A.M – 12:00 P.M.
2318 Rayburn House Office Building

**Purpose:**

On Wednesday, February 13, 2008 at 10:00am, the Committee on Science and Technology will hold a hearing on the National Aeronautics and Space Administration's (NASA) Fiscal Year 2009 budget Request and NASA's proposed Fiscal Year 2008 Operating Plan.

**Witness:**

**Dr. Michael D. Griffin**
Administrator
National Aeronautics and Space Administration

## BACKGROUND INFORMATION

### *Overview*

The National Aeronautics and Space Administration (NASA), which was established in 1958, is the nation's primary civil space and aeronautics R&D agency. The current civil service workforce consists of approximately 18,400 employees, of which approximately 16,310 are full-time, permanent civil servants. NASA has ten field Centers, including the Jet Propulsion Laboratory (JPL) FFRDC. Although there have been discussions in the past regarding the future disposition of NASA's Centers (e.g., potential closure

or privatization of one or more Centers), NASA Administrator Griffin has stated his intention to maintain "ten healthy Centers." In October 2007, NASA assigned work for the Exploration initiative's Constellation Program to each of the ten NASA Centers.

NASA conducts research and development activities in a wide range of disciplines including aeronautics, astrophysics, heliophysics, planetary science, Earth science and applications, microgravity research, and long-term technology development. NASA also operates a fleet of three Space Shuttles and is assembling and operating the International Space Station (ISS). NASA also maintains a space communications network that supports both NASA missions and other federal agency requirements. Almost 90 % of NASA's budget is for contracted work. In addition, a number of NASA's scientific and human space flight activities involve collaboration with international participants.

In January 2004, President Bush announced his "Vision for U.S. Space Exploration" (VSE). According to the President, the United States is to do the following:

- *"Implement a sustained and affordable human and robotic program to explore the solar system and beyond;*
- *Extend human presence across the solar system, starting with a human return to the Moon by the year 2020, in preparation for human exploration of Mars and other destinations;*
- *Develop the innovative technologies, knowledge, and infrastructures both to explore and support decisions about the destinations for human exploration; and*
- *Promote international and commercial participation in exploration to further U.S. scientific, security, and economic interests."*

With respect to the Space Shuttle, the President's policy stated that NASA should:

- *"Focus use of the Space Shuttle to complete assembly of the International Space Station; and*
- *Retire the Space Shuttle as soon as assembly of the International Space Station is completed, planned for the end of this decade."*

With respect to development of a new human transportation system, the President's policy states that the U.S. shall:

- *"Develop a new crew exploration vehicle to provide crew transportation for missions beyond low Earth orbit;*
- *Conduct the initial test flight before the end of this decade* [i.e., before end of 2010] *in order to provide an operational capability to support human exploration missions no later than 2014."*

## ***Budgetary Information***

NASA's proposed budget for FY 2009 is $17.6 billion, an increase of 1.8% over the FY 2008 President's request for NASA and an increase of 2.9% over the FY 08 appropriation for NASA, when the recession of $192.5 million contained in the Consolidated Appropriations Act for 2008 [P.L. 110-161] is added. Attachment 1 summarizes the FY 09 budget request and its five-year funding plan. It should be noted that NASA's budget has been restructured from three main appropriations accounts—Science, Aeronautics, and Exploration; Exploration Capabilities; and Inspector General—to seven accounts—Science; Aeronautics; Exploration; Space Operations; Education; Cross Agency Support; and Inspector General—as directed in the Consolidated Appropriations Act for FY 08. As part of the budget restructuring, NASA shifted from a full-cost budget, in which each project budget included overhead costs, to a direct cost budget. All overhead budget estimates are now consolidated into the Cross Agency Support budget line. NASA has stated that maintaining a full cost budget with seven appropriations accounts would be overly complex and inefficient. The direct cost budget shows program budget estimates that are based entirely on program content. Individual project managers continue to operate in a full-cost environment, including management of overhead costs.

Attachment 2 compares the NASA budget plan that accompanied the President's Vision initiative with the actual funds requested (or planned to be requested per the FY 09 budget request's five-year plan) by the President for the years FY 06-13. As can be seen, the President's requests have been significantly less (i.e., typically on the order of a half-billion dollars or more in the early years) than what was projected by the Administration as being needed to carry out the Exploration initiative and NASA's other core missions. The cumulative shortfall over that period is in excess of $4 billion.

The FY 08 appropriation for NASA contained in the Consolidated Appropriation Act of FY 08 maintains the President's FY 08 request of $17.3 billion for NASA. Under the terms of the Consolidated Appropriation, NASA is to submit to Congress by March 15, 2008 an Operating Plan that reflects how the agency will allocate its FY 08 appropriation within the constraints of the Consolidated Appropriation. Administrator Griffin has been asked to discuss the FY 08 Operating Plan at the hearing.

To put the FY 09 budget request into context, NASA has been tasked with flying the Shuttle safely until the end of the decade and then retiring the Shuttle fleet; assembling, operating, and utilizing the International Space Station; completing the development of a new Crew Exploration Vehicle/Crew Launch Vehicle by 2014; pursuing human exploration of the Moon no later than 2020; and conducting science and aeronautics programs. The NASA Authorization Act of 2005, which was signed into law in December 2005, authorized an FY 08 funding level for NASA of $18.69 billion; the FY 08 NASA budget request and appropriation was $17.3 billion, not including $192.5 million in rescissions as directed. The Committee intends to reauthorize NASA this year.

With respect to NASA's contract management practices, NASA remains on GAO's "high risk" list for its contract management practices. With respect to its financial management, an independent audit for FY 07 was unable to provide "an opinion on the consolidated balance sheet as of September 30, 2007". Although NASA took several actions to comply with the Federal Financial Improvement Act of 1996, the audit found that the agency's financial management systems "are not substantially compliant" with the Act. NASA will need to address other "material weaknesses" identified in the audit.

## ***Program Areas***

### **Space Science**

The President's FY 09 budget requests $3.1 billion in direct program dollars (previous budget requests were prepared in full cost accounting and

included overhead costs) to fund NASA's space science programs, including Heliophysics, which seeks to understand the Sun and how it affects the Earth and the solar system; Planetary Science, which seeks to answer questions about the origin and evolution of the solar system and the prospects for life beyond Earth; and Astrophysics, which seeks answers to questions about the origin, structure, evolution and future of the universe and to search for Earth-like planets. The proposed budget represents an effective decrease of $264.7 million in direct program dollars from the FY 08 appropriation. Most of that decrease is attributed to a transfer of the management and budget for ground based communications systems—Deep Space Mission Systems and Near Earth Networks programs—from the Heliophysics Division to the Space Operations Mission Directorate, which is implementing a plan to consolidate all of NASA's communications activities into its Space and Flight Support Program.

Space Science topics and issues related to the FY 09 budget request include the following:

***Programmatic Balance and New Initiatives***—The FY 09 budget request provides increases (as compared to the FY 08 budget appropriation) for research and analysis (R&A) programs, which fund grants to analyze science mission data and are an important means of training future space scientists and engineers. R&A accounts had been cut in the recent years, a trend that threatened the health of space science disciplines. The FY 09 request increases funding for small mission projects (balloons, airborne platforms, and small space missions) that help train young scientists and engineers and provide frequent opportunities for science return. The President's FY 09 budget initiates work on a flagship planetary science mission to the Outer Planets (Jupiter's moon Europa, and Saturn's moon Titan are two possible destinations) and a joint mission with DOE, Joint Dark Energy Mission (JDEM), to investigate dark energy in the universe. The FY 09 budget includes plans to begin studies on a "cost constrained Solar Probe mission" that would improve our understanding of the solar wind. It also includes funding to explore technical approaches for a medium-class mission to detect and characterize exoplanets that would be initiated in FY 10. This effort is intended to replace the Space Interferometry Mission (SIM) that was previously reduced to a technology development activity by NASA, a decision reversed by the Omnibus appropriations act, which included an explanatory statement that said "With the funds proposed, NASA is to begin the development phase of the [SIM] program…" NASA also includes $67.3

million in support of a Mars Sample Return mission to take place in 2018 and 2020. Most of the proposed new missions have been identified as priorities in National Research Council reports. NASA has indicated that it will phase these initiatives to fit within the budget, however the bulk of development costs will occur toward the middle of the next decade, which is beyond the horizon of the FY 09 budget and its 5-year run-out. In addition, the new initiatives are not supported by a new infusion of funding into the overall science account; new initiatives in Earth and space science are paid for by cutting back funding in other science areas.

***Mars Exploration***—The FY 09 budget request reduces the programmatic content in the Mars Exploration budget by $156.5 million from the FY 08 appropriation. The FY 09 decrease results from moving funds that were allocated to a 2011 Mars Scout mission [now scheduled for 2013] to help fund new initiatives in the Earth sciences program. The President's FY 09 request decreases the Mars Exploration budget by $918 million, in direct dollars, for FY 09 through FY 12. NASA's plans for Mars Exploration include the launch of a Mars Science Laboratory in 2009, a Mars Scout mission in 2013 and a 2016 mission that has yet to be defined.

After 2013, NASA plans to focus the program on developing a Mars Sample Return mission, which has been a high priority in National Research Council (NRC) reports. The President's FY 09 budget request does not include funds to initiate a Mars Sample Return. According to NASA officials, a Mars Sample Return mission would be launched in two parts, in 2018 and 2020, and would cost in the range of $4 billion dollars, some fraction of which NASA anticipates to be funded by international partner(s). NASA plans to conduct architecture studies over the next year and is discussing potential international collaboration on a sample return mission. A National Research Council report released in late 2007, *Grading NASA's Solar System Exploration Program: A Midtern Review*, raised several concerns regarding a future Mars Sample Return mission including the need for investment in a technology development program to reduce the major engineering risks associated with a Mars Sample Return mission. These engineering challenges are likely to require long lead times to ensure the technology is mature in preparation for a mission's development phase. A topic that may be raised at the hearing is what the potential shift in NASA's Mars Exploration program is and how the science and engineering community is involved in this change in focus.

***Ambitious Program Containing Several Major New Initiatives***—
The President's FY 09 budget requests funds for several new space science initiatives, many of which have estimated budgets over $500 million and are anticipated to launch with international or interagency collaboration:

| | |
|---|---|
| Outer planets mission | NASA estimated level of $2 billion for U.S. portion |
| New Frontiers mission | NASA estimated level of $840 million |
| Joint Dark Energy mission | NASA estimated level of $600 million for NASA |
| Exoplanet mission | NASA estimated level of $600 million for NASA |
| Solar Probe mission | NASA estimated level of $750 million |

Large, complex missions have the potential to encounter technical challenges, and there are a number of past examples of such missions that have encountered similar instances of cost growth and schedule delays. Members may wish to ask NASA for specific details on its approach to successfully completing these initiatives within a budget limited to inflationary growth.

***Technology Development***—Recent NRC reports recommend that NASA invest in technology development outside of the mission project lines. One NRC report states, "*The committee is concerned because NASA has not invested in required technology and shows little indication of reversing this trend. If this trend is not reversed immediately, the number and types of missions that the agency will be able to undertake in the future will be severely reduced.*" Inadequate technology development has been identified as a major factor in mission cost growth. The President's FY 09 budget request cuts technology development program lines and continues the trend noted by the NRC. For example, the FY 09 budget virtually cancels a flight technology validation program and cuts programmatic content for technology development in the planetary sciences by $65.7 million over the FY 09-12 period. NASA officials told Committee staff that technology development will occur within the mission budget lines as needed. Members may wish to probe the implications of the proposed cuts to NASA's technology development programs on NASA's ability to pursue several new missions and to maintain schedule and cost discipline in executing them.

***Congressional Direction***—The President's FY 09 budget request supports Congressional direction for NASA to initiate an outer planets mission and a Joint Dark Energy Mission, but departs from Congressional direction for

NASA to begin development of the Space Interferometry Mission. NASA's plan for SIM is to consider its technical approach as one of several candidates that will compete for an exoplanet mission. The FY 08 consolidated appropriation provides full funding and support for the Mars Exploration Program, while the FY09 budget request cuts the program over the FY 09-12 period. The FY 08 appropriation directs NASA to request a new start for a Solar Probe mission in FY 09, however the FY 09 budget requests no funds in FY 09 and only $3.4 million in FY 10 for initial concept work on a Solar Probe mission that it plans to launch by 2015. The explanatory text accompanying the FY 08 appropriation supports the Arecibo Observatory and directs NASA to provide additional funding for Arecibo. NASA officials told Committee staff that the FY 09 budget does not include any NASA funds or plans for Arecibo and that NASA did not need Arecibo. The explanatory text accompanying the FY 08 appropriation for NASA notes Congressional support for the Alpha Magnetic Spectrometer (AMS) experiment, which was intended to fly on the Shuttle for attachment to the ISS, and directed NASA to prepare a report, within 30 days, on options for flying AMS. NASA, to date, has not provided Congress with the report.

## Earth Science

The President's budget for FY 09 requests $1.4 billion in direct dollars for Earth science research, applications, Earth observing missions, education and outreach, and technology development. The proposed FY 09 Earth science budget represents an increase of approximately $87.2 million over the FY 08 budget appropriation, as compared in direct dollars. The FY 09 budget requests $910 million over the FY 09–13 period to execute 5 new missions based on recommendations in the National Research Council's Earth sciences decadal survey. $570 million is made available from cuts to the science programs and the rest is obtained restructuring other Earth Science activities. The first two missions are identified as the Soil Moisture Active-Passive (SMAP) and ICESat-II; the additional three will be identified by the end of 2008, one of which will be a technology demonstration mission in the $100 - $200 million range. NASA's Earth science budget also requests funds to continue several missions currently under development, including the Landsat Data Continuity Mission, the Glory mission, the NPOESS Preparatory Project (NPP), the Global Precipitation

Measurement mission (GPM), Aquarius, and the Orbiting Carbon Observatory.

The proposed FY 09 budget requests increases to the Earth science research and analysis (R&A) accounts reversing a trend of cuts and flat funding in previous budget requests. The R&A accounts fund grants for fundamental research, technology development, training of graduate students, theory research, and data analysis, in essence the intellectual underpinning for the program.

Earth Science topics and issues related to the FY 09 budget request include the following:

***Research to Operations***—The 2005 NASA Authorization Act directs NASA to prepare a report with the National Oceanic and Atmospheric Administration (NOAA) each year, on how Earth science programs will be coordinated in the following year. The Act also directs NASA to provide transition plans for "existing and future Earth observing systems found to have potential operational capabilities." The first plan, which was delivered to Congress in June 2007, identified forums that have been established to coordinate NASA and NOAA Earth science programs. Over the last year, NASA and NOAA have coordinated plans to address climate measurements that were eliminated in the restructuring of the NPOESS program and in planning for the GOES-R system, among other activities. The decisions have not come easily and have involved consultation with OSTP and OMB and input from the National Research Council. Even with this process, decisions have only recently been made to restore climate instruments to the NPOESS Preparatory Project (NPP). NASA has not yet manifested the Total Solar Irradiance Sensor (TSIS) to a satellite platform, however an announcement is expected in March 2008. Within the next few years, several Earth science missions will be launched and NASA will begin to formulate new missions in response to the Earth science decadal survey; planning for research to operations will be an important consideration. It is not clear whether or not the FY 09 request incorporates a budget for planning and transitioning research to operations.

***Earth Science Applications***—The National Research Council's Earth sciences decadal survey recommended that *"Socioeconomic factors should be considered in the planning and implementation of Earth observation missions and in developing an Earth knowledge and information system."*

The FY08 Consolidated Appropriation provided $15 million in additional funds for NASA's Applied Sciences program, which applies the research results of NASA's Earth science missions to decision making tools in the areas of climate, ecosystems, agriculture, water, disaster management and other areas that benefit society. Members may wish to ask whether NASA plans any changes to the Applied Sciences program in keeping with the emphasis on the societal benefits of Earth science research that was discussed in the decadal survey. Members may wish to ask more specifically whether NASA's Applied Sciences programs include, or plan to include, activities that would help state, local, private, and Federal bodies adapt to and mitigate the impacts of climate change discussed in the Intergovernmental Panel on Climate Change (IPCC) assessments.

## Aeronautics Research

The President's FY 09 budget requests $446.5 million for Aeronautics Research, which includes aviation safety, airspace systems, fundamental aeronautics, and aeronautics test program. NASA states that its Aeronautics Research is now aligned with the National Aeronautics R&D Policy and the National Plan for Aeronautics R&D and Related Infrastructure, which were developed by the Administration over the past two years. From a direct cost perspective, the FY 09 budget for Aeronautics represents an effective $65.2 million decrease from the FY08 appropriation. After FY 09, the NASA Aeronautics funding would essentially stay level through FY 13, thus continuing to decline in purchasing power. As a point of comparison, NASA Aeronautics funding was about $1.85 billion (2006 dollars) in 1994—the current budget request is thus only about 24% of that level.

The aeronautics community relies upon NASA for aeronautical research and development. Beginning in late 2005, NASA began restructuring its aeronautics program to move away from a program that included technology demonstration projects and R&D that led to greater technology maturity towards a program focused on more fundamental research. These changes in NASA's Aeronautics program occur at a time when the Next Generation Air Transportation System R&D initiative known as NextGen is ramping up. NextGen is intended to transform the existing air traffic control system to accommodate projected growth in air passenger and cargo rates over the next decade. As part of this modernization, NextGen aims to develop a more efficient; and more environmentally friendly national air transportation

system, while maintaining safety. The development of NextGen is being overseen by the Joint Planning and Development Office (JDPO), a joint initiative of the Department of Transportation, NASA, Commerce, Defense Homeland Security, and the White House OSTP. FAA has traditionally relied on NASA for a significant portion of the R&D related to air traffic management as well as research to help address substantial noise, emissions, efficiency, performance, and safety challenges that are required to ensure vehicles can support the NextGen vision.

Aeronautics topics and issues related to the FY 09 budget request include the following:

***Potential "Technology Gap" for NextGen***—NASA's redirection of its aeronautics research priorities raised Congressional concern last year regarding the possibility of a significant "technology gap" in a number of key NextGen technology areas. While some progress has been made in the past year as a result of JDPO's completion of concept of operations, planning and architecture documents (and the first ever plan for research and development, including agency roles and responsibilities), much work remains to be done in adequately planning, resourcing, and scheduling research activities. The $25 million reduction in NASA's budget from FY08 to FY 09 for Airspace Systems—which funds the agency's air traffic management work in support of NextGen—does not generate confidence in NASA's ability to meet its future JDPO responsibilities and specifically in affecting the "technology gap" in an urgent manner.

## International Space Station

The President's FY 09 NASA budget requests $2.06 billion for the International Space Station (ISS) program for on-orbit assembly, launch processing activities, operations and continuation of research payload and experiment deliveries to orbit. The FY 09 budget funds the delivery and operation of the habitability modifications to allow an increase in ISS crew size to six. Up to this point, the ISS was limited to three crew members, thus limiting the amount of research that could be performed as assembly and operational responsibilities required considerable attention. NASA's plan to complete the ISS will meet the commitment to the International Partners. In addition, a key challenge facing the ISS Program will be the need to purchase alternate cargo and crew transportation services after the Shuttle is

retired, which is scheduled for 2010. NASA's FY 09 budget request includes $2.6 billion for the purchase of cargo transportation services over five years, $600 million of which is committed to purchases of crew transportation from Russia through FY 11. From a direct cost perspective, the proposed FY 09 budget represents an effective increase of $247 million from that appropriated in FY 08.

ISS topics and issues related to the FY 09 budget request include the following:

***ISS Cargo and Crew Transportation Services In the Post-Shuttle Era***— The Commercial Crew and Cargo Program is NASA's effort to foster the development of a cost-effective commercial space transportation capability for the post-Shuttle Era. This capability will initially be utilized to carry cargo to the ISS; future options could involve developing a crew transportation capability. The development of the commercial cargo/ crew transportation capability is being funded in the Constellation budget. Once the services have been demonstrated, the operational responsibility for the program will move to the ISS program within the Space Operations Missions Directorate.

As the Space Shuttle nears retirement, NASA's stated preferred solution for ISS crew and cargo delivery and return requirements is to use commercial services provided by space transportation companies. NASA's Commercial Orbital Transportation Services (COTS) project is intended to facilitate U.S. private industry's development of cargo and crew space transportation capabilities with the goal of demonstrating reliable, cost effective access to low Earth orbit. NASA had initially selected two partners for its COTS project under Space Act Agreements. One partner failed to meet NASA's milestones and NASA terminated the Agreement. With the recent GAO decision rejecting a challenge by the terminated partner to NASA's plans to utilize a Space Act Agreement rather than a government contract, NASA is now working toward choosing one or more additional funded partner(s), and a decision is expected in February 2008. If NASA's preferred solution of using commercial services is not attainable, NASA will need to rely on alternatives such as continued purchases of Russian Progress vehicles, European Automated Transfer Vehicles (ATV), or Japanese H-II Transfer Vehicles (HTV). Those alternatives, however, would require some time to procure. Furthermore, purchases of Russian capabilities beyond 2011 will require negotiations to address requirements of the Iran, North Korea and

Syria Non-Proliferation Act (INKSNA). A Request for Proposals (RFP) will be sent out for Phase 2 of the COTS program in April 2008 with a contract award by the end of the year. An issue that could be raised at the hearing is when the State Department would need to initiate negotiations to ensure NASA does not face a shortfall in cargo transportation capability—should it be forced to purchase such capabilities from Russia.

***Establishing ISS Program Service Life***—NASA indicates that while the FY 09 budget run out does not presently allocate funds for operating ISS beyond 2016, it is not taking any action to preclude it. Likewise, out year projections do not include costs to retire and decommission ISS. An issue that could be addressed at the hearing is what impact a possible U.S. departure would have on the ISS international partners.

***International Space Station Research***—The ISS is intended to serve as an on-orbit facility where R&D in support of both human exploration and non-exploration purposes and other exploration technologies is to be conducted. However, the ISS research budget, which is bookkept in the Exploration Systems (ESMD) budget has been significantly cut back in recent years to help fund the Crew Exploration Vehicle/Crew Launch Vehicle and for other purposes.

## Space Shuttle

The President's FY 09 budget requests $2.98 billion to operate and maintain NASA's three Space Shuttles, and to conduct five ISS assembly flights in FY 09. Assembly flights include the launch of the last major power element for the ISS and other significant infrastructure and international partner hardware. From a direct cost perspective, the proposed budget represents an effective decrease of $285 million from that appropriated in FY 08.

Space Shuttle topics and issues related to the FY 09 budget request include the following:

***Maintaining the flight schedule***—NASA plans to complete six shuttle flights in FY 08—five for ISS assembly and one Hubble Space Telescope servicing mission. In FY 09, NASA plans to fly five additional missions. This tempo has not been achieved since the *Columbia* accident. So while

NASA should be commended for not allowing schedule pressures to detract from its safety focus, the frequent delays encountered since return to flight after the Columbia tragedy pose daunting challenges to the agency's flight manifest and its plan to conduct all missions in the window available.

***Fly-out of Planned Shuttle Missions***—NASA's Shuttle manifest shows two logistics flights before the Space Shuttle is retired by the projected September 2010 date. However, the Administration has not committed to completing these two so-called "contingency" flights although the funding necessary to accomplish them is included--assuming the flights are carried out by October 2010. Furthermore, as previously indicated, the window for all shuttle flights grows smaller when missions are delayed and may have an impact on whether these two logistics missions can be flown. These two missions will carry spares for the ISS that only the Space Shuttle can accommodate, and the program considers the flights as necessary rather than "nice-to-have." Provision of such spares is paramount to maintaining the extended health of the ISS.

***Space Shuttle Program Transition and Retirement***—There will be a significant level of effort required for program shutdown after the Shuttle's retirement in FY 10. NASA's FY 09 budget request's five-year plan does not include funds or a plan to address Space Shuttle program transition and retirement past FY 10 even though NASA acknowledges that there will be costs associated with the shutdown. While NASA indicated that concrete plans and budgets would be included in the FY 09 request, this did not materialize. NASA recently told the Committee that initial cost estimates for transition that reached into the billions of dollars are still being refined and that the agency's present goal is to bring this down to less than $500 million. Currently, NASA estimates the cost at approximately $1.2 billion. According to NASA, attainment of this level of reduction is dependent on decisions to be made on the state in which the orbiters will be preserved and what Space Shuttle buildings and facilities can be effectively used by the Constellation Program or others. In addition, a drastic "step function" may occur in the number of Civil Service Full Time Equivalents (FTEs) and the number of contractor personnel supporting the Space Shuttle. NASA is currently refining its schedule for moving personnel off of the Space Shuttle. The most recent estimates for personnel remaining on the Shuttle program by year are listed below:

| | FY 07 | FY 08 | FY 09 | FY 10 | FY 11 |
|---|---|---|---|---|---|
| Civil Service FTEs | 1,765 | 1,805 | 1,741 | 1,671 | 0 |
| Contractor personnel | 16,105 | 15,395 | 13,698 | 11,023 | 0 |

## Exploration Initiative

The President's proposal for NASA's FY 09 budget provides $3.50 billion for Exploration Systems to fund Constellation Systems, which includes the development, demonstration, and deployment of the Orion Crew Exploration Vehicle (CEV) and the Ares I Crew Launch Vehicle (CLV) as well as associated ground and in-orbit infrastructure; and Advanced Capabilities, which includes human research to support ISS and future exploration; a lunar precursor robotic program; microgravity research; and technology development to support Orion and other exploration programs. From a direct cost perspective, the proposed FY 09 budget represents an increase of $357.4 million from that appropriated in FY 08. In addition, the President's request for the Constellation program increases from that appropriated in FY 08 by $576.3 million.

Exploration topics and issues related to the FY 09 budget request include the following:

***CEV and CLV schedule and budget***—The President's Vision statement directed NASA to have the CEV operational no later than 2014. The NASA Authorization Act of 2005 directed the NASA Administrator *"manage human space flight programs to strive to achieve…launching the Crew Exploration Vehicle as close to 2010 as possible"* subject to the proviso that the Administrator shall *"construct an architecture and implementation plan for NASA's human exploration program that is not critically dependent on the achievement of milestones by fixed dates."* NASA originally said that its budget plan would deliver an operational CEV in 2014. However, in FY 07, NASA concluded that *"As a result of this analysis over the past two months, the FY 2008 budget request does not support a 2014 initial operational capability, but March 2015, even before the FY 07 CR impact…"* At last year's budget hearing before the Committee, the NASA Administrator said

that while the reduction in funding caused by the 2007 Continuing Resolution extended the operational date to September of 2015, NASA terminated some lower priority activities to buy back some schedule for the CEV. This returned NASA to the March of 2015 date. The FY 09 budget request funds activity levels that maintain NASA's commitment to reach initial capability for both Orion and Ares I by March 2015 and thus does not permit acceleration of such operational capability. However, NASA states that while it can only commit to the March of 2015 date, it will strive to improve upon that milestone, to effectively reduce the gap in U.S. manned transportation capability caused by the retirement of the Space Shuttle. Meeting this date will require timely resolution of design issues that have surfaced, particularly in the Ares I program. An October 2007 GAO report on Ares I found that "*requirements instability*," "*technology and hardware development knowledge gaps*", an "*aggressive schedule*", and "*projected funding shortfalls*" represent significant challenges for the program. Although NASA states that threats to Orion and Ares I projects are being worked through using a rigorous risk management process, an area of concern due to its potential impact on NASA's ability to maintain its scheduled operational date of March of 2015 is the level of reserves through FY 10. These are characterized by NASA as minimal, less than 8 percent. Another area of concern that could have ramifications for weight and cost is whether Orion will be designed to make land or water landings. A decision from NASA is expected by March of 2008.

***Reduced funding of Exploration Technology Development***— The Exploration Technology Development Program (ETDP) provides new technologies that will enable NASA to conduct future human missions and reduce risk and lifecycle cost. ETDP investments reduce the risk of infusing new technologies into flight projects by maturing them to the level of demonstration in a relevant environment. For example, one project is developing technologies for atmospheric management, environmental monitoring and control, advanced air and water recovery systems, and waste disposal for use inside crew habitats. Despite the critical role technology development plays in reducing the risks of future space travel, funding for exploration technology development is being reduced by $42.9 million from that appropriated in FY 08. Funding surpassing that provided in FY08 is not projected to occur until FY 10 at the earliest.

***Lunar Robotic Precursor Program (LRPR)***—NASA's LRPR includes the Lunar Reconnaissance Orbiter (LRO), which will take high-resolution

images of the moon, map resources, and assess the lunar environment for future exploration, and the Lunar Crater Observation and Sensing Satellite (LCROSS), which will explore the darker region at the lunar poles. The combined mission is scheduled to launch in late 2008 on an Atlas V. The LRPR will also manage the development of two small lunar landers that are being initiated through the Science Mission Directorate's FY 09 budget plans.

## Space Communications

The President's FY 09 budget requests $582.9 million for Space Communications and Navigation, about $280 million above the FY 08 appropriation, as compared in direct dollars. Most of the increase was acquired from the transfer of the Deep Space Network and Near Earth Network from the Science Mission Directorate. The transfer was part an effort to consolidate the management and budget for all space communications activities within the Space Operations Mission Directorate. The FY 09 budget includes $154 million to develop two replacement satellites for the Tracking and Data Relay Satellite System (TDRSS), which provides in-orbit communications links between on-orbit systems [e.g., the Shuttle, ISS, Hubble, and near-Earth orbiting satellites]. Other agencies also rely on TDRSS. The communications support provided by TDRSS is projected to decline by 2011. These replacements will ensure TDRSS support until 2016.

*Deep Space Network*—In a report to the Committee in April 2006, the GAO raised concerns about the DSN's aging and fragile infrastructure. While NASA is working toward consolidating its space communications into a single integrated network architecture, an issue that could be raised at the hearing is why NASA, despite warnings about aging, DSN's funding for the next five years is essentially flat.

## Education

The President's budget proposes $115.6 million in FY 09 to support NASA's Education program, including projects targeted at higher education, minority university research and education, elementary and secondary education; and the E-education project, which supports development of

technology products, services, and applications, as the informal education project, which seeks to expand student, educator, and public learning in STEM areas. The proposed FY 09 budget represents a reduction of $10 million from the FY 08 budget appropriation. The cuts were allocated across the portfolio of programs. A recent National Research Council review of NASA's K-12 education program recommended an increased use of partners in its pre-college education programs, definition of realistic project goals, and development of a plan for project and program evaluations.

In addition to the projects included in NASA's education office, the Science Mission Directorate, for example, includes educational programs through some of its divisions and individual space missions. Members may wish to ask whether NASA is taking appropriate steps to maximize the effectiveness of the agency's investments in education, including how these investments relate to STEM education.

Attachment 1

# FY 2009 Budget Request

| Budget Authority, $ in millions<br>By appropriation account<br>By Theme | FY 2007 | FY 2008 | FY 2009 | FY 2010 | FY 2011 | FY 2012 | FY 2013 |
|---|---|---|---|---|---|---|---|
| **Science** | **$4,609.9** | **$4,706.2** | **$4,441.5** | **$4,482.0** | **$4,534.9** | **$4,643.4** | **$4,761.6** |
| Earth Science | $1,198.5 | $1,280.3 | $1,367.5 | $1,350.7 | $1,250.9 | $1,264.4 | $1,290.3 |
| Planetary Science | $1,215.6 | $1,247.5 | $1,334.2 | $1,410.1 | $1,537.5 | $1,570.0 | $1,608.7 |
| Astrophysics | $1,365.0 | $1,337.5 | $1,162.5 | $1,122.4 | $1,057.1 | $1,087.7 | $1,116.0 |
| Heliophysics | $830.8 | $840.9 | $577.3 * | $598.9 | $689.4 | $741.2 | $746.6 |
| **Aeronautics** | **$593.8** | **$511.7** | **$446.5** | **$447.5** | **$452.4** | **$456.7** | **$467.7** |
| **Exploration** | **$2,869.8** | **$3,143.1** | **$3,500.5** | **$3,737.7** | **$7,048.2** | **$7,116.8** | **$7,666.8** |
| Constellation Systems | $2,114.7 | $2,471.9 | $3,048.2 | $3,252.8 | $6,479.5 | $6,521.4 | $7,080.5 |
| Advanced Capabilities | $755.1 | $671.1 | $452.3 | $484.9 | $568.7 | $595.5 | $586.3 |
| **Space Operations** | **$5,113.5** | **$5,526.2** | **$5,774.7** | **$5,872.8** | **$2,900.1** | **$3,089.9** | **$2,788.5** |
| Space Shuttle | $3,315.3 | $3,266.7 | $2,981.7 | $2,983.7 | $95.7 | $0.0 | $0.0 |
| International Space Station | $1,469.0 | $1,813.2 | $2,060.2 | $2,277.0 | $2,178.4 | $2,448.2 | $2,143.1 |
| Space and Flight Support (SFS) | $329.2 | $446.3 | $732.8 * | $612.1 | $626.0 | $641.7 | $645.4 |
| **Education** | **$115.9** | **$146.8** | **$115.6** | **$126.1** | **$123.8** | **$123.8** | **$123.8** |
| **Cross-Agency Support** | **$2,949.9** | **$3,242.9** | **$3,299.9** | **$3,323.9** | **$3,363.7** | **$3,436.1** | **$3,511.3** |
| Center Management and Operations | $1,754.9 | $2,013.0 | $2,045.6 | $2,046.7 | $2,088.0 | $2,155.3 | $2,211.6 |
| Agency Management and Operations | $971.2 | $830.2 | $945.6 | $945.5 | $939.8 | $950.5 | $961.3 |
| Institutional Investments | $223.8 | $319.7 | $308.7 | $331.7 | $335.9 | $330.4 | $338.3 |
| Congressionally Directed Items | $0.0 | $80.0 | $0.0 | $0.0 | $0.0 | $0.0 | $0.0 |
| **Inspector General** | **$32.2** | **$32.6** | **$35.5** | **$36.4** | **$37.3** | **$38.3** | **$39.2** |
| *FY08 Rescission*** | | *($192.5)* | | | | | |
| **NASA FY 2009** | **$16,285.0** | **$17,116.9** | **$17,614.2** | **$18,026.3** | **$18,460.4** | **$18,905.0** | **$19,358.8** |
| Year to Year Change | | 5.1% | 2.9% | 2.3% | 2.4% | 2.4% | 2.4% |

Budgets include all direct costs required to execute the programs. Indirect costs are now budgeted within Cross-Agency Support.

* Deep Space and Near Earth Networks Transfer ($256M) to SFS in FY 2009

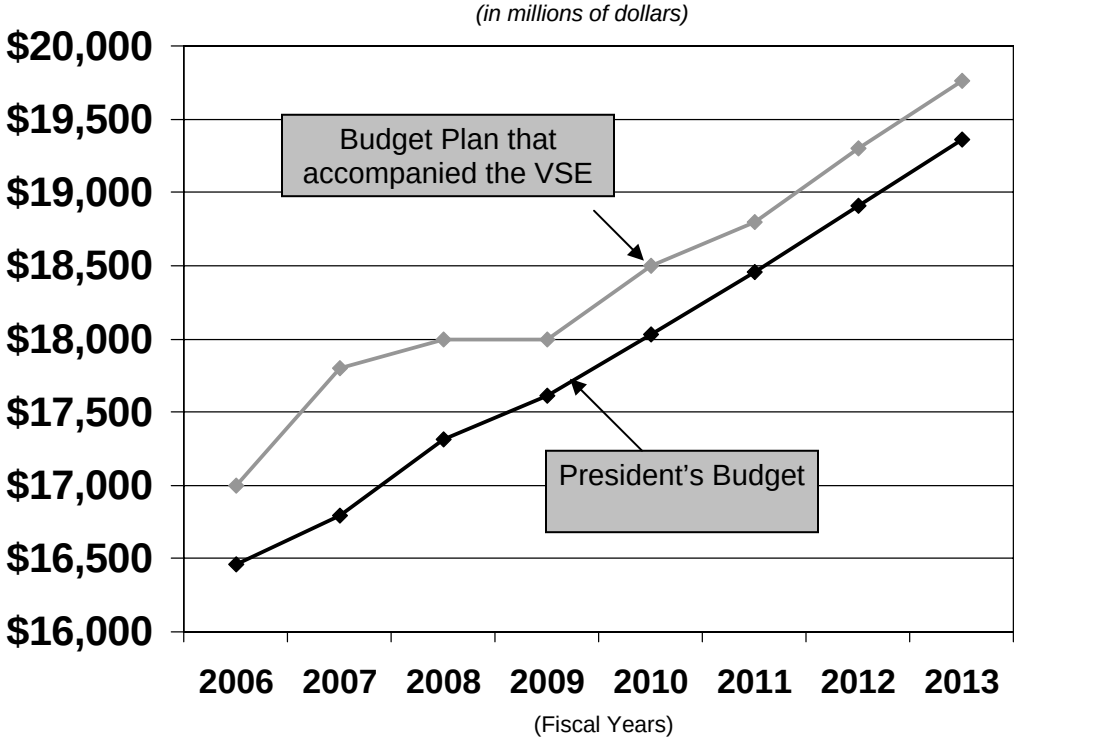
** FY08 Appropriation rescinded $192.475M in prior-year unobligated balances, effectively reducing FY 2008 authority.

Source: NASA

FY08 budgets are the enacted levels per the Agency's FY 2009 Budget Estimates. Totals may not add due to rounding

**Attachment 2**

Comparison of Budget Plan that accompanied the VSE (Vision for Space Exploration) with actual/planned President's Budget Requests for NASA
*(in millions of dollars)*




VSE = Vision for Space Exploration