

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

NASA's Fiscal Year 2010 Budget Request

Tuesday, May 19, 2009

2:00 P.M. – 4:00 P.M.

2318 Rayburn House Office Building

Purpose:

On Tuesday, May 19, 2009 at 2:00 pm, the Committee on Science and Technology will hold a hearing on the National Aeronautics and Space Administration's (NASA) Fiscal Year 2010 Budget Request, NASA's proposed Fiscal Year 2009 Operating Plan, and use of funds provided through the Recovery Act.

Witness:

Mr. Christopher Scolese

Acting 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 projected civil service workforce for FY 2009 is 17,900 employees. NASA has ten field Centers, including the Jet Propulsion Laboratory (JPL), a Federally Funded Research and Development Center (FFRDC). 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 is undertaking an exploration initiative with the goals of developing a new human space transportation system for both

low Earth orbit and for missions beyond low Earth orbit, returning American astronauts to the Moon by 2020, and carrying out a broad program of human and robotic exploration of the solar system. NASA also maintains a space communications network that supports both NASA missions and other federal agency requirements. As of 2007, the most recent date for which complete data are available, about 82 % of NASA's budget was for contracted work. In addition, a number of NASA's scientific and human space flight activities involve collaboration with international participants.

Budgetary Information

NASA's proposed budget for FY 2010 is \$18.7 billion, an increase of 5.1% over the enacted FY 09 appropriation for NASA. The FY10 budget projection for NASA beyond FY10 is essentially flat through FY13. Attachment 1 summarizes the FY 10 budget request and its five-year funding plan. In addition, The American Recovery and Reinvestment Act [P.L. 111-5], included \$1 billion for NASA's Earth science, aeronautics exploration programs, cross-agency support, and Inspector General. Recovery Act funds are to be expended by September 30, 2010.

The President's request for FY10 continues the budgetary structure that was introduced for the FY 09 budget and is presented in seven accounts—Science; Aeronautics; Exploration; Space Operations; Education; Cross Agency Support; and Inspector General. As part of the budget restructuring that was introduced with the FY 09 President's request, 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. 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 Vision for Space Exploration introduced by President Bush in 2004 with the actual funds requested for NASA. As can be seen, previous budget requests for NASA 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 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 additional funding provided in the FY 09 appropriation and the FY10 budget request help to redress that shortfall. However the FY 10 budget request does not project growth for the NASA budget beyond FY10, and the disparity between the 2004 budget projections for FY 11-14 that the agency was planning against and the budgets that are now being proposed through FY 2014 is shown in the chart. In addition, the impact of

the budgetary shortfalls since 2004 has been exacerbated by the requirement to absorb the cost of the Shuttle's return-to-flight following the Columbia accident, the additional cost associated with the under budgeting of Shuttle transition and retirement that occurred in the FY 05 budget plan, and the under budgeting of ISS program support that also occurred in the FY 05 budget plan, which NASA indicates resulted in an unfunded lien against the agency's budgets of about \$6.5 billion through FY 10

To put the FY 10 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; completing assembly of, operating, and utilizing the International Space Station; completing the development of a new Crew Exploration Vehicle/Crew Launch Vehicle by 2015; returning American astronauts to the Moon by 2020; and conducting science and aeronautics programs. The NASA Authorization Act of 2008 [P.L. 110-422] authorized an FY 09 funding level for NASA of \$20.21 billion; the FY 09 NASA budget request was \$17.61 billion and the appropriation for FY 09 was \$17.78 billion. The Committee is planning to move a multi-year reauthorization of NASA this year.

Acquisition Management

Problems of cost growth and schedule delay in NASA's programs were addressed in the past two NASA Authorization Acts. Specifically:

- Provisions in the NASA Authorization Act of 2005 [P.L. 109-155] were enacted to help NASA and Congress spot potential cost growth and schedule problems early in the development phase of a major program. Under the 2005 Act, a Baseline Report is required whenever a major program completes required reviews and is approved to proceed to implementation. After completing the Baseline Report, the Act requires NASA to report periodically on a major program through an Annual Report, which is provided as part of the annual agency budget submittal to the Congress, until the program enters operation. The provision defines a major program as an activity with a life-cycle cost estimate greater than \$100 million. Having established the baseline, the 2005 legislation sets thresholds that, if exceeded, require agency action.
- Concerns regarding the increasing number of Earth and space science missions that were exceeding the 15 percent threshold established in the NASA Authorization Act of 2005 prompted a requirement in the NASA Authorization Act of 2008 [P.L. 110-422] for an independent review of the situation. The Act directs the NASA Administrator to arrange for an independent external assessment to identify the

primary causes of cost growth in large, medium, and small space and Earth science spacecraft mission classes.

NASA's submission provided in conjunction with the FY 2010 budget indicates that five of eleven projects included in this year's report have had schedule growth in excess of six months from their baseline. Three of these five projects have reported cost growth of 15 percent or more from their baseline. The Mars Science Laboratory reported a 68% increase from its baseline development cost estimate, from \$969 million to \$1.63 billion, and a 26 month delay.

With respect to NASA's contract management practices, NASA remains on the General Accountability Office's (GAO)'s "high risk" list for its contract management practices. Regarding financial management, an independent audit was unable to provide "an opinion on NASA's financial statements for the fiscal years ended September 30, 2008 and 2007." Although the audit found that NASA had improved its internal controls, the auditor (Ernst & Young LLP) disclaimed an opinion due to "continued significant weaknesses in NASA's financial management processes and systems, including issues related to internal controls for property accounting." NASA will need to address other "material weaknesses" identified in the audit.

NASA has taken actions to improve its cost estimating and budgeting process for its space mission acquisitions, and has been recognized by the GAO for its progress in those areas. Acquisition management is an area that the Committee will continue to watch closely. The Subcommittee on Space and Aeronautics held a hearing in March 2009 on NASA's acquisition management and will continue to conduct oversight of this issue.

PROGRAM AREAS

Earth Science

The President's budget for FY10 requests \$1.4 billion in direct dollars for Earth science research, applications, Earth observing missions, education and outreach, and technology development, and increase of about \$25 million over the FY09 enacted budget. In addition, Earth science received \$325 million in Recovery Act funds. When taken together, the Earth Science account represents an increase of over \$1.2 billion for the FY09-FY13 period over the previous NASA budget plan, including the Recovery Act

funds. The budget proposal for Earth science reflects the Administration's commitment to fund "space-based research that supports the Administration's commitment to deploy a global climate change research and monitoring system." The budget increases for Earth science are aimed at accelerating the development of missions recommended in the National Academies' Earth Science Decadal Survey and on completing development of Earth science "foundational" missions.

Thus far, the Soil Moisture Active-Passive (SMAP) has entered its formulation phase and the Ice, Cloud, and Land Elevation Satellite (ICESat II), will soon enter its formulation phase. The other two missions in the Decadal Survey's first tier of priority, the Climate Absolute Radiance and Refractivity Observatory (CLARREO) and the Deformation, Ecosystem Structure, and Dynamics of Ice (DESDynI) projects are in the pre-formulation stage (concept study). The FY10 budget also includes \$12.9 million in FY10 and about \$233 million over FY10-13 for Venture-class missions, which will support a program for competitive suborbital, airborne, and small satellite projects that was recommended in the Decadal Survey. The augmentation for Earth science has been done, in part, with the goal of accelerating work on the Decadal Survey missions. An issue for the hearing is how much "acceleration" is this funding buying?

NASA has allocated at least \$100 million of Recovery funds to support "foundational missions" that are currently in the formulation and implementation phases of development. These missions include the Global Precipitation Measurement (GPM) Mission, the Landsat Data Continuity Mission, and Glory. The FY10 budget proposal does not include funds to re-fly an Orbiting Carbon Observatory (OCO) satellite (or a similar sensor), which was lost due to a launch failure in late February 2009. NASA is analyzing options to re-fly the satellite or a similar sensor and expects to have a decision by late June. NASA would need to reallocate funding among its programs in order to replace the OCO satellite. If NASA were to fund an OCO replacement using funds allocated to SMAP and ICESat II, those satellite mission developments could be expected to slip by roughly two years or more, according to NASA officials.

Other Changes to Earth Science Program Areas

The proposed FY10 provides increases for research and computing over the FY10-13 period, as compared to the FY09 enacted budget, but makes modest cuts to technology, Applied Sciences, and multi-mission operations budgets. NASA's Applied Sciences program, involves the development of decision support tools that apply the research results of NASA's Earth science missions to support other Federal agency and institutional missions in the areas of climate, ecosystems, agriculture, water, disaster management and other areas that benefit society. How NASA's plans to support decision

support tools for stakeholders, especially in the area of climate change, is a potential issue to explore in the hearing.

Research to Operations

The 2005 NASA Authorization Act and the 2008 NASA Authorization Act directed NASA to coordinate with the National Oceanic and Atmospheric Administration (NOAA) and report on plans for transitioning research sensors and satellites into operational service. In addition, the 2008 Authorization Act directed the Office of Science and Technology Policy (OSTP) to develop a process and to coordinate agency budget requests to enable the transitions. NASA and NOAA have continued to coordinate plans to address climate measurements that were eliminated in the restructuring of the National Polar-orbiting Operational Environmental Satellite System (NPOESS) program, to acquire the Geostationary Operational Environmental Satellite System (GOES)-R weather spacecraft and instruments, and to plan for Earth science decadal survey missions. NASA has not provided details on the level of resources required to enable effective planning and transition of its sensors and satellites into operations. The hearing could explore this question, especially given the importance for long-range planning on climate monitoring.

Space Science

The President's FY10 budget requests \$3.07 billion in direct program dollars (not including Earth science) 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 budget request for space science is about \$126.3 million less than the FY09 enacted budget (including the transfer of funding for the lunar precursor robotic program to space science from the Exploration Systems budget). Over the FY10-13 period, the Astrophysics budget remains essentially flat, the Planetary Science program is reduced by approximately \$100 million, and the Heliophysics budget decreases by about \$35 million, as compared to the FY09 budget projection for FY10-13.

Space Science topics and issues related to the FY 10 budget request include the following:

Program Readjustments to Reflect Budgetary Outlook

While the previous FY09 budget request included new initiatives including a Mars Sample Return mission, an Outer Planets Flagship mission, and a Joint Dark Energy mission, among others, that could not realistically be accommodated within the FY09 budget proposal, the FY10 budget plan for space science no longer includes these or other major new initiatives. For example, NASA selected the Europa Jupiter System target as the focus of an Outer Planets Flagship mission, but elected to proceed with technology development, further definition, and discussions on a potential partnership with the European Space Agency (ESA) on a potential future mission. The FY10 budget plan for planetary sciences does not include a Mars Sample Return mission. NASA officials have indicated their interest in working more closely with ESA on potential Mars missions for the 2016 and 2018 launch opportunities. In addition, NASA is sustaining technology development on potential exosolar planet detection and dark energy missions. NASA has reported that it will base its decisions on which missions to initiate on the results of the National Academies decadal surveys for astronomy and astrophysics and for planetary science that are expected to be finished in 2010 and 2011 respectively.

Research

The FY10 request for Planetary Sciences restructured the program to include a new Lunar Quest budget line, which organizes planetary activities in lunar science, a lunar atmosphere and dust mission, and an International Lunar Network activity into a single program. The FY10 budget request for Lunar Quest is \$103.6 million. The status of the International Lunar Network activity is pending the outcome of the Human Spaceflight Review that is described in a later section of the Charter.

The Mars Exploration Program

The FY 10 budget requests \$416 million for the Mars Exploration Program, an increase of about \$116 million over the FY10 request in the previous budget submission. The NASA budget requests an increase of \$431.3 million for Mars Exploration over the FY10-13 period, as compared to the FY09 budget request, in large part to complete work on the Mars Science Laboratory (MSL) mission. NASA moved MSL's launch date from 2009 to 2011 due to technical problems with the mission. The Management and Performance section of the FY10 budget request reports that MSL experienced a 68 percent cost growth. NASA has stated its interest in cooperating with ESA on future

Mars missions. According to NASA officials, the agency has initiated a review of the Mars architecture.

Aeronautics Research

For FY 2010, NASA is requesting \$507 million for aeronautics research, \$143 million less than that enacted in FY 2009 (The FY 2009 enacted level includes \$150 million appropriated by the Recovery Act). The requested FY 2010 level is about \$60 million greater than that projected for FY 2010 in last year's budget submission.

NASA's aeronautics research directly supports the goals and objectives of the National Aeronautics Research and Development Policy signed by the President in December 2006. The budget request funds activities that include (1) foundational research across a number of core competencies that support aeronautics and space exploration activities; (2) research in key areas related to the development of advanced aircraft technologies and systems, including those related to aircraft safety, environmental compatibility, and fuel efficiency; and (3) research that supports the Next Generation Air Transportation System (NextGen). NextGen is a joint effort between the Federal Aviation Administration (FAA), NASA, and the Departments of Defense, Homeland Security and Commerce that will transform the entire national air transportation system, gradually allowing aircraft to safely fly more closely, reduce delays, and providing benefits for the environment and the economy through reductions in carbon emissions, fuel consumption, and noise. The aeronautics budget also funds the Aeronautics Test Program which encompasses the critical suite of aeronautics test facilities needed to conduct aeronautics research.

In FY 2010, the Aeronautics Research Mission Directorate plans to realign its NextGen work to distinguish research conducted on concepts and technologies from that focused on systems analysis, integration, and evaluation. In addition, in FY 2010, NASA plans to establish a program of integrated, system-level focused activities, the first of which will be the Environmentally Responsible Aviation (ERA) Project. ERA's research goal will be the reduction of environmental impacts of aviation in terms of noise and emissions.

Human Space Flight

NASA's Human Space Flight activities to be funded in FY 2010 encompass completing construction of the International Space Station (ISS), retiring the Space Shuttle fleet upon completion of the ISS and delivery of the AMS to the ISS, stimulating development and demonstration of commercial space transportation vehicles that may support NASA's ISS cargo and potentially its crew requirements, and continuing the development of systems

to deliver people and cargo to the ISS and the Moon and to explore other destinations. Along with the budget release, the Administration also announced the establishment of an independent review of NASA's human space flight activities. Results from that review will support a planned August 2009 decision on how the nation's human space flight will proceed. OSTP Director John Holdren's May 7, 2009 letter to NASA's Acting Administrator and a recent communication to the Committee from NASA concerning the Human Space Flight Review are attached as Attachments 3 and 4 respectively.

Space Shuttle

NASA is requesting approximately \$3.16 billion for the Space Shuttle Program, an increase of about \$175 million over that enacted in FY 2009 and an increase of about \$173 million from that projected for FY 2010 in last year's budget submission. Requested funding will enable the agency to conduct an additional Shuttle mission to transport the Alpha Magnetic Spectrometer (AMS) per the direction of the NASA Authorization Act of 2008 [P.L.110-422]. Following return of the Hubble servicing mission currently underway, eight Space Shuttle flights will remain to be flown. NASA believes these flights can be accomplished by the end of 2010, after which the Shuttle fleet will be retired.

According to NASA, it has accounted for Shuttle transition and retirement costs in projected budgets for the Shuttle Program in FY 2011 (\$383 million) and FY 2012 (\$88 million). This is a significant reduction from the multi-billion dollar cost estimate projected by NASA two years ago.

International Space Station

NASA is requesting approximately \$2.27 billion for the ISS, an increase of about \$207 million over that enacted in FY 2009 and a decrease of about \$10 million from that projected in last year's budget submission for FY 2010. Since the first component of the Station was put in orbit in November 1998, the ISS has grown into a fully functioning laboratory that will shortly house an increased crew size of six. The recent additions of the final set of solar arrays and a replacement Distillation Assembly for the water recycling system make this increased crew size possible. NASA plans to complete assembly of the ISS in 2010, including the additional research capability provided by the AMS.

NASA and its Russian, Japanese, European, and Canadian ISS partners are nearing completion of their goal of being able to conduct various types of research on a Space Station in Earth orbit. Some of NASA's work is focused on increasing knowledge of the effects of long-duration human space flight, which is critical for the design and operation of future human space vehicles to return U.S. astronauts to the Moon and explore other destinations. Other non-exploration-related research is also being conducted, as described in the next section. At present, the U.S. has made no final decision on whether or not to operate and utilize the ISS after 2015; however, the international partners have indicated a desire to conduct research beyond that time. The question of whether to operate and utilize the ISS beyond 2015 will be addressed by the aforementioned Human Space Flight Review.

The ISS Cargo Crew Services budget request for FY 2010 is \$628 million, an increase of about \$323 million over that enacted for FY 2009. It is worth noting that the ISS Cargo Crew Services budget is projected to reach about \$1.14 billion in FY 2012. This activity consists of International Partners and commercial purchases. NASA has contracted with Russia's Roskosmos to purchase cargo transportation through 2011 and crew transportation through the spring of 2012. NASA recently made awards to SpaceX and Orbital Sciences to provide cargo and return services beginning in 2011 under the Commercial Resupply Services contract.

International Space Station Utilization

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. To that end, NASA is conducting research on the effects of long-duration spaceflight on humans, as well as examining potential countermeasures. NASA is also using the ISS to demonstrate advanced communications networking. For example, NASA is testing Disruption Tolerant Networking (DTN) software, a "deep space communications network modeled on the Internet", according to a November 2008 press release issued by NASA and JPL. NASA is also using the ISS to experiment with Communication, Navigation and Networking re-Configurable Testbed (CoNNeCT), which will use software reprogrammable radios that can be used to support long-duration space exploration missions. In addition, the ISS is currently testing and demonstrating technologies critical for long-term exploration, such as various life support system technologies.

The International Space Station National Laboratory activity allows other Federal agencies and commercial partners to utilize research capacity on the ISS. NASA has

signed memoranda of understanding with the National Institutes of Health and the USDA Agricultural Research Service for their potential research utilization of the ISS. A commercial company has been conducting research on salmonella that is directed at developing a salmonella target vaccine. According to NASA, non-NASA partners will be required to pay for the transportation of their research experiments to and from the ISS.

The FY10 budget request for ISS research, which is bookkept in the Exploration Systems (ESMD) budget has been cut by about \$20 million from the FY09 enacted budget and is projected to be relatively flat in the out years. The status of the research community and investigations that are ready to fly on the ISS will be an issue for any potential plans to increase the utilization of the ISS. Previous budget cuts to space life sciences and physical sciences research have drastically reduced the number of principal investigators working in these areas of research since FY 2004. In addition, the number of post-doctoral students, PhD, masters and bachelor of science students has dropped precipitously since FY 2004.

In the near future, NASA expects to increase the ISS crew from 3 to 6, which will increase the crew time available for research, according to NASA officials. In addition, following the planned retirement of the Space Shuttle, opportunities to ferry research supplies, hardware, and samples to and from the ISS will depend on the availability of commercial and international cargo resupply services.

Exploration Initiative

President Bush proposed an exploration initiative in 2004 that envisioned a broad program of human and robotic exploration of the solar system, including completion of the ISS, development of a new human space transportation system, a human landing on the Moon by 2020, and exploration of other solar system destinations. The Congress authorized the exploration initiative in the NASA Authorization Act of 2005 (P.L. 109-155) and the NASA Authorization Act of 2008 (P.L. 110-422).

The President's proposal for NASA's FY 2010 budget provides \$3.96 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; 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. The funding requested for FY 2010 is an increase of about \$58 million over that enacted for FY 2009 and is about \$225 million greater than that projected for FY 2010 in last year's President's budget request.

According to NASA, its requested FY 2010 funding level of \$3.50 billion for Constellation Systems, coupled with an enacted FY 2009 funding level of \$3.43 billion, puts it in a position to achieve the projected Initial Operational Capability (IOC) date of March 2015 for the Orion/Ares I. The Orion crew exploration vehicle (\$1.38 billion) and Ares I crew launch vehicle (\$1.42 billion) form the bulk of the Constellation FY 2010 budget request. The FY 2010 budget request for the Ares V cargo launch vehicle (\$25 million) and its runout budget for FY 2011 through FY 2014 (\$100 million total) is insufficient to initiate full scale development of the heavy-lift launch vehicle that is designed to support exploration missions beyond low Earth orbit. In addition, the five-year budget plan contains no significant funding for the Altair lunar lander.

Cargo and Crew Transportation

Once the Shuttle fleet is retired, NASA will rely on a variety of sources to transport cargo and crew to the ISS. The agency's Commercial Crew and Cargo Program, whose goal is to spur private industry to provide cost-effective cargo delivery to the ISS, requests about \$39 million in FY 2010; with the infusion of Recovery Act funds, the FY 2009 enacted level was \$303 million. Flight demonstrations to the ISS are being planned by SpaceX and Orbital Sciences for May 2010 and March 2011 respectively. The Crew and Cargo Program is administered by the Exploration Systems Mission Directorate under Constellation Systems. The demonstration program ends in 2011.

Human Space Flight Review

As part of the submission of its FY 2010 NASA budget request, OSTP Director John Holdren announced that the Obama Administration was asking Mr. Norman Augustine to chair an independent review of NASA's planned human space flight activities. The stated goal of the review is *"to ensure that the nation is pursuing the best trajectory for the future of human space flight—one that is safe, innovative, affordable, and sustainable."* The panel is to report its results by August of this year. According to Dr. Holdren's May 7th letter to NASA's Acting Administrator:

“The review should aim, specifically, to identify and characterize a range of options that spans the reasonable possibilities for continuation of U.S. human space flight activities beyond retirement of the Space Shuttle. Results and supporting analysis should be provided to involved Administration agencies and offices in sufficient time to support an August 2009 decision on the way forward. The identification and characterization of options should be cognizant of—and should address the implications for—the following objectives: (1) expediting a new U.S. capability to support utilization of the International Space Station; (2) supporting missions to the Moon and other destinations beyond low Earth orbit; (3) stimulating commercial space flight capabilities; and (4) fitting within the current budget profile for NASA exploration activities.”

Space Communications

The President’s FY 10 budget requests \$496.6 million for Space Communications and Navigation, about \$86 million less than the FY 09 enacted budget. The budget reflects the fact that NASA has largely completed acquisitions to replenish aging Tracking and Data Relay Satellite System (TDRSS) spacecraft, which are used to support “tracking, data, voice, and video services to the International Space Station (ISS), Space and Earth science missions, as well as other government agency users”.

The FY10 budget request includes plans for NASA’s Space Communications and Navigation program to demonstrate optical communications, which provide higher data rates and involve lower weight, space, and power requirements on spacecraft. Optical communications will help enable more science data to be transmitted to Earth more efficiently. NASA is planning to use a lunar dust and atmosphere mission, anticipated to launch in 2012, to conduct the first optical communications demonstration.

The Deep Space Network (DSN) “consists of three facilities spaced approximately 120 degrees apart on the globe to enable continuous communications to spacecraft as the Earth rotates.” The DSN is aging and the GAO has raised concerns about its fragility and continuing ability to service a mounting workload. NASA’s FY10 budget does not include funds for an upgrade. NASA will construct a new 34-meter beam waveguide antenna in Australia and maintain the existing DSN system while completing an analysis to support a plan for a new phased-array DSN system.

Education

The President's budget proposes \$126.1 million in FY10 to support NASA's Education program. Although the proposed FY10 budget represents no change in the request for FY10 made in the previous budget plan, it reflects a reduction of about \$43 million from the FY09 enacted budget.

The FY10 budget reflects some reorganization of education projects into three program areas:

- The Higher Ed STEM Education program includes the Minority University Research and Education Program (MUREP), Space Grant, and Experimental Program to Stimulate Competitive Research (EPSCoR).
- The K-12 STEM Education program is aimed at engaging and retaining students in STEM disciplines through flight opportunities, hands-on science and engineering activities, and the use of NASA content in teacher development resources.
- Informal STEM Education supports NASA Center activities that respond to requests from community and other informal education providers that use NASA content to engage participants in STEM activities. This program also supports museums, science centers, planetariums, and other venues that help "the American public understand NASA's exploration mission".

In addition to the programs included in NASA's Office of Education, the Science Mission Directorate, the Aeronautics Mission Directorate, the Exploration Systems Mission Directorate, and the Space Operations Mission Directorate as well as the NASA Centers all fund educational projects. How NASA is coordinating education among the Office of Education, the Centers, and the mission directorates on education activities and whether that coordination is effective are potential issues for the hearing.

Facilities and Maintenance

NASA's institutional investments are intended to ensure that facilities and field installations can meet the agency's mission requirements in a safe, secure and environmentally sound manner. NASA is requesting \$355.4 million in FY 2010 for institutional investments. Of that amount, about \$284 million is for construction of facilities which provides for the construction, repair, rehabilitation, and modification of basic infrastructure and institutional facilities. Replacement and renewal projects replacing old, inefficient, and deteriorated buildings with energy efficient buildings will reduce utility usage. The remaining \$71 million requested for FY 2010 is for environmental compliance and restoration which provides the personnel, services, and activities necessary to complete the cleanup of hazardous materials and wastes that have been released to the surface or groundwater at NASA installations. These activities are

mandated under a variety of federal and state environmental laws and regulations, as well as legally enforceable orders and agreements.

NASA has recently undergone a comprehensive review of its facilities and is developing plans to reduce and renew these critical assets. It is worth noting that NASA's estimate of backlogged facilities and maintenance requirements totals \$2 billion. So while projected budget requests for construction and facilities rise from FY 2011 (\$326 million) to FY 2014 (\$397.4 million), it is unlikely that such projected levels will appreciably reduce the backlog in the near future.

In the 2008 NASA Authorization Act (P.L. 110-422, Section 1022), the Committee had expressed concern over the need for adequate maintenance and upgrading of NASA's facilities. In that legislation, the NASA Administrator was directed to determine and prioritize the maintenance and upgrade backlog at each of NASA's Centers and associated facilities and "*develop a strategy and budget plan to reduce that maintenance and upgrade backlog by 50% over the next five years*". The Administrator is to deliver those reports to Congress concurrent with the delivery of the FY 2011 budget request.

Earth-Bound Applications of NASA-Developed Technologies

Technologies and devices developed by NASA to enable space missions and aeronautics research can provide societal benefits when transferred to terrestrial applications. For example:

- A resin developed by NASA for space applications was licensed to a medical technology company who in turn incorporated the material into its design for a left-heart lead. The left-heart lead, which was recently approved by the Food and Drug Administration, delivers electrical impulses directly to the heart from a pacing device implanted in a patient's chest. The NASA-developed resin is highly flexible, resistant to chemicals, and can withstand extreme hot and cold temperatures. The "super plastic" is biologically inert, thus making it suitable for medical use, including implantable devices. The NASA-developed insulation material enabled the company to develop one of the thinnest left-heart leads available.
- An electronic nose developed for monitoring air quality on the International Space Station has shown promise as a new weapon against brain cancer. The electronic nose, developed by NASA to automatically monitor the station's air, is able to detect contaminants within a range of one to approximately 10,000 parts per million. In a series of experiments, researchers used NASA's device to "sniff" brain cancer cells and cells in other organs. Their data demonstrated that the electronic nose can sense

differences in odor from normal versus cancerous cells. These experiments will help pave the way for more sophisticated biochemical analysis and experimentation.

Transfer of NASA technology to the private sector is performed by NASA's Innovative Partnerships Program. The agency's view is that advancing technology through partnerships enables it to address its own needs and apply NASA-derived technology to a range of applications that can provide broad benefit to the public. The program consists of three elements: Technology Infusion, Innovation Incubator, and Partnership Development. For FY 2010, NASA is requesting \$184.8 million for the Innovative Partnerships program, an increase of about \$25 million over that enacted in FY 2009 and an increase of about \$3 million from that projected for FY 2010 in last year's budget submission.

Attachment 1

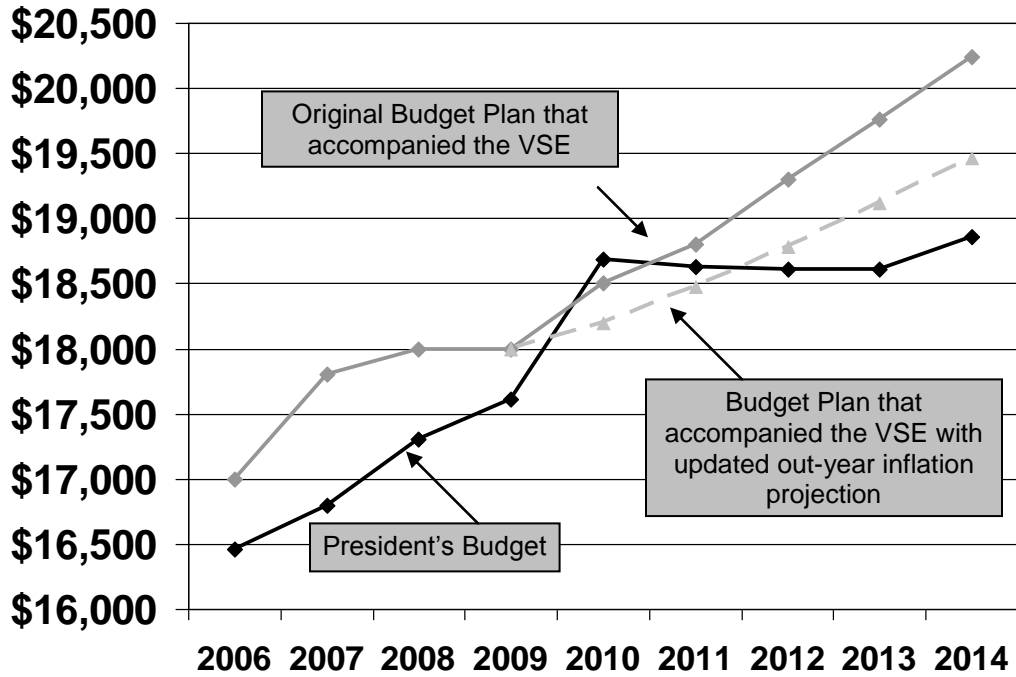
NASA's FY 2010 Budget Request

Budget Authority (\$M)	FY 2008	FY 2009	Recovery Act	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Science	4,733.2	4,503.0	400.0	4,477.2	4,747.4	4,890.9	5,069.0	5,185.4
Earth Science	1,237.4	1,379.6	325.0	1,405.0	1,500.0	1,550.0	1,600.0	1,650.0
Planetary Science	1,312.6	1,325.6		1,346.2	1,500.6	1,577.7	1,600.0	1,633.2
Astrophysics	1,395.6	1,206.2	75.0	1,120.9	1,074.1	1,042.7	1,126.3	1,139.6
Heliophysics	787.6	591.6		605.0	672.6	720.5	742.7	762.6
Aeronautics	511.4	500.0	150.0	507.0	514.0	521.0	529.0	536.0
Exploration	3,299.4	3,505.5	400.0	3,963.1*	6,076.6*	6,028.5*	5,966.5*	6,195.3*
Constellation Systems	2,675.9	3,033.1	400.0	3,505.4	5,543.3	5,472.0	5,407.6	5,602.6
Advanced Capabilities	623.5	472.3		457.7	533.3	556.5	558.9	592.7
Space Operations	5,427.2	5,764.7	0.0	6,175.6	3,663.8	3,485.3	3,318.6	3,154.8
Space Shuttle	3,295.4	2,981.7		3,157.1	382.8	87.8	0.0	0.0
International Space Station	1,685.5	2,060.2		2,267.0	2,548.2	2,651.6	2,568.9	2,405.9
Space and Flight Support (SFS)	446.2	722.8		751.5	732.7	745.9	749.7	748.9
Education	146.8	169.2	0.0	126.1	123.8	123.8	123.8	125.5
Cross-Agency Support	3,251.4	3,306.4	50.0	3,400.6	3,468.4	3,525.7	3,561.4	3,621.4
Center Management and Operations	2,011.7	2,024.0		2,084.0	2,119.2	2,142.5	2,166.1	2,189.9
Agency Management and Operations	834.1	921.2		961.2	956.9	964.5	972.3	981.5
Institutional Investments	325.5	293.7	50.0	355.4	392.3	418.7	423.0	450.0
Congressionally Directed Items	80.0	67.5		0.0	0.0	0.0	0.0	0.0
Inspector General	32.6	33.6	2.0	36.4	37.0	37.8	38.7	39.6
NASA FY 2010	17,401.9	17,782.4	1,002.0	18,686.0	18,631.0	18,613.0	18,607.0	18,858.0
<i>Year to Year Change</i>		2.2%		5.1%	-0.3%	-0.1%	0.0%	1.3%

*Following the human spaceflight review, the Administration will provide an updated request for Exploration activities reflecting the review's results.

Attachment 2

Comparison of Budget Plan that accompanied the VSE (Vision for Space Exploration) in 2004
with actual/planned President's Budget Requests for NASA
(in millions of dollars)



Attachment 3

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY
WASHINGTON, D.C. 20502

May 7, 2009

Christopher Scolese
NASA Acting Administrator
NASA Headquarters
Washington, DC 20546

Dear Chris,

The President believes strongly that space flight is important to America's economic, technological, and scientific leadership, and supports renewed human exploration to the Moon and other destinations beyond low Earth orbit. He fully understands that a strong and vibrant National Aeronautics and Space Administration can serve as a high-tech crucible for ingenuity, helping America maintain its innovative edge. And he appreciates that a robust human spaceflight program, in particular, can nourish the imagination, enrich an appreciation of our planetary home, and inspire the kind of bold achievements for which NASA and this nation have come to be known.

Given the magnitude of America's human space flight ambitions, however, and the significant investment of both funds and scientific capital that will be required to achieve the program's goals, it would be only prudent for the new Administration to review the array of challenges in the program and the options for addressing them as we move forward.

To this end, and in order for the United States to advance its goals and international leadership with regard to space exploration, I request that NASA initiate an independent review of ongoing U.S. human space flight plans and programs, as well as alternatives, to ensure that the nation is pursuing the best trajectory for the future of human space flight – one that is safe, innovative, affordable, and sustainable.

The review should aim, specifically, to identify and characterize a range of options that spans the reasonable possibilities for continuation of U.S. human space flight activities beyond retirement of the Space Shuttle. Results and supporting analysis should be provided to involved Administration agencies and offices in sufficient time to support an August 2009 decision on the way forward. The identification and characterization of options should be cognizant of – and should address the implications for – the following objectives: (1) expediting a new U.S. capability to support utilization of the International Space Station; (2) supporting missions to the Moon and other destinations beyond low Earth orbit; (3) stimulating commercial space flight capabilities; and (4) fitting within the current budget profile for NASA exploration activities.

This independent review should be led by a blue-ribbon panel of outside experts who would work closely with NASA. It should seek input from Congress, the White House, the public, industry, and international partners. In addition to the objectives described above, the review should determine the appropriate amount of R&D and complementary

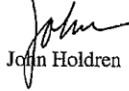
Enclosure 1

robotic activities needed to make human space-flight activities most productive and affordable over the long term, as well as appropriate opportunities for international collaboration. It should also evaluate what capabilities would be enabled by each of the potential architectures considered. And it should evaluate options for extending International Space Station operations beyond 2016.

While the study is ongoing, NASA should continue to work on all of its current exploration projects, including *Ares I*, *Orion*, Commercial Crew and Cargo efforts, and lunar systems.

For fifty years, NASA has thrilled and educated the world with its space exploration programs, while serving as a crucial home to scientific and technological innovation, enhancing America's leadership in Earth observation, and maintaining our national security. The results of this important review will help ensure that the agency continues to lead in these roles for decades to come.

Sincerely,



John Holdren

Director, Office of Science and Technology Policy
Assistant to the President for Science and Technology

VSE = Vision for Space Exploration

Attachment 4

National Aeronautics and Space Administration
Office of the Administrator
Washington, DC 20546-0001



May 11, 2009

The Honorable Bart Gordon
Chairman
Committee on Science and Technology
U.S. House of Representatives
Washington, DC 20515

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COMMITTEE ON SCIENCE
& TECHNOLOGY

Dear Mr. Chairman:

The purpose of this letter is to notify the Committee that, at the request of the Director of the Office of Science and Technology Policy, NASA is initiating an independent review of planned U.S. human space flight activities, with the goal of ensuring that the Nation is on a vigorous and sustainable path to achieving its boldest aspirations in space. This review will be conducted by a blue-ribbon panel of outside experts chaired by Norman R. Augustine, supported by a NASA team led by Dr. W. Michael Hawes, Associate Administrator for Program Analysis and Evaluation. The panel will present its results in time to support an Administration decision on the way forward by August 2009.

This Review of U.S. Human Space Flight Plans will examine ongoing and planned NASA human space flight development activities, as well as potential alternatives, and present options for advancing a safe, innovative, sustainable, and affordable human space flight program in the years following completion of the current Space Shuttle manifest and retirement. Specifically, the review panel will consider:

- expediting a new U.S. capability to support use of the International Space Station (ISS);
- supporting missions to the Moon and other destinations beyond low Earth orbit;
- stimulating commercial space flight capabilities; and,
- fitting within the current budget profile for NASA exploration activities.

The independent review panel will seek input from Congress, the White House, the public, industry, and international partners. In addition to the objectives described above, the review will examine the appropriate amount of R&D and complementary robotic activities needed to make human space flight activities most productive and affordable over the long term, as well as appropriate opportunities for international collaboration. It will also evaluate what capabilities would be enabled by each of the potential architectures considered. And, it will evaluate options for extending ISS operations beyond 2016.

It is important to note that the President has submitted a FY 2010 budget request for NASA Exploration Systems of \$3.963 billion, an increase of \$457.6 million above the FY 2009 Omnibus Appropriations level. During the review, the NASA workforce will continue to focus on the safe flight and operation of the Space Shuttle and ISS and continue to work on all of its current exploration projects, including Ares I, Orion, and Commercial Crew and Cargo efforts.

The Committee to Review U.S. Human Space Flight Plans will be established and operate pursuant to the Federal Advisory Committee Act, as amended, 5, U.S.C. App. NASA's current estimate of resources required for the review is approximately \$3 million. NASA will identify resources for the review within available FY 2009 Exploration Systems appropriations and Cross-Agency Support/Agency Management appropriations for independent assessments.

Enclosed, for your information, is a copy of the letter from Dr. John P. Holdren to NASA requesting initiation of the review and my letter in response. I would be pleased to discuss the establishment and objectives of the Review of U.S. Human Space Flight Plans with you in greater detail at your convenience.

Sincerely,

Handwritten signature of Christopher J. Scolese in cursive script.

Christopher J. Scolese
Acting Administrator

2 Enclosures