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111TH CONGRESS }  
2d Session }

SENATE

{ REPORT  
{ 111-278

NATIONAL AERONAUTICS AND SPACE ADMIN-  
ISTRATION AUTHORIZATION ACT OF 2010

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R E P O R T

OF THE

COMMITTEE ON COMMERCE, SCIENCE, AND  
TRANSPORTATION

ON

S. 3729



AUGUST 5, 2010.—Ordered to be printed

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SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ONE HUNDRED ELEVENTH CONGRESS

SECOND SESSION

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Mr. ROCKEFELLER, from the Committee on Commerce, Science, and  
Transportation, submitted the following

REPORT

[To accompany S. 3729]

The Committee on Commerce, Science, and Transportation reports favorably an original bill to authorize the programs of the National Aeronautics and Space Administration for fiscal years 2011 through 2013, and for other purposes, and recommends that the bill do pass.

PURPOSE OF THE BILL

The purpose of the National Aeronautics and Space Administration Authorization Act of 2010 is to authorize the agency's programs for fiscal years 2011 through 2013. The legislation would establish a balanced programmatic portfolio across the agency while providing specific direction on a number of issues related to human space flight and space technology.

BACKGROUND AND NEEDS

The National Aeronautics and Space Administration (NASA) was established in 1958 and is responsible for the nation's civil space program. NASA provides U.S. leadership in science and engineering by undertaking missions to challenge the brightest minds and stimulate the highest degree of precision and technical excellence in the commercial and industrial sectors. Among the agency's flagship programs, human space exploration began with Project Mercury in 1959 and extends through today's Space Shuttle and International Space Station (ISS) programs. NASA also provides opportunities for groundbreaking research and applications in aeronautics, communications, transportation, Earth science, and other scientific and technical disciplines.

With an average annual investment of less than one percent of the total Federal budget, NASA's discoveries and accomplishments are numerous and many address national needs. For example, NASA's Earth observations yielded breaking news as the GRACE (Gravity Recovery and Climate Experiment) satellite uncovered startling depletions of groundwater reserves under California and northwest India. NASA airborne radar capabilities were rapidly mobilized to analyze deformation of the fault lines after the devastating January 2010 earthquake in Haiti, and NASA satellite images have been used to respond to the Gulf of Mexico oil spill resulting from the April 20, 2010, Deepwater Horizon drilling rig explosion. The space program has also provided hundreds of spinoff technologies that support national security, public safety, and U.S. innovation and global competitiveness, such as global positioning systems (GPS), satellite radio, healthcare products including heart and kidney pumps and LASIK eye surgical devices, and tactical reconnaissance robots used in Iraq and Afghanistan.

The fiscal year (FY) 2010 President's budget request for NASA announced the intention to establish an independent panel to evaluate the country's strategy for human space exploration. In May 2009, President Obama established the Review of U.S. Human Space Flight Plans Committee (a.k.a. the Augustine Committee) to conduct a review of ongoing U.S. human space flight plans and programs to make sure that the United States is pursuing the best trajectory for the future of human space flight—one that is safe, innovative, affordable, and sustainable.

The Augustine Committee submitted their findings to the President in September 2009. They determined that the current exploration program of record—Constellation, with a planned return to the Moon by 2020—had little chance of success within current budget constraints and program requirements. The Augustine Committee also observed that NASA had siphoned funding from other important programs, such as robotic exploration and technology development, in an attempt to keep the other elements of the exploration program on track. They recognized the value of the ISS for research and international collaboration and suggested that the Administration consider extending the ISS beyond 2015.

The President's FY 2011 budget request proposed a number of significant changes in mission direction for NASA. The major proposed changes included extension of the ISS from 2015 through at least 2020; significant investment in the commercial space industry to develop crew transport to the ISS; the cancellation of the Constellation program; aggressive investments in research and technology development; restoration of funding for Earth sciences; and support for aeronautics, the NextGen partnership with the Federal Aviation Administration, and green aviation research and development. The Administration's proposal sought a hiatus until 2015 in NASA's vehicle, launch, and launch-related activities. It also sought to decrease a singular focus on the Moon as a destination for exploration. In April 2010, the President modified the proposal to include a scaled-back version of a crew vehicle, but only to be used for ISS emergency crew rescue and return.

The President's FY 2011 budget request prompted considerable debate and discussion between Congress, the Administration, industry, and other stakeholders over the dramatic change in direc-

tion for the agency. With the impending retirement of the Space Shuttle and the proposed termination of the Constellation program, the potential five-year hiatus before developing a new NASA launch vehicle would create a major displacement of human capital, skills, and disruption to the nation's industrial base. This potential dissolution of a national capability and the reliance on undefined future technology advancements was a matter of considerable concern as the Committee began its review of the Administration's FY 2011 budget request. Further, the Committee was cognizant of the fact that NASA had already invested approximately \$9 billion in the Constellation program. Its outright cancellation, without an alternative launch system development, would not only risk the loss of the design and hardware heritage resulting from that investment, but would potentially cost an approximate \$2.5 billion in contract termination fees based on estimates provided by the agency.

Against this backdrop, the Committee proceeded to develop a legislative framework that would address these and other concerns, but still provide support for several key elements of the Administration's proposal and new National Space Policy. The Committee reported original bill would provide policy direction to allow NASA to maximize the use of recent investments and existing capabilities while still enabling the agency to develop substantial new technologies, commercial and international partnerships, and innovative approaches to meet its overall goal of ensuring long-term human presence and expansion in space. The reported legislation also would address the imbalances in NASA's aeronautics and science mission areas by establishing authorization levels that increase funding in these critical areas.

#### SUMMARY OF PROVISIONS

The legislation would provide an authorization of appropriations for NASA for fiscal years 2011 through 2013 at \$19 billion, \$19.45 billion, and \$19.96 billion, respectively. The legislation would provide for a balanced set of programs in human space flight and exploration, aeronautics research and development, and scientific research, including Earth observations and applications, and require a decadal-like survey to review the goals, capabilities, and direction of U.S. human exploration of space. It would establish an overall goal for human space flight to expand permanent human presence beyond low-Earth orbit, along with a number of related key objectives. It also would provide that human space flight activities should contribute to national and global needs and challenges.

The bill would initiate steps to develop a Space Launch System and a multi-purpose crew vehicle as a follow-on to the Space Shuttle and Constellation-based Ares I and Orion projects. In combination with appropriate new technologies and robotic elements, these fundamental capabilities would support initial exploration missions beyond low-Earth orbit to such destinations as lunar orbital and Lagrangian points. These capabilities would provide the foundation for pursuit of international and other collaborative activities in the conduct of these and potential follow-on missions to the lunar surface and deep-space destinations, such as asteroids and ultimately the surface of Mars.

To implement these capabilities, the bill would direct development of a heavy-lift launch vehicle to be initiated immediately upon enactment with a 2016 goal for core operational capabilities. The bill would stipulate the continued development of a multi-purpose crew vehicle capable of supporting missions beyond low-Earth orbit with a 2016 goal for full operational capabilities. Taken together, these elements would provide a government-owned and operated capability to support exploration missions and activities beyond low-Earth orbit, and crew and cargo delivery to the ISS as a backup, if necessary, to commercially developed means of fulfilling the ISS supporting missions. The Space Launch System and multi-purpose crew vehicle would be carried out within a performance and cost framework that focuses on maximum use of the workforce, assets, contracts, and capabilities of the Space Shuttle, Constellation, and other NASA programs.

The bill would continue commercial cargo development and expand the Commercial Crew Development Program in FY 2011. The initiation of formal procurement for commercial crew development would be expected to begin in FY 2012, contingent upon the outcome of a series of studies and reviews to ensure effective implementation, direction, and oversight.

The bill would support continuation and full utilization of the ISS until at least 2020, including a requirement to select an independent entity to manage the ISS national laboratory, the addition of a Space Shuttle flight in FY 2011 to help ensure the availability of spare and replacement parts for full ISS functionality, and an authorization of funding to help expedite development of commercial cargo transportation services already under development.

While establishing a renewed commitment to development of a sustainable and successful human space flight capability, the legislation would direct the establishment and sustainment of a balanced portfolio for NASA across all of its mission areas, including aeronautics, Earth and space science, and education. It would require improved interagency coordination of Earth observations, expansion of NASA's sub-orbital research activities, and the establishment of a national policy to guide NASA's space technology efforts. Since the aerospace industry is one of the few remaining manufacturing industries that continues to be a major U.S. exporter, the bill would maintain support for a strong aeronautics research portfolio ranging from fundamental research through systems research.

The bill would address the fundamental need to ensure the nation's competitiveness and technological excellence by supporting new education initiatives, such as teacher training programs, increased investments in NASA EPSCoR (Experimental Program to Stimulate Competitive Research) and the NASA Space Grant program. To fit current and future missions and expected funding levels, the bill would require NASA to examine alternative management models for NASA's workforce, centers, and capabilities, while enforcing short-term prohibitions on major center displacements and reductions-in-force until such examination and analysis is completed.

## LEGISLATIVE HISTORY

The reported original bill was developed over several months through a bipartisan effort at the direction of Committee leadership to address the interests and concerns not only of members of the Committee, but members across the Senate, including the Appropriations Committee. Once a consensus emerged, Chairman Rockefeller offered the legislation as an original Committee bill with the full support of the Ranking Member, Senator Hutchison, and the Chairman and Ranking Member of the Science and Space Subcommittee, Senators Nelson and Vitter.

On July 15, 2010, the Committee met in open executive session and, by a unanimous voice vote, ordered the original bill to be reported favorably.

On July 20, 2010, Representative Bart Gordon introduced H.R. 5781, the National Aeronautics and Space Administration Act of 2010, which was reported as amended from the House Committee on Science and Technology on July 28, 2010. The House bill is similar to the Committee-reported legislation in that it would support a balanced mission portfolio for NASA. The House bill also includes technology investments, leverages existing skills and experience, and includes better controls on program cost and schedule. The primary differences are the plan and timeline for a heavy lift launch vehicle and the level of support for the development of commercial capabilities to the ISS.

On March 3, 2010, Senator Hutchison introduced S. 3068, the Human Space Flight Capability Assurance and Enhancement Act of 2010. The legislation was an early effort to address the human space flight concerns raised by the FY 2011 budget request and offered as part of the initial Committee discussions in developing a full NASA authorization bill. Representative Suzanne Kosmas introduced the House companion bill, H.R. 4804.

The Committee held three hearings to consider elements of the President's FY 2011 budget request for NASA. The first hearing was held on February 24, 2010, to consider the NASA FY 2011 budget request overall. The NASA Administrator appeared before the Committee, as did several space policy and operations experts. The second hearing was held on March 16, 2010, to specifically consider commercial space capabilities. Witnesses included representatives from NASA, the Federal Aviation Administration, and various commercial space companies. The third hearing was held on May 12, 2010, and considered the Administration's proposal for human space flight. Witnesses for this hearing included two former Apollo astronauts, Neil Armstrong and Eugene Cernan; the chairman of the U.S. Human Space Flight Plans Committee; the Administrator of NASA; and the Director of the Office of Science and Technology Policy. Another former Apollo astronaut, James Lovell, provided testimony for the record.

## ESTIMATED COSTS

In accordance with paragraph 11(a) of rule XXVI of the Standing Rules of the Senate and section 403 of the Congressional Budget Act of 1974, the Committee provides the following statement, prepared by the Congressional Budget Office:

U.S. CONGRESS,  
 CONGRESSIONAL BUDGET OFFICE,  
 Washington, DC, August 5, 2010.

Hon. JOHN D. ROCKEFELLER IV,  
 Chairman, Committee on Commerce, Science, and Transportation,  
 U.S. Senate, Washington, DC.

DEAR MR. CHAIRMAN: The Congressional Budget Office has reviewed the National Aeronautics and Space Administration Authorization Act of 2010, as ordered reported by the Senate Committee on Commerce, Science, and Transportation on July 21, 2010. Enacting the bill would have no significant impact on direct spending or revenues over the 2010–2020 period. The bill would authorize the appropriation of more than \$58 billion for the operations of the National Aeronautics and Space Administration over the 2011–2013 period; however, CBO has not yet completed an estimate of all of the legislation’s costs that would be subject to appropriation.

The bill contains no intergovernmental or private-sector mandates as defined in the Unfunded Mandates Reform Act and would impose no costs on state, local, or tribal governments.

If you wish further details on this estimate, we will be pleased to provide them. The CBO staff contact is Martin von Gnechten.

Sincerely,

DOUGLAS W. ELMENDORF,  
 Director.

Enclosure.

#### REGULATORY IMPACT STATEMENT

In accordance with paragraph 11(b) of rule XXVI of the Standing Rules of the Senate, the Committee provides the following evaluation of the regulatory impact of the legislation, as reported:

##### NUMBER OF PERSONS COVERED

The bill would authorize appropriations for NASA for FY 2011 through FY 2013. NASA conducts a number of scientific research and development activities concerning aeronautics, Earth science, space science, and space exploration and operations. The Committee believes the bill would not subject any individuals or businesses affected by the bill to any additional regulations.

##### ECONOMIC IMPACT

This legislation would authorize \$19 billion for NASA in FY 2011, \$19.45 billion in FY 2012, and \$19.96 billion in FY 2013. The legislation would authorize sufficient levels to sustain ongoing and new awards, cooperative agreements, and contracts related to NASA’s missions. A number of sections of the bill would enhance economic and educational outreach, licensing and applications, technology transfer, and commercial innovation and partnership opportunities. The bill is not expected to have an adverse impact on the nation’s economy.

##### PRIVACY

This legislation would not have a negative impact on the personal privacy of individuals.



## PAPERWORK

The Committee does not anticipate a major increase in the paperwork burdens for individuals or businesses; however, there are a number of reports required of NASA. These reports are focused around specific critical areas of interest to the Committee and nation, including various aspects of proposed commercial capability development plans, launch vehicle architecture, long-range exploration goals and missions, space station requirements assessment, and facilities and workforce alignment, among others.

## CONGRESSIONALLY DIRECTED SPENDING

In compliance with paragraph 4(b) of rule XLIV of the Standing Rules of the Senate, the Committee provides that no provisions contained in the bill, as reported, meet the definition of congressionally directed spending items under the rule.

## SECTION-BY-SECTION ANALYSIS

*Section 1. Short title; table of contents.*

This section would provide that the legislation may be cited as the National Aeronautics and Space Administration Act of 2010. This section would also provide the table of contents for the legislation.

*Section 2. Findings.*

This section would identify key findings of the Act concerning the history, the future, and the value of programs at NASA. The findings also would update the national and global context for NASA's human space flight programs and establish an incremental and integrated approach to fully maximize the nation's investments in establishing a low-Earth orbit infrastructure and simultaneously create the capabilities to move out beyond this region in a sustained, focused and open manner with an array of partnerships including the international community and U.S. commercial enterprises.

*Section 3. Definitions.*

This section would define ten key terms used in the Act.

## TITLE I—AUTHORIZATION OF APPROPRIATIONS

*Sections 101 through 103. Fiscal year 2011 through 2013.*

Sections 101, 102, and 103 would provide the amounts to be authorized for appropriations for FY 2011, 2012, and 2013. These levels would align with the President's top-line budget request for FY 2011 and projections for FY 2012 and FY 2013. The Committee considered the five-year budget implications of the human space flight activities in the legislation to ensure that available resources matched restructured and new programmatic efforts required by this reauthorization. The levels authorized are intended to leverage and build off of previous investments, architectures, and hardware from both the Space Shuttle and Constellation programs. If appropriately utilized in the design and development of new systems authorized by this Act, it will contribute to reductions in initial devel-

opment costs and ensure the availability of these new systems within the schedule set by this legislation.

## TITLE II—POLICY, GOALS, AND OBJECTIVES FOR HUMAN SPACE FLIGHT AND EXPLORATION

### *Section 201. United States human space flight policy.*

This section would also reaffirm Congress’s support for an uninterrupted capability for human space flight and operations in low-Earth orbit and beyond. This section would also reaffirm the policy that reliance and use of non-U.S. human space flight capabilities shall only occur as a contingency when no U.S.-owned and operated capability is available.

### *Section 202. Goals and objectives.*

This section would establish NASA’s long-term goal as the expansion of a permanent human presence beyond low-Earth orbit. Key objectives would include: full utilization of the ISS as a national laboratory; determination of the ability of humans to live in space for extended periods of time; assessment of the viability and use of space resources to lay the foundation for sustainable economic activities in space; building upon international partnerships; and maximization of the role of space exploration in advancing knowledge and inspiring young people into higher educational pursuits.

### *Section 203. Assurance of core capabilities.*

This section would provide a sense of Congress that existing space capabilities such as the ISS and Space Shuttle, and initial capabilities of follow-on transportation systems should be utilized to provide operational experience, technology development, and the requisite infrastructure for expanded future exploration missions. This section also would require the Administrator to refurbish the ET-94 Space Shuttle external tank as a means of retaining necessary skills and capabilities in the fabrication and preparation for flight readiness of large-diameter vehicle components necessary for development of the new Space Launch System. The refurbished tank could also be used if the President or Congress determines additional contingency Shuttle missions to the ISS are necessary.

### *Section 204. Independent study on human exploration of space.*

This section would require the Administrator to provide for an independent review by the National Academies covering human space exploration goals, capabilities, and direction, including goals set by the Congress and the President. The review would solicit inputs from a broad spectrum of stakeholders and would examine goals in the context of current and potential national capabilities, ongoing technology development activities, and potential partner capabilities and interests. The study would make findings and recommendations for a U.S. human space exploration strategy for fiscal years 2014 through 2023. It is anticipated that such a study would provide supporting rationale to ensure a sustainable space program, tied to national goals and objectives, which would be compelling and supportable by future administrations.

TITLE III—EXPANSION OF HUMAN SPACE FLIGHT BEYOND  
THE INTERNATIONAL SPACE STATION AND LOW-EARTH  
ORBIT

*Section 301. Human space flight beyond low-Earth orbit.*

This section would identify key findings regarding the purpose of extending human presence in space beyond low-Earth orbit to address national priorities and purposes. This section also would require the Administrator to submit to Congress a report within 120 days after enactment on the efforts of NASA to expand international collaboration on the ISS and progress on the initial near-term missions in cis-lunar space (the area between the Earth and orbits of the Moon) authorized by this legislation. The report would include a discussion of the role of NASA's contribution of a Space Launch System, a multi-purpose crew vehicle, and other appropriate technology to these missions.

*Section 302. Space Launch System as follow-on launch vehicle to the Space Shuttle.*

This section would direct U.S. space policy toward the development of a Space Launch System follow-on to the Space Shuttle capable of traveling beyond low-Earth orbit. This section would direct the Administrator to begin development of this vehicle upon enactment with an initial capability to lift payloads between 70 and 100 tons into low-Earth orbit, lift the multipurpose crew vehicle, and serve as a backup, if necessary, for ISS cargo or crew transportation. The vehicle would be evolvable to lift greater payloads to missions beyond low-Earth orbit. This section would provide for the minimization of termination liability on existing contracts by the modification or extension of contracts in cases where they can be transitioned and applied to the development of hardware and systems under the new Space Launch System. It also would provide for the retention of critical skills and capabilities, where appropriate, in the fields of liquid and solid engines, large diameter fuel tanks, and other rocket propulsion hardware skills and capabilities.

The Committee anticipates that in order to meet the specified vehicle capabilities and requirements, the most cost-effective and "evolvable" design concept is likely to follow what is known as an "in-line" vehicle design, with a large center tank structure with attached multiple liquid propulsion engines and, at a minimum, two solid rocket motors composed of at least four segments being attached to the tank structure to form the core, initial stage of the propulsion vehicle. The Committee will closely monitor NASA's early planning and design efforts to ensure compliance with the intent of this section.

This section would establish a priority for development and operational capability of the core elements of the Space Launch System by December 31, 2016. This goal is provided to help ensure an immediate focus on the development of the core stage of this vehicle to ensure the most effective transition from the Space Shuttle and other programs, and the ability to initiate meaningful partner discussions on the missions authorized in this Act. Should resources and manufacturing capacity be available to permit parallel development of both the core elements of the launch system and an inte-

grated upper stage for missions beyond low-Earth orbit, the Committee believes such concurrent development should be pursued.

In order to meet the mission and cost goals of the vehicle authorized by this section, NASA should focus on designing and building “to cost” versus overall performance. The Committee notes that this requirement represents a fundamental change from NASA’s recent history with the Constellation program and a number of previous NASA launch initiatives, and believes it is critical that NASA follow this guidance. In the near-term, NASA should maximize the use of existing assets and capabilities from Shuttle and Ares programs to the extent practicable, while constraining requirements and performance to only those necessary to meet the schedule authorized for early operational capability. Modifications of ground infrastructure and other elements to support the vehicle should be minimized.

The Committee has structured its approach to the development of this vehicle in part to reduce the five-year hiatus proposed by the Administration before initiating heavy-lift launch vehicle development. Such a delay, and the concurrent dissolution of the skills and capabilities associated with human space flight capability development that would likely ensue, is not an acceptable national risk. The use of existing technologies, capabilities, facilities, and infrastructure to the maximum possible extent, coupled with the immediate initiation of design and development activities, will provide the greatest opportunity to retire the development costs for this vehicle by the end of 2016 while ensuring the continuation of a critical national capability.

*Section 303. Multi-purpose crew vehicle.*

Upon enactment, this section would require the Administrator to continue development of a multi-purpose crew vehicle based on the concept, designs, prototypes and other materials developed within the Orion project. The vehicle would be required to achieve full operational capability no later than December 31, 2016. Minimum requirements would include the capability of serving as the primary crew transportation vehicle for missions beyond low-Earth orbit and conducting in-space operations, and to be a readily modifiable platform to incorporate new technology and complement commercial operations. NASA would be authorized to conduct a test to the ISS of the vehicle’s capability prior to its full operational capability being available.

As with the new Space Launch System, it is the view of the Committee that this program must also be developed with an approach that places emphasis on designing and building “to cost” versus overall performance, with the primary goal of achieving the ability to conduct missions beyond low-Earth orbit, as authorized by this Act. The Committee supports the development of a commercial crew service that includes crew rescue capability. The multi-purpose crew vehicle would only be made available for routine ISS crew transportation if a commercial crew service is not available and if subsequent action is taken by Congress to authorize that function.

*Section 304. Utilization of existing workforce and assets in development of Space Launch System and multi-purpose crew vehicle.*

This section would require NASA to utilize existing contracts, workforce, and capabilities, to the extent practicable, from the Space Shuttle and former Orion and Ares I projects in developing the Space Launch System and multi-purpose crew transportation vehicles. To meet these requirements, this section would require the Administrator to take appropriate actions to utilize existing expertise, infrastructure, and testing capability to ensure timely and cost-effective development of the previously mentioned vehicles. This approach is critical to ensure that rocket and capsule development shall have the maximum opportunity to be conducted effectively and on a timely basis, and within the constrained budget environment that must be anticipated in a period of general fiscal austerity and limited government resources.

*Section 305. NASA launch support and infrastructure modernization program.*

This section would require the Administrator to improve the infrastructure, operations, and processing at the Kennedy Space Center in Florida, including ground preparation for the Space Launch System. This section would also require the Administrator to submit to Congress within 120 days after enactment a report on the implementation plan for the program. While the section would support overall improvements at the Kennedy Space Center for multiple users and operations, consideration should be given to all necessary launch infrastructure and operations associated with the Space Launch System and multi-purpose crew vehicle.

*Section 306. Report on effects of transition to Space Launch System on the solid and liquid rocket motor industrial bases.*

This section would require the Administrator, in consultation with the Secretaries of Defense and Commerce, to submit to Congress within 120 days after the date of enactment a report on the effects of the retirement of the Space Shuttle and the transition to the Space Launch System on the solid and liquid rocket motor industrial bases in the United States. Streamlining the overall supporting industrial base is both possible and necessary to ensure long-term operational efficiencies and cost reductions. In order to do this efficiently, it is the Committee's view that a current and accurate assessment of the propulsion industrial base be conducted in coordination with other government entities whose programs and activities are impacted by the health and availability of this base.

*Section 307. Sense of Congress on other technology and robotic elements in human space flight and exploration.*

This section would state the importance of investing in new technologies to enhance existing capabilities for human space flight, and that collaborations with international partners to do this can contribute to the overall goal of extending human presence in space.

*Section 308. Development of technologies and in-space capabilities for beyond near-Earth space missions.*

This section would authorize the Administrator to develop technologies necessary for missions beyond low-Earth orbit. To develop these technologies, this section would allow the Administrator to invest in a space suit, a space-based transfer vehicle, advanced life support capabilities, improved in-space propulsion systems, in-space propellant transfer and storage systems, in situ resource utilization capabilities, and technologies to mitigate of biological impediments to human deep space missions, including radiation challenges. This section would allow the Administrator to utilize the ISS as a test-bed for technologies developed in these areas, where applicable, and require the Administrator to pursue technology development through a coordinated agency technology approach, which includes mission-driven technology developments and risk reduction.

**TITLE IV—DEVELOPMENT AND USE OF COMMERCIAL CREW AND CARGO TRANSPORTATION CAPABILITIES**

*Section 401. Commercial Cargo Development program.*

This section would require the Administrator to continue the Commercial Orbital Transportation Services program to develop the means to adequately supply the ISS. The section would allow funds to be used to support flight tests, accelerate development, and develop necessary ground infrastructure.

With the extension of the ISS to at least 2020 and the upcoming retirement of the Space Shuttle, the Committee is concerned about the viability of commercial cargo delivery to supplement international partner capabilities to the ISS. Such concerns have been identified and validated through a 2009 Government Accountability Office study indicating that delays in the availability of commercial capabilities would lead to a significant reduction in NASA's use of the ISS for scientific research. The viability of commercial cargo capabilities is also an important gauge for assessing the timing and overall feasibility of commercial crew services and capabilities.

*Section 402. Commercial Crew Development program.*

This section would require the Administrator to continue the Commercial Crew Development (CCDev) program in FY 2011, building upon FY 2010 agreements to reduce risk and develop technologies. This section also would allow new agreements for the purpose of maturing concepts and supporting technologies to advance the development of commercial crew services.

*Section 403. Requirements applicable to development of commercial crew transportation capabilities and services.*

This section would require the Administrator to complete a number of steps prior to initiating a formal procurement process for commercial crew services. The Committee believes that it is necessary to develop a realistic, business-like foundation for the development of commercial crew capabilities and services. Combined with the short-term increase in the CCDev program and clarification that commercial crew service requirements shall include the capability to provide a crew rescue function for the ISS, the Com-

mittee believes that it is setting an acceptable balance between new capability development and appropriate government oversight and determination in this new, challenging area of space flight activity. The Committee supports appropriate funding needed to help facilitate the development of this capability through the end of the development time period (estimated to be not later than 2016).

*Section 404. Report on International Space Station cargo return capability.*

This section would require the Administrator to submit to Congress within 120 days after enactment a report on alternative commercially developed means for the safe return from the ISS of research samples and small to mid-sized equipment. With the retirement of the Space Shuttle, there is a loss of the Shuttle's capability to return equipment and research articles from the ISS. Where analysis on Earth of returned samples can enhance research outcomes, it is important that other means be sought to retain this capability. The Committee believes that the assessment required by this section is an important step in ensuring the ISS can be fully utilized as an orbiting research laboratory.

TITLE V—CONTINUATION, SUPPORT, AND EVOLUTION OF  
THE INTERNATIONAL SPACE STATION

*Section 501. Continuation of the International Space Station through 2020.*

This section provides authority for the U.S. to set policy, in consultation with its international partners, to support full and complete utilization of the ISS through at least 2020. The section also would require NASA to pursue additional international, commercial, and intergovernmental partnership arrangements to enhance the overall sustainability of the ISS and seek means to reduce or offset U.S. operating costs associated with the ISS.

The Committee notes that with the retirement of the Space Shuttle, and until the replacement vehicles authorized in this legislation are operational, the ISS will be the only active U.S. human space flight activity. It is imperative, therefore, that every necessary effort is made to ensure both the viability and utility of the ISS as a functioning habitable spacecraft and as a research facility.

*Section 502. Maximum utilization of the International Space Station.*

This section would provide that NASA maximize the returns from the ISS with respect to scientific and technological research and development, advancement of space exploration, and international collaboration. The section would direct NASA to increase the innovative use of the ISS national laboratory authority and to seek greater international and domestic collaboration.

*Section 503. Maintenance of the United States segment and assurance of continued operations of the International Space Station.*

This section would require the Administrator to ensure safe operation of the U.S. segment of the ISS through at least September 30, 2020, and submit to Congress an assessment including an inventory of equipment necessary for such operation, possible deliv-

ery methods, safety of such methods, and cost. This section would also require a Government Accountability Office report from the Comptroller General evaluating the accuracy of NASA's ISS assessment within 90 days of its submission to Congress.

Until the required ISS inventory and assessment are completed, it cannot be known for certain whether another Shuttle mission would be required to deliver necessary spare or replacement items that could only be accommodated within the Space Shuttle payload bay. The Committee does not expect such a finding and has been encouraged by steps taken by NASA, to date, to anticipate and provide for repositioning of such items aboard the ISS. However, the external tank refurbishment authorized by this Act is prudent to provide a means to ensure the longest lead-time element could be available on a timely basis to provide a realistic option to respond to a determination that an additional flight (after the Launch-On-Need) might be essential to ensure ISS sustainability.

This section would authorize funds to be appropriated to allow the Administrator to fly the Launch-On-Need Shuttle mission in FY 2011 pending the results of a required safety assessment.

*Section 504. Management of the ISS national laboratory.*

This section would require the Administrator to enter into a cooperative agreement with an appropriate not-for-profit organization to manage the activities of the ISS national laboratory, and to designate an official of NASA's Space Operations Mission Directorate to serve as liaison between NASA and the organization. It also would guarantee national laboratory managed experiments access to a minimum 50% of U.S. research capacity and crew time.

Noting the prior shifts in NASA mission and research priorities, the Committee believes that an independent body should be established to serve as the designated agent to manage the ISS national laboratory. Furthermore, the Committee believes it is essential to the effective and successful implementation of a broad-based research agenda that the independent national laboratory entity be allocated a fixed amount of the available research capacity aboard the ISS for its management and use. In its review of NASA ISS research planning, the Committee found that NASA's planned usage of its allocation of ISS research capacity accounted for less than 50 percent of the available resources. Thus, the Committee has directed that no less than the remaining 50 percent of ISS research capacity within the U.S. segment (including U.S. allocations within partner laboratory facilities) be allocated to and managed by the independent research management entity.

**TITLE VI—SPACE SHUTTLE RETIREMENT AND TRANSITION**

*Section 601. Sense of Congress on the Space Shuttle program.*

This section would identify key findings regarding the value of the Space Shuttle program as a national asset. This section also would include a sense of Congress that the retirement of the Space Shuttle be done in a manner that builds on the legacy of the program, and that the United States maintains the skills and industrial capability to provide a follow-on launch system for missions beyond low-Earth orbit.



*Section 602. Retirement of Space Shuttle orbiters and transition of Space Shuttle program.*

This section would require the Administrator to retire the Space Shuttle orbiters on a schedule established by the Administrator in line with the requirements for ISS utilization set forth in this legislation. The Administrator would strive to transfer workforce, assets, and infrastructure of the program to the follow-on Space Launch System, with unneeded equipment divested among the Federal Government and private sector, and displaced workers assisted in retraining and job placement. Recognizing that not all of the Shuttle capabilities would be transferred, the Committee notes that funds from section 102 could be used for these transition purposes.

*Section 603. Disposition of orbiter vehicles.*

This section would require the Administrator to decommission any remaining Space Shuttle orbiter vehicles in accordance with established safety and historic preservation procedures. Placement of orbiter vehicles would be determined through a competitive procedure established under section 613(a) of the National Aeronautics and Space Administration Authorization Act of 2008 (426 U.S.C. 17761(a)). The section also would require that this competitive process take into account locations with the best potential value to the public, particularly to advance educational opportunities in science, technology, engineering, and mathematics, and with an historical connection to the Shuttle program.

## TITLE VII—EARTH SCIENCE

*Section 701. Sense of Congress.*

This section would emphasize the importance of Earth observations to the understanding of the Earth system, the protection of human health and safety, the growth of the U.S. economy, and the strengthening of national security. This section also would reaffirm the critical role of NASA in Earth science, the need to maintain domestic and international data collaboration, and the vital role fulfilled by Earth-observing satellites and monitoring programs.

*Section 702. Interagency collaboration implementation approach.*

This section would require the Director of the Office of Science and Technology Policy to establish a mechanism to ensure greater coordination across the Federal Government on civilian Earth observation. This would include the development of a strategic implementation plan updated at least every 3 years with independent advisory input. This section also would require the Director to provide to Congress within 90 days of enactment a report on the implementation plan for this mechanism.

*Section 703. Transitioning experimental research to operations.*

This section would require the Administrator, in coordination with the Administrator of the National Oceanic and Atmospheric Administration (NOAA) and the Director of the United States Geological Survey (USGS), to establish a formal mechanism to support the transition of NASA research and capabilities to NOAA and USGS operations. This section would encourage NASA to consider

establishing an Interagency Transition Office for this purpose and would require NASA to provide within 90 days of enactment an implementation plan for this mechanism.

*Section 704. Decadal survey missions implementation for Earth observation.*

This section would require the Administrator to implement, as appropriate, missions identified in the Earth Science Decadal Survey within the scope of funds authorized for the Science Mission Directorate.

*Section 705. Expansion of Earth science applications.*

This section would support an expanded role for NASA in Earth science applications with all levels of government, academia, the private sector, nonprofit organizations, and international partners.

*Section 706. Instrument test-beds and venture class missions.*

This section would require the Administrator to pursue innovative ways to fly instrument-level payloads for early demonstration or as co-manifested payloads.

*Section 707. Sense of Congress on NPOESS follow-on program.*

This section would affirm that polar orbiting satellites are vital for weather prediction, climate and environmental monitoring, national security, emergency response, and climate research. The section would support the Office of Science and Technology Policy's decision to restructure the National Polar Orbiting Environmental Satellite System (NPOESS) program, suggest that NOAA and the Department of Defense should assure satellite data continuity, and indicate that the agencies should immediately notify Congress of any impediments to meet launch readiness dates.

## TITLE VIII—SPACE SCIENCE

*Section 801. Technology development.*

This section would ensure that the Science Mission Directorate maintains a long-term technology development program for space and Earth science that is coordinated with overall agency technology investments in the other NASA mission directorates.

*Section 802. Suborbital research activities.*

This section would direct the Administrator to establish a Suborbital Research Program to be overseen by a designated official in the Science Mission Directorate. The designated official would develop strategic plans to maintain, renew, and extend suborbital capabilities and integrate them into NASA's workforce development. The program would advance science and develop the aerospace workforce. The section also would require the Administrator to report annually to Congress on the number of suborbital missions and the number of undergraduate and graduate students participating in each mission. The section would authorize such sums as may be necessary for these activities.

*Section 803. Overall science portfolio-sense of the Congress.*

This section would reaffirm the sense of Congress that a balanced and adequately funded portfolio of research, space missions, and suborbital missions serves as a catalyst for innovation.

*Section 804. In-space servicing.*

This section would direct the Administrator to ensure the development of in-space human servicing and repair capabilities for future observatory-class scientific spacecrafts to the extent practicable and appropriate. The Committee believes that this capability complements the bill's focus on the development of a human space flight approach that leverages on-orbit capabilities and a space launch and crew vehicle with additional complementary capabilities.

*Section 805. Decadal results.*

This section would direct NASA to take into account recommendations from the National Academies' decadal surveys when submitting their budget request.

*Section 806. On-going restoration of radioisotope thermoelectric generator material production.*

This section would require the Administrator to coordinate with the Secretary of Energy to restart and sustain domestic production of radioisotope thermoelectric generator material for deep space and other science and exploration missions. This section also would provide that funds authorized by this Act for NASA would be available under a reimbursable agreement with the Department of Energy for the purpose of this section. A report would be required within 120 days after enactment to Congress regarding the plan and schedule for this production.

*Section 807. Collaboration with ESMD and SOMD on robotic missions.*

This section would direct the Exploration Systems and Space Operations Mission Directorates to coordinate with the Science Mission Directorate to develop a plan for interagency and international collaboration for future robotic missions. The section would require NASA to provide a report within 90 days and would prohibit the cancellation or initiation of any ESMD or SMD robotic project before the report is submitted.

*Section 808. Near-Earth object survey and policy with respect to threats posed.*

This section would require the Director of the Office of Science and Technology Policy to implement a policy by FY 2012 for notifying Federal agencies and emergency response institutions of any impending near-Earth object threats and for assigning a Federal agency to be responsible for protecting the United States and working with the international community in response to such threats.

*Section 809. Space weather.*

This section would require the Office of Science and Technology Policy to improve preparation, avoidance, and mitigation of severe space weather events, coordinate across agencies, and submit a re-

port to Congress within 180 days of the date of enactment that details current and future systems necessary to gather data for space weather forecasting.

## TITLE IX—AERONAUTICS AND SPACE TECHNOLOGY

### *Section 901. Sense of Congress.*

This section would reaffirm that aeronautics research is vital to NASA’s mission and to U.S. leadership in global aviation and deserves continued support. The section would affirm the roles of the National Aeronautics Research and Development Policy and the National Science and Technology Council Subcommittee on Aeronautics Science and Technology in guiding and coordinating research and development and maintaining aeronautics infrastructure.

### *Section 902. Aeronautics research goals.*

This section would specify aeronautics research goals of supporting airspace capacity, environmental sustainability, and aviation safety.

### *Section 903. Research collaboration.*

This section would require the Administrator to coordinate with the Department of Defense to jointly support common infrastructure for research, development, testing, and engineering infrastructure. This section would require the Administrator to continue to coordinate with the Federal Aviation Administration in the development of the Next Generation Air Transportation Program and to accelerate the development and demonstration of NextGen technologies where possible.

### *Section 904. Goal for agency space technology.*

This section would support an agency-wide space technology base to help align mission directorates and support long-term needs. The program would develop and build upon existing partnerships.

### *Section 905. Implementation plan for agency space technology.*

This section would require NASA to provide a plan within 120 days of the date of enactment that outlines how the Agency Space Technology program will meet the goals of section 904 and be integrated with mission directorate technology efforts. Because this is a new program at NASA, the Committee is requesting an integrated agency plan to ensure proper oversight and planning have gone into this newly authorized area. This section also would provide important information that can help inform NASA’s participation in the development of a national space technology policy stipulated in section 906.

### *Section 906. National space technology policy.*

This section would require the President or the President’s designee to assess and develop a national policy to guide the space technology programs across the Federal government. A report to Congress setting forth the national space technology policy would be required to Congress within a year after enactment, and a subsequent report from NASA would describe how NASA will carry

out the policy. The Committee believes that completion of an overall plan for space technology that coordinates with other agency efforts is essential before committing to the greater level of authorized funding provided in Title I for this area starting in FY 2012.

*Section 907. Commercial reusable suborbital research program.*

This section would establish a Commercial Reusable Suborbital Research Program within the Space Technology Program to provide for the development of payloads for scientific research, technology development, and education, as well as flight opportunities for these payloads to microgravity environments and suborbital altitudes. This section would require an annual report to Congress on the program's progress and provide an authorization of appropriations of \$15 million for each of FY 2011 through 2013 to carry out this section.

#### TITLE X—EDUCATION

*Section 1001. Report on education implementation outcomes.*

This section would require the Administrator to submit a report to Congress within 120 days on the metrics, internal and external relationships, and resources committed by NASA to development of a national STEM (science, technology, engineering, and mathematics) workforce, retention of students in STEM disciplines over time, and development of partnerships between formal and informal STEM providers.

*Section 1002. Sense of Congress on the Experimental Program to Stimulate Competitive Research.*

This section would affirm that EPSCoR has promoted broader geographic distribution of research and development by improving research infrastructure in states that have traditionally received less NASA research and development funding. This section would further affirm that EPSCoR has provided an excellent return on investment and that the program should coordinate with similar programs at other Federal agencies to promote continued improvement and efficiency.

*Section 1003. Science, technology, engineering, and mathematics commercial orbital platform program.*

This section would require NASA to establish a program to annually sponsor scientific and educational payloads developed with students and educators to be flown on commercially available orbital platforms, when available. This section would set a goal of launching at least 50 such payloads, with at least one from each of the 50 states, to orbit on at least one mission per year.

#### TITLE XI—RESCOPING AND REVITALIZING INSTITUTIONAL CAPABILITIES

*Section 1101. Sense of Congress.*

This section would provide the sense of Congress that NASA needs to re-scope and downsize, where appropriate, to fit mission needs and funding levels.

*Section 1102. Institutional requirements study.*

This section would require the Administrator to provide a report to Congress within 1 year of the date of enactment that examines NASA's structure, organization, and institutional assets and identifies a strategy to match NASA's facilities, laboratories, and test capabilities to NASA's missions and goals.

*Section 1103. NASA capabilities study requirement.*

This section would, after the completion of the study described in section 1102, require the Administrator to contract with an independent entity to submit a report to Congress within 1 year from initiation of this analysis that examines alternative management models for NASA's workforce, centers, and capabilities, including the potential conversion of NASA centers to federally funded research and development centers.

*Section 1104. Sense of Congress on community transition support.*

This section would affirm that Congress is supportive of the Administration's efforts to assist communities that are adversely impacted by changes to NASA programs.

*Section 1105. Workforce stabilization and critical skills preservation.*

This section would require Congress to approve any transfer of functions, missions, or activities before the completion of the study required under section 1103. This section also would require the Administrator to preserve critical skills and competencies and minimize workforce disruptions, including a prohibition on reductions in force, until the strategy required by section 1103 has been received by Congress.

## TITLE XII—OTHER MATTERS

*Section 1201. Report on space traffic management.*

This section would require the Administration to submit a report to Congress on the status of international discussions regarding space traffic management.

*Section 1202. National and international orbital debris mitigation.*

This section would require the Administrator to initiate discussions across the Federal government and with other space-faring nations for orbital debris prevention and mitigation. The Office of Science and Technology Policy would coordinate with the National Security Council to prepare a strategy and recommendations for international collaboration for review by the President.

*Section 1203. Reports on program and cost assessment and control assessment.*

This section would require the Administrator to submit a report to Congress annually that describes all programs that exceed baseline costs by 15% or are more than two years behind their projected development schedule. The report also would contain a corrective action plan for each of the programs to control cost and schedule, or to decrease the program scope or requirements.

*Section 1204. Eligibility for service of individual currently serving as Administrator of NASA.*

This section would confirm that the current NASA Administrator comes from civilian life and is therefore eligible to serve in such position.

*Section 1205. Sense of Congress on independent verification and validation of NASA software.*

This section would affirm that independent verification and validation of NASA software is critical to assuring mission safety, and affirm that the creation of NASA's Independent Verification and Validation Facility was the result of recommendations from the National Research Council and the Presidential Commission on the Space Shuttle Challenger Accident. This section would affirm the sense of Congress that NASA's Independent Verification and Validation Facility shall be the sole provider of verification and validation services for NASA software.

*Section 1206. Counterfeit parts.*

This section would require the Administrator to implement employee training regarding counterfeit parts and establish a tracking database for counterfeit electronic parts in the NASA supply chain and to report counterfeit parts to appropriate law enforcement agencies. This section would require the Administrator to purchase electronic parts from a list of trusted manufacturers that is updated annually and to provide a report to Congress within one year of the date of enactment on progress toward implementing this section.

*Section 1207. Information security.*

This section would require the NASA chief information officer to report to Congress within 120 days of the date of enactment and annually thereafter regarding efforts to reduce network risk by providing dynamic, comprehensive information about unauthorized access to information infrastructure. This section also would require the chief information officer to institute an information security awareness and education program for all NASA information infrastructure users.

*Section 1208. National Center for Human Performance.*

This section would designate the Texas Medical Center in Houston as an Institution of Excellence for Human Performance in recognition of its work studying human performance in space, health, the military, athletics and the arts.

*Section 1209. Enhanced-use Leasing.*

This section would provide a Sense of Congress supporting NASA's enhanced-use leasing program and its continued utilization.

*Section 1210. Sense of Congress concerning the Stennis Space Center.*

This section would support the Stennis Space Center test facilities and their continued utilization in testing liquid propulsion technologies.

VOTES IN COMMITTEE

On a motion made by Senator Kay Bailey Hutchison, Ranking Minority Member of the Committee, during the executive session of the Committee on July 15, 2010, several amendments, as modified by prior agreement, were adopted en bloc, and the legislation ordered reported, by a voice vote of the Committee, with no dissenting votes.

CHANGES IN EXISTING LAW

In compliance with paragraph 12 of rule XXVI of the Standing Rules of the Senate, the Committee states that the bill as reported would make no change to existing law.

