COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON SPACE
SUBCOMMITTEE REPORT

H.R. 4412, "National Aeronautics and Space Administration Authorization Act of 2014''

I. Purpose

The purpose of H.R. 4412, sponsored by Rep. Steven Palazzo and Rep. Lamar Smith, is to reauthorize the science, aeronautics, and human space flight and exploration programs of the National Aeronautics and Space Administration (NASA) for the fiscal year 2014, and address space and aeronautics policy and programmatic issues.

II. Background and Need for Legislation

The National Research Council's report *NASA's Strategic Direction and the Need for a National Consensus,* issued in December 2012, provides context and summarizes the need for the reauthorization.

> *"Despite NASA's broad portfolio that spans human spaceflight, space and Earth science, and aeronautics research, in the public mind the agency is most closely associated with human spaceflight. In 2004, after many years of uncertainty about the futures of the space shuttle and the ISS, President George W. Bush announced a 'Vision for Space Exploration' that called for astronauts to return to the Moon by 2020 and someday to go to Mars. Similar goals had been expressed by President George H.W. Bush in 1989, but they did not receive bipartisan support, and the President's proposed budgets for achieving these goals were rejected. By 1992, the goals were essentially abandoned.*
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> *The 2004 Vision announcement followed by almost exactly a year the space shuttle Columbia tragedy that cost the lives of seven astronauts. The Columbia Accident Investigation Board noted in its report that if astronauts lives were to be at risk through space exploration, the rationale and goals needed to be better defined.*
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> *President George W. Bush did not propose adding significant funding to NASA's budget to accomplish the new goals, however. Instead, his plan was to terminate the space shuttle program in 2010 after completing construction of the ISS and to end U.S. involvement in the ISS in the 2015-2016 timeframe. The space shuttle and ISS funds would be redirected to achieving the Moon/Mars goals.*
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> *In 2005, a Republican-controlled Congress passed the 2005 NASA Authorization Act, which supported President Bush's Moon/Mars program while also stressing the need for adequate utilization of the ISS and holding open the possibility of continuing the space shuttle program beyond 2010. Three years later, a*

Democratic-controlled Congress passed the 2008 NASA Authorization Act that was similar to the 2005 act. At that point in time, Congress and the White House, Democrats and Republicans, were all in general agreement about the future of the human spaceflight program. NASA pursued the presidential and congressional policies by initiating the Constellation program to build capabilities to send people back to the Moon and to Mars, including new launch vehicles and spacecraft.

In January 2009, President Barack Obama convened a special committee to look at the human spaceflight program and offer options. Chaired by Norman Augustine, the committee concluded that there were "technical and budgetary issues" in major components of the Constellation program (e.g., Ares I, Orion) that were creating considerable schedule delays. Independent analyses showed that "the length of the gap in U.S. ability to launch astronauts into space [would] be at least seven years." The Augustine committee concluded further that in order for NASA to pursue a mission of sending humans beyond low Earth orbit (LEO), NASA required additional funding of $3 billion more per year. [The NRC report did not note, however, that the Administration also slashed funding for Exploration Systems in the FY10 budget request[1]]

In February 2010, as part of the fiscal year (FY) 2011 budget request, the White House proposed terminating the Constellation program and replacing it with a NASA effort to develop technologies for human exploration beyond LEO. No decision on what kind of vehicles to build would be made until at least 2015, and no specific destination or timeframe for human expeditions beyond LEO was included.

Meanwhile, the President decided that instead of NASA developing a replacement capability for the space shuttle to ferry astronauts to and from the ISS, NASA would build on its Commercial Orbital Transportation Services (COTS) partnership agreements with U.S. industry, initiated in 2006. This approach would enable them to contract for the development of "commercial crew" space transportation systems, where NASA would help pay companies to develop their own space transportation systems, and the companies would invest significant amounts of their own money toward development with the expectation of the emergence of a private human spaceflight market.

Congress also wanted a destination and a timetable for sending astronauts beyond LEO. In April 2010, the President announced his goals of sending astronauts to an asteroid by 2025 and to orbit Mars in the 2030s. These goals were officially expressed in the 2010 National Space Policy issued by the White House two months later.

The totality of the decisions to proceed with President Bush's plan to terminate the space shuttle, but to also end the Constellation program that was developing a

[1] http://www.nasa.gov/pdf/345955main_8_Exploration_%20FY_2010_UPDATED_final.pdf

replacement U.S. crew transportation capability, resulted in programmatic disruptions. These decisions also resulted in an indefinite extension of the number of years the United States would need to depend on Russia to take NASA astronauts to and from the ISS. In addition, the decisions to rely on the commercial sector to build a new U.S. crew space transportation system, when some were skeptical that the companies were technically ready to take on such a responsibility, and the decision to replace the Moon with an unspecified asteroid as the next destination for human spaceflight, made without prior consultation and contravening two existing laws, were met with Congressional skepticism.

A number of influential members of Congress insisted that the government – NASA- build a new crew transportation system regardless of any commercial crew aspirations. Congress wanted a new large rocket reminiscent of the Saturn V used for the Apollo program to enable trips beyond LEO, whatever the destination, and to accelerate, as much as possible, restoring U.S. ability to launch people into space rather than relying on Russia for transport.

In October 2010, Congress and the White House reached a compromise in the 2010 NASA Authorization Act. In essence, the agreement was for NASA to do both what the White House and Congress wanted. NASA would proceed with the White House plan for commercial crew transport as well as Congress's plan for a NASA-developed Space Launch System (SLS), based heavily upon legacy systems such as those developed for the space shuttle program, and an Orion spacecraft that would take humans beyond LEO and serve as a backup in case the commercial systems did not materialize.

The budget outlook for NASA, meanwhile, worsened. The President had planned to add $6 billion to NASA's budget over 5 years when he announced his new plan in the FY2011 budget request. A year later, with Republicans regaining control of the House and deficit-reduction becoming the dominant political theme, NASA was hoping for level funding at best. Today, the same NASA that was deemed by the Augustine committee to be unable to afford the Constellation program now must fund Constellation's replacement SLS/Orion and also fund commercial crew transport. NASA still must find funds for a habitation and support module to enable long duration trips beyond LEO.

Some in Congress remain wary of the administration's plans, stating that budget requests since the 2010 NASA Authorization Act have favored spending on commercial crew rather than SLS/Orion. NASA also took longer than expected to choose an SLS design, prompting congressional criticism that the agency was delaying making a decision. All the while, support for the idea of sending astronauts to an asteroid failed to gain widespread support, and NASA has not undertaken any visible steps required to make such a mission possible. These issues, in part, led Congress to commission the current study to examine NASA's strategic direction.

The one piece of common ground is that sending humans to Mars remains the long-term goal for everyone involved in this debate. As shown in Box 1.1 [excluded], that has been the driving force in presidential policies and speeches for decades. The debate is about the steps between the ISS and Mars and when we will get there, dictated largely by budget constraints."

III. Subcommittee Actions

In the 113th Congress, the Subcommittee on Space held a hearing on February 27, 2013, titled "A Review of the Space Leadership Preservation Act" to receive testimony on this piece of legislation that would also inform the Committee's consideration of the policies, organization, programs, and budget for re-authorizing the National Aeronautics and Space Administration in this Congress.

The Subcommittee heard from four witnesses:

Panel 1

- The Honorable Frank R. Wolf
- The Honorable John Culberson

Panel 2

- Mr. A. Thomas Young, Chair of the Board for SAIC (testifying on his own behalf)
- Mr. Elliot Pulham, Chief Executive Officer, The Space Foundation

The Committee on Science, Space, and Technology then held two hearings to address efforts to track and mitigate asteroids and meteors.

The first, held on March 19, 2013, was titled, "Threats from Space: A Review of U.S. Government Efforts to Track and Mitigate Asteroids and Meteors, Part 1". The Committee heard from three witnesses:

- The Honorable John P. Holdren, Director of the Office of Science and Technology Policy for the Executive Office of the President
- Gen. William L. Shelton, Commander of the U.S. Air Force Space Command
- The Honorable Charles F. Bolden, Jr., Administrator of the National Aeronautics and Space Administration

The second hearing, held on April 10, 2013, was titled, "Threats from Space, Part II: A Review of Private Sector Efforts to Track and Mitigate Asteroids and Meteors". The Committee heard from three witnesses:

- Dr. Ed Lu, Chairman & CEO, B612 Foundation
- Dr. Donald K. Yeomans, Manager, Near-Earth Objects Program Office, Jet Propulsion Laboratory
- Dr. Michael F. A'Hearn, Vice-Chair, Committee to Review Near-Earth Object Surveys and Hazard Mitigation Strategies, National Research Council

On April 24, 2013, the Subcommittee on Space held a hearing titled, "An Overview of the National Aeronautics and Space Administration Budget for Fiscal Year 2014," to review the Administration's FY 2014 budget request for the National Aeronautics and Space Administration and examine its priorities and challenges. The Subcommittee heard from one witness:

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

On Thursday, May 9, 2013, the Subcommittees on Space and Research held a joint hearing titled "Exoplanet Discoveries: Have We Found Other Earths?" The purpose of the hearing was to review the recent discovery of three super-Earth sized planets by NASA's Kepler space telescope. The hearing also assessed the state of exoplanet surveying, characterization, and research; NASA's Exoplanet Exploration Program; National Science Foundation's (NSF) Division of Astronomical Science; as well as coordination within the government and with external partners. NASA and NSF both contribute to the search for exoplanets. NASA provides space-based telescopes to identify potential planets, while NSF builds ground-based telescopes. Both agencies fund research that assists in categorizing and characterizing candidate planets. The Subcommittees heard from three witnesses:

- Dr. Laurance Doyle, Principal Investigator, Center for the Study of Life in the Universe, SETI Institute, and member of the NASA Kepler Mission Science Team
- Dr. John Grunsfeld, Associate Administrator, Science Mission Directorate, NASA
- Dr. James (Jim) Ulvestad, Division Director, Division of Astronomical Sciences, Directorate for Mathematical and Physical Sciences, NSF

On May 21, 2013, the Subcommittee on Space held a hearing titled, "Next Steps in Human Exploration to Mars and Beyond." The purpose of this hearing was to examine possible options for the next steps in human space flight and how these options move the United States closer to a human mission to Mars and beyond. In particular, the Subcommittee explored whether the Administration's proposed asteroid rendezvous mission is a better precursor for an eventual manned mission to Mars compared to Apollo-like follow-on missions to return to the Moon. The Subcommittee heard from four witnesses:

- Dr. Louis Friedman, Co-Lead, Keck Institute for Space Studies Asteroid Retrieval Mission Study and Executive Director Emeritus, The Planetary Society
- Dr. Paul Spudis, Senior Staff Scientist at the Lunar and Planetary Institute
- Dr. Steve Squyres, Goldwin Smith Professor of Astronomy at Cornell University
- Mr. Doug Cooke, Owner, Cooke Concepts and Solutions

On June 19, 2013, the Subcommittee on Space held a hearing titled, "NASA Authorization Act of 2013," to review a discussion draft of the National Aeronautics and Space Administration (NASA) Authorization Act of 2013. The Subcommittee heard from two witnesses:

- Dr. Steven M. Squyres, Goldwin Smith Professor of Astronomy, Cornell University
- Mr. A. Thomas Young, Executive Vice President (retired), Lockheed Martin Corporation

On September 20th, the Space Subcommittee held a hearing titled, "NASA Infrastructure: Enabling Discovery and Ensuring Capability," to review NASA's efforts to manage its facilities and infrastructure, the agency's current legislative authority, and its proposed legislation to provide greater flexibility to the agency. NASA is the ninth largest Federal Government real property holder; however, nearly 80 percent of the agency's facilities are 40 or more years old. A 2012 study by NASA estimated that NASA may have as many as 865 unneeded facilities, with maintenance costs of over $24 million a year. Similarly, NASA has a backlog of over $2.19 billion in deferred maintenance. The Subcommittee heard from two witnesses:

- The Honorable Paul K. Martin, Inspector General, National Aeronautics and Space Administration
- Mr. Richard Keegan, Associate Deputy Administrator, National Aeronautics and Space Administration

On December 4, 2013, the Committee on Science, Space, and Technology held a hearing titled, "Astrobiology: The Search for Biosignatures in our Solar System and Beyond," to examine astrobiology research and the search for biosignatures. The hearing included a general assessment of the multi- and interdisciplinary nature of astrobiology research, including the role astrobiology plays in formulating NASA space missions. It also examined the techniques and capabilities necessary to determine the potential for the existence of biosignatures within our Solar System. With the discovery of potential Earth-like planets outside of our Solar System, the hearing also investigated what methods are being used to determine if any of these planets may harbor life. The hearing explored existing and planned astrobiology research strategies and roadmaps. The Committee heard from three witnesses:

- Dr. Mary Voytek, Senior Scientist for Astrobiology in the Science Mission Directorate at NASA headquarters
- Dr. Sara Seager, Professor of Physics and of Planetary Science at M.I.T. and 2013 recipient of a MacArthur Foundation "Genius Grant" for her work in exoplanet research
- Dr. Steven J. Dick, Baruch S. Blumberg Chair of Astrobiology, John W. Kluge Center, Library of Congress

On February 27, 2014, the Committee on Science, Space, and Technology, held a hearing titled "Mars Flyby 2021: The First Deep Space Mission for the Orion and SLS?" This hearing explored the need for a roadmap of missions to guide investments in NASA's human spaceflight programs, how a manned mission to flyby the planets Mars and Venus launching in 2021 might fit into a series of missions and how the Space Launch System (SLS) and Orion Multipurpose Crew Vehicle could contribute to that mission. The Committee heard from four witnesses:

- Dr. Scott Pace, Director of the Space Policy Institute, George Washington University
- General Lester Lyles (Ret.), Independent Aerospace Consultant and former Chairman of the National Research Council Committee on the Rationale and Goals of the U.S. Civil Space Program
- Mr. Doug Cooke, Owner, Cooke Concepts and Solutions and former NASA Associate Administrator for Exploration Systems Mission Directorate;

- Dr. Sandy Magnus, Executive Director, American Institute of Aeronautics and Astronautics

On March 27, 2014, the Subcommittee held a hearing titled, "An Overview of the National Aeronautics and Space Administration Budget for Fiscal Year 2015". The purpose of the hearing was to review the Administration's fiscal year 2015 (FY15) budget request for the National Aeronautics and Space Administration and examine its priorities and challenges. The Committee heard from one witness:

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

The Subcommittee on Space met to consider H.R. 4412 on Wednesday, April 9, 2014.

The Subcommittee considered and approved by voice vote one amendment in the nature of a substitute offered by Mr. Palazzo and Ms. Edwards to H.R.4412.
The bill, as amended, was agreed to by voice vote, and was favorably reported to the full Committee by voice vote.

IV. Section by Section Analysis of H.R. 4412 as Amended

H.R. 4412, the National Aeronautics and Space Administration Authorization Act of 2014

Section 1. Short Title; Table of Contents
This Act may be cited as the "National Aeronautics and Space Administration Authorization Act of 2014".

Section 2. Definitions.
This section provides relevant definitions within the Act.

TITLE I - AUTHORIZATION OF APPROPRIATIONS

Sec. 101. Fiscal Year 2014.
This section authorizes NASA at levels in line with the Consolidated Appropriations Act, 2014 (P.L. 113-76).

TITLE II - HUMAN SPACE FLIGHT

Subtitle A – Exploration

Sec. 201. Space Exploration Policy.
Section 201 states that exploration deeper into the solar system shall be a core mission of NASA. It further states that it is the policy of the United States that the goal of NASA's exploration program to successfully conduct a crewed mission to the surface of Mars to begin human exploration of that planet. This section adds relevant definitions to title 51 and also adds language to title 42 regarding the acceleration of development of capabilities to enable a human

exploration mission to the surface of Mars and beyond through the prioritization of those technologies and capabilities best suited for such a mission in accordance with the Exploration Roadmap under title 51. This section states that non-United States human space flight capabilities should only be used as a contingency when no domestic commercial or public-private partnership provider that meets NASA's safety requirements is available.

Sec. 202. Stepping Stone Approach to Exploration.
This section requires the development of a Mars Human Exploration Roadmap defining the capabilities and technologies necessary to extend human presence to the surface of Mars. This section establishes requirements for the content of the roadmap. The roadmap must be transmitted to Congress, updated no less frequently than every two years, and include addenda from the NASA Advisory Council and Aerospace Safety Advisory Panel, each with a statement of review.

Sec. 203. Space Launch System.
Section 203 contains findings regarding the importance of the SLS and describes its intended uses. It includes a sense of Congress stating that the President's budget requests for the Space Launch System and Orion multipurpose crew vehicle development, test, and operational phases should strive to accurately reflect the resource requirements of each of those phases. This section requires the Administrator to make expeditious development, test, and achievement of operational readiness of the Space Launch System and the Orion crew capsule the highest priority of the exploration program. It requires a Government Accountability Office review of NASA's acquisition of ground systems in support of the Space Launch System, and establishes requirements for the review. This section requires the Administrator to report on the effort and budget required to enable and utilize a cargo variant of the SLS configuration. This section further requires NASA to conduct a competition among students in elementary and secondary schools to name the elements of NASA's exploration program. Section 203 requires a report to Congress describing the estimated cost of an advanced booster for SLS, detailing changes in development costs that may result from conducting a competition for an advanced booster, and outlining potential schedule delay resulting from a competition. It directs NASA to conduct a competition for an advanced booster if the Associate Administrator reports the results would be cost reductions and no adverse schedule impact in the required report.

Sec. 204. Orion Crew Capsule.
Section 204 states that Orion must meet the practical needs and the minimum capability requirements described in law. It requires a report to Congress detailing the components and systems of Orion that ensure it is in compliance with the law and the expected date that Orion will be available to transport crew and cargo to the ISS, as well as certification that the requirements of the law will be met in time for the first crewed test flight in the year 2021.

Sec. 205. Space Radiation.
This section requires the Administrator to develop a space radiation mitigation and management strategy and implementation plan. The strategy and plan must be submitted to Congress. The Administrator, in consultation with the heads of other agencies, must assess the national capabilities for carrying out critical ground-based research on space radiation biology.

Sec. 206. Planetary Protection for Human Exploration Missions.
This section requires the Administrator to contract with the National Academies for a study to explore the planetary protection ramifications of future missions by astronauts. The study must be submitted to Congress.

Subtitle B – Space Operations

Sec. 211. International Space Station (ISS).
This section states that the ISS shall have two primary objectives: supporting the goal established in Section 201 of this Act and pursuing a research program that advances knowledge and provides benefits to the Nation. It shall continue to be the policy of the United States, in consultation with its international partners in the ISS program, to support full and complete utilization of the ISS. Section 211 states that the ISS shall be utilized to the maximum extent practicable for the development of capabilities and technologies needed for the future of human exploration beyond low-Earth orbit. This section requires the Administrator to take all necessary steps to support the operation and full utilization of the ISS and seek to minimize the operating costs of the ISS. It further states that reliance on foreign carriers for crew and cargo is unacceptable and the Nation's human space flight program must acquire the capability to launch American astronauts on American rockets from American soil as soon as possible. It reaffirms Congress' commitment to the development of a commercially developed launch and delivery system to the ISS for crew missions. This section reaffirms that NASA shall make use of the United States' commercially provided ISS crew transfer and crew rescue services to the maximum extent practicable. Section 211 reaffirms that the Orion crew capsule shall provide an alternative means to deliver crew and cargo to the International Space Station, in the event other vehicles are unable to perform that function. It also reaffirms that NASA shall pursue means to maximize ISS logistics capabilities, reduce risks to ISS systems sustainability, and minimize United States operations costs relating to the ISS. This section amends the law to state that it is the policy of the United States to maintain an uninterrupted capability for human space flight and operations in low-Earth orbit and beyond as an essential instrument of national security and the capability to ensure continued United States participation and leadership in the exploration and utilization of space. This section requires the Administrator to submit a report to Congress on the feasibility of extending the operation of the ISS and also requires the Director of OSTP to develop and transmit to Congress a strategic plan for conducting research in the physical and life sciences and related technologies on the ISS through at least 2020. Finally, this section requires the Comptroller General to submit a report to Congress on the progress of the chosen not-for-profit entity for management of the National Laboratory.

Sec. 212. Commercial Crew Program.
Section 212 states it is the sense of Congress that United States commercially-provided crew transportation systems offer the potential of serving as the primary means of transporting American astronauts to and from the ISS and serving as ISS emergency crew rescue vehicles. It is the sense of Congress that credibility in the Administration's budgetary estimates for the Commercial Crew Program can be enhanced by an independently developed cost estimate. This section states that the objective of the Commercial Crew Program shall be to assist the development of at least one crew transportation system to carry NASA astronauts safely, reliably, and affordably to and from the ISS and to serve as an emergency crew rescue vehicle as

soon as practicable under the funding levels authorized in this Act. This section requires NASA to take steps established by the Columbia Accident Investigation Board to ensure safety. It requires the Administrator to strive, through the competitive selection process, to minimize the Program's lifecycle cost to NASA. Section 212 requires the Administrator to ensure that every crew transportation services provider has provided evidence-based support for their costs and schedule. This section requires the Administrator to arrange for the initiation of an Independent Cost and Schedule Estimate, to be provided to Congress, which meets specified requirements. This section also requires the Administrator to transmit an implementation plan based on the estimate with four distinct options for the final stage of the Commercial Crew program: a strategy that assumes an appropriation of $600 million over three years; a strategy that assumes an appropriation of $700 million over three years; a strategy that assumes an appropriation of $800 million over three years; and a strategy that has yet to be considered previously, but that NASA believes could ensure the flight readiness date of 2017 for at least one provider or decrease the program cost. Each strategy shall include the contracting instruments NASA will employ to acquire the services in each phase of development or acquisition and the number of commercial providers NASA will include in the program.

TITLE III – SCIENCE

Subtitle A – General

Sec. 301. Science Portfolio.
Section 301 amends the law to state that a balanced and adequately funded set of activities contributes to a robust and productive science program that serves as a catalyst for innovation and discovery. This section states that unless otherwise directed by Congress, NASA shall take into account the current decadal surveys from the National Academies when submitting the President's budget request to Congress.

Sec. 302. Radioisotope Power Systems.
This section requires the Administrator to conduct and transmit to Congress an analysis of NASA requirements for radioisotope power system material needed to carry out high priority robotic missions in the solar system and other surface exploration activities beyond low-Earth orbit, as well as the risks to NASA missions in meeting those requirements due to a lack of adequate domestic production of radioisotope power system material.

Sec. 303. Congressional Declaration of Policy and Purpose.
This section amends current law to add the search for life's origin, evolution, distribution, and future in the Universe to the list of objectives of NASA's activities.

Subtitle B – Astrophysics

Sec. 311. Decadal Cadence.
This section states that the Administrator shall ensure to the maximum extent practicable a steady cadence of large, medium, and small missions when following the guidance provided by the decadal surveys.

Sec. 312. Extrasolar Planet Exploration Strategy.
This section requires the Administrator to contract with the National Academies to develop a strategy for the study and exploration of extrasolar planets that would provide a foundation for NASA roadmaps, strategic plans, and activities related to exoplanet research and exploration.

Sec. 313. James Webb Space Telescope.
This section states that it is the sense of Congress that the James Webb Space Telescope (JWST) program will revolutionize our understanding of star and planet formation and how galaxies evolved and advance the search for the origins of the universe; the JWST program will enable American scientists to maintain their leadership in astrophysics and other disciplines; the JWST program is making steady progress towards a lunch in 2018; the on-time and on-budget delivery of JWST is a high congressional priority; and maintaining this progress will require the Administrator to ensure that integrated testing is appropriately timed and sufficiently comprehensive to enable potential issues to be identified and addressed early enough to handle within JWST's development schedule.

Sec. 314. National Reconnaissance Office Telescope Donation
This section requires the Administrator to report to Congress on NASA's plan for developing the Wide-Field Infrared Survey Telescope including a plan for the Wide-Field Infrared Survey Telescope 2.4, which includes the donated 2.4-meter aperture National Reconnaissance Office telescope.

Subtitle C –Planetary Science

Sec. 321. Decadal Cadence.
This section states that when following the guidance provided by the decadal surveys, the Administrator shall ensure to the greatest extent practicable that NASA carries out a balanced set of programs in accordance with the priorities established in the most recent decadal survey, including: a Discovery-class mission at least once every 24 months; a New Frontiers-class mission at least once every 60 months; and a Flagship-class mission at least once per decadal survey period, starting with a Europa mission with a goal of launching by 2021.

Sec. 322. Near Earth Objects.
This section requires the Administrator to continue to discover, track, catalogue, and characterize the physical characteristic of near-Earth objects equal to or greater than 140 meters in diameter in order to assess the threat of such near-Earth objects to Earth. It shall be the goal of the Survey to achieve 90 percent completion of its near-earth object catalogue by 2020. Section 322 reaffirms the policy in title 51 relating to detecting, tracking, cataloguing, and characterizing asteroids and comets. This section requires the Office of Science and Technology Policy to transmit to Congress an initial report that provides the following: recommendations and a proposed budget to carry out the Survey program; an analysis of possible options NASA could employ to divert an object on a likely collision course with Earth; and a description of the status of efforts to coordinate and cooperate with other countries to discover hazardous asteroids and comets, plan a mitigation strategy, and implement that strategy. It further requires the Administrator to transmit an annual report that provides a summary of all activities and expenditures taken with regards to the Survey since the enactment of this act. This section

requires a technical and scientific assessment of the capabilities and resources to accelerate the Survey and expand NASA's Near-Earth Object program to include detection, tracking, cataloging, and characterizing potentially hazardous near-Earth objects less than 140 meters in diameter.

Sec. 323. Near-Earth Object Public-Private Partnerships.
This section states it is the sense of Congress that NASA should seek to leverage the capabilities of private sector and philanthropic organizations in carrying out the Near-Earth Object Survey program in order to meet the goal of the Survey program. It requires the Administrator to transmit a report to Congress describing how the Administration can expand collaborative partnerships to detect, catalogue, and categorize near-Earth asteroids.

Sec. 324. Astrobiology Strategy.
This section would require the Administrator to contract with the National Academies to develop a science strategy for astrobiology to be used in planning and funding research and other activities and initiatives in the field of astrobiology. This section would also require the Administrator to transmit a report containing the strategy to Congress.

Sec. 325. Astrobiology Public-Private Partnerships.
This section requires a report to Congress describing how NASA can expand collaborative public-private partnerships to study life's origin, evolution, distribution, and future in the Universe.

Sec. 326. Assessment of Mars Architecture.
This section requires the Administrator to contract with the National Academies to assess NASA's revised post-2016 Mars exploration architecture and its responsiveness to the National Academies' planetary science decadal surveys and other relevant National Academies Mars-related reports; the long-term goals of NASA's Mars Exploration Program and the program's ability to optimize the science return; the Mars architecture's relationship to Mars-related activities to be undertaken by agencies and organizations outside of the United States; and the extent to which the Mars architecture represents a reasonably balanced mission portfolio. The results of the assessment must be transmitted to Congress.

Subtitle D –Heliophysics

Sec. 331. Decadal Cadence.
This section states that the Administrator shall ensure to the extent practicable a steady cadence of large, medium, and small heliophysics missions when following the guidance provided by the decadal surveys.

Subtitle E – Earth Science

Sec. 341. Reimbursement for Additional Responsibilities.
This section states it is the sense of Congress that NASA is being asked to undertake important Earth science activities in an environment of increasingly constrained fiscal resources, and that any transfer of additional responsibilities to NASA should be accompanied by the provision of

additional resources to allow NASA to carry out the increased responsibilities without adversely impacting its implementation of its existing Earth science programs and priorities.

TITLE IV- AERONAUTICS

Sec. 401. Sense of Congress.
Section 401states that it is the sense of Congress that a robust aeronautics research portfolio will help maintain the United States' status as a leader in aviation, enhance the competitiveness of the United States in the world economy, and improve the quality of life of all citizens. It further states that aeronautics research is essential to NASA's mission and should be supported and that the Administrator should coordinate with other stakeholders to minimize duplication and leverage resources. This section states that carrying aeronautics research to a level of maturity that allows NASA's research results to be transitioned to the users is critical to their eventual adoption.

Sec. 402. Aeronautics Research Goals.
This section instructs the Administrator to ensure that NASA maintains a strong aeronautics research portfolio, ranging from fundamental research through integrated systems research, with specific research goals including: enhance airspace operations and safety; improve air vehicle performance; strengthen aviation safety; and demonstrate concepts at the system level.

Sec. 403. Unmanned Aerial Systems Research and Development.
This section requires the Administrator to direct research and technological development to facilitate the safe integration of unmanned aerial systems into the National Airspace System. It requires the Administrator to update and transmit to Congress a roadmap for unmanned aerial systems research and development. This section requires that operational flight data from specified cooperative agreements be made available to NASA and the FAA for the development of regulatory standards.

Sec. 404. Research Program on Composite Materials Used In Aeronautics.
Section 404 requires the Administrator to continue NASA's cooperative research program with industry to identify and demonstrate more effective and safe ways of developing, manufacturing, and maintaining composite materials. This section states that the Administrator, in overseeing NASA's work on composite materials, shall consult with relevant Federal agencies and partners in industry to accelerate safe development and certification processes for new composite materials and design methods while maintaining rigorous inspection of new composite materials. It requires the Administrator to transmit to Congress a report detailing the work of NASA on new composite materials and the coordination efforts among agencies.

Sec. 405. Hypersonic Research.
This section requires the Administrator to develop and transmit to Congress a roadmap for hypersonic aircraft research.

Sec. 406. Supersonic Research.
This section contains findings regarding the importance of supersonic overland flight and continuing NASA's research program in supersonic flight. It requires the Administrator to

develop and transmit to Congress a roadmap for supersonic aeronautics research and development with the goal of developing and demonstrating, in a relevant environment, airframe and propulsion technologies to minimize the environmental impact of supersonic overland flight in an efficient and economical manner.

Sec. 407. Research on NextGen Airspace Management Concepts And Tools.
This section requires the Administrator, in consultation with the relevant federal agencies, to review NASA's research and development activities in support of NextGen and make any necessary adjustments to NASA's research and development activities in support of NextGen. It also requires the Administrator to report to Congress regarding the progress of NASA's research and development activities in support of the NextGen airspace management modernization initiative, including details of technology transfer to other agencies, consultation with other agencies, and any adjustments made to research activities.

Sec. 408. Rotorcraft Research.
This section requires the Administrator to prepare and transmit to Congress a plan for research relating to rotorcraft and other runway-independent air vehicles. The plan must include specific goals for the research, a timeline for implementation, metrics for success, and guidelines for collaboration and coordination with industry and other Federal agencies.

Sec. 409. Transformative Aeronautics Research.
This section states that it is the sense of Congress that the Administrator should encourage investigations into the early-stage advance of new processes, novel concepts, and innovative technology that have the potential to meet national aeronautics needs.

Sec. 410. Study of United States Leadership in Aeronautics Research.
This section requires the Administrator to enter into an arrangement with the National Academies for a study to assess the position of the United States in civil aeronautics research compared to the rest of the world. This section establishes requirements for the study. The study must be transmitted to Congress.

TITLE V - SPACE TECHNOLOGY

Sec. 501. Sense of Congress.
This section contains a sense of Congress regarding the importance of space technology**.**

Sec. 502. Space Technology Program.
Section 502 creates a Space Technology Program to pursue the development of technologies that enable exploration of the solar system or advanced space science through various elements of NASA. This section also states that the Administrator shall organize and manage NASA's Small Business Innovation Research program and Small Business Technology Transfer program within the Space Technology Program. Additionally, this section requires the Administrator to certify that no project within the Space Technology Program is also under development in any established mission directorate. It requires the Administrator to ensure that NASA's work in space technology is fully coordinated, aligned, and leveraged within NASA. Work being conducted by the Human Exploration and Operations Mission Directorate in support of advanced

space technologies and systems focusing on human space exploration should continue. This section requires a report to Congress comparing NASA's space technology investments with the high-priority technology areas identified by the National Academies in the National Research Council's report on NASA's Space Technology Roadmaps. It requires an annual submission with the budget for each fiscal year describing the rationale for assigning organizational responsibility for, in the year prior to the budget fiscal year, each initiated project, program, and mission focused on research and development of advanced technologies for human space exploration.

Sec. 503. Utilization of the International Space Station for Technology Demonstrations.
This section requires the Administrator to utilize the ISS and commercial services for Space Technology Demonstration missions in low-Earth orbit wherever it is practical and cost effective to do so.

TITLE VI- Other Provisions

Sec. 601. Asteroid Retrieval Mission.
This section requires the Administrator to report to Congress on the proposed Asteroid Retrieval Mission including a detailed budget profile; a detailed technical plan; a description of the technologies and capabilities anticipated to be gained that will enable future missions to Mars that could not be gained by lunar missions; a description of the technologies and capabilities anticipated to be gained from the proposed mission that will enable future planetary defense missions; and a review by the Small Bodies Assessment Group and the NASA Advisory Council. This section requires a report conducted by an independent, private systems engineering and technical assistance organization analyzing the proposal for a Mars Flyby human spaceflight mission to be launched in 2021. The report must be transmitted to Congress.

Sec. 602 . Termination Liability.
This section directs that funds set aside for contract termination liability shall be utilized for development work.

Sec. 603. Baseline and Cost Controls.
This section amends requirements associated with Baseline and Cost Controls to make the reporting more timely.

Sec. 604. Project and Program Reserves.
This section states that it is the sense of Congress that the judicious use of program and project reserves provides NASA managers with the flexibility needed to manage projects and programs to ensure that the impacts of contingencies can be mitigated. It requires the Administrator to report to Congress on NASA's criteria for establishing the amount of reserves at the project and program levels; how such criteria relate to NASA's policy of budgeting at a 70 percent confidence level; and NASA's criteria for waiving the policy of budgeting at a 70 percent confidence level, and strategies for controlling costs when a waiver is granted.

Sec. 605. Independent Reviews.
This section requires the Administrator to report to Congress on NASA's procedure for independent reviews of projects and programs at lifecycle milestones and how NASA ensures the independence of the individuals conducting those reviews as well as the independence of internal and external entities that conduct review of projects and programs at lifecycle milestones.

Sec. 606. Commercial Technology Transfer Program.
This section adds "protecting national security" to the considerations used to evaluate when to transfer technology.

Sec. 607. NASA Advisory Council
This section requires the Administrator to contract with the National Academy of Public Administration for an assessment of the effectiveness of the NASA Advisory Council, any organizational or other issues that the Academy determines need to be addressed, and any recommendations for improving the Council's effectiveness. It amends current law to state that in the performance of its functions, the Administrator is authorized to appoint such advisory committees as may be appropriate for purposes of consultation and advice to the Administration and Congress. The inclusion of "Congress" will sunset on September 30, 2014.

Sec. 608. Cost Estimation.
This section states that it is the sense of Congress that realistic cost estimating is important to the success of major development projects, and that it is important that NASA continue its efforts to develop and implement guidance in establishing realistic cost estimates. It requires the Administrator to provide guidance on when an Independent
Cost Assessment should be used and the criteria to be used to make such a determination to program and projects. This section requires a report to Congress on the implementation of more effective cost estimation practices.

Sec. 609. Avoiding Organizational Conflicts of Interest in Major NASA Acquisition Programs.
This section requires the Administrator to revise the NASA Supplement to the Federal Acquisition Regulation to provide uniform guidance and recommend revised requirements for organizational conflicts of interest by contractors in major acquisition programs in order to address specified concerns.

Sc. 610. Facilities and Infrastructure.
This section states that it is the sense of Congress that NASA must reverse the deteriorating condition of its facilities and infrastructure; NASA has a role in providing laboratory capabilities to industry participants that are economically viable as commercial entities and thus are not available elsewhere; NASA should seek to establish strategic partnerships with other Federal agencies, academic institutions, and industry, as appropriate; and decisions on whether to dispose of, maintain, or modernize existing facilities must be made in the context of meeting future NASA and other Federal agencies' laboratory needs, including those required to meet the activities supporting the Roadmap required by Sec 202. It further states that it is the policy of the United States that NASA maintain reliable and efficient facilities and that decisions on whether

to dispose of, maintain, or modernize existing facilities be made in the context of meeting future NASA needs. This section requires the Administrator to develop a plan that has the goal of positioning NASA to have the facilities, laboratories, tools, and approaches necessary to address future NASA requirements. It requires the Administrator to establish and make publically available a policy that guides the agency's use of existing authorities to out-grant, lease, excess to the General Services Administration, sell, decommission, demolish, or otherwise transfer property, facilities, or infrastructure. This section requires the Administrator to establish a capital fund for the modernization of facilities and laboratories.

Sec. 612. Detection and Avoidance of Counterfeit Electronic Parts.
This section requires NASA to revise the NASA Supplement for the Federal Acquisition Regulation to address the detection and avoidance of counterfeit electronic parts. The revised regulations must provide that contractors who supply electronic parts or products including electronic parts are responsible for detecting and avoiding the use or inclusion of counterfeit electronic parts or suspect counterfeit parts in such products, and for any corrective actions that may be required to remedy the use of such parts. The costs of counterfeit electronic parts and the cost of corrective action are not allowable costs under Agency contracts except under specified exemptions. It sets requirements for acquisition of electronic parts by NASA contractors and subcontractors to ensure authenticity. This section requires that any contractor or subcontractor who becomes aware of a possible counterfeit part must notify NASA within 30 calendar days.

Sec. 613. Space Act Agreements.
This section sets the following conditions for Space Act Agreements: funds provided by the government under a funded Space Act Agreement should not exceed the total amount provided by other parties to the agreement or other transaction; a Space Act Agreement may be used only when the use of a standard contract, grant, or cooperative agreement is not feasible or appropriate; Space Act Agreements must be available for public notice and comment prior to agreement; the Administrator shall publically disclose on NASA's website and make available in a searchable format all Space Act Agreements with appropriate redactions for proprietary information in a timely manner; and the Administrator must submit to Congress an annual report on the use of Space Act Agreement authority by NASA during the previous fiscal year. The report must include a list of anticipated agreements for the upcoming fiscal year. The report must also include a discussion of the benefits NASA has accumulated by using Space Act Agreements.