identification of fuels suitable for planetary surface and in-space power, NEP, and NTP applications.

(ii) Identify candidate fuel or fuels. DoD and NASA, in cooperation with DOE and private-sector partners, as appropriate, should identify candidate fuel or fuels to meet the identified mission requirements. This review and assessment should account for current and expected United States capabilities to produce and qualify for use candidate fuels, and for potential commonality of fuels or fuel variants across multiple planetary surface and in-space power, in-space propulsion, and terrestrial applications.

(iii) Qualify at least one candidate fuel. DoD and NASA, in cooperation with DOE and private-sector partners, as appropriate, should qualify a fuel or fuels for demonstrations of a planetary surface power reactor and an in-space propulsion system. While seeking opportunities to use private-sector-partner capabilities, agencies should ensure that the Federal Government retains an ability for screening and qualification of candidate fuels.

(iv) Supply fuel for demonstrations. DOE, in cooperation with NASA and DoD, and with private-sector partners, as appropriate, should identify feedstock and uranium that can be made available for planetary surface power and in-space propulsion demonstrations. DOE shall ensure that any provision of nuclear material for SNPP will not disrupt enriched uranium supplies for the United States nuclear weapons program and the naval propulsion program, and that SNPP needs are included among broader considerations of nuclear fuel supply provisioning and management.

(b) By the mid- to late-2020s, demonstrate a fission power system on the surface of the Moon that is scalable to a power range of 40 kWe and higher to support sustained lunar presence and exploration of Mars.

(i) Initiate a surface power project. NASA should initiate a fission surface power project for lunar surface demonstration by 2027, with scalability to Mars exploration. NASA should consult with DoD and other agencies, and with the private sector, as appropriate, when developing project requirements.

(ii) Conduct technology and requirements assessment. NASA, in coordination with DoD and other agencies, and with private-sector partners, as appropriate, should evaluate technology options for a surface power system including reactor designs, power conversion, shielding, and thermal management. NASA should work with other agencies, and private-sector partners, as appropriate, to evaluate opportunities for commonality among other SNPP needs, including in-space power and terrestrial power needs, possible NEP technology needs, and reactor demonstrations planned by NASA, other agencies, or the private sector.

(iii) Engage the private sector. DOE and NASA should determine a mechanism or mechanisms for engaging with the private sector to meet NASA's SNPP surface power needs in an effective manner consistent with the guiding principles set forth in this memorandum. In evaluating mechanisms, DOE and NASA should consider the possibility of NASA issuing a request for proposal for the development and construction of the surface power reactor system or demonstration.

(iv) System development. NASA should work with DOE, and with other agencies and private-sector partners, as appropriate, to develop the lunar surface power demonstration project.

(v) Conduct demonstration mission. NASA, in coordination with other agencies and with private-sector partners, as appropriate, should launch and conduct the lunar surface power demonstration project.

(c) By the late-2020s, establish the technical foundations and capabilities—including through identification and resolution of the key technical challenges—that will enable NTP options to meet future DoD and NASA mission needs.

(i) Conduct requirements assessment. DoD and NASA, in cooperation with DOE, and with other agencies and private-sector partners, as appropriate, should assess the ability of NTP capabilities to enable and advance existing and potential future DoD and NASA mission requirements.

(ii) Conduct technology assessment. DoD and NASA, in cooperation with DOE, and with other agencies and private-sector partners, as appropriate, should evaluate technology options and associated key technical challenges for an NTP system, including reactor designs, power conversion, and thermal management. DoD and NASA should work with their partners to evaluate and use opportunities for commonality with other SNPP needs, terrestrial power needs, and reactor demonstration projects planned by agencies and the private sector.

(iii) Technology development. DoD, in coordination with DOE and other agencies, and with private-sector partners, as appropriate, should develop reactor and propulsion system technologies that will resolve the key technical challenges in areas such as reactor design and production, propulsion system and spacecraft design, and SNPP system integration.

(d) By 2030, develop advanced RPS capabilities that provide higher fuel efficiency, higher specific energy, and longer operational lifetime than existing RPS capabilities, thus enabling survivable surface elements to support robotic and human exploration of the Moon and Mars and extending robotic exploration of the solar system.

(i) Maintain RPS capability. Mission sponsoring agencies should assess their needs for radioisotope heat source material to meet emerging mission requirements, and should work with DOE to jointly identify the means to produce or acquire the necessary material on a timeline that meets mission requirements.

(ii) Engage the private sector. NASA, in coordination with DOE and DOC, should conduct an assessment of opportunities for engaging the private sector to meet RPS needs in an effective manner consistent with the guiding principles established in this memorandum.

(iii) Conduct technology and requirements assessment. NASA, in coordination with DOE and DoD, and with other agencies and private-sector partners, as appropriate, should assess requirements for next-generation RPS systems and evaluate technology options for meeting those requirements.

(iv) System development. DOE, in coordination with NASA and DoD, and with other agencies and private-sector partners, as appropriate, should develop one or more next-generation RPS system or systems to meet the goals of higher fuel efficiency, higher specific energy, and longer operational lifetime for the required range of power.

SEC. 6. *Implementation*. The Vice President, through the National Space Council, shall coordinate implementation of this memorandum.

SEC. 7. *General Provisions*. (a) Nothing in this memorandum shall be construed to impair or otherwise affect:

(i) the authority granted by law to an executive department or agency, or the head thereof; or

(ii) the functions of the Director of the Office of Management and Budget relating to budgetary, administrative, or legislative proposals.

(b) This memorandum shall be implemented consistent with applicable law and subject to the availability of appropriations.

(c) This memorandum is not intended to, and does not, create any right or benefit, substantive or procedural, enforceable at law or in equity by any party against the United States, its departments, agencies, or entities, its officers, employees, or agents, or any other person.

(d) The Secretary of Energy is authorized and directed to publish this memorandum in the Federal Register.

DONALD J. TRUMP.

§ 20302. Vision for space exploration

(a) IN GENERAL.—The Administrator shall establish a program to develop a sustained human

presence in cis-lunar space or on the Moon, including a robust precursor program, to promote exploration, science, commerce, and United States preeminence in space, and as a stepping-stone to future exploration of Mars and other destinations. The Administrator is further authorized to develop and conduct appropriate international collaborations in pursuit of these goals.

(b) FUTURE EXPLORATION OF MARS.—The Administrator shall manage human space flight programs, including the Space Launch System and Orion, to enable humans to explore Mars and other destinations by defining a series of sustainable steps and conducting mission planning, research, and technology development on a timetable that is technically and fiscally possible, consistent with section 70504.

(c) DEFINITIONS.—In this section:

(1) ORION.—The term ''Orion'' means the multipurpose crew vehicle described under section 303 of the National Aeronautics and Space Administration Authorization Act of 2010 (42 U.S.C. 18323).

(2) SPACE LAUNCH SYSTEM.—The term ''Space Launch System'' means has the meaning[1] given the term in section 3 of the National Aeronautics and Space Administration Authorization Act of 2010 (42 U.S.C. 18302).

(Pub. L. 111–314, § 3, Dec. 18, 2010, 124 Stat. 3356; Pub. L. 115–10, title IV, § 413, Mar. 21, 2017, 131 Stat. 33.)

HISTORICAL AND REVISION NOTES

Revised Section	*Source (U.S. Code)*	*Source (Statutes at Large)*
20302	42 U.S.C. 16611(b).	Pub. L. 109–155, title I, § 101(b), Dec. 30, 2005, 119 Stat. 2898.

Editorial Notes

AMENDMENTS

2017—Subsec. (a). Pub. L. 115–10, § 413(1), inserted ''in cis-lunar space or'' after ''sustained human presence''.

Subsec. (b). Pub. L. 115–10, § 413(2), amended subsec. (b) generally. Prior to amendment, text read as follows: ''The Administrator shall manage human space flight programs to strive to achieve the following milestones (in conformity with section 70502 of this title):

''(1) Returning Americans to the Moon no later than 2020.

''(2) Launching the Crew Exploration Vehicle as close to 2010 as possible.

''(3) Increasing knowledge of the impacts of long duration stays in space on the human body using the most appropriate facilities available, including the International Space Station.

''(4) Enabling humans to land on and return from Mars and other destinations on a timetable that is technically and fiscally possible.''

Subsec. (c). Pub. L. 115–10, § 413(3), added subsec. (c).

Statutory Notes and Related Subsidiaries

HUMAN SPACE EXPLORATION

Pub. L. 115–10, title IV, §§ 431, 432, Mar. 21, 2017, 131 Stat. 38, provided that:

''SEC. 431. FINDINGS ON HUMAN SPACE EXPLORATION.

''Congress makes the following findings:

''(1) In accordance with section 204 of the National Aeronautics and Space Administration Authorization Act of 2010 (124 Stat. 2813), the National Academies of Sciences, Engineering, and Medicine, through its Committee on Human Spaceflight, conducted a review of the goals, core capabilities, and direction of human space flight, and published the findings and recommendations in a 2014 report entitled, 'Pathways to Exploration: Rationales and Approaches for a U.S. Program of Human Space Exploration'.

''(2) The Committee on Human Spaceflight included leaders from the aerospace, scientific, security, and policy communities.

''(3) With input from the public, the Committee on Human Spaceflight concluded that many practical and aspirational rationales for human space flight together constitute a compelling case for continued national investment and pursuit of human space exploration toward the horizon goal of Mars.

''(4) According to the Committee on Human Spaceflight, the rationales include economic benefits, national security, national prestige, inspiring students and other citizens, scientific discovery, human survival, and a sense of shared destiny.

''(5) The Committee on Human Spaceflight affirmed that Mars is the appropriate long-term goal for the human space flight program.

''(6) The Committee on Human Spaceflight recommended that NASA define a series of sustainable steps and conduct mission planning and technology development as needed to achieve the long-term goal of placing humans on the surface of Mars.

''(7) Expanding human presence beyond low-Earth orbit and advancing toward human missions to Mars requires early planning and timely decisions to be made in the near-term on the necessary courses of action for commitments to achieve short-term and long-term goals and objectives.

''(8) In addition to the 2014 report described in paragraph (1), there are several independently developed reports or concepts that describe potential Mars architectures or concepts and identify Mars as the long-term goal for human space exploration, including NASA's 'The Global Exploration Roadmap' of 2013, 'NASA's Journey to Mars–Pioneering Next Steps in Space Exploration' of 2015, NASA Jet Propulsion Laboratory's 'Minimal Architecture for Human Journeys to Mars' of 2015, and Explore Mars' 'The Humans to Mars Report 2016'.

''SEC. 432. HUMAN EXPLORATION ROADMAP.

''(a) SENSE OF CONGRESS.—It is the sense of Congress that—

''(1) expanding human presence beyond low-Earth orbit and advancing toward human missions to Mars in the 2030s requires early strategic planning and timely decisions to be made in the near-term on the necessary courses of action for commitments to achieve short-term and long-term goals and objectives;

''(2) for strong and sustained United States leadership, a need exists to advance a human exploration roadmap, addressing exploration objectives in collaboration with international, academic, and industry partners;

''(3) an approach that incrementally advances toward a long-term goal is one in which nearer-term developments and implementation would influence future development and implementation; and

''(4) a human exploration roadmap should begin with low-Earth orbit, then address in greater detail progress beyond low-Earth orbit to cis-lunar space, and then address future missions aimed at human arrival and activities near and then on the surface of Mars.

''(b) HUMAN EXPLORATION ROADMAP.—

''(1) IN GENERAL.—The Administrator shall develop a human exploration roadmap, including a critical decision plan, to expand human presence beyond low-Earth orbit to the surface of Mars and beyond, con-

[1] So in original.

sidering potential interim destinations such as cis-lunar space and the moons of Mars.

''(2) SCOPE.—The human exploration roadmap shall include—

''(A) an integrated set of exploration, science, and other goals and objectives of a United States human space exploration program to achieve the long-term goal of human missions near or on the surface of Mars in the 2030s;

''(B) opportunities for international, academic, and industry partnerships for exploration-related systems, services, research, and technology if those opportunities provide cost-savings, accelerate program schedules, or otherwise benefit the goals and objectives developed under subparagraph (A);

''(C) sets and sequences of precursor missions in cis-lunar space and other missions or activities necessary—

''(i) to demonstrate the proficiency of the capabilities and technologies identified under subparagraph (D); and

''(ii) to meet the goals and objectives developed under subparagraph (A), including anticipated timelines and missions for the Space Launch System and Orion;

''(D) an identification of the specific capabilities and technologies, including the Space Launch System, Orion, a deep space habitat, and other capabilities, that facilitate the goals and objectives developed under subparagraph (A);

''(E) a description of how cis-lunar elements, objectives, and activities advance the human exploration of Mars;

''(F) an assessment of potential human health and other risks, including radiation exposure;

''(G) mitigation plans, whenever possible, to address the risks identified in subparagraph (F);

''(H) a description of those technologies already under development across the Federal Government or by other entities that facilitate the goals and objectives developed under subparagraph (A);

''(I) a specific process for the evolution of the capabilities of the fully integrated Orion with the Space Launch System and a description of how these systems facilitate the goals and objectives developed under subparagraph (A) and demonstrate the capabilities and technologies described in subparagraph (D);

''(J) a description of the capabilities and technologies that need to be demonstrated or research data that could be gained through the utilization of the ISS and the status of the development of such capabilities and technologies;

''(K) a framework for international cooperation in the development of all capabilities and technologies identified under this section, including an assessment of the risks posed by relying on international partners for capabilities and technologies on the critical path of development;

''(L) a process for partnering with nongovernmental entities using Space Act Agreements or other acquisition instruments for future human space exploration; and

''(M) include [sic] information on the phasing of planned intermediate destinations, Mars mission risk areas and potential risk mitigation approaches, technology requirements and phasing of required technology development activities, the management strategy to be followed, related ISS activities, planned international collaborative activities, potential commercial contributions, and other activities relevant to the achievement of the goal established in this section.

''(3) CONSIDERATIONS.—In developing the human exploration roadmap, the Administrator shall consider—

''(A) using key exploration capabilities, namely the Space Launch System and Orion;

''(B) using existing commercially available technologies and capabilities or those technologies and capabilities being developed by industry for commercial purposes;

''(C) establishing an organizational approach to ensure collaboration and coordination among NASA's Mission Directorates under section 821 [set out as a note under section 20111 of this title], when appropriate, including to collect and return to Earth a sample from the Martian surface;

''(D) building upon the initial uncrewed mission, EM–1, and first crewed mission, EM–2, of the Space Launch System and Orion to establish a sustainable cadence of missions extending human exploration missions into cis-lunar space, including anticipated timelines and milestones;

''(E) developing the robotic and precursor missions and activities that will demonstrate, test, and develop key technologies and capabilities essential for achieving human missions to Mars, including long-duration human operations beyond low-Earth orbit, space suits, solar electric propulsion, deep space habitats, environmental control life support systems, Mars lander and ascent vehicle, entry, descent, landing, ascent, Mars surface systems, and in-situ resource utilization;

''(F) demonstrating and testing 1 or more habitat modules in cis-lunar space to prepare for Mars missions;

''(G) using public-private, firm fixed-price partnerships, where practicable;

''(H) collaborating with international, academic, and industry partners, when appropriate;

''(I) any risks to human health and sensitive onboard technologies, including radiation exposure;

''(J) any risks identified through research outcomes under the NASA Human Research Program's Behavioral Health Element; and

''(K) the recommendations and ideas of several independently developed reports or concepts that describe potential Mars architectures or concepts and identify Mars as the long-term goal for human space exploration, including the reports described under section 431.

''(4) CRITICAL DECISION PLAN ON HUMAN SPACE EXPLORATION.—As part of the human exploration roadmap, the Administrator shall include a critical decision plan—

''(A) identifying and defining key decisions guiding human space exploration priorities and plans that need to be made before June 30, 2020, including decisions that may guide human space exploration capability development, precursor missions, long-term missions, and activities;

''(B) defining decisions needed to maximize efficiencies and resources for reaching the near, intermediate, and long-term goals and objectives of human space exploration; and

''(C) identifying and defining timelines and milestones for a sustainable cadence of missions beginning with EM–3 for the Space Launch System and Orion to extend human exploration from cis-lunar space to the surface of Mars.

''(5) REPORTS.—

''(A) INITIAL HUMAN EXPLORATION ROADMAP.—The Administrator shall submit to the appropriate committees of Congress—

''(i) an initial human exploration roadmap, including a critical decision plan, before December 1, 2017; and

''(ii) an updated human exploration roadmap periodically as the Administrator considers necessary but not less than biennially.

''(B) CONTENTS.—Each human exploration roadmap under this paragraph shall include a description of—

''(i) the achievements and goals accomplished in the process of developing such capabilities and technologies during the 2-year period prior to the submission of the human exploration roadmap; and

''(ii) the expected goals and achievements in the following 2-year period.

''(C) SUBMISSION WITH BUDGET.—Each human exploration roadmap under this section shall be included in the budget for that fiscal year transmitted to Congress under section 1105(a) of title 31, United States Code.''

[For definitions of terms used in sections 431 and 432 of Pub. L. 115–10, set out above, see section 2 of Pub. L. 115–10, set out as a note under section 10101 of this title.]

§ 20303. Contribution to innovation

(a) PARTICIPATION IN INTERAGENCY ACTIVITIES.—The Administration shall be a full participant in any interagency effort to promote innovation and economic competitiveness through near-term and long-term basic scientific research and development and the promotion of science, technology, engineering, and mathematics education, consistent with the Administration's mission, including authorized activities.

(b) HISTORIC FOUNDATION.—In order to carry out the participation described in subsection (a), the Administrator shall build on the historic role of the Administration in stimulating excellence in the advancement of physical science and engineering disciplines and in providing opportunities and incentives for the pursuit of academic studies in science, technology, engineering, and mathematics.

(c) BALANCED SCIENCE PROGRAM AND ROBUST AUTHORIZATION LEVELS.—The balanced science program authorized by section 101(d) of the National Aeronautics and Space Administration Authorization Act of 2005 (42 U.S.C. 16611(d))[1] shall be an element of the contribution by the Administration to the interagency programs.

(d) ANNUAL REPORT.—

(1) REQUIREMENT.—The Administrator shall submit to Congress and the President an annual report describing the activities conducted pursuant to this section, including a description of the goals and the objective metrics upon which funding decisions were made.

(2) CONTENT.—Each report submitted pursuant to paragraph (1) shall include, with regard to science, technology, engineering, and mathematics education programs, at a minimum, the following:

(A) A description of each program.

(B) The amount spent on each program.

(C) The number of students or teachers served by each program.

(Pub. L. 111–314, § 3, Dec. 18, 2010, 124 Stat. 3356.)

HISTORICAL AND REVISION NOTES

Revised Section	*Source (U.S. Code)*	*Source (Statutes at Large)*
20303(a)	42 U.S.C. 16611a(a).	Pub. L. 110–69, title II, § 2001(a), (b), (c), (e), Aug. 9, 2007, 121 Stat. 582.
20303(b)	42 U.S.C. 16611a(b).	
20303(c)	42 U.S.C. 16611a(c).	
20303(d)	42 U.S.C. 16611a(e).	

Editorial Notes

REFERENCES IN TEXT

Section 101(d) of the National Aeronautics and Space Administration Authorization Act of 2005 (42 U.S.C. 16611(d)), referred to in subsec. (c), is section 101(d) of Pub. L. 109–155, title I, Dec. 30, 2005, 119 Stat. 2897, which was omitted from the Code following the enactment of this title by Pub. L. 111–314.

Statutory Notes and Related Subsidiaries

INTERNATIONAL SPACE STATION'S CONTRIBUTION TO NATIONAL COMPETITIVENESS ENHANCEMENT

Pub. L. 111–358, title II, § 204, Jan. 4, 2011, 124 Stat. 3994, provided that:

''(a) SENSE OF CONGRESS.—It is the sense of the Congress that the International Space Station represents a valuable and unique national asset which can be utilized to increase educational opportunities and scientific and technological innovation which will enhance the Nation's economic security and competitiveness in the global technology fields of endeavor. If the period for active utilization of the International Space Station is extended to at least the year 2020, the potential for such opportunities and innovation would be increased. Efforts should be made to fully realize that potential.

''(b) EVALUATION AND ASSESSMENT OF NASA'S INTERAGENCY CONTRIBUTION.—Pursuant to the authority provided in title II of the America COMPETES Act (Public Law 110–69 [see Tables for classification]), the Administrator [of NASA] shall evaluate and, where possible, expand efforts to maximize NASA's [National Aeronautics and Space Administration's] contribution to interagency efforts to enhance science, technology, engineering, and mathematics education capabilities, and to enhance the Nation's technological excellence and global competitiveness. The Administrator shall identify these enhancements in the annual reports required by section 2001(e) of that Act ([former] 42 U.S.C. 16611a(e)) [now 51 U.S.C. 20303(d)].

''(c) REPORT TO THE CONGRESS.—Within 120 days after the date of enactment of this Act [Jan. 4, 2011], the Administrator shall provide to the House of Representatives Committee on Science and Technology [now Committee on Science, Space, and Technology] and the Senate Committee on Commerce, Science, and Transportation a report on the assessment made pursuant to subsection (a). The report shall include—

''(1) a description of current and potential activities associated with utilization of the International Space Station which are supportive of the goals of educational excellence and innovation and competitive enhancement established or reaffirmed by this Act [see Short Title of 2011 Amendment note set out under section 1861 of Title 42, The Public Health and Welfare], including a summary of the goals supported, the number of individuals or organizations participating in or benefiting from such activities, and a summary of how such activities might be expanded or improved upon;

''(2) a description of government and private partnerships which are, or may be, established to effectively utilize the capabilities represented by the International Space Station to enhance United States competitiveness, innovation and science, technology, engineering, and mathematics education; and

''(3) a summary of proposed actions or activities to be undertaken to ensure the maximum utilization of the International Space Station to contribute to fulfillment of the goals and objectives of this Act, and the identification of any additional authority, assets, or funding that would be required to support such activities.''

§ 20304. Basic research enhancement

(a) DEFINITION OF BASIC RESEARCH.—In this section, the term ''basic research'' has the meaning given the term in Office of Management and Budget Circular No. A–11.

(b) COORDINATION.—The Administrator, the Director of the National Science Foundation, the

[1] See References in Text note below.