参考資料２

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Highlights:

- The National Aeronautics and Space Administration (NASA) is responsible for leading an innovative and sustainable program of exploration with commercial and international partners to enable human expansion across the solar system and bring new knowledge and opportunities back to Earth. As it pioneers the space frontier, NASA supports growth of the Nation's economy in space, increases understanding of the universe and our place in it, works with industry to improve America's aerospace technologies, and advances American leadership.
- The Budget supports the Administration's new space exploration policy by refocusing existing NASA activities towards exploration, by redirecting funding to innovative new programs that support the new policy, and by providing additional funding to support new public-private initiatives.
- The Budget requests a total of $19.6 billion for NASA, a $500 million (2.6 percent) increase from the 2018 Budget ($61 million below NASA's 2017 funding level).
- The Budget proposes to end direct U.S. Government funding for the space station by 2025 and provides $150 million to begin a program that would encourage commercial development of capabilities that NASA can use in its place.
- The Budget refocuses and consolidates NASA's space technology development programs to support space exploration activities.
- The Budget continues strong programs in science and aeronautics, including a supersonic "X-plane," planetary defense from hazardous asteroids, and potentially a bold mission to retrieve pieces of Mars for scientific study on Earth.

The President's 2019 Budget:

The Budget supports an innovative and sustainable program of exploration with commercial and international partners to enable the return of humans to the Moon for long-term exploration and utilization, followed by human missions to Mars and other destinations. As it pioneers the space frontier, NASA supports growth of the Nation's space economy, increases understanding of the universe and America's place in it, and advances America's aerospace technology.

"The directive I am signing today will refocus America's space program on human exploration and discovery. It marks a first step in returning American astronauts to the Moon for the first time since 1972, for long-term exploration and use. This time, we will not only plant our flag and leave our footprints—we will establish a foundation for an eventual mission to Mars, and perhaps someday, worlds beyond."

President Donald J. Trump
November 11, 2017

The Budget takes concrete actions to once again launch Americans into space from American soil. The Budget partners with industry to land robotic missions on the surface of the Moon in the next few years, paving the way for a return of U.S. astronauts—this time not just to visit, but to lay the foundation for further journeys of exploration and the expansion of the U.S. economy into space. The Budget supports a sustainable space exploration program to be proud of—one that reflects American ingenuity, ambition, and leadership. Specifically, the Budget:

Renews Focus on Human Exploration and Discovery and Expands Commercial Partnerships to Strengthen U.S. Leadership in Space. The Budget provides $10 billion for Human Exploration and Operations to pursue a campaign that would establish U.S. preeminence to, around, and on the Moon. This would be achieved through a renewed focus on new approaches and industrial partners, and by pursuing near-term milestones for lunar exploration, such as the commercial launch of a key power and propulsion space tug in 2022. A new lunar robotic exploration program would support innovative approaches to achieve human and science exploration goals. This new program would fund contracts for transportation services and the development of small rovers and instruments to meet lunar science and exploration needs. The Budget also supports the creation of a new Exploration Research and Technology program to enable lower-cost technology and systems needed to sustainably return humans to the Moon and beyond. In addition, the Budget fully funds the Space Launch System (SLS) rocket and Orion crew capsule as key elements of the human space exploration program. The Budget provides $3.7 billion for SLS and Orion, which would keep the programs on track for a test launch by 2020 and a first crewed launch around the Moon by 2023.

Provides Cost Savings by Phasing out Government Programs and Replacing them with Commercial or Public-Private Operations. The Budget proposes to end direct U.S. financial support for the International Space Station in 2025, after which NASA would rely on commercial partners for its low Earth orbit research and technology demonstration requirements. A new $150 million program would begin support for commercial partners to encourage development of capabilities that the private sector and NASA can use. The Budget also proposes a transition away from NASA's current Government-owned and operated fleet of communications satellites and associated ground stations. Instead, the Budget proposes a greater reliance on commercial communications satellite capabilities. The Budget also proposes canceling an over-budget project to upgrade the current NASA-owned system in order to make resources available for these new partnerships.

Continues Robotic Exploration of the Solar System. The Budget provides $2.2 billion to Planetary Science and maintains support for competed science missions and the next Mars rover, which would launch in 2020. The Budget also provides $50 million to explore possibilities for retrieving geologic samples from Mars, which has long been a high-priority science goal and a keystone of future Mars exploration. A $150 million planetary defense program would help protect the Earth from potentially hazardous asteroids.

Fully Funds an Experimental Supersonic Airplane and Increases Hypersonics Research Funding. The Budget fully funds the Low-Boom Flight Demonstrator, an experimental supersonic (faster than the speed of sound) airplane that would make its first flight in 2021. This "X-plane" would

open a new market for U.S. companies to build faster commercial airliners, creating jobs and cutting cross-country flight times in half. The Budget also increases funding for research on flight at speeds more than five times the speed of sound, commonly referred to as hypersonics. Hypersonics research is critical to understanding how crewed and robotic spacecraft can safely enter and exit the atmospheres of planets. Hypersonics also has applications for national defense.

"American companies are on the cutting edge of space technology, and they're developing new rockets, spaceships, and satellites that will take us further into space, faster than ever before. Like the railroads that brought American explorers, entrepreneurs, and settlers to tame the Wild West, these groundbreaking new technologies will open untold opportunities to extend the range of American action and values into the new worlds of outer space. And by fostering much stronger partnerships between the Federal Government and the realm of industry, and bringing the full force of our national interest to bear, American leadership in space will be assured."

Vice President Michael R. Pence
October 5, 2017

Supports a Focused Earth Science Program. The Budget provides $1.8 billion for a focused, balanced Earth Science portfolio that supports the priorities of the science and applications communities. The Budget maintains the Nation's 45-year record of space-based land imagery by funding Landsat 9 and a Sustainable Land Imaging program. The Budget maintains the Administration's previous termination of five Earth Science missions—PACE, OCO-3, RBI, DSCOVR Earth-viewing instruments, and CLARREO Pathfinder—to achieve savings.

Terminates a New Space Telescope while Increasing Support for other Astrophysics Priorities. The Budget terminates development of the WFIRST space telescope, which was not executable within its previous budget and would have required a significant funding increase in 2019 and future years. The Budget redirects funding from this mission to competed research including smaller, principal-investigator-led astrophysics missions. These missions have a history of providing high scientific impact while training the next generation of scientists and engineers. The Budget continues to fund the $8.8 billion James Webb Space Telescope, which is expected to launch in 2019 and operate for many years to come.

Redirects Education Funding to Higher Priorities. The Budget continues to support the termination of the $100 million Office of Education, redirecting those funds to NASA's core mission of exploration. The Science Activation program within the Science Mission Directorate—a focused, science-driven program with clear objectives, evaluation strategies, and strong partnerships—is retained.

Supports the Technology Demonstration of In-Space Robotic Manufacturing and Assembly. The Budget provides $54.2 million for public-private partnerships to demonstrate new technologies used to build large structures in a space environment. Such structures could be key to supporting future exploration and commercial space activities.

NASA FY 2019 BUDGET REQUEST

Actuals FY2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
$19.7B	$19.5B	$19.9B	$19.6B	$19.6B	$19.6B	$19.6B

The President's Fiscal Year 2019 Budget
An Innovative and Sustainable Program of Exploration

NASA is focused on its core exploration mission and the many ways that the agency returns value to the nation through knowledge and discoveries, deepening partnerships with industry and other nations, finding solutions to tough problems, and inspiring the next generation. This budget places NASA at the forefront of a global effort to advance humanity's future in space, and draws on our nation's great capacity for innovation and exploration to raise the bar of human potential and improve life across the globe.

The Budget provides $10.5 billion for a focused exploration campaign. Building emerging commercial capabilities, as well as on the Space Launch System and Orion, this Budget expands exploration by 1) pursuing a cis-lunar strategy that establishes U.S. preeminence to, around, and on the Moon, and 2) facilitating development of a commercial space economy. NASA will engage with partners through non-traditional partnerships, commercial service purchases, and expanded international cooperative agreements.

Deep Space Exploration Systems – $4,558.8 million
- Develops infrastructure to explore and utilize the Moon and its surface.
- Establishes a Lunar Orbital Platform-Gateway in cislunar space, to include a power and propulsion element by 2022, and habitation, airlock, and the required logistics capabilities soon after.
- Continues development of the Space Launch System rocket and Orion crew vehicle to send astronauts on deep space missions.
- Initiates robotic lunar technology investments for future large scale missions to the Moon's surface, using innovative acquisition approaches to partner with U.S. industry and other nations.

Exploration Research & Technology – $1,002.7 million
- Conducts technology research and development to address requirements for human and robotic space exploration, and fosters commercial expansion in low Earth orbit, cislunar space and beyond.
- Continues development of high-powered solar electric propulsion for the Lunar Orbital Platform – Gateway and other NASA exploration missions as well as help support commercial potential for the U.S. aerospace industry.
- Supports the In-Space Robotic Manufacturing and Assembly mission that will use public-private partnerships to demonstrate new technologies to build large structures in a space environment.
- Conducts cutting-edge research on the effect of spaceflight and the space environment on the human body, via the Human Research Program.

LEO and Space Operations – $4,624.6 million
- Initiates a new Commercial LEO Development effort, initially funded with $150 million in FY 2019, for NASA to encourage and fund the development of new commercial orbital platforms and capabilities for use by the private sector and NASA.
- Continues commercial development of U.S. crew transportation systems that will support the International Space Station beginning in 2019, building on the success of commercial cargo transportation services.
- Continues use of the International Space Station as a platform to identify and quantify risks to human health and performance, develop countermeasures, and develop and test technologies that will protect astronauts during extended human exploration missions; conduct world class science to improve life on Earth; and further commercial activities in LEO. Ends direct federal support for ISS in 2025.

Science – $5,895.0 million

- Launches a new Lunar Discovery and Exploration Program, taking advantage of emerging commercial capabilities to deliver science and technology payloads to the surface of the Moon.
- $2,234.7 million for Planetary Science, keeping on track the Mars 2020 rover (2020 launch) and Europa Clipper (2025 launch). Continues formulation of the New Frontiers candidates CAESAR and Dragonfly, and development of the Discovery missions Lucy and Psyche.
- $1,784.2 million for Earth Science, includes launches of GRACE Follow-On, ICESat-2, ECOSTRESS, and GEDI. Supports continued and expanded commercial partnerships with low-Earth orbit and geostationary hosted payloads and pilot NASA purchases of data products from commercial small satellite constellations. Proposes the termination of PACE, OCO-3, DSCOVR Earth-viewing instruments, and CLARREO Pathfinder given higher priorities within NASA. In January 2018 NASA cancelled the Radiation Budget Instrument due to cost and technical challenges.
- $1,185.4 million for Astrophysics, supporting launch of the James Webb Space Telescope in 2019. Terminates WFIRST due to it significant cost and higher priorities elsewhere within NASA. Funding made available from the proposed termination is redirected towards future competed missions and research.
- $690.7 million for Heliophysics, supporting the DRIVE initiative and research to improve space weather observation, forecasting, and modeling.
- Continues formulation and development of over 40 missions and operation of over 60 missions producing leading-edge science.
- Funds over 10,000 U.S. scientists in universities, industry, and government labs through over 3,000 openly competed research awards.

Aeronautics Research - $ 633.9 million

- Advances aeronautics research that may lead to major advances in air traffic management intended to safely increase air traffic capacity, reduce flight delays, and enable safe, robust UAS integration.
- Completes the Critical Design Review for the Low Boom Flight Demonstrator X-Plane, which will demonstrate quiet overland supersonic flight and enable the creation of a new civil supersonic market for U.S. industry.
- Increases funding for fundamental research on hypersonics, improving the design of future hypersonic vehicles and enabling stronger collaboration with other government agencies and universities.
- Develops promising subsonic aircraft technologies that dramatically reduce fuel consumption, noise, and emissions enabling the U.S. aviation industry to maintain and advance its global leadership.

Office of Education - $ 0.0

The Budget provides no funding for the Office of Education, redirecting those funds to NASA's core mission of exploration. While grant programs like Space Grant, EPSoR, and MUREP will no longer be funded, NASA will continue to support other education activities, such as internships and fellowships funded by the mission directorates. The Budget also continues support for the Science Activation program within the Science Mission Directorate, which delivers science content and expertise through cooperative agreements with more than 25 organizations.

Safety, Security and Mission Services ($2,749.7 million) and Construction & Environmental Compliance and Restoration ($388.2 million)

- Funds Agency-wide mission support operations, including facilities and environmental activities.
- Increases funding to strengthen agency-wide cybersecurity to protect data, systems, and operations.
- Ensures NASA infrastructure and assets are safe, secure, environmentally sound, and operate efficiently.

FY 2019 Budget Request
Deep Space Exploration Systems
($ Millions)

	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023
Deep Space Exploration Systems	**4,184.0**	**4,222.6**	**4,558.8**	**4,859.1**	**4,764.5**	**4,752.5**	**4,769.8**
Exploration Systems Development			**3,669.8**				
Exploration Ground Systems			428.2				
Orion Program			1,163.5				
Space Launch System			2,078.1				
Advanced Exploration Systems			**889.0**				
Adv Cislunar and Surface Capabilities			116.5				
Exploration Advanced Systems			268.2				
Lunar Orbital Platform - Gateway			504.2				

The FY 2019 Budget includes a new account structure for human space exploration and technology programs to improve alignment of funding with NASA's new strategic space exploration objectives.

- **Exploration Systems Development (ESD)**

  - ESD programs are working together to build the space transportation system made up of the Orion crew vehicle, Space Launch System (SLS) rocket, and Exploration Ground Systems (EGS). This system will enable the Agency's new mission to extend human presence into the solar system, starting with a return to the Moon. The Exploration Mission (EM)-1 uncrewed test flight is planned for FY 2020 and EM-2 first crewed flight is planned for 2023.

  - The Orion program will continue final assembly and testing of the EM-1 crew vehicle at KSC and continue hardware production of the EM-2 crew vehicle at MAF and KSC.

  - The SLS rocket's production and certification for flight will continue at MAF and MSFC along with engine and core stage testing at SSC. Key rocket components will deliver to EGS at KSC for integration into the final flight launch vehicle with the Orion crew vehicle.

  - EGS will continue to prepare launch infrastructure and operations requirements in support of the SLS and Orion programs. Modifications to existing facility and command and control systems will be ongoing.

  - NASA will explore approaches for reducing the costs of future exploration missions to enable a more expansive exploration program.

- **Advanced Exploration Systems**

  - Exploration Advanced Systems (EAS) focuses on advanced design, development, and demonstration of exploration capabilities to reduce risk, lower life cycle cost and validate operational concepts for future human missions to deep space. EAS leads development of new approaches to project and engineering management, such as rapid systems development or alternative management concepts, open innovation, and collaboration.

  - Lunar Orbital Platform – Gateway (LOP-G) will establish a platform to mature necessary short- and long-duration deep space exploration capabilities through the 2020s. The LOP-G

will be assembled in orbit around the Moon where it can also be used as a staging point for missions to the lunar surface and to destinations in deep space, providing a flexible human exploration architecture. LOP-G can be evolved depending on mission needs (exploration, science, commercial and international partners), as there are various concepts for its configuration. Current analysis is that the initial functionality will include four main elements: a Power and Propulsion Element (PPE), a small habitation element, airlock element(s) to enable Extra-Vehicular Activities (EVA), utilization, and required logistics element(s).

- Advanced Cislunar Surface Capabilities (ACSC) plans to develop a series of progressively more capable robotic lunar missions to the surface of the moon. ACSC will use innovative approaches to engage U.S. industry capabilities and possible international partners as the agency moves toward human exploration of the lunar surface.

FY 2019 Budget Request
Exploration Research and Technology
($ Millions)

	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023
Exploration Research and Technology	**826.5**	**820.8**	**1,002.7**	**912.7**	**912.7**	**912.7**	**912.7**
Exploration Research and Technology			**1,002.7**				
Early Stage Innovation and Partnerships			108.4				
Technology Demonstration			332.7				
Technology Maturation			216.5				
Human Research Program			140.0				
SBIR and STTR			205.0				

The FY 2019 Budget includes a new account structure for human space exploration and technology programs to improve alignment of funding with NASA's new strategic space exploration objectives.

The Exploration Research & Technology account consolidates and refocuses the programs of the former Space Technology Mission Directorate on research and technology development that addresses human space exploration needs, while continuing to foster commercial expansion in low Earth orbit, cislunar space and beyond. Primary focus areas include:

- Advanced environmental control and life support systems & in-situ resource utilization (ISRU);
- Power and propulsion technology;
- Advanced materials;
- Communications, navigation and avionics;
- Entry, descent and landing;
- Autonomous operations;
- In-space manufacturing and on-orbit assembly; and
- Research to enable humans to safely and effectively operate in various space environments.

Exploration Research & Technology will continue to support a combination of unique in-house activities competitive programs, and public-private partnerships to develop and test technologies that enable exploration missions. The Exploration Research & Technology account includes the following programs:

- **Early Stage Innovation and Partnerships** support basic research, applied research, and early technology development to spur innovations that transform future capabilities. The program cultivates new ideas and alternative approaches to solving difficult and far reaching exploration challenges by leveraging the technical capabilities of the experts across the nation; academia, industry, entrepreneurs, and the NASA Centers.
- **Technology Maturation** advances disruptive space technologies that may eventually support exploration and other missions from proof of concept to demonstration, maturing transformational and foundational technologies that primarily reside between early stage research and flight demonstration.
- **Technology Demonstration** conducts system level ground-based testing to determine feasibility, as well as space flight demonstrations of technologies and systems to effectively transition technologies and new capabilities for NASA exploration missions and for use by other government agencies and industry.
- **Human Research Program** conducts cutting edge research on the effects of spaceflight to the human body using the ISS and supports Deep Space Exploration habitat design and development to ensure crew health and performance risks are adequately addressed.

- **Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR)** Programs leverage the Nation’s innovative small business community to support early-stage research and development in support of NASA's mission in human exploration, science and aeronautics.

FY 2019 Budget Request
LEO and Space Flight Operations
($ Millions)

	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023
LEO and Spaceflight Operations	**4,942.5**	**4,850.1**	**4,624.6**	**4,273.7**	**4,393.3**	**4,430.3**	**4,438.0**
International Space Station			**1,462.2**				
Space Transportation			**2,108.7**				
Commercial Crew Program			173.1				
Crew and Cargo Program			1,935.6				
Space and Flight Support (SFS)			**903.7**				
21st Century Space Launch Complex			0.0				
Human Space Flight Operations			135.4				
Launch Services			86.6				
Rocket Propulsion Test			47.6				
Space Communications and Navigation			634.1				
Commercial LEO Development			**150.0**				

The FY 2019 Budget includes a new account structure for human space exploration and technology programs to improve alignment of funding with NASA's new strategic space exploration objectives.

- **International Space Station (ISS)**

  - NASA is developing plans to transition NASA activities to commercial partners following the end of direct federal funding for the ISS in 2025.

  - As the world's only current crewed space-based multinational research laboratory and technology test bed, ISS is critical to the future of deep space human exploration. The ISS also:

    - Promotes commerce in space through public-private partnerships as new commercialization concepts are explored.

    - Advances exploration of the solar system and enables scientists to identify and quantify risks to human health and performance, develop countermeasures, and develop and test technologies that protect astronauts during extended human space exploration.

    - Supports unique research and development opportunities in the areas of biological and physical sciences processes.

    - Maintains the ISS international partnership that has brought together many spacefaring nations in peaceful cooperative activity..

    - Supports current and planned Earth and Space Science observation missions.

- **Space Transportation**

  - Continues NASA's partnership with U.S. commercial space industry to develop and operate safe, reliable, and affordable systems to transport crew to and from the ISS and low Earth orbit. This strategy will lay the foundation for more affordable and sustainable future human space transportation capabilities, bolster American leadership, reduce our current reliance on foreign providers for this service, and help stimulate the American aerospace industry.

  - Sustains NASA's ISS cargo supply function in partnership with American private industry.

  - Continues to advance commercial spaceflight and generate American jobs.

- **Space and Flight Support**

  - Provides mission-critical space communications and navigation services to customer missions, including human, science, and commercial crew and cargo missions.

  - Provides seed funding for the transition of the Space Network communications satellite system to commercial partnerships and services.

  - Advances next generation near Earth (TDRS system replacement) and deep space (Mars network) architecture options, incorporating new capabilities for on-demand services, Delay/Disruption Tolerant networking, and autonomous navigation; using public-private partnership type acquisition strategies where feasible.

  - Infuses new technologies to enable significant reductions in system acquisition and operations cost while improving network flexibility, scalability, and security.

  - Supports the readiness and health of the crew for all NASA human spaceflight endeavors.

  - Provides safe, reliable, and cost-effective launch services for civil sector missions, as well as gives launch-related support to over 40 NASA scientific spacecraft missions in various phases of development.

  - Continues to strategically manage NASA's rocket testing core capability to meet U.S. rocket testing requirements.

- **Commercial LEO Development**

  - Proposes to end direct U.S. financial support for the International Space Station in 2025, after which NASA would rely on commercial partners for its low Earth orbit research and technology demonstration requirements.

  - Assist the commercial space industry in developing a sustained commercial low earth orbit presence.

  - Encourages and funds commercial development of platforms and capabilities for use by the private sector and NASA to enable a seamless transition from ISS.

  - NASA plans to task commercial industry to submit formal proposals for future platforms and capabilities. We expect to see market analysis and business plans as part of these proposals.

FY 2019 Budget Request
Science
($ Millions)

	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023
Science	**5,762.2**	**5,725.8**	**5,895.0**	**5,859.9**	**5,841.1**	**5,822.4**	**5,803.6**
Earth Science			**1,784.2**				
Planetary Science			**2,234.7**				
Astrophysics			**1,185.4**				
Heliophysics			**690.7**				

- Includes four major science areas

  - **Planetary Science** to explore the planetary bodies of our solar system. Included is a new Lunar Discovery and Exploration program that supports public-private partnerships and innovative approaches to achieving human and science exploration goals, including the eventual return of humans to the moon, and a new Planetary Defense program for near-Earth object detection and mitigation. The Budget provides continued funding for the Europa Clipper mission, the InSight and Mars 2020 missions, the recently selected Lucy and Psyche missions, the next New Frontiers mission, and radioisotope power systems for deep-space missions.

  - **Astrophysics** to study the universe and search for Earth-like planets, including the James Webb Space Telescope, TESS, and the recently selected IXPE and GUSTO missions. TESS is on track for launch in 2018, and Webb will launch in 2019. The WFIRST mission is proposed for termination due to its significant cost and higher priorities within NASA. Funding made available from the proposed WFIRST termination is redirected towards competed Astrophysics missions and research, including Explorer and probe-class missions, consistent with priorities outlined in the Decadal Survey.

  - **Heliophysics** to study the Sun and its influence throughout the solar system, including launch of Parker Solar Probe in 2018 and the Solar Orbiter Collaboration with ESA. The Budget increases funding to support the DRIVE initiative and interagency efforts to improve space weather predictive capabilities, both priorities in the Decadal Survey.

  - **Earth Science** to improve modeling of Earth as a system, weather prediction, and natural hazard mitigation by making observations of the land, atmosphere, and oceans from spacecraft and suborbital platforms. Consistent with the FY 2018 Budget Request, assumes termination of five Earth science missions: PACE, OCO-3, RBI, DSCOVR Earth-viewing instruments, and CLARREO Pathfinder. Following a detailed internal review in January 2018, NASA cancelled the RBI due to cost and technical challenges.

- Supports about 100 space missions
  - About 40 missions currently preparing for launch and about 60 operating missions.
  - In addition, ongoing flights of sounding rockets, aircraft, and high-altitude balloons.
- Focuses on three interdisciplinary objectives
  - Discovering the secrets of the Universe
  - Searching for life in the Solar System and beyond
  - Safeguarding and improving life on Earth

- Invests in developing advanced technologies

  - Providing novel partnership opportunities between commercial partners and NASA through a new Lunar Discovery and Exploration program, a CubeSat/SmallSat initiative targeted at specific high-priority science goals, and other efforts.
  - Developing optics and detectors to find planets around other stars, instruments to look for signs of past or present life on Mars and other planetary bodies, and instruments to take the pulse of our planet.
  - Engaging industry, academia, and other government labs via open, competitive solicitations.

- Supports over 10,000 U.S. scientists
  - Over 3,000 openly competed research awards with universities, industry, and government labs.
  - World-leading research, frequently highlighted on the covers of *Science*, *Nature*, and major newspapers.

- Includes partnerships with a dozen other Federal agencies and sixty other nations
  - Collaborating with other science agencies and agencies that need science results, including NSF, DOE, NOAA, FAA, USDA, DOI, EPA, and DOD
  - Partnering with longstanding and newly space-faring nations.
  - Building and launching the nation's weather satellites for NOAA.

- Provides benefits to our nation and our planet
  - Leading the scientific exploration of the Earth, the solar system, and the universe beyond.
  - Enhancing economic growth and improving quality of life via high-tech jobs and new technologies.
  - Assisting responses to national and international disasters.

FY 2019 Budget Request
Aeronautics
($ Millions)

	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023
Aeronautics	**656.0**	**655.5**	**633.9**	**623.9**	**608.9**	**608.9**	**608.9**
Aeronautics			**633.9**				
Advanced Air Vehicles Program			230.6				
Airspace Operations and Safety Program			90.8				
Integrated Aviation Systems Program			189.2				
Transformative Aero Concepts Program			123.3				

NASA Aeronautics conducts research to transform advances in the safety, capacity, and efficiency of the air transportation system and to sustain U.S. technological leadership in the aviation industry. The budget request supports four distinct programs within the Agency's aeronautics portfolio:

- **Airspace Operations and Safety Program** (AOSP) works in close partnership with the FAA and the aviation community to enable modernization and transformation of the NAS to meet evolving user needs. The program is on the leading edge of research into increasingly autonomous aviation systems, including innovation in the management of Unmanned Aircraft Systems (UAS) traffic at low altitude and other novel aviation vehicles. The program is also pioneering the real-time integration and analysis of data to support system-wide safety assurance. In FY 2019, AOSP will:
    - Demonstrate an integrated arrival, departure, and surface system capability to improve airport operating efficiency.
    - Demonstrate a new UAS traffic management capability focused on large scale, beyond visual line of sight UAS operations at low altitude in moderately populated areas.
- **Advanced Air Vehicles Program** (AAVP) researches technologies to meet growing long-term civil aviation needs and conduct hypersonic research to meet national needs. The program works in close partnership with academia and industry to pioneer fundamental research and to mature the most promising technologies and concepts for transition to the aviation industry. In FY 2019, AAVP will:
    - Increase NASA's investment in hypersonics, supporting key experiments to demonstrate an autonomous mode transition for hypersonic systems and stronger collaboration with other government agencies and universities.
    - Complete the Advanced Composites Project and deliver the tools and computational models that will enable reductions in development time of 30 percent.
    - Complete testing of light weight high aspect ratio wing to validate efficiency benefits.
- **Integrated Aviation Systems Program** (IASP) includes the low boom flight demonstrator project that will pave the way for eventual over-land commercial supersonic flight. The program explores, assesses, and demonstrates the benefits of the most promising technologies at an integrated system level in a relevant environment, which is often in flight. The program develops and tests technologies to enable routine access of UAS into the NAS. In FY 2019, IASP will:
    - Complete a critical design review of the Low Boom Flight Demonstrator X-Plane that will demonstrate quiet overland supersonic flight, enabling the creation of a new civil supersonic market for U.S. industry.
    - Advance electric propulsion systems by flight testing an all-electric aircraft, the X-57.
- **Transformative Aeronautics Concepts Program** (TACP) demonstrates initial feasibility of concepts supporting the discovery and development of new transformative solutions supporting the NASA Aeronautics strategy. In FY 2019, TACP will:
    - Develop multidisciplinary design optimization capabilities that will enable assessment of On Demand Mobility vehicle designs.

- Award the third round of the competitive University Leadership Initiative proposals to address critical barriers to achieving Aeronautics strategic objectives.

FY 2019 Budget Request
Safety, Security, and Mission Services
($ Millions)

	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023
Safety, Security, and Mission Services	**2,768.6**	**2,749.8**	**2,749.7**	**2,744.8**	**2,738.6**	**2,732.3**	**2,726.1**
Center Management and Operations			**1,949.6**				
Agency Management and Operations			**800.1**				
Agency Management			359.5				
Safety and Mission Success			175.8				
Agency IT Services (AITS)			238.1				
Strategic Capabilities Asset Program			26.7				

Directly enables NASA's portfolio of missions in aeronautics and space exploration. The FY 2019 request provides the operations, tools, equipment, and capabilities to safely operate and maintain NASA centers and facilities and the independent technical authority required to reduce risk to life and program objectives for all NASA missions.

- **Center Management and Operations** fund ongoing management, operations, and maintenance of NASA Centers and associated component facilities, including:

  - **Center Institutional Capabilities** provide the basic support required to meet internal and external requirements; effectively manage human capital, information technology, and facility assets; responsibly execute financial management and acquisition responsibilities; and provide a safe, secure, and environmentally sustainable workplace.

  - **Center Programmatic Capabilities** provide technical facilities, workforce expertise and skills, equipment, and other cross-cutting resources required to implement the programs at the Centers and ensure engineering and safety oversight of NASA programs.

- **Agency Management and Operations** fund the management and oversight of Agency programs and functions, and performance of NASA-wide mission support activities, including:

  - **Agency Management** supports executive-based, Agency-level functional and administrative management requirements and the operational activities at Headquarters.

  - **Safety and Mission Success** activities help reduce the risk and loss of life and/or mission, in our manned and unmanned programs. The activities include engineering; safety and mission assurance; independent health and medical oversight; and independent software verification and validation.

  - **Agency Information Technology Services** provide mission-enabling IT capabilities, risk-based cyber security, and a sustainable management approach to support NASA's diverse mission needs; Investments in critical IT infrastructure and enterprise solutions support modernization of Agency systems, increased automation, and optimization of enterprise-wide IT service solutions. The FY 2019 request increases Agency IT Services to strengthen cybersecurity capabilities and safeguard critical systems and data.

    Strategic Capabilities Assets Program provide the skilled workforce and essential preventive maintenance to keep core test facilities available to meet the current and future Agency needs and to ensure core test facilities are in a state of readiness.

FY 2019 Budget Request
Construction & Environmental Compliance Restoration
($ Millions)

	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023
Construction & Envrmtl Compl Restoration	**375.6**	**358.3**	**388.2**	**293.8**	**293.8**	**293.8**	**293.8**
Construction of Facilities			**305.3**				
Institutional CoF			250.9				
Science CoF			9.6				
Exploration CoF			25.9				
Space Operations CoF			18.9				
Environmental Compliance and Restoration			**82.9**				

Directly enables NASA's portfolio of missions in aeronautics and space exploration. With installations in 14 states, NASA collectively manages $39 billion in constructed assets with an inventory of over 5,000 buildings and structures. The focus is on renewing and sustaining only what is crucial to mission success and divesting of unneeded older, costly real property to lower the cost of operations. The budget funds:

- **Institutional Construction of Facilities** to fund capital repairs and improvement to ensure that center infrastructure critical to achieving NASA's space and aeronautics programs are safe, secure, environmentally sound, and operate efficiently. NASA seeks to achieve a sustainable and energy-efficient infrastructure by replacing old, inefficient, deteriorated buildings with new, efficient, high-performance buildings while reducing the footprint.

  - In addition to critical repair projects, the FY 2019 budget provides $35.6 million to construct the Glenn Research Center Aerospace Communications facility. This state of the art facility replaces obsolete facilities to enable the development of communications and navigation infrastructure, and service for human Lunar and Mars missions.

  - The request also provides $15.0 million for the continued restoration of the Kennedy Space Center shoreline, and $24.6 million for shoreline protection at the Wallops Flight Facility. Restoration of the shoreline is essential to protect critical launch operations from inland flooding which would halt operations.

  - Other critical projects include repairing the Lewis Field Storm Sewer System at the Glenn Research Center. This Center-wide storm system impacts several buildings containing research and test labs that have experienced water failures of varying severity. Storm water in facilities has impacted mission readiness in support of the International Space Station (ISS), Space Launch System (SLS), Orion Multi-Purpose Crew Vehicle (MPCV), Subsonic air transportation system and Aeronautics Evaluation and Test Capabilities.

  - Another critical repair is the revitalization of Pressure and Propellant Distribution Systems at the Marshall Space Flight Center. This project restores the cross-center distribution system that provides high pressure air to the core research and test facilities that support missions including ISS Payload Operations Center and the Environmental Control and Life Support Systems (ECLSS) onboard ISS, Advanced Exploration

Systems, SLS, Orion MPCV, Solar Probe Plus, Technology Demonstration Missions, Space Technologies Demonstrations, and Exploration Robotic Programs.

- **Programmatic Construction of Facilities** projects to carry out specific Science, Exploration Systems, and Space Operations programmatic requirements. Funding in this category is realigned from the mission directorates to the CECR budget to effect statutory direction that all NASA construction projects be funded in the CECR account. Projects include $13.3 million for continued modifications required to Kennedy Space Center facilities for Exploration Upper Stage, and $16.9 million to improve reliability of NASA's Deep Space Network. Funding associated with all program designs and out-year programmatic construction activities remains in program accounts.

- **Environmental Compliance and Restoration** to support cleanup of hazardous materials and waste released to the surface or groundwater at NASA installations, NASA-owned industrial plants supporting NASA activities, current or former sites where NASA operations contributed to environmental problems, and other sites where the Agency is legally obligated to address hazardous pollutants. The FY 2019 budget provides $82.9 million for remedial investigations, soil and groundwater cleanups at Santa Susana Field Laboratory, White Sands Test Facility, Kennedy Space Center, and Marshall Space Flight Center and continued operations of treatment systems and monitoring at the rest of the NASA centers and facilities.