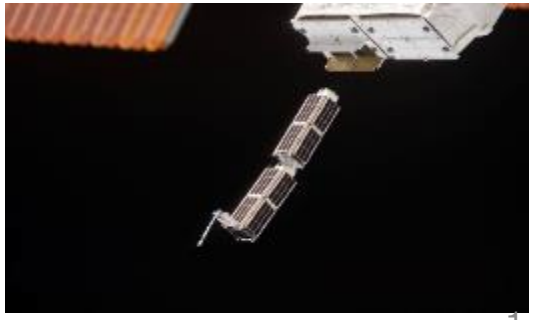
National Aeronautics and Space Administration

FY 2018 BUDGET ESTIMATES

www.nasa.gov

2018 Budget Highlights

- Provides $19.1 billion to increase understanding of the universe and our place in it, advance America's world-leading aerospace technology, inspire the Nation, and open the space frontier.
- Increases cooperation with industry through public-private partnerships, focuses the Nation's efforts on deep space exploration rather than Earth-centric research, and develops technologies that would help achieve U.S. space goals and benefit the economy.
- Continues leadership in driving commercial partnerships, which has enabled us to turn over cargo resupply services for the International Space Station (ISS) to American industry and is building toward the imminent return of the capability to launch astronauts from American soil.



Highlights *(continued)*

- Continues development of the Orion crew vehicle, Space Launch System (SLS), and Exploration Ground Systems (EGS) that will send astronauts on deep space exploration missions in the 2020's and beyond.

- Invests in space technologies that strengthen our national security and the industrial base while contributing to economic development and growth. Also enables NASA's missions by reducing cost and complexity while increasing capabilities for science and exploration.

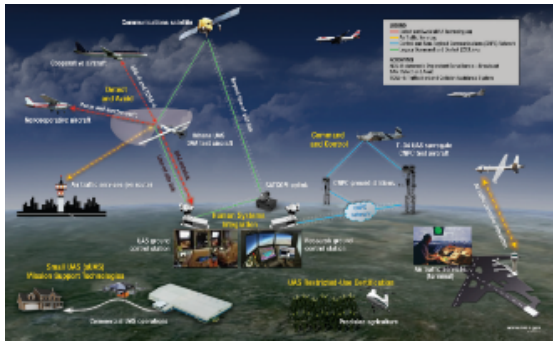
- Supports operation of the ISS to at least 2024, providing a unique environment for research on human health and space operations necessary for future long-term human missions, expanding commercial activity in low Earth orbit, and providing direct benefits to the people of Earth.

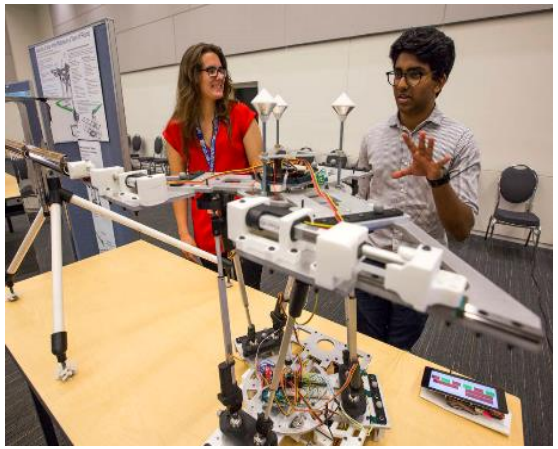
Highlights *(continued)*

- Maintains commitment to studying our home planet and the universe
- Enables our wide ranging science work on many fronts, which continues to lead the world in its size, scope, and scientific output.
- Reinvigorates robotic exploration of the solar system, including funding for a Europa Clipper mission to fly repeatedly by Jupiter's icy ocean moon Europa.
- Maintains a robust Earth Science program while terminating several missions.
- Supports initiatives that use smaller, less expensive satellites and/or public-private partnerships to advance science, in keeping with recent National Academies recommendations.

Highlights *(continued)*

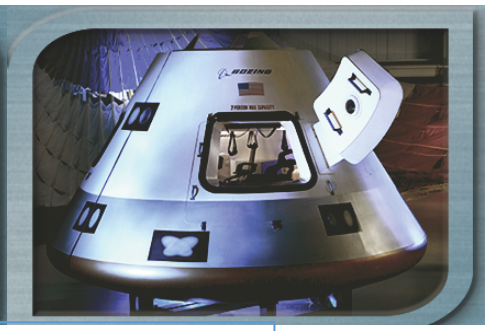
- Maintains a robust investment in air traffic management improvements that will safely increase air traffic capacity, reduce flight delays, and enable safe, robust UAS integration.
- Continues development of the Low Boom Flight Demonstrator, designed to make supersonic commercial air travel a reality once again.
- Continues to leverage our unique assets to further advance our Nation's educational goals, while closing out the Office of Education and its projects.
- Strengthens cybersecurity capabilities, safeguarding critical systems and data plus continues to support improved overall management of IT.





Anticipated Accomplishments in FY 2018

Advanced Exploration Systems
Develop prototype habitats for space exploration through public-private partnerships

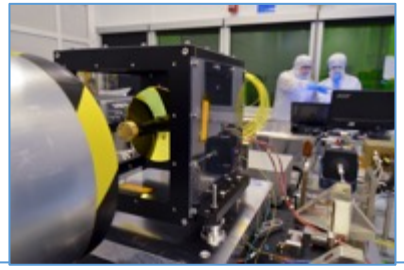


Commercial Crew
First Commercial Crew Post Certification Mission planned for September 2018

Exploration Systems
Continuing systems integration in preparation for the EM-1 launch

James Webb Space Telescope
Completes its assembly and testing, and ships for launch in October 2018.

X-57 Flights
Conduct flight tests of a new distributed electric propulsion system



Space Technology
Completes Laser Comm hardware build, and launches and demos Green Propellant and Deep Space Atomic Clock.

Science Launches in 2018
ICON, GRACE-FO, InSIght, ICESat-2, TESS, and SPP

FY 2018 Budget Request ($M)

Budget Authority ($ in millions)	Actual 2016	Enacted 2017	Request 2018	Notional 2019	2020	2021	2022
			Fiscal Year				
NASA Total	19,285.0	19,653.3	19,092.2	19,092.2	19,092.2	19,092.2	19,092.2
Science	5,584.1	5,764.9	5,711.8	5,728.7	5,728.7	5,728.7	5,728.7
Earth Science	1,926.6		1,754.1	1,769.1	1,769.1	1,769.1	1,769.1
Planetary Science	1,628.0		1,929.5	1,921.4	1,916.4	1,911.4	1,911.4
Astrophysics	762.4		816.7	1,045.8	1,153.2	1,200.6	1,200.4
James Webb Space Telescope	620.0		533.7	304.6	197.2	149.8	150.0
Heliophysics	647.2		677.8	687.8	692.8	697.8	697.8
Aeronautics	633.8	660.0	624.0	624.4	624.4	624.4	624.4
Space Technology	686.4	686.5	678.6	679.3	679.3	679.3	679.3
Exploration	3,996.2	4,324.0	3,934.1	4,259.7	4,513.3	4,437.9	4,449.9
Exploration Systems Development	3,640.8	3,929.0	3,584.1	3,739.7	3,898.2	3,771.5	3,762.3
Exploration Research and Development	355.4	395.0	350.0	520.0	615.1	666.4	687.6
Space Operations	5,032.3	4,950.7	4,740.8	4,532.8	4,279.2	4,354.6	4,342.6
Space Shuttle	5.4	--	--	--	--	--	--
International Space Station	1,436.4	--	1,490.6	1,561.3	1,611.4	1,616.5	1,635.2
Space Transportation	2,667.8	--	2,415.1	2,118.7	1,811.4	1,868.6	1,808.9
Space and Flight Support (SFS)	922.7	--	835.0	852.7	856.4	869.4	898.5
Education	115.0	100.0	37.3				
Safety, Security, and Mission Services	2,772.4	2,768.6	2,830.2	2,859.4	2,859.4	2,859.4	2,859.4
Center Management and Operations	1,987.6	--	1,992.5	2,036.8	2,036.8	2,036.8	2,036.8
Agency Management and Operations	784.8	--	837.7	822.6	822.6	822.6	822.6
Construction and Environmental Compliance and Restoration	427.4	360.7	496.1	368.6	368.6	368.6	368.6
Construction of Facilities	352.9	--	408.2	280.7	280.7	280.7	280.7
Environmental Compliance and Restoration	74.5	--	87.9	87.9	87.9	87.9	87.9
Inspector General	37.4	37.9	39.3	39.3	39.3	39.3	39.3
NASA Total	19,285.0	19,653.3	19,092.2	19,092.2	19,092.2	19,092.2	19,092.2

FY 2016 reflects funding amounts specified in Public Law 114-113, Consolidated Appropriations Act, 2016, as executed under the Agency's current FY 2016 Operating Plan.

FY 2017 Enacted reflects the funding amounts specified in Division B of the Consolidated Appropriations Act, 2017, P.L. 115-31. Table does not reflect emergency supplemental funds also appropriated in FY 2017, totaling $184 million.

In the outyears, Human Exploration and Operations is held flat at the combined level of the Exploration and Space Operations accounts.

NASA Mission Launches (Fiscal Years 2017 – 2022)

NASA Mission on US ELV

Reimbursable Mission for NOAA

**** NASA does not directly manage/control JASD missions. LRDs reflected are to the best of our knowledge

Joint NASA-Int'l Partner Mission

Int'l Mission with NASA contribution

Joint NASA-USAF Mission

Exploration Systems Development Mission

Commercial Crew Mission

Commercial Resupply Services Mission

Future Commercial Resupply Mission

Aeronautics Mission

ARMD missions in blue text

HEOMD missions in white text

SMD missions in black text

STMD missions in yellow text

✓ Mission successfully launched

X Mission unsuccessful

** Ground-based elements (includes suborbital) block of 5 missions + Future CRS Capabilities unknown, will be updated after award of CRS-2 when cargo delivery capabilities are known

*** Instrument only

FY2017	FY2018	FY2019	FY2020	FY2021	FY2022
JPSS-1	GOES-S	Comm Crew	Comm Crew	Low Boom Flight Demonstrator	Comm Crew
✓ GOES-R	InSight	Comm Crew	Comm Crew	Comm Crew	Comm Crew
✓ CYGNSS	GOLD***	Metop-C***	GOES-T	Comm Crew	JPSS-2
✓ SAGE-III***	ICON	BepiColombo***	Mars-2020	Helio Expl MoO-1***	JUICE***
NICER***	SPP	Solar Orb***	ExoMars Rover***	MAIA MoO***	Psyche
ISS-CREAM	TSIS-1 MoO***	GEDI MoO***	Future Cargo+	TROPICS MoO***	Lucy
SpaceX-12 CRS	GRACE FO	ECOSTRESS MoO***	Future Cargo+	EVS-3**	LWS-MoO-4***
SpaceX-11 CRS	ICESat-2	EVS-2**	Future Cargo+	GeoCarb	STP MoO-3***
✓ SpaceX-10 CRS	TESS	JWST	Future Cargo+	Astro MoO-1***	Helio SMEX-1
Orbital ATK-8 CRS	SpaceX-15 CRS	SpaceX-19 CRS	SpaceX-20 CRS	IXPE	Helio Expl MoO-2***
✓ Orbital ATK-7 CRS	SpaceX-14 CRS	SpaceX-18 CRS	Ascent Abort-2	Euclid***	TEMPO MoO***
✓ Orbital ATK-5 CRS	SpaceX-13 CRS	SpaceX-17 CRS	TDM LCRD	Future Cargo+	OMPS-L***
TDRS-M	Orbital ATK-9 CRS	SpaceX-16 CRS	TDM TRN	Future Cargo+	NI-SAR
TDM GPIM	CCtCap DM-2 - SpaceX flight test w/ crew	Orbital ATK-11 CRS	TDM MOXIE	Future Cargo+	Sentinel-6a
TDM DSAC	CCtCap DM-1 - SpaceX flight test w/o crew	Orbital ATK-10 CRS	GCD MEDLI2	Future Cargo+	SWOT
GCD SEXTANT	CCtCap - Boeing crewed flight test	EM-1	GCD MEDA	Future Cargo+	Landsat-9
	CCtCap - Boeing orbital flight test	TDM e-Cryo			Future Cargo+
	TDM IRMA				Future Cargo+
					Future Cargo+
					Future Cargo+
					EM-2 Crew (EUS) Power/Prop Bus
					TDM-High Mass Entry Descent/Landing
					TDM Satellite Servicing
					TDM SEP
					TDM DSOC

Notional

Dates reflect Agency Baseline Commitments or updated Agency schedules and may include schedule margin beyond any manifested launch dates

Earth Science

($M)	2017	2018	2019	2020	2021	2022
Earth Science	--	$1,754	$1,769	$1,769	$1,769	$1,769

- Maintains a robust program of competed Venture-class missions.
- Supports formulation and development of ICESat-2, GRACE Follow-On, SWOT, NISAR, Landsat 9, Sentinel-6, TSIS-1, TEMPO, GEDI, MAIA, ECOSTRESS, OMPS-L, TROPICS, and GeoCarb.
- Multi-Decadal Sustainable Land Imaging (SLI) program provides Land Imaging Technology and System Innovation.
- Supports initiatives to use smaller, less expensive satellites and/or public-private partnerships to advance science in a cost-effective manner, including cubesats and small satellite constellations.
- Operates 18 additional missions, and the Airborne Science project.
- NASA will receive a new Earth Science Decadal Survey later this year.

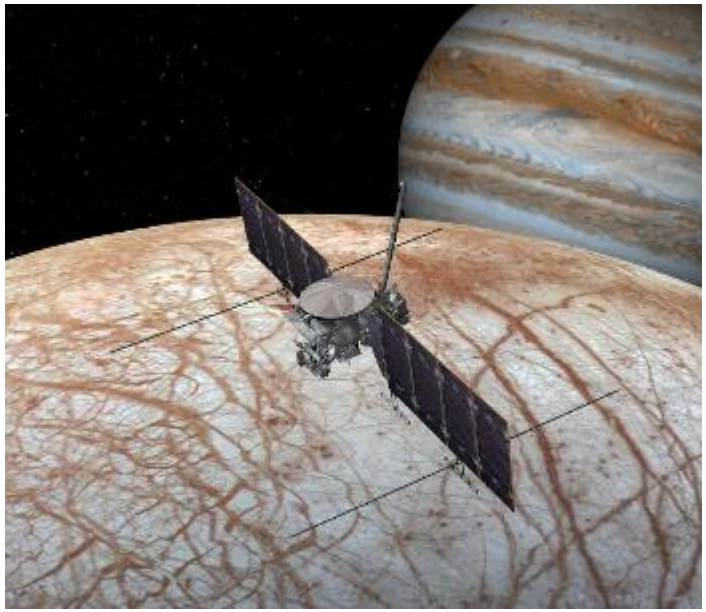
Earth Science (cont.)

- Terminates Carbon Monitoring System and reduces funding for Earth science research grants.
- Proposes termination of five Earth Science missions —PACE, OCO-3, RBI, DSCOVR Earth-viewing instruments, and CLARREO Pathfinder.
- Terminations are due to budget priorities and the need to adjust the Agency's budget to match the nation's current fiscal position.

Planetary Science

($M)	2017	2018	2019	2020	2021	2022
Planetary Science	--	$1,930	$1,921	$1,916	$1,911	$1,911

- Continues development of Mars 2020 and formulation of Europa Clipper.
- Supports two new Discovery class missions.
  - Lucy – first mission to Jupiter's Trojan asteroids, fossils of planet formation.
  - Psyche – mission to the main asteroid belt, will study what may be the exposed core of an early planet.

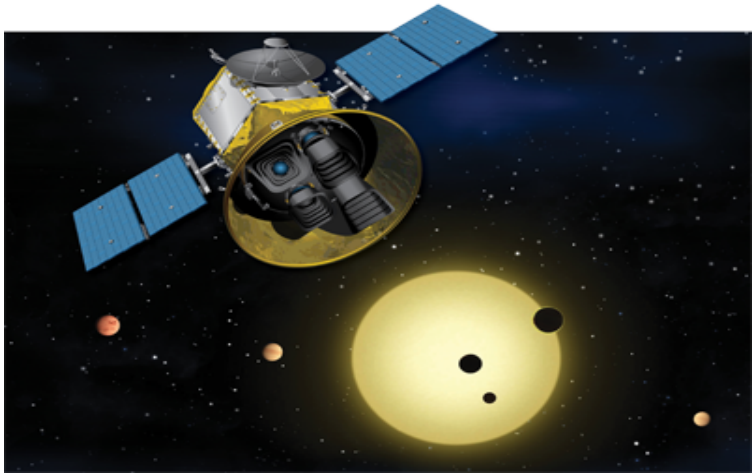


- Supports selection of up to 3 missions for Phase A study from the New Frontiers AO 4.
- Operates 10 Planetary missions.
- Proposes $43 million to change the paradigm for robotic solar system exploration. Initiative includes small satellites/Cubesats, life-detection instruments, and/or commercial partnerships.
- Does not fund a Europa lander mission to preserve balance in a Planetary program that is already supporting two flagship missions (Mars 2020 and Europa Clipper)

Astrophysics

($M)	2017	2018	2019	2020	2021	2022
Astrophysics	--	$817	$1,046	$1,153	$1,201	$1,200

- Continues development of the TESS exoplanet mission for launch by FY2018. TESS will continue the search for exoplanets, scanning all of the sky for exoplanets closer to Earth than those found by Kepler.
- Supports the WFIRST mission.
- Supports the next Explorer missions, IXPE and GUSTO.
- Funds STEM Science Activation at $44M.
- Supports nine operating missions and the balloon project.



James Webb Space Telescope

($M)	2017	2018	2019	2020	2021	2022
Webb	$569	$534	$305	$197	$150	$150

- Supports the commitment of an October 2018 launch date.
- Complete integration and testing.
- Conduct testing of the Webb flight operations system and science processing system.
- Install ground support equipment at the launch site in Kourou, French Guiana.
- Transport Webb to the launch site!

Heliophysics

($M)	2017	2018	2019	2020	2021	2022
Heliophysics	--	$678	$699	$693	$698	$698

- Continues development of Solar Probe Plus (SPP), Ionospheric Connection Explorer (ICON), and Global-scale Observations of the Limb and Disk (GOLD) all to be launched in FY 2018.
- Continues Solar Orbiter Collaboration (SOC) partnership with ESA (FY 2019 launch).
- Operates over 17 Heliophysics missions (28 individual spacecraft).
- Supports the Sounding Rockets and Cubesat projects.

Aeronautics

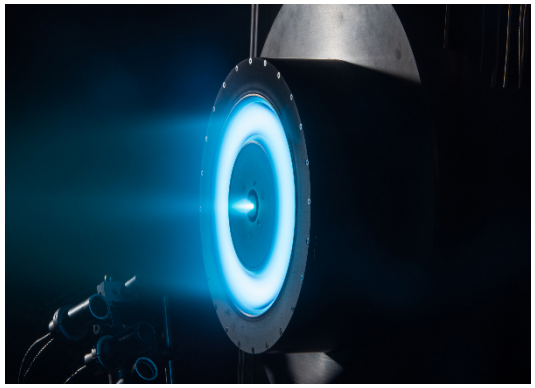
($M)	2017	2018	2019	2020	2021	2022
Aeronautics	$660	$624	$624	$624	$624	$624

- Awards a design and build contract for the Low Boom Flight Demonstrator X-Plane that will demonstrate quiet overland supersonic flight and open a new market to U.S. industry.
- Advances electric propulsion systems by flight testing an all electric aircraft, the X-57.

- Develops key technologies that will integrate UAS operations in the National Air Space, as well as realize safe, low-altitude operations of small UAS.
- Demonstrates new air traffic management tools that integrate aircraft arrival, departure, and airport operations to reduce flight delays and increase air traffic capacity.
- Continues execution of the first competitive University Leadership Initiative awards that enable university leaders to pursue transformative concepts to overcome barriers facing the aviation industry.

Space Technology

($M)	2017	2018	2019	2020	2021	2022
Space Tech	$687	$679	$679	$679	$679	$679



- Completes hardware build for the Laser Communications Relay Demonstration project and will start system integration and test to support a 2019 launch readiness date.
- Finalizes hardware development for MOXIE and Terrain Relative Navigation projects and will begin integration and test to support the Mars 2020 schedule.
- Continues development of high-powered solar electric propulsion technologies that will enable greater efficiency in orbit transfer and accommodate increasing power demands for satellites.
- Transforms satellite servicing investment to support a nascent commercial satellite industry as well as application by NASA and other government agencies.
- Continues to explore pilot opportunities to accelerate small businesses ability to advance the commercial aerospace sector and NASA missions through the SBIR/STTR programs.
- Enhances public-private partnerships with industry to explore solutions to common challenges in areas such as robotics, manufacturing, and materials and by establishing public-private partnerships through Announcement of Collaborative Opportunity and Tipping Point solicitations.

Exploration Systems Development

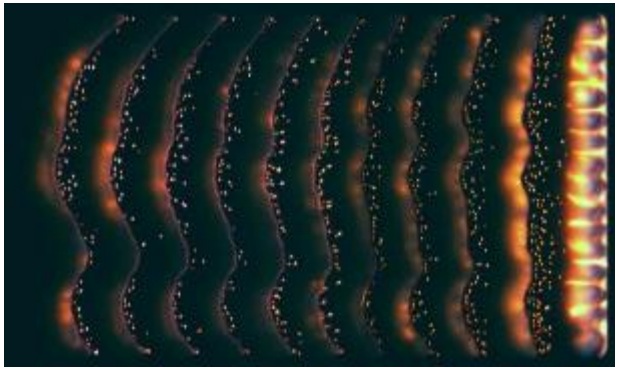
($M)	2017	2018	2019	2020	2021	2022
ESD	$3,929	$3,584	$3,739	$3,898	$3,771	$3,762

- Provides funding for SLS, Orion and EGS to prepare for Exploration Mission (EM-1), the first pairing of Orion and SLS and EM-2, the first crewed mission
- Provides for mating of Launch Abort System Orion Crew Module and Service Module to Ground Operations for final preparation and stacking at KSC
- Final assembly of the components for EM-1 will begin with integrating the Interim Cryogenic Propulsion Stage (ICPS), Launch Vehicle Stage Adapter (LVSA) and Boosters including the Solid Rocket Motor Segments
- Validates all EGS software and hardware

Exploration Research and Development

($M)	2017	2018	2019	2020	2021	2022
ERD	$395	$350	$520	$615	$666	$687

- Human Research Program (HRP) is responsible for understanding and mitigating the highest risks to astronaut health and performance to ensure crews remain healthy and productive during long-duration missions beyond Earth orbit
- AES pioneers new human spaceflight systems and technologies, including habitation systems, crew mobility systems, vehicle systems, autonomous systems, and robotic precursors for future human missions beyond Earth orbit
  - AES is using public-private partnerships to rapidly develop habitation capabilities leading to a habitat in cislunar space in the mid-2020s
  - The Asteroid Redirect Mission (ARM) will not be pursued; will begin studies toward an initial power/propulsion bus for cislunar capability and development for operational demonstration of a solar electric propulsion (SEP) capability for future exploration



International Space Station

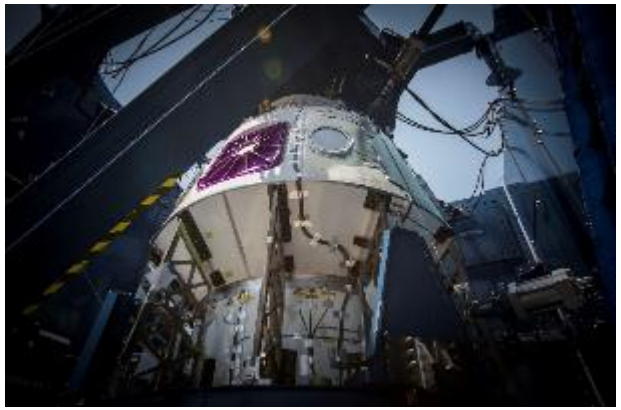
($M)	2017	2018	2019	2020	2021	2022
ISS	--	$1,490	$1,561	$1,611	$1,616	$1,635

- As the world's only crewed space-based multinational research laboratory and technology test bed, ISS is critical to the future of human exploration and to learning how to live and work in space
- Focus Areas:
  - Enable long-duration human deep space exploration via research and technology demonstration
  - Enable the development and advancement of a commercial marketplace in low Earth orbit
  - Return benefits to humanity on Earth through space-based research and technology development
  - Maintain U.S. global leadership of space exploration
- The National Laboratory includes projects that support these focus areas, expand the number of researchers and companies using the ISS, and enable new public-private partnerships

Space Transportation

($M)	2017	2018	2019	2020	2021	2022
Space Trans	--	$2,415	$2,118	$1,811	$1,868	$1,808

- Continues NASA's partnership with U.S. commercial space industry to regain the capability to send astronauts into space safely, reliably, and affordably from American soil by the end of 2018, and continue to operate systems to transport cargo to and from the ISS
- Assures U.S. access to the ISS, bolsters American leadership, and ends our dependence on Russian spaceflight capabilities for crew transportation
- Enables continued research and technology development by providing a stable crew and cargo flight plan
- Stimulates growth of the space transportation industry available to all potential customers, strengthening America's space industrial base



Space and Flight Support

($M)	2017	2018	2019	2020	2021	2022
SFS	--	$835	$852	$856	$869	$898

- Continues providing mission critical space communications and navigation services to customer missions, including human, science, and commercial crew and cargo missions
- Enables modernization of the Space Network ground system and Deep Space and Near Earth Networks
- Supports readiness and crew health for all NASA human space flight endeavors
- Provides safe, reliable, and cost-effective launch services for NASA payloads in FY 2018 and launch vehicle acquisition and advisory services to over 40 NASA scientific spacecraft missions in various phases of development
- Continues certification of new commercial launch vehicles
- Provides NASA's rocket testing capability to meet US rocket testing requirements and provides valuable propulsion data to SLS and Orion as they prepare for EM-1 and EM-2

Office of Education

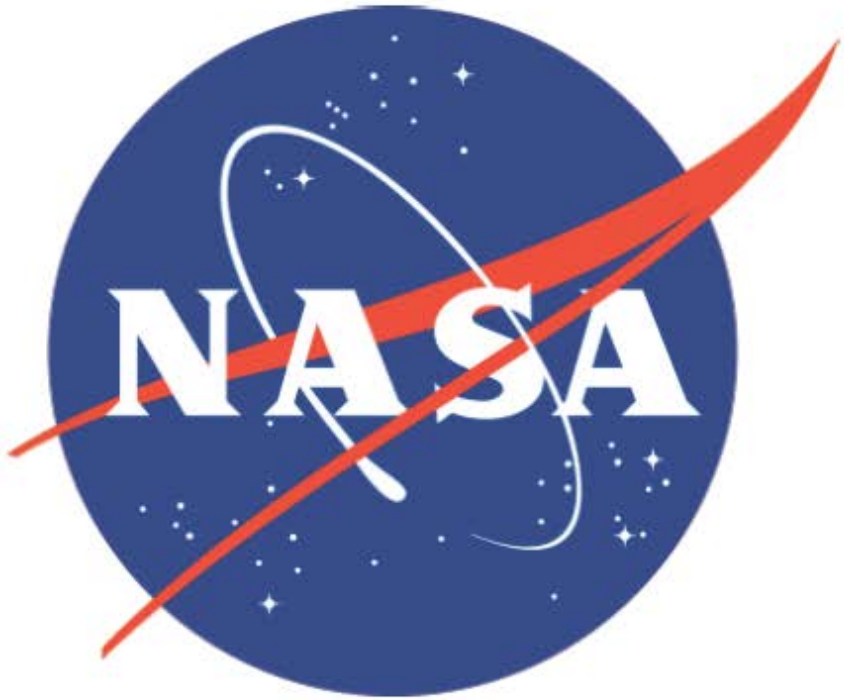
- Proposes to terminate the Office of Education, with $37 million provided for close-out costs.
- The Office of Education has experienced significant challenges in implementing a focused NASA-wide education strategy, including providing oversight and integration of agency-wide education activities. An agency-wide approach is in work as an outcome of NASA's Education & Outreach Business Services Assessment.
- Internships, fellowships, and outreach activities funded outside the Office of Education are planned to continue.
- SMD's STEM Science Activation program will continue to focus on delivering SMD content to learners of all ages through cooperative agreement awards. SMD does not intend to take ownership of programs formerly funded by OE, which fall outside the scope and resources of its STEM Science Activation program.

Safety, Security, and Mission Services and Construction

($M)	2017	2018	2019	2020	2021	2022
SS&MS	$2,769	$2,830	$2,859	$2,859	$2,859	$2,859
Construction & ECR	$361	$496	$369	$369	$369	$369

- Safety, Security, and Mission Services
  - * Funds ongoing operations of NASA Centers and major component facilities to achieve a safe, healthy, and environmentally responsible workplace.
  - * Provides independent technical and safety oversight of NASA missions and operations.
  - * Ensures core services are ready and available for performing mission roles and responsibilities by optimizing acquisition, human capital management, budget management, and facilities management to maintain a minimum set of capabilities.
  - * Provides strategic IT investments to improve security, reduce costs, and increase efficiency by modernizing systems, increasing automation, and delivering affordable enterprise-wide solution.

  - * Integrates, simplifies, and consolidates infrastructure into a more secure, effective, and efficient environment.
  - * Strengthens cybersecurity capabilities by safeguarding critical systems and data plus continues to support improved overall management of IT.
- Construction and Environmental Compliance and Restoration
  - * Funds repair, revitalization, demolition, and recapitalization projects that reduce the Agency's footprint and provide efficient, modernized facilities.
  - * Invests in energy savings projects to reduce utility usage and costs.
  - * Constructs new or modified facilities to conduct NASA's program missions.
  - * Manages NASA's environmental clean-up responsibilities.


NASA

Acronyms

- AES: Advanced Exploration Systems
- ARM: Asteroid Redirect Mission
- BSA: Baseline Service Assessment
- CLARREO: Climate Absolute Radiance and Refractivity Observatory
- CRS: Cargo Resupply Services
- CYGNSS: Cyclone Global Navigation Satellite System
- DSAC: Deep Space Atomic Clock
- DSCOVR: Deep Space Climate Observatory
- DSOC: Deep Space Optical Communications
- ECOSTRESS: Ecosystem Spaceborne Thermal Radiometer Experiment on Space Station
- EGS: Exploration Ground Systems
- EUS: Exploration Upper Stage
- EVS: Earth Venture Sub-Orbital solicitation
- GCD: Game-Changing Development
- GEDI: Global Ecosystem Dynamics Investigation
- GOES: Geostationary Operational Environmental Satellite
- GOLD: Global Scale Observations of the Limb and Disk
- GPIM: Green Propellant Infusion Mission
- GRACE-FO: Gravity Recovery and Climate Experiment – Follow-On
- GUSTO: Galactic/extragalactic ULDB Spectroscopic Terahertz Observatory
- HRP: Human Research Program
- ICESat: Ice Cloud and Land Elevation Satellite
- ICON: Ionospheric Connection Explorer
- ICPS: Interim Cryogenic Propulsion Stage
- IRMA: In-space Robotic Manufacturing and Assembly
- ISS: International Space Station
- ISS CREAM: ISS Cosmic Ray Energetics And Mass
- IXPE: Imaging X-ray Polarimetry Explorer
- JPSS: Joint Polar Satellite System
- JUICE: Jupiter Icy Moons Explorer
- JWST: James Webb Space Telescope
- LCRD: Laser Communications Relay Demonstration
- LVSA: Launch Vehicle Stage Adapter
- LWS: Living With a Star
- MAIA: Multi-Angle Imager for Aerosols
- MEDA: Mars Environmental Dynamics Analyzer
- MEDLI: Mars Entry, Descent, and Landing Instrument
- MoO: Missions-of-Opportunity
- MOXIE: Mars Oxygen ISRU Experiment
- NICER: Neutron Star Interior Composition Explorer
- NI-SAR: NASA-ISRO Synthetic Aperture Radar
- OCO: Orbiting Carbon Observatory
- OMPS: Ozone Mapping Profiler Suite
- PACE: Plankton, Aerosol, Cloud, ocean Ecosystem
- RBI: Radiation Budget Instrument
- SAGE: Stratospheric Aerosol and Gas Experiment
- SBIR: Small Business Innovation Research
- SEP: Solar Electric Propulsion
- SLI: Sustainable Land Imaging
- SLS: Space Launch System
- SMEX: Small Explorer class
- SOC: Solar Orbiter Collaboration
- SPP: Solar Probe Plus
- STEM: Science, Technology, Engineering and Mathematics
- STP: Solar Terrestrial Probes
- STTR: Small business Technology Transfer
- SWOT: Surface Water and Ocean Topography
- TDM: Technology Demonstration Mission
- TDRS: Tracking and Data Relay Satellite
- TEMPO: Tropospheric Emissions Monitoring of Pollution
- TESS: Transiting Exoplanet Survey Satellite
- TRN: Terrain Relative Navigation
- TROPICS: Time-Resolved Observations of Precipitation structure and storm Intensity with a Constellation of Smallsats
- TSIS: Total and Spectral Solar Irradiance Sensor
- UAS: Unmanned Aircraft Systems
- WFIRST: Wide Field Infra Red Survey telescope (AFTA: Astrophysics Focused Telescope Assets)