



## **NASA'S FY2018 BUDGET REQUEST**

President Trump released a FY2018 budget blueprint on March 16, 2017 providing an overview of his budget request for NASA and other agencies. The blueprint provides the top-line request for NASA, \$19.1 billion, and a few specifics for selected programs, but details will not be available until the full budget request is submitted several weeks from now.

This fact sheet has three tables:

- Table 1 compares what Congress appropriated for FY2016, President Obama's FY2017 request, and what is currently known about the Trump Administration's FY2018 request. (For action on the still-pending FY2017 request, see the FY2017 version of this fact sheet.)
- Table 2 shows NASA's funding for the "Asteroid Initiative," which includes the Asteroid Redirect Mission (ARM). Those activities are not grouped together in NASA's budget documents and are spread across several NASA Headquarters organizations. This table brings it all together through FY2017 using data provided by NASA. President Trump has proposed terminating ARM in FY2018, but NASA Acting Administrator Robert Lightfoot said in a statement that some technology activities, such as the development of high power solar electric propulsion, will continue.
- Table 3 consolidates the funding for the Space Launch System (SLS), which is spread across three subaccounts.

### **Quick Summary**

Compared to many other non-defense federal agencies, NASA fared quite well in the Trump FY2018 request. Its budget would be cut just 0.8 percent compared to its current funding level. That essentially is its FY2016 level of \$19.265 billion since the agency is funded under a Continuing Resolution while Congress continues to debate the FY2017 request.

The [budget blueprint](#) --

- "Supports and expands public-private partnerships as the foundation of future U.S. civilian space efforts."
- "Paves the way for eventual over-land commercial supersonic flights and safer, more efficient air travel" providing \$624 million for aeronautics.
- Provides \$1.9 billion for robotic planetary exploration, including Europa Clipper and Mars 2020. It specifically states that no funding for a Europa lander is included.

- Provides \$3.7 billion for the Space Launch System/Orion/exploration ground systems program.
- Cancels the Asteroid Redirect Mission.
- Provides \$1.8 billion for earth science, \$102 million less than the annualized level in the FY2017 Continuing Resolution, terminating four missions: PACE, OCO-3, DSCOVR earth-viewing instruments, and CLARREO Pathfinder. Reduces funds for Earth science research grants.
- Eliminates NASA's Office of Education.
- Restructures the RESTORE-L satellite servicing mission to reduce cost and "better position it to support a nascent commercial satellite servicing industry."
- Strengthens NASA's cybersecurity capabilities.

## Key Issues

More issues may surface once the detailed budget is submitted, but for now, it seems likely that the key issues will be the earth science budget cuts, the lack of funding for a Europa lander, and the elimination of NASA's Office of Education.

However, many NASA supporters in Congress and the space community are eager to move forward with human exploration beyond low Earth orbit and were hoping for a bold statement about restoring human missions to the surface of the Moon to NASA's plan. The budget request for SLS and Orion is status quo, however, and no bold vision was announced. If this emerges as an issue, it will be added later.

Usually a proposal to cancel any government program encounters resistance, but the Asteroid Redirect Mission never gained popularity in Congress and the proposal to terminate it is not likely to engender debate as long as a key related technology development program continues – high power solar electric propulsion. Indeed, in a March 16, 2017 statement about the budget request, NASA Acting Administrator Robert Lightfoot specifically said that the SEP portion of the program would continue. High power SEP is useful for operations in Earth orbit as well as in deep space. Although ARM's cancellation is not expected to be the subject of significant debate, it is included here for completeness.

## *Earth Science*

The Trump Administration proposed deep cuts to climate change research across the government and NASA's earth science program was expected to be significantly impacted. However, it was cut only \$102 million from FY2016, leaving \$1.8 billion. The cuts would terminate four NASA earth science missions – PACE, CLARREO-Pathfinder, OCO-3, and DSCOVR Earth-facing instruments. The last three involve relatively small amounts of money (budget numbers below are from NASA's FY2017 budget book, which included projected budgets through FY2021).

- **PACE**, the Plankton, Aerosol, Clouds and Ocean Ecosystem spacecraft, is the most expensive of the four. (In some NASA descriptions, the "P" starts for "Pre-"). The FY2017 request was \$89 million. The projected requests were \$78.9 million (FY2018), \$144.4 million (FY2019), \$196.0 million (FY2020) and \$137.1 million (FY2021), so a total of \$556.3 million would be saved in those four fiscal years. The mission is cost-capped at \$805 million including launch, operations, and science investigations. A

NASA description explains that it would make global ocean color measurements to expand knowledge of key climate variables such as aerosol particles and clouds, extend the long-term record of the photoplankton pigment chlorophyll, and provide new insights on biodiversity. Its launch is currently scheduled for 2022-2023. PACE is being built and tested at NASA's Goddard Space Flight Center in Greenbelt, MD.

- **CLARREO Pathfinder and OCO-3** are instruments that would be attached to the International Space Station (ISS) so are comparatively inexpensive since they are not free-flying satellites.

CLARREO is the Climate Absolute Radiance and Refractivity Observatory, a mission that was recommended by the 2007 Earth Science and Applications from Space Decadal Survey produced by the National Academies of Sciences, Engineering, and Medicine. In 2016, a decision was made to focus first on a technology demonstration mission – CLARREO Pathfinder – to attach a Reflected Solar Spectrometer to the ISS around 2020. The FY2017 request for CLARREO Pathfinder was \$19 million. The budget projection was for it to grow to \$28 million in FY2018, then ramp down to \$15.4 million in FY2019, \$2.1 million in FY2020 and \$0.2 million in FY2021. Thus the total savings (assuming no termination costs) for FY2018-2021 would be \$45.6 million. CLARREO Pathfinder is managed by NASA's Langley Research Center in Hampton, VA.

OCO is the Orbiting Carbon Observatory. The first OCO was lost in a launch failure. A replacement, OCO-2, was launched in 2014. OCO-3 would use spare parts from OCO-2 to build an instrument to be attached to the ISS. According to NASA, the purpose is to study the distribution of carbon dioxide on Earth as it relates to urban populations and changing patterns of fossil fuel combustion. The FY2017 request was \$26.3 million. The projection was for that amount to decline to \$9.5 million in FY2018 and \$4.2 million in FY2019, then rise to \$6.6 million in FY2020 and \$6.8 million in FY2021. Termination (assuming no termination costs) would save \$27.1 million in FY2018-2021. OCO-3 is a project of the Jet Propulsion Laboratory (JPL) in Pasadena, CA.

- **DSCOVR, the Deep Space Climate Observatory**, was launched in 2015. Its primary mission today is to provide space weather data and is funded by NOAA, not NASA. However, NASA designed and built two of the four instruments on DSCOVR: the Earth-Polychromatic Imaging Camera (EPIC) that constantly provides full-disk views of Earth from the spacecraft's vantage point 1.5 million kilometers away, and the National Institute of Standards and Technology Advanced Radiometer (NISTAR).

The Trump budget blueprint proposes eliminating funding for these two “earth-facing” (as opposed to Sun-facing) instruments. In the NASA budget, DSCOVR is funded at \$1.7 million in the FY2017. The projection is for that to decline to \$1.2 million in both FY2018 and FY2019, \$0.8 million in FY2020, and zero in FY2021. That represents a total savings (assuming no termination costs) of \$3.2 million from FY2018-2021. NASA said in a March 17, 2017 email to SpacePolicyOnline.com that its money is used for analysis and processing of the data from the two NASA-provided instruments.

DSCOVR originated in the Clinton Administration where it was championed by Vice President Al Gore. His goal was to have a satellite that provided a constant view of Earth to help remind everyone of the fragility of the planet and its climate. He named the spacecraft Triana, but it was harshly criticized by Republicans in Congress and dubbed “Goresat.” After a review by the National Academy of Sciences, science instruments were added to make it more scientifically valuable, but President George W. Bush suspended the program when he took office. The satellite remained in storage throughout most of the Bush term, but was resurrected and launched during the Obama Administration. Today it is operated by NOAA since its primary role is providing space weather data.

Budget savings do not appear to be the driving force for proposing these terminations. Instead, it apparently is based on Trump Administration skepticism about climate change. In releasing the budget blueprint, White House Office of Management and Budget (OMB) Director Mick Mulvaney said of climate change research: “We’re not spending money on that anymore. We consider that to be a waste of your money to go out and do that.” The Trump budget proposal cancels or sharply reduces funding for climate change initiatives across the government.

Many congressional critics of NASA’s earth science program are climate change skeptics, but the argument is rarely couched in those terms. Instead, the line of reasoning is that other federal agencies study the Earth, but only NASA sends probes to other places in the solar system, launches telescopes into space, or supports human exploration of space. They argue those are NASA’s core missions, not earth science. Supporters of NASA’s earth science program note that the 1958 National Aeronautics and Space Act that created NASA lists “expansion of human knowledge of phenomena in the atmosphere and space” first among the agency’s objectives.

All things considered, the fact that most of NASA’s earth science program remains intact in the Trump budget proposal is somewhat surprising.

### ***Planetary Science and the Europa Mission***

Congress is a strong supporter of NASA’s planetary science program on a bipartisan basis. Attempts by the Obama Administration to cut funding for planetary science in recent years were firmly rejected and the Trump budget blueprint provides a substantial boost likely to be welcomed in Congress (the FY2016 appropriation was \$1.63 billion; the FY2017 request was \$1.39 billion). However, the impact on NASA’s other space science programs in astrophysics and heliophysics is unknown since the total amount for science was not revealed in the blueprint.

One planetary science program – robotic exploration of Jupiter’s moon Europa -- has particularly enthusiastic support from Rep. John Culberson (R-TX), who chairs the House appropriations Commerce-Justice-Science (CJS) subcommittee that funds NASA. Europa has an ocean under its icy crust and some scientists believe conditions there might be suitable for microbial life to develop. Culberson has said in many venues that he believes there is life in Europa’s ocean and he is intent on funding spacecraft to find it.

Culberson already has added substantial amounts to NASA’s budget to initiate a Europa mission even though NASA had no plans to do so. NASA generally follows the recommendations of the Decadal Surveys written by scientific experts under the aegis of the National Academy of

Sciences, Engineering and Medicine. The most recent Decadal Survey for planetary science identified a series of missions aimed at returning a sample of Mars to Earth as its top priority for a large “flagship” program. A mission to Europa was listed second, primarily because of its high cost. The report left open the possibility that a lower cost Europa mission would be a higher priority if more funding than expected became available.

Project managers at the Jet Propulsion Laboratory (JPL) reformulated the mission to lower the cost and Culberson added the money. Currently, the mission is named Europa Clipper and involves a spacecraft that will orbit Jupiter and make multiple flybys of Europa, some of them close to the surface. Fissures in Europa’s icy surface allow material from the ocean to spew out and some scientists believe plumes rise above the surface to an altitude the spacecraft could reach. Culberson wants Europa Clipper launched in 2022 using NASA’s new big rocket, the Space Launch System, which is currently under development.

Culberson also wants NASA to build a second spacecraft that could land on the surface, with a launch in 2024 also on SLS.

As required by Congress, NASA submitted a budget projection for how much it would cost to launch a Europa mission by 2022, but it is for NASA’s current orbiter/flyby mission, not adding a lander: \$194 million in FY2017, \$272 million in FY2018, \$456 million in FY2019, \$678 million in FY2020, and \$482 million in FY2021. NASA is still formulating a concept for a lander.

The Trump budget blueprint includes funding for the Europa Clipper mission, but not for the lander. This is certain to provoke debate because of Culberson’s determination and influential position as chairman of the House Appropriations subcommittee that funds NASA. If he presses ahead with the lander plans, the question will be whether he adds money to the budget or requires NASA to find the funds from within its other programs.

### ***Education***

NASA funds education activities both through its Office of Education and as part of science missions in the Science Mission Directorate (SMD). Generally speaking, these efforts are part of an effort to encourage students to study Science, Technology, Engineering and Math (STEM) fields, which has been supported on a bipartisan basis in the White House and Congress for many years.

The Trump budget blueprint, however, would eliminate NASA’s Office of Education, currently funded at \$115 million, “resulting in a more focused education effort” through SMD’s education activities. It asserts that the Office of Education “has experienced significant challenges in implementing a NASA-wide education strategy and is performing functions that are duplicative of other parts of the agency.”

The criticism may come as a surprise to many in Congress and the science community. Efforts in the Obama Administration to streamline STEM education programs across the government were firmly rejected by Congress on a bipartisan basis. During that period, NASA’s education programs were reassessed and reconfigured to better differentiate between Office of Education and SMD activities.

Programs within NASA's Office of Education are very popular in Congress, which routinely adds money to the amounts requested by whatever Administration is in power. Three programs of special interest to many Members of Congress are the following:

- [National Space Grant and Fellowship Program](#), a national network of 850 affiliates in colleges, universities, industry, museums, science centers, and state and local agencies in all 50 states plus the District of Columbia and Puerto Rico that fund fellowships and scholarships for students in STEM fields.
- [Experimental Program to Stimulate Competitive Research \(EPSCoR\)](#) that provides seed funding to enable [27 jurisdictions](#) (24 states plus Guam, Puerto Rico and the U.S. Virgin Islands) to develop academic research enterprises directed toward long-term, self-sustaining, nationally-competitive capabilities in aerospace and aerospace-related research.
- [Minority University Research and Education Program \(MUREP\)](#) that enhances the capabilities of Historically Black Colleges and Universities (HBCUs), Hispanic Serving Institutions (HSIs), and Tribal Colleges and Universities (TCUs) through grants with the goal of recruiting underrepresented and underserved students into STEM fields through completion of undergraduate or graduate degrees.

### ***Asteroid Redirect Mission (ARM)***

President Obama's proposal to send astronauts to an asteroid by 2025 as the next step in human space exploration has been described in prior year editions of this fact sheet. This Asteroid Redirect Mission (ARM) evolved over time into a mission for a robotic probe to be sent to an asteroid, pick up a boulder from its surface, and move the boulder into a Lunar Distant Retrograde Orbit where it would be visited by astronauts in an Orion spacecraft. The Trump budget blueprint proposes terminating ARM.

ARM has been controversial since it began, not least because Obama proposed it as an alternative to President George W. Bush's plan to return astronauts to the lunar surface by 2020. Obama said in an April 15, 2010 speech at Kennedy Space Center, FL that America has already sent astronauts to the Moon and there is no need to return. Instead, he wanted to focus on getting astronauts into orbit around Mars by the 2030s and landing there later. He proposed sending humans to an asteroid as the next human spaceflight destination as a steppingstone to Mars.

The ARM program involves a number of tasks, from locating candidate asteroids to developing high power solar electric propulsion (SEP) to developing a robotic probe and capture system to pluck the boulder from an asteroid's surface and move it to lunar orbit to developing the systems to take astronauts to the boulder in order to collect a sample and bring it back to Earth.<sup>1</sup>

NASA describes ARM in two parts: the Asteroid Redirect Robotic Mission (ARRM) and the Asteroid Redirect Crewed Mission (ARCM). ARRM must be launched first in order to obtain

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<sup>1</sup> One goal of ARM is to return a sample of an asteroid to Earth, but ARM should not be confused with NASA's OSIRIS-REx robotic mission that also will return an asteroid sample to Earth. OSIRIS-REx was launched in September 2016 and the sample should be back on Earth in 2023.



and move the boulder into lunar orbit. NASA officials had been saying that ARRM would be launched in 2020, but that slipped to 2021 and ARCM to 2026. NASA Administrator Charlie Bolden repeatedly stated that the robotic portion would cost no more than \$1.25 billion (excluding launch and operations), but ARM program director Michele Gates [conceded](#) in August 2016 that the cost had grown to \$1.4 billion. If launch and operations costs are included, the total is approximately \$2 billion (Gates said her cost estimates use \$500 million as a placeholder for launch).

Congress supports development of high power SEP, which can be used for many missions in Earth orbit and deep space, not just ARM, and the search for asteroids. It has been lukewarm, at best, however, about the idea of moving part of an asteroid to lunar orbit where it can be visited by astronauts. ARM has been harshly criticized by some Republicans as a waste of money and Democrats do not defend it. The proposal for its termination is not expected to be controversial since the portions of most interest to a broad segment of the space community and Congress would continue.

## **Outlook for NASA's FY2018 Appropriations Debate**

NASA's appropriations are part of the Commerce-Justice-Science (CJS) bill, one of 12 appropriations bills on which Congress is supposed to act in each fiscal year. The House and Senate Appropriations Committees have CJS subcommittees. The House CJS subcommittee is chaired by Rep. John Culberson (R-TX), while the Senate CJS subcommittee is chaired by Sen. Richard Shelby (R-AL). They held those positions in the last Congress as well. The top Democrats in the 115<sup>th</sup> Congress are Rep. Jose Serrano (D-NY) and Sen. Jeanne Shaheen (D-NH), succeeding Rep. Mike Honda (D-CA), who lost his reelection bid, and Sen. Barbara Mikulski (D-MD), who retired.

The Appropriations Committees face a challenging task. They appropriate funds for the "discretionary" part of the federal budget, which is approximately one-third of total federal spending. The other two-thirds is for "mandatory" spending such as Medicare and Social Security and interest on the national debt, over which they have no jurisdiction.

The Trump budget blueprint addresses only discretionary spending, which is divided into "defense" and "non-defense." NASA is part of non-defense discretionary spending.

The Trump budget proposal is to add \$54 billion to defense and cut \$54 billion from non-defense compared to the spending caps set by law in the 2011 Budget Control Act (BCA). The BCA sets total FY2018 discretionary spending at \$1.065 trillion: \$549 billion for defense and \$516 billion for non-defense.

The BCA has been discussed in prior year versions of this fact sheet. In essence, if Congress exceeds the caps set by law, automatic across-the-board cuts called a "sequester" go into effect. The cuts are made equally to every defense and non-defense discretionary program regardless of their relative merits. That happened in FY2013. The resulting effects were so harmful that Congress and the White House agreed to relax the limits for FY2014-2015 and then for FY2016-2017, but the BCA caps extend through 2023 and there is no agreement for those years. Trump said in his budget blueprint that he "repeals" the sequester for defense spending, but he cannot

repeal the law (Congress would have to do that), he can only ignore the caps, as did President Obama in FY2017. In Trump's case, he raised the amount for defense and cut non-defense by an equal amount, holding to the top line, but supporters of the non-defense programs are certain to oppose it. Proposed cuts to the State Department and foreign aid produced an immediate outcry and a leading Republican Senator, Lindsey Graham (R-SC), called the budget proposal "dead on arrival."

Even supporters of defense spending are unhappy saying the proposed increase is too little. The chairmen of the House and Senate Armed Services Committees (Rep. Mac Thornberry and Sen. John McCain) have both criticized the request as falling short of what Trump promised during his campaign and what is needed for a strong military.

Although NASA fared quite well in the Trump proposal, it will be up to the appropriators to decide which programs to fund and which to cut. For example, the CJS subcommittee funds not only NASA, but the National Science Foundation (NSF), the Department of Commerce (including NOAA), and the Department of Justice, all of which have many popular programs. Through the congressional budget process, each of the subcommittees will be allocated a set amount of money to spend. The CJS subcommittees will have to decide whether to fund a science program at NASA or NSF or a weather satellite or fisheries program at NOAA or a community policing program at the Department of Justice, for example.

Meanwhile, Congress has not yet completed action on the FY2017 budget. Rep. Rodney Frelinghuysen (R-NJ), who chairs the full House Appropriations Committee, issued a lukewarm response to Trump's proposals,<sup>2</sup> saying his committee would focus first on finishing the FY2017 appropriations and then take a "careful look" at the FY2018 proposal: "As directed under the Constitution, Congress has the power of the purse. While the President may offer proposals, Congress must review both requests to assure the wise investment of taxpayer dollars."

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<sup>2</sup> In addition to the FY2018 budget blueprint, President Trump sent a supplemental request to Congress on March 16 asking for more money for the Department of Defense and Department of Homeland Security in FY2017. It calls for offsetting part of the increase by cutting \$18 billion from non-defense programs in FY2017, which already has been underway since October 1, 2016. Politico [quoted](#) senior Republican and Democratic appropriators as rejecting the idea of cuts so late in the fiscal year.



**Table 1: NASA's FY2018 Budget Request**  
(in \$ millions, see notes below)

Account	2016 Approps	FY2017 Req (note 2)	FY2018 Req (note 5)	Authorization			Appropriations		
				House	Senate	Final	House	Senate	Final
<b>Science</b>	<b>5,589.4</b>	<b>5,302.5</b>							
<i>Earth Science</i>	<i>1,921.0</i>	<i>1,972.2</i>	<i>1,800.0</i>						
<i>Planetary Science</i>	<i>1,631.0</i>	<i>1,390.7</i>	<i>1,900.0</i>						
<i>Astrophysics</i>	<i>730.6</i>	<i>696.5</i>							
<i>JWST</i>	<i>620.0</i>	<i>569.4</i>							
<i>Heliophysics</i>	<i>649.8</i>	<i>673.7</i>							
<i>Education</i>	<i>note 3 37.0</i>	<i>N/A</i>							
<b>Aeronautics</b>	<b>640.0</b>	<b>634.5</b>							
<b>Space Technology</b>	<b>686.5</b>	<b>690.6</b>							
<b>Exploration</b>	<b>4,030.0</b>	<b>3,163.9</b>							
<i>Expl Sys Dev</i>	<i>3,680.0</i>	<i>2,686.5</i>	<i>3,700.0</i>						
<i>(Orion)</i>	<i>(1,270.0)</i>	<i>N/A</i>							
<i>(SLS)</i>	<i>(2,000.0)</i>	<i>N/A</i>							
<i>(Expl Ground Sys)</i>	<i>(410.0)</i>	<i>N/A</i>							
<i>Expl R&amp;D</i>	<i>350.0</i>	<i>477.4</i>							
<b>Space Operations</b>	<b>5,029.2</b>	<b>5,075.8</b>							
<i>ISS</i>	<i>N/A</i>	<i>N/A</i>							
<i>Space Trans</i>	<i>N/A</i>	<i>N/A</i>							
<i>(Cmrcl Crew)</i>	<i>(1,243.9)</i>	<i>N/A</i>							
<i>(Crew and Cargo)<sup>note 4</sup></i>	<i>N/A</i>	<i>N/A</i>							
<i>Space &amp; Flt Sprt</i>	<i>N/A</i>	<i>N/A</i>							
<b>Education</b>	<b>115.0</b>	<b>100.1</b>	<b>0.0</b>						
<b>Safety/Security/MS</b>	<b>2,768.6</b>	<b>2,836.8</b>							
<b>CECR</b>	<b>388.9</b>	<b>419.8</b>							
<b>Inspector General</b>	<b>37.4</b>	<b>38.1</b>							
<b>TOTAL</b>	<b>19,285.0</b>	<b>18,262.1</b>	<b>19,100.0</b>						

Notes: (1) Columns may not add due to rounding. Text and numbers in *italics* are subtotals. Text and numbers in *(italics in parentheses)* are sub-subtotals. N/A = not applicable or not available.

(2) President's Obama's FY2017 request for NASA was extremely complicated. Although NASA budget documents portrayed the request as for \$19.025 billion, only \$18.262 billion was in appropriated funds. The remaining \$763 million was to come from mandatory spending (the part of the budget that pays for Medicare and Social Security, for example) and from a tax President Obama wanted to levy on oil companies. The congressional committees that fund NASA only have jurisdiction over appropriations – the \$18.262 billion – and they ignored the part of the request that relied on mythical funding that was to come from mandatory spending and a tax that was never approved. Thus, this column shows the Obama request for \$18.262 billion. More information on the Obama request and how the \$19.025 billion would have been allocated is in the FY2017 version of this fact sheet.

(3) For FY2017, NASA incorporates funding for education-related activities in SMD within the astrophysics budget (\$25 million) and the earth science budget (\$6 million). Congress routinely breaks SMD education funding out into a separate line item, as shown here for FY2016. However, for FY2017, the Senate Appropriations Committee followed NASA's lead and allocated \$42 million for education as part of the astrophysics budget.

(4) The NASA request in this line is labeled “crew and cargo” and pays not only for commercial cargo flights to ISS, but payments to Russia for taking U.S., European, Japanese and Canadian crews to and from ISS on Soyuz spacecraft. The language in the Senate report refers only to \$1.028 billion provided for cargo. No mention is made of the Soyuz payments. Since the report does not specify the amounts for line items such as ISS or Space and Flight Support, it may be that it allocated more for this line than shown in the report, or it is providing NASA flexibility on how to spend the other funds in this account.

(5) As of the date of this report, the President has released only a budget blueprint with few specific funding levels. More information will be available when the detailed budget request is submitted in several weeks.

**Table 2: Funding for the Asteroid Initiative, Including the Asteroid Redirect Mission (ARM)  
(in \$ millions)**

Purpose	FY2014 Enacted	FY2015 Request	FY2016 Request	FY2017 Request
<b>“Direct” Funding (see notes)</b>				
ARM Formulation (HEOMD)	0	0	38	67.8
Asteroid Grand Challenge and related activities (Office of Chief Technologist)	7	7	7	~1
<b>“Leveraged” Funding (see notes)</b>				
Asteroid Detection (SMD)	40.5	40	50	50
Solar Electric Propulsion (STMD)	39	93	69	66.7
EVA Suits, In-Space Robotic Servicing (HEOMD and STMD)	40	40	56	~32
<b>TOTAL</b>	<b>126.5</b>	<b>180</b>	<b>220</b>	<b>217</b>

**Notes:** (1) Figures in this table for FY2014- 2016 are from a chart provided to SpacePolicyOnline.com by NASA on February 2, 2015. Data for FY2017 were provided in a NASA budget media teleconference on February 9, 2016. Some of the numbers were described as approximations and are designated here as ~, but the total of \$217 million was stated definitively. Congress does not specify funding for ARM in its reports on appropriations bills so appropriated levels after FY2014 are not included.

(2) In FY2016, NASA distinguished between “direct” and “leveraged” funding for ARM, where direct funding is specifically related to the Asteroid Initiative (which includes ARM) while “leveraged” funding is for NASA activities that would be undertaken even if the Asteroid Initiative did not proceed.

(3) HEOMD = Human Exploration and Operations Mission Directorate. SMD = Science Mission Directorate. STMD = Space Technology Mission Directorate

**Table 3: Funding for the Space Launch System: NASA Request versus Congressional Appropriations  
(in \$ millions)**

Account: Subaccount	FY2014	FY2015		FY2016		FY2017
	Enacted	Request	Final	Request	Final	Request (incl mandatory)**
Exploration: Exploration Systems Development/ SLS	1,600.0	1,380.3	1,700.0	1,356.5	2,000.0 (incl \$85 M for EUS)	1,310.5
Exploration: Exploration Systems Development/ Exploration Ground Systems	318.2	351.3	351.3	410.1	410.0	429.4
CECR: Exploration Construction of Facilities	*139.3	52.3	*67.9	10.0	*10.0	8.8
<b>TOTAL</b>	<b>2,057.5</b>	<b>1,783.9</b>	<b>2,119.2</b>	<b>1,776.6</b>	<b>2,410.0</b>	<b>1,748.7</b>

Notes: CECR = Construction, Environmental Compliance and Restoration. EUS is the Exploration Upper Stage, which is needed for certain SLS missions. NASA did not request EUS funding in FY2016.

\* The \$139.3 figure for FY2014 CECR is from NASA’s FY2016 budget request . CECR funding figures for FY2015, FY2016 and FY2017 are from NASA’s FY2017 budget book, p. EXP-19.

\*\* As explained elsewhere, the President’s budget request included amounts that were to be obtained not only from appropriated funds, but from “mandatory” spending. Congress rejected that approach and focused only on the request for appropriated funds. Funding figures provided by NASA did not break out funding for SLS in terms of appropriated funding, it showed only this amount for the request including mandatory spending. See the FY2017 version of this fact sheet for more information.