



## **NASA'S FY2016 BUDGET REQUEST**

### **Overview**

For FY2016, President Obama requested \$18.529 billion for NASA, an increase of \$519 million (2.9 percent) above the FY2015 appropriated level. The final FY2016 Consolidated Appropriations Act (P.L. 114-113) provides \$19.285 billion for NASA, an increase of \$756 million above the request and \$1.275 billion more than FY2015.

This fact sheet has four tables:

- Table 1 compares what Congress appropriated for FY2015, the FY2016 President's request, the amounts in the House-passed and Senate Appropriations Committee-approved Commerce-Justice-Science (CJS) appropriations bill, and the final amount in the FY2016 Consolidated Appropriations Act (H.R. 2029, P.L. 114-113).
- Table 2 shows the funding levels in the House authorization bill for FY2016 and FY2017 that was [approved](#) by the House Science, Space and Technology Committee on April 30, 2015 on a party-line vote, but not yet reported to the House (H.R. 2039). The bill authorizes funding under two different scenarios depending on whether the budget caps set by the 2011 Budget Control Act (BCA) are repealed or replaced. The first set of figures, designated by the committee as "aspirational," apply if the caps are repealed or replaced. The second set, designated as "constrained," apply if the caps are not repealed or replaced.
- Table 3 shows NASA's funding for its "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 using data provided by NASA.
- Table 4 consolidates the funding for the Space Launch System (SLS), which is spread across three subaccounts, where those figures are publicly available.

### **Background on Key Issues in the President's Budget Request and Budget Caps**

The President's budget request was a substantial increase above the FY2015 appropriated level, but in keeping with the increase that Congress provided for FY2015. For that year, the President requested \$17.647 billion, while Congress appropriated \$18.010 billion (see our [fact sheet on the FY2015 NASA budget](#) for details). Some saw the request as a glass half full, a great

improvement over what was projected for NASA at this time last year. Others saw it as a glass half empty because the Obama Administration requested a 6 percent increase for research and development across the government and see NASA's 2.9 percent as too low.

The debate over NASA's FY2016 budget, however, took place in a broader context that pitted the White House and congressional Democrats against congressional Republicans over the total amount the government could spend in FY2016. Under the 2011 Budget Control Act (BCA), limits – “**budget caps**” – were placed on how much the government may spend in each fiscal year from FY2011 to FY2021.

Neither party likes the BCA caps and in 2013 the two sides agreed to relax them for FY2014 and FY2015. For FY2016, however, the BCA caps were back in force. Republicans found a way around the cap for defense spending by adding tens of billions of dollars to an account (Overseas Contingency Operations—OCO) that is not included in the cap and changing the rules on how OCO money may be spent (for regular defense needs rather than only for executing the war in Afghanistan, for example).

For non-defense spending, like that in the CJS bill, Republicans initially insisted on holding to the BCA caps. The White House and congressional Democrats demanded a relaxation of the caps for non-defense spending, too, and the President vowed to veto any appropriations bill that did not treat non-defense spending the same as defense spending.

On October 30, 2015, all parties agreed to a [budget/debt limit deal](#) that lifted the budget caps and paved the way for agreement on a FY2016 spending package. Policy provisions (“riders”) delayed agreement on a final appropriations bill until December 16. Votes on the final bill are expected imminently. Passage is expected, but not assured. NASA and the rest of the government are being funded by Continuing Resolutions (CRs) in the meantime.

As for NASA specifically, four key issues emerged during the debate over the President's request: the increase in funding for earth science; the decrease in funding for planetary science; the request for the Asteroid Redirect Mission (ARM); and funding for human spaceflight – the Space Launch System (SLS), Orion spacecraft, and commercial crew.

## **Earth Science**

The President requested a substantial increase for NASA's earth science budget: \$1.947 billion, a \$174.8 million increase over FY2015. The increase reflected a decision to fund a “multi-decadal sustainable land imaging program” that includes building and launching the next Landsat satellite, and an administration decision to transfer to NASA from NOAA responsibility for all non-defense satellite earth observation programs other than weather satellites.

After considerable debate, the final appropriations bill includes \$1.921 billion for earth science, very close to the request.

**Land Imaging.** Landsat has a long and tortuous history that is too complex to explain fully in this brief report, but here is its essence. NASA launched the first Landsat satellite (then called Earth Resources Technology Satellite – ERTS) in 1972, with a total of five NASA-built satellites launched by 1984. In the late 1970s, however, the Carter Administration (and the Reagan

Administration thereafter) decided the program was sufficiently mature to leave NASA, which focuses on research and development, and transferred it to NOAA (which has operational responsibilities) with the goal of privatizing it. The privatization effort resulted in the construction of Landsat 6, but it was lost in a launch failure, which also ended the privatization effort. Data from Landsat are widely used and a decision was made to continue launching these satellites and the program ultimately was returned to NASA, but with the U.S. Geological Survey (USGS) assuming operational responsibilities for the satellites once they are in orbit. USGS already had been in charge of distributing Landsat data from the Earth Resources Observation and Science Center (EROS) in South Dakota for many years

NASA built Landsat 7 as well as Landsat 8, the newest in the series, which was launched in 2013. The Obama Administration proposed transferring the entire Landsat program to USGS, including responsibility for building Landsat 9 and subsequent satellites. Congress [rejected](#) the proposal and the program remained at NASA. NASA became determined to create a long-term “sustainable” program that would provide stability instead of Landsat perennially seeming to be a waif in search of a home. The FY2016 budget request has funding for this sustainable program, which includes money to begin building Landsat 9 for launch in 2023; a separate “Thermal Infrared Free Flyer” (TIR-FF) for launch in 2019 to ensure continuity of thermal infrared data; and investments in new technology and system innovation to reduce the cost of future Landsats.

NASA’s earth science program is a target of climate change skeptics on Capitol Hill, but Sen. Barbara Mikulski (D-MD), the top Democrat on the Senate Appropriations Committee (and its Commerce-Justice-Science subcommittee that funds NASA) is a strong supporter of earth science at NASA. On the authorization side, Sen. John Thune (R-SD), chairs the Senate Commerce, Science and Transportation Committee that oversees NASA, and the EROS Center is in his state.

In the final appropriations bill, Landsat receives \$100 million “of which up to \$58 million may be derived from prior-year balances.” NASA is directed to build Landsat 9 “as a copy of Landsat-8” and the target launch year is 2020, not 2023. No funding is provided for TIR-FF.

**Responsibilities of NASA Versus NOAA.** The division of responsibilities between NASA and NOAA for weather and climate satellite research and observations also has a long and complex history. NOAA has been responsible for operational civilian weather satellites for decades, but its interest in climate observations from satellites has grown. Beginning in 1994, it became one of the two major agencies (DOD was the other) that tried to merge the defense and civil weather satellite programs in the National Polar-orbiting Operational Environmental Satellite System (NPOESS), to which a number of climate sensors were added over the years.

Cost increases and schedule delays in NPOESS led to its cancellation and cost increases in NOAA’s replacement program, the Joint Polar Satellite System (JPSS), prompted sharp rebukes even from supporters in Congress. Congress has made clear in recent years that it wants NOAA to focus on weather, not climate, and to reduce the percentage of NOAA’s budget devoted to satellites versus its other responsibilities.

Under the proposal in the FY2016 budget request, NOAA will retain responsibility for weather satellites (JPSS and GOES-R), radio occultation satellites (COSMIC-2), and space weather

satellites (DSCOVR was launched in February 2015 and NOAA wants to begin planning for a successor). For more information on NOAA's satellite programs, see our [fact sheet](#).

NOAA has been trying to determine how to launch three instruments that were intended to be flown on NPOESS. One of those, the Total and Spectral Solar Irradiance Sensor (TSIS), has been in limbo for several years, but in the FY2016 budget would be assigned to NASA instead of NOAA. NASA plans to place TSIS-1 on the International Space Station instead of launching it as a stand-alone satellite. NASA would also take on responsibility for any future ocean altimetry satellites in the Jason series (NOAA's Jason-3 is scheduled for launch in January 2016).

Past attempts to shift programs from NOAA to NASA have resulted in opposition from some NASA supporters in Congress who see it as a drain on NASA's budget. Others oppose climate science research more generally and may regard the increase in NASA's budget for earth science unjustified. [NASA told SpacePolicyOnline.com](#) via email on February 2, 2014 that approximately \$54 million of the \$174.8 million increase requested for the earth science program in FY2016 is attributable to the shift of activities from NOAA to NASA.

## **Planetary Science**

The President requested \$1.361 billion for planetary science, a decrease of \$76.6 million compared to the FY2015 appropriations. Planetary science is very popular on both sides of Capitol Hill and the decrease was certain to cause complaints. The new chairman of the House Appropriations CJS subcommittee, Rep. John Culberson (R-TX), is a very strong supporter of planetary science, especially a robotic mission to Europa, a moon of Jupiter that is thought to have a liquid ocean under its icy crust. NASA did not plan to launch a mission to Europa because of budget constraints, but Culberson has been one of the leaders in Congress adding money to NASA's budget for each of the past three years to work on such a project. In FY2015, for the first time, NASA requested a small amount for Europa – \$15 million – which Congress increased to \$100 million. The FY2016 request was for \$30 million to begin mission formulation, a significant step.

In the final appropriations bill, Congress increased planetary science overall by \$270 million. Europa receives \$175 million and NASA is directed to build a lander, as well as an orbiter, and launch the spacecraft in 2022, not later in the decade as NASA planned.

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

President Obama's proposal two years ago to send a robotic probe to a small asteroid and redirect it into a retrograde orbit around the Moon where it would be visited by astronauts to retrieve a sample and return it to Earth has been controversial since it began. This is not a line item in NASA's budget and the money for it is spread across the Science Mission Directorate (SMD), the Space Technology Mission Directorate (STMD) and the Human Exploration and Operations Mission Directorate (HEOMD). ARM is part of an "Asteroid Initiative" that includes other funding in the Office of the Chief Technologist.

It is very difficult to track the money for this program since it is located in so many places and not identified in NASA's budget documents or congressional appropriations bills. Table 3 displays the figures provided to [SpacePolicyOnline.com](#) by NASA on February 2, 2015. This

year, NASA stresses that most of the \$220 million associated with the program is not specifically for ARM, but is being “leveraged” from activities that NASA would engage in even if ARM did not exist. NASA counts only \$38 million in the HEOMD budget for formulation and the \$7 million in the Office of Chief Technologist for the Asteroid Grand Challenge as “direct” funding.

ARM involves locating asteroids, developing high power solar electric propulsion (SEP), and developing a robotic probe (powered by SEP) and capture system to either bag a small asteroid or pluck a boulder from a larger asteroid and nudge it into lunar orbit. NASA calls those Option A and Option B, respectively, and in March 2015 chose Option B for implementing the mission. NASA continues to insist that ARM will cost \$1.25 billion, but it is not clear what is included in that estimate. It does NOT include the costs of the crew portion of the mission (launching the astronauts and their activities at the asteroid) or the launch of the robotic spacecraft. NASA officials say that it does include the cost of SEP and presumably includes the cost of the spacecraft and the mechanism for capturing the boulder from the asteroid’s surface.

The NASA Advisory Council (NAC) has been asking intense questions about the cost of the portion of the mission that involves redirecting the asteroid. It wanted an independent cost estimate (ICE) for Options A and B before the choice was made, but NASA declined to do so. NAC is concerned that if the cost grows beyond \$1.25 billion, it could delay achieving NASA’s long term goal – sending humans to Mars – and does not see the relevance of moving an asteroid to that goal. At its April 2015 meeting, NAC [adopted a finding](#) that NASA should not send the SEP-powered spacecraft to an asteroid at all, but instead send it all the way to Mars and back as a test of the SEP.

The final appropriations bill says little about ARM as discussed below (see page 10).

## **SLS/Orion and Commercial Crew**

The FY2016 budget request continued the long standing tension between Congress and the Obama Administration over the relative priority of building SLS and Orion versus commercial crew.

Congress directed NASA to build SLS and Orion in the 2010 NASA Authorization Act. It wants the agency to focus on sending humans beyond low Earth orbit (LEO) – eventually to Mars – not only on utilization of the International Space Station (ISS), which is in LEO.

In 2010, NASA was advocating a public-private partnership to build commercial crew transportation systems to take astronauts to and from the ISS. The compromise reached in the 2010 NASA Authorization Act allowed NASA to proceed with commercial crew while at the same time it began a new “heavy lift” launch vehicle, SLS, and crew spacecraft, Orion, to take crews beyond LEO. Members of the House and Senate have complained each year since then that the Administration favors commercial crew over SLS/Orion and routinely adds money for SLS/Orion and cuts funding for commercial crew.

The request for FY2016 was no different. NASA requested significantly less for SLS and Orion than Congress appropriated for FY2015 and a substantial increase for commercial crew, as shown in Table 1. NASA officials including Administrator Bolden insisted that if Congress did not provide the full \$1.2 billion for commercial crew, NASA would have to renegotiate its fixed

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price contracts with Boeing and SpaceX and would not be able to guarantee that the systems would be ready by the end of 2017. Until the commercial crew systems are available, NASA will continue to be dependent on Russia to ferry astronauts to and from ISS. NASA has not had an ability to launch people into space since the space shuttle was terminated in 2011.

The final appropriations bill fully funds commercial crew and adds substantial funds for SLS and Orion as discussed below (see page 10).

## **NASA FY2016 Appropriations**

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.

Congress did not complete action on any of the 12 appropriations bills by the time FY2016 began on October 1, 2015. Instead it passed three short-term Continuing Resolutions (CRs) until agreement on a FY2016 bill could be reached. Agencies are funded at their FY2015 levels minus a 0.2108 percent across-the-board reduction to keep the total within agreed budget caps.

The following sections describe House and Senate appropriations action and the final agreement in the FY2016 Consolidated Appropriations Act.

### **House Appropriations Action**

The House CJS subcommittee held a [hearing](#) on the FY2016 request on March 4, 2015. The House Appropriations Committee approved its version of the CJS bill on May 20, 2015. The bill, H.R. 2578, passed the House on June 3. No changes were made to the NASA section. Several were considered, but either withdrawn or rejected. A SpacePolicyOnline.com [article](#) summarizes the debate.

Table 1 shows the amounts approved by the House in the bill and accompanying [report](#) (H.R. 114-130). Although the total was the same as the President's request -- \$18.529 billion -- the funding was allocated differently. The House cut funding for Science; Space Technology; Space Operations; Safety, Security and Mission Assurance; and Construction, Environmental Compliance and Restoration (CECR). Additions were made to Aeronautics, Exploration, and Education. The two areas most affected were Science, especially the earth science program, and Exploration.

**Science.** The bill reflected CJS subcommittee chairman John Culberson's (R-TX) enthusiasm for a robotic probe to Europa, a moon of Jupiter with an icy crust covering a liquid ocean, which means it is a candidate for the existence of life. The bill added \$110 million to the \$30 million requested for Europa, specified that it be launched by 2022, and that SLS be used as the launch vehicle. NASA had not planned on paying for a Europa mission and does not see how it can afford one for launch as early as 2022. Culberson clearly has other ideas. In fact, the report accompanying the bill directs NASA to create an "Ocean Worlds Exploration Program" of which the Europa mission is part. The program's goal is to "discover extant life on another world." The bill also specifies that \$25 million of the \$625 million it allocates for Space Technology

(which is cut \$100 million from the request) be spent on “icy satellite surface technology and test-bed activities.” Europa is an icy satellite (or icy moon) and although the current proposal for a Europa mission is for an orbiter, advocates want to add a lander.

The bill also added \$26.5 million for astrophysics, which partially pays for a \$35.8 million increase for NASA’s exoplanets program to accelerate efforts to directly image exoplanets using the Wide-Field Infrared Survey Telescope (WFIRST). NASA plans to build WFIRST after the James Webb Space Telescope (JWST) is completed.

The earth science program bore the brunt of cuts to offset those increases as well as an overall cut to the Science budget of \$51 million. The House reduced earth science by \$258.1 million compared with the \$1.947 billion request, approximately 13 percent less. No funds were provided for the Thermal Infrared Free-Flyer (TIR-FF) that NASA proposed to ensure there are no gaps in providing thermal infrared imaging data.

**Exploration.** Another area of disagreement with the Obama Administration was the requested funding for SLS and Orion. The House committee’s report said the request “reflects flagging commitment on the part of NASA to present a bold vision.” Orion was funded at the requested level of \$1.096 billion, but significant funds were added for SLS development whether compared to the request or current funding. Conversely, the request for commercial crew was cut.

The House bill added almost \$500 million above the \$1.357 billion requested for SLS development. The request, however, was sharply less than the \$1.700 billion Congress provided in FY2015, a source of congressional complaints that NASA is underfunding the program. The House provided \$1.850 billion, of which no less than \$50 million is for an “enhanced upper stage.” SLS requires a large upper stage to launch many of the envisioned payloads that is often called the “exploration upper stage” or EUS. NASA does not have the funds for it now and is developing an “interim” upper stage for early SLS flights. Advocates think it would be more cost effective to move directly to the EUS. The House bill also created a new SLS budget line, “program integration,” funded at \$53 million. The House bill combined the \$1.850 billion for SLS development (including EUS), the \$410 million for associated ground systems (same as the request), and the \$53 million for program integration for a total of \$2.313 billion. The comparable number in the request is \$1.767 billion, so, in total, for all three aspects of the SLS program in the Exploration budget, the committee added \$546 million, a 31 percent increase.

Commercial crew, by contrast, received \$1 billion even, \$224 million less than the request (a 20 percent cut), but \$195 million more than FY2015.

**Asteroid Redirect Mission.** In its report, the House committee said that while questions remain about ARM’s overarching mission, it has been useful in motivating NASA to develop new rocket propulsion technologies, which the committee supports. It urged NASA to finalize a mission concept that “will galvanize support and interest.”

**NASA and White House Reaction.** On May 19, the day before full committee markup, the Director of the Office of Management and Budget (OMB), Shaun Donovan, sent a [letter](#) to the chairman and ranking member of the House Appropriations Committee (Rep. Hal Rogers, R-KY, and Rep. Nita Lowey, D-NY) expressing White House concerns about the bill overall, including NASA. NASA Administrator Charlie Bolden posted his own concerns on his [blog](#).

The top issue for both of them is the cuts to Space Technology and commercial crew that they see “imperiling” the Journey to Mars, in Bolden’s words. While the cuts in other areas, such as earth science, warranted a mention, they were not at top of the list. Donovan’s letter said the White House looked forward to working with the committee to resolve the issues.

That was the position of Democrats on the Appropriations Committee during markup as well. Rep. Mike Honda (D-CA) introduced, but withdrew, an amendment to add money to the Science budget. Then-CJS ranking member Rep. Chaka Fattah (D-PA) thanked him for withdrawing it so that everyone could work together to find a solution. Subcommittee chairman Culberson said he is a big fan of science and would try to fix the problem within the budget caps imposed by the Budget Control Act (BCA). Fattah rejoined that he would try to raise the caps. (See the discussion of the budget cap issue at the beginning of this report.)

The House committee did not fix any of the problems cited in Donovan’s letter and the White House [issued a veto threat](#) against the bill before floor debate.

### **Senate Appropriations Action**

The Senate CJS subcommittee held its NASA [hearing](#) on April 16, 2015. The Senate Appropriations Committee marked up its version of the bill on June 11, 2015 (subcommittee markup was on June 10). The committee approved \$18,289.5 million for NASA, \$240 million less than the request. No further action was taken by the Senate on this bill. NASA’s appropriations were approved as part of the FY2016 Consolidated Appropriations Act.

In the Senate committee’s markup, the Science account overall, SLS, Orion, and Education fared well. Aeronautics, Space Technology, commercial crew, and NASA’s internal accounts did not.

As for Space Operations, it is difficult to compare the requested versus committee-approved funding because it is not broken out in sufficient detail and the committee shifted one program (commercial crew) into and one program (satellite servicing) out of this account.

The Exploration account is where funding for human spaceflight development programs – SLS, Orion, and commercial crew – and Exploration R&D are located. Space Operations is for operational activities including ISS operations, procurement of launch services, space communications, and so forth. The committee said it wanted to consolidate all funding for ISS into one account and therefore moved commercial crew there as a subaccount of ISS Crew and Cargo, which is a subaccount of ISS, which is a subaccount of Space Operations.

As for satellite servicing, the committee specified that \$150 million be spent on RESTORE-L, but placed it in the Space Technology account, at the same time cutting Space Technology by \$125 million (from \$725 million to \$600 million), making that cut deeper than it appeared. None of the \$725 million requested for Space Technology was allocated for RESTORE-L.

**Science.** The Senate committee provided \$5,295 million for science, \$6.4 million more than the request. Several pages of the committee’s report specified how that money is to be spent. For earth science, the committee provided \$1,931.6, just \$15.7 million less than the request. The report specified that \$100 million was for Landsat-9 and no funding was provided for the Thermal-Infrared-Free-Flyer (TIR-FF). Instead, NASA was directed to accelerate the pace of



building Landsat-9 so it is ready for launch by 2020 (instead of 2023) presumably thereby negating the need for TIR-FF.

For planetary science, the committee provided \$1,321 million, \$40 million less than the request. It did not specify any funds for a Europa mission (\$30 million was requested, but the House added another \$110 million), but stated that NASA's baseline plan should assume use of SLS for launching such a spacecraft.

As it did last year, the Senate committee pulled out funding for Science Mission Directorate (SMD) education activities into a separate line and funded it at \$42 million, \$22 million more than the request. NASA includes SMD's education funding in the astrophysics line, so the committee's action also means that the astrophysics budget, which at first glance appears to get a \$21.5 million increase (from \$709.1 million to \$730.6 million), actually gets a \$41.5 million increase since the \$20 million for education is moved to a separate line.

**Exploration.** As explained above, at first glance it looks as though the Exploration account was cut substantially, but that is because the request for commercial crew was moved to Space Operations. The programs remaining in the Exploration account fared well. Orion was funded at \$1.2 billion, \$104 million more than the request. SLS got \$1.9 billion, \$543.5 million more than the request, and of that amount, \$100 million was specified for the Exploration Upper Stage (EUS).

**Commercial Crew.** As explained above, commercial crew was moved to the Space Operations account and the requested funding was cut \$344 million (\$900 million compared to the \$1.244 billion request). The House provided \$1 billion, sparking great concern by NASA and the White House Office of Management and Budget (OMB). The Senate committee's cut therefore created even greater consternation in the Obama Administration.

**Asteroid Redirect Mission.** The Senate report was silent on ARM.

## **Final Appropriations Action**

In the early hours of December 16, 2015, congressional negotiators announced they had reached a compromise on an appropriations bill combining all 12 regular appropriations bills, including CJS, into a single consolidated bill, H. R. 2029. The House and Senate passed the bill, and the President signed it into law, on December 18. The final funding figures are shown in Table 1, but the table must be used with care because Congress shifted some programs from one account to another and therefore can be misleading. The following text explains some of those changes.

**Science.** The final agreement provides \$5.589 billion for SMD, including \$175 million for a Europa mission. Congress directs NASA not only to build the currently planned Europa orbiter spacecraft, but also a lander. Congress includes \$197 million for planetary science technology, of which \$25 million is for icy satellites surface technology (the House bill placed that \$25 million in the STMD budget instead). Earth science is funded at \$1.921 billion, very close to the \$1.947 billion requested. Of that amount, \$100 million is for Landsat 9, which is required to be a copy of Landsat 8. No funds are provided for TIR-FF.

**Exploration.** Congress moved the commercial crew program out of the Exploration account and into the Space Operations account, making it difficult to make an apples-to-apples comparison of how these accounts fared at the top level. It is more useful to look at the individual programs within the account. SLS receives \$2.0 billion, a \$643.5 million increase over the \$1.356 billion request and \$300 million more than the \$1.7 billion Congress allocated for FY2015. NASA is directed to build the Enhanced Upper Stage (EUS) and \$85 million is allocated for it. It does not create a new “program integration” line item as proposed by the House. Orion gets a small increase compared to the request: \$1.27 billion versus \$1.096 billion. Exploration R&D is cut from \$399 million requested to \$350 million. The congressional language directs that \$55 million in Advanced Exploration Systems be spent on a prototype deep space habitation module to be ready by 2018. The final agreement also directs NASA to human-rate all systems prior to the EM-2 mission and “notes that additional funds above the request have been provided to address this untenable gap presented by NASA in its budget request.” The “untenable gap” refers to NASA’s current plan for a five year gap between the first test flight of SLS (EM-1), with an unoccupied Orion capsule, in 2018, and the second SLS launch (EM-2), with a crew, in 2023 (NASA insists it is still working toward a 2021 date for EM-2 as originally planned, but does not use that as its official baseline for the program).

**Space Operations.** As noted above, comparing last year’s funding or the request to what Congress allocated is difficult because it moved the commercial crew program from Exploration into Space Operations and moved satellite servicing from Space Operations to Space Technology. The final agreement does not indicate how the \$5.029 billion for Space Operations is divided between its two sub-accounts: International Space Station (ISS) and Space and Flight Support. The only hard figure is the \$1.244 billion for commercial crew, which is the same as the request. Commercial crew is now a sub-account of ISS Crew and Cargo services, which is a sub-account of ISS, which is a sub-account of Space Operations. Congress moved the satellite servicing technology development program RESTORE-L out of this account and into Space Technology.

**Space Technology.** The Space Technology Mission Directorate (STMD) once again was cut, and as with Space Operations and Exploration, it is difficult to compare numbers because Congress moved satellite servicing technology (RESTORE-L) from Space Operations to this account as the Senate committee recommended. Congress cut STMD overall, but the amount of the cut is greater than it appears because NASA must spend \$133 million on RESTORE-L. None of the funding NASA requested for STMD was allocated to RESTORE-L so other STMD activities will have to make up the difference. Thus, while it appears SMTD was cut \$38 million (from \$725 million to \$686.5 million), effectively it was cut \$171 million (\$38 million + \$133 million).

**Aeronautics.** The aeronautics program gets \$640 million, an increase of \$68.6 million compared to the request and \$11 million less than FY2015.

**Asteroid Redirect Mission (ARM).** All that is said about ARM in the final bill is that none of the satellite servicing technology development funded in Space Technology may be used to support activities unique to ARM, and semi-annual reports are required on ARM and several other NASA programs.

## NASA Authorization Bills

(Not sure of the difference between an appropriation and an authorization? See our [“What’s a Markup”](#) Fact Sheet.)

NASA’s authorization (“oversight”) committees are the House Science, Space, and Technology (SS&T) Committee and Senate Commerce, Science, and Transportation Committee. The 2010 NASA Authorization Act (P.L. 111-267) is the most recent NASA authorization act. Its funding recommendations covered only through FY2013, but the policy provisions remain in effect until and unless they are repealed or replaced.

**House-passed 2015 NASA Authorization Act.** The House [passed](#) a one-year FY2015 NASA authorization (H.R. 810) on February 10, 2015 under suspension of the rules. It is virtually identical to the 2014 NASA Authorization Act passed by the House in 2014 other than substituting the amounts appropriated for NASA for FY2015 for those appropriated for FY2014. The Senate never acted on the 2014 bill and it died at the end of the 113<sup>th</sup> Congress. It has not yet acted on the 2015 bill.

**House NASA Authorization Act for 2016 and 2017 (H.R. 2039).** The policy provisions of H.R. 2039 are virtually identical to those in H.R. 810. The funding provisions are completely new, however, since they cover future years. As shown in Table 2 below, the funding recommendations are complicated because the bill recommends funding at two different levels depending on whether or not the budget caps set in the 2011 Budget Control Act (BCA) are removed.

- The first set of funding recommendations assumes the BCA caps are lifted. A press release from committee Republicans refers to those levels as **“aspirational.”**
- The second set assumes the BCA caps are not lifted; the press release calls that set **“constrained.”**
- A third scenario is mentioned – where the funding falls somewhere in between – in which case any additional funds would be applied proportionately among all of NASA’s funding accounts.

In total, the aspirational level for FY2016 is the same as the President’s request of \$18.529 billion. The constrained level is what NASA received for FY2015 -- \$18.010 billion. There are many differences, however, in how the legislation would allocate that money compared to the President’s request.

Proposed cuts to NASA’s earth science program were the most divisive issue during committee markup on April 30. Whether compared to NASA’s current FY2015 budget or the President’s FY2016 request, under either the aspirational or constrained scenario, earth science would be sharply reduced.

NASA’s earth science program is funded at \$1.773 billion in FY2015. The request for FY2016 is \$1.947 billion. Under the bill’s aspirational scenario, it would receive \$1.450 billion in FY2016. Under the constrained scenario, it would receive \$1.199 billion. Using current funding and the aspirational scenario for FY2016, it would be an approximately 18 percent cut.

Compared to the President's request, it would be a roughly 26 percent cut. If the BCA caps are not removed and the constrained scenario plays out for FY2016, it would be about a 32 percent cut compared to current funding or a 38 percent cut compared to the President's request.

House and Senate Republicans on NASA's authorization committees argue that NASA's unique expertise is space exploration and studying the Earth should not be one of its priorities. Although many also are climate change skeptics, publicly they do not frame their arguments in that context, instead insisting that other agencies should pay for that research, not NASA.

Space technology is another area that would suffer compared to the President's request. It is currently funded at \$596 million. The President's request for FY2016 is \$725 million. Under the bill's aspirational scenario, it would receive \$596 million – its current level – for FY2016. Compared to the request, that is a cut of about 18 percent. Under the constrained scenario, space technology would receive \$500 million, approximately 16 percent less than today and about 31 percent less than the President's request.

By comparison, NASA's human exploration program – the Space Launch System (SLS), Orion, and associated ground systems – and planetary science and astrophysics fare much better as shown in Table 2. The President's request would cut funding for SLS and Orion; this bill would restore them to their FY2015 levels. Republicans and Democrats in Congress complain that the Obama White House underfunds SLS and Orion knowing full well that they are congressional priorities because the White House favors the commercial crew program. The House bill does provide the full request for commercial crew in FY2016 (\$1.244 billion) under the aspirational scenario, but less (\$1.136 billion) in the constrained scenario.

The President's request also cuts planetary science, another congressional favorite. It is funded at \$1.438 billion this year and the request would cut that down to \$1.361 billion. The House bill instead would raise it to \$1.5 billion regardless of what happens with the BCA caps. The bill states that up to \$30 million is specifically for the Astrobiology Institute. Astrophysics (excluding the James Webb Space Telescope, which has its own budget account) is currently funded at \$685 million and the President's request would increase it to \$709 million. The House bill would raise it even more, to \$731 million, under the aspirational scenario. In the constrained scenario, it would receive the \$709 million requested.

Overall, the House bill demonstrates well known differences between Republicans and the Obama White House over NASA's priorities. Congressional Democrats also disagree with the Obama Administration on many of those issues, but earth science funding is one area where Democrats have tried to protect NASA's program. The committee [approved](#) the bill on April 30, 2015, on a party-line vote. The debate was highly partisan. No further action has taken place.

**Table 1: NASA's FY2016 Budget Request and Congressional Action**  
(in \$ millions, see notes below)

Account	2015 Approps	2016 Request	Authorization			Appropriations		
			House cmte apprvd (note 6)	Senate	Final	House- passed	Senate cmte apprvd	Final (P.L. 114-113)
<b>Science</b>	<b>5,244.7</b>	<b>5,288.6</b>	<b>4,951.7</b>			<b>5,237.5</b>	<b>5,295.0</b>	<b>5,589.4</b>
<i>Earth Science</i>	<i>1,772.5</i>	<i>1,947.3</i>	<i>1,450.0</i>			<i>1,689.2</i>	<i>1,931.6</i>	<i>1,921.0</i>
<i>Planetary Science</i>	<i>1,437.8</i>	<i>1,361.2</i>	<i>1,500.0</i>			<i>1,557.0</i>	<i>1,321.0</i>	<i>1,631.0</i>
<i>Astrophysics</i>	<i>684.8</i>	<i>709.1</i>	<i>730.7</i>			<i>735.6</i>	<i>note 5 730.6</i>	<i>730.6</i>
<i>JWST</i>	<i>645.4</i>	<i>620.0</i>	<i>620.0</i>			<i>620.0</i>	<i>620.0</i>	<i>620.0</i>
<i>Heliophysics</i>	<i>662.2</i>	<i>651.0</i>	<i>651.0</i>			<i>642.0</i>	<i>649.8</i>	<i>649.8</i>
<i>Education</i>	<i>42.0</i>	<i>note 5</i>	<i>note 5</i>			<i>note 5</i>	<i>note 5 42.0</i>	<i>note 5 37.0</i>
<b>Aeronautics</b>	<b>651.0</b>	<b>571.4</b>	<b>571.4</b>			<b>600.0</b>	<b>524.7</b>	<b>640.0</b>
<b>Space Technology</b>	<b>596.0</b>	<b>724.8</b>	<b>596.0</b>			<b>625.0</b>	<b>600.0</b>	<b>686.5</b>
<b>Exploration</b>	<b>4,356.7</b>	<b>4,505.9</b>	<b>4,953.1</b>			<b>4,759.3</b>	<i>note 7 3,831.2</i>	<i>note 7 4,030.0</i>
<i>Expl Sys Dev</i>	<i>3,245.3</i>	<i>2,862.9</i>	<i>3,310.0</i>			<i>3,409.3</i>	<i>3,510.0</i>	<i>3,680.0</i>
<i>(Orion)</i>	<i>(1,194.0)</i>	<i>(1,096.3)</i>	<i>(1,200.0)</i>			<i>(1,096.3)</i>	<i>(1,200.0)</i>	<i>(1,270.0)</i>
<i>(SLS)</i>	<i>(1,700.0)</i>	<i>(1,356.5)</i>	<i>(1,700.0)</i>			<i>(1,850.0)</i>	<i>(1,900.0)</i>	<i>(2,000.0)</i>
<i>(Expl Ground Sys)</i>	<i>(351.3)</i>	<i>(410.1)</i>	<i>(410.0)</i>			<i>(410.0)</i>	<i>(410.0)</i>	<i>(410.0)</i>
<i>(Prog Integration)</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>			<i>(53.0)</i>	<i>N/A</i>	<i>N/A</i>
<i>CmrcI Spflt</i> <sup>note 7</sup>	<i>805.0</i>	<i>1,243.8</i>	<i>1,243.8</i>			<i>1,000.0</i>	<i>note 7 [\$900.0]</i>	<i>note 7 [\$1,243.8]</i>
<i>Expl R&amp;D</i>	<i>306.4</i>	<i>399.2</i>	<i>399.2</i>			<i>350.0</i>	<i>321.2</i>	<i>350.0</i>
<b>Space Operations</b>	<b>3,827.8</b>	<b>4,003.7</b>	<b>3,992.5</b>			<b>3,957.3</b>	<i>note 7 4,756.4</i>	<i>note 7 5,029.2</i>
<i>ISS</i>	<i>N/A</i>	<i>3,105.6</i>	<i>N/A</i>			<i>3,075.6</i>	<i>note 7 3,951.6</i>	<i>not specified</i>
<i>(CmrcI Spflt)</i> <sup>note 7</sup>	<i>note 7</i>	<i>note 7</i>	<i>note 7</i>	<i>note 7</i>	<i>note 7</i>	<i>note 7</i>	<i>note 7 900.0</i>	<i>note 7 1,243.8</i>
<i>Space &amp; Flt Sprt</i>	<i>N/A</i>	<i>898.1</i>	<i>N/A</i>			<i>881.7</i>	<i>not specified</i>	<i>not specified</i>
<b>Education</b>	<b>119.0</b>	<b>88.9</b>	<b>119.0</b>			<b>119.0</b>	<b>108.0</b>	<b>115.0</b>
<b>Safety/Security/MS</b>	<b>2,758.9</b>	<b>2,843.1</b>	<b>2,843.1</b>			<b>2,768.6</b>	<b>2,784.0</b>	<b>2,768.6</b>
<b>CECR</b>	<b>419.1</b>	<b>465.3</b>	<b>465.3</b>			<b>425.0</b>	<b>352.8</b>	<b>388.9</b>
<b>Inspector General</b>	<b>37.0</b>	<b>37.4</b>	<b>37.0</b>			<b>37.4</b>	<b>37.4</b>	<b>37.4</b>
<b>TOTAL</b>	<b>18,010.2</b>	<b>18,529.1</b>	<b>18,529.1</b>			<b>18,529.1</b>	<b>18,289.5</b>	<b>19,285.0</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. Figures for NASA's FY2015 appropriations are from the joint explanatory statement to accompany the FY2015 Consolidated and Further Continuing

Appropriations Act (the “CRomnibus”). Figures for the FY2016 request are from NASA budget materials at <http://www.nasa.gov/budget>. The budget account “Safety, Security and Mission Services” previously was called Cross-Agency Support. Congress changed the name in the FY2015 appropriations bill.

(2) CECR = Construction, Environmental Compliance and Restoration. CoF = Construction of Facilities. NA = not applicable/not available/not specified

(3) The Asteroid Initiative is not specifically identified in NASA’s budget documents. Funding is spread through the Human Exploration and Operations Mission Directorate, the Space Technology Mission Directorate, the Science Mission Directorate, and the Office of Chief Technologist. See table 3.

(4) The Space Launch System (SLS) is funded in three different accounts. For convenience, table 4 delineates that funding.

(5) In the FY2015 budget, Congress (at the initiation of the Senate Appropriations Committee) broke out funding for education activities in the Science Mission Directorate (SMD) as a separate line item although NASA included it as part of the Astrophysics budget. For FY2016, NASA again included SMD education in the Astrophysics budget: \$20 million out of the total of \$709.1 million requested. The House Appropriations Committee kept the funding in the Astrophysics budget, but increased the amount to \$32 million. The Senate committee, as it did last year, breaks SMD education funding out as a separate line item and provides \$42 million, the same as FY2015. Since the \$20 million in Astrophysics intended for SMD education was moved to a separate line, that means Astrophysics programs actually got a \$41.5 million increase above the request. (The \$709.1 million request for Astrophysics is composed of \$689.1 million for programs and \$20 million for SMD education. The committee approved \$730.6 million, with none in that line item for SMD education.)

(6) As shown in Table 2 below, the House authorizing committee presented two budget scenarios: “aspirational” and “constrained” depending on whether the NASA budget would be constrained by budget caps. The subsequent House Appropriations Committee action recommended total NASA funding of \$18,529.1 million, which is the same as the House authorizing committee’s aspirational level. Therefore, the aspirational level is used in this table.

(7) The Senate Appropriations Committee chose to move commercial spaceflight (often called “commercial crew”) to the Space Operations account. It is now apparently a sub-account of ISS Crew and Cargo, which is itself a subaccount of International Space Station, which is a subaccount of Space Operations. That level of detail is not usually included in this table, but because of the interest in this topic, we have broken it out here. The Senate committee’s report says that of the \$2,505.5 million provided for ISS Crew and Cargo, \$900 million is for “development milestone payments to U.S. -based ISS crew providers, which has previously been accounted for within the Exploration account.” The request for ISS Crew and Cargo was \$1,605.5 million. Because of the shift, in the table it appears as though Exploration was cut and Space Operations was increased, but that is an apples to oranges comparison. The final FY2016 appropriations bill adopted the Senate’s position of moving this to the Space Operations account, although it provided the full funding request.

**Table 2: House NASA Authorization Act for 2016 and 2017 (H.R. 2039)**  
(in \$ millions)

Account	2015 Appropriated	2016 Request	House Auth 2016 (see note 2)		House Auth 2017 (see note 2)	
			Aspirational	Constrained	Aspirational	Constrained
<b>Science</b>	<b>5,244.7</b>	<b>5,288.6</b>	<b>4,951.7</b>	<b>4,678.6</b>	<b>4,935.3</b>	<b>4,678.6</b>
<i>Earth Science</i>	<i>1,772.5</i>	<i>1,947.3</i>	<i>1,450.0</i>	<i>1,198.5</i>	<i>1,450.0</i>	<i>1,198.5</i>
<i>Planetary Science</i>	<i>1,437.8</i>	<i>1,361.2</i>	<i>1,500.0</i>	<i>1,500.0</i>	<i>1,500.0</i>	<i>1,500.0</i>
<i>Astrophysics</i>	<i>684.8</i>	<i>709.1</i>	<i>730.7</i>	<i>709.1</i>	<i>730.7</i>	<i>709.1</i>
<i>JWST</i>	<i>645.4</i>	<i>620.0</i>	<i>620.0</i>	<i>620.0</i>	<i>569.4</i>	<i>620.0</i>
<i>Heliophysics</i>	<i>662.2</i>	<i>651.0</i>	<i>651.0</i>	<i>651.0</i>	<i>685.2</i>	<i>651.0</i>
<i>Education</i>	<i>42.0</i>	<i>see note 3</i>	<i>not specified</i>	<i>not specified</i>	<i>not specified</i>	<i>not specified</i>
<b>Aeronautics</b>	<b>651.0</b>	<b>571.4</b>	<b>571.4</b>	<b>571.4</b>	<b>580.0</b>	<b>571.4</b>
<b>Space Technology</b>	<b>596.0</b>	<b>724.8</b>	<b>596.0</b>	<b>500.0</b>	<b>596.0</b>	<b>500.0</b>
<b>Exploration</b>	<b>4,356.7</b>	<b>4,505.9</b>	<b>4,953.1</b>	<b>4,845.4</b>	<b>5,268.0</b>	<b>4,845.4</b>
<i>Expl Sys Dev</i>	<i>3,245.3</i>	<i>2,862.9</i>	<i>3,310.0</i>	<i>3,310.0</i>	<i>3,681.5</i>	<i>3,310.0</i>
<i>(Orion)</i>	<i>(1,194.0)</i>	<i>(1,096.3)</i>	<i>(1,200.0)</i>	<i>(1,200.0)</i>	<i>(1,349.6)</i>	<i>(1,200.0)</i>
<i>(SLS)</i>	<i>(1,700.0)</i>	<i>(1,356.5)</i>	<i>(1,700.0)</i>	<i>(1,700.0)</i>	<i>(1,899.6)</i>	<i>(1,700.0)</i>
<i>(Expl Ground Sys)</i>	<i>(351.3)</i>	<i>(410.1)</i>	<i>(410.0)</i>	<i>(410.0)</i>	<i>(432.3)</i>	<i>(410.0)</i>
<i>Commercial Spflt</i>	<i>805.0</i>	<i>1,243.8</i>	<i>1,243.8</i>	<i>1,136.1</i>	<i>1,184.8</i>	<i>1,136.1</i>
<i>Expl R&amp;D</i>	<i>306.4</i>	<i>399.2</i>	<i>399.2</i>	<i>399.2</i>	<i>401.7</i>	<i>399.2</i>
<b>Space Operations</b>	<b>3,827.8</b>	<b>4,003.7</b>	<b>3,992.5</b>	<b>3,950.4</b>	<b>3,992.5</b>	<b>3,950.4</b>
<i>ISS</i>	<i>not specified</i>	<i>3,105.6</i>	<i>not specified</i>	<i>not specified</i>	<i>not specified</i>	<i>not specified</i>
<i>Space &amp; Flt Sprt</i>	<i>not specified</i>	<i>898.1</i>	<i>not specified</i>	<i>not specified</i>	<i>not specified</i>	<i>not specified</i>
<b>Education</b>	<b>119.0</b>	<b>88.9</b>	<b>119.0</b>	<b>119.0</b>	<b>119.0</b>	<b>119.0</b>
<b>Safety/Security/MS</b>	<b>2,758.9</b>	<b>2,843.1</b>	<b>2,843.1</b>	<b>2,843.1</b>	<b>2,843.1</b>	<b>2,843.1</b>
<b>CECR</b>	<b>419.1</b>	<b>465.3</b>	<b>465.3</b>	<b>465.3</b>	<b>436.1</b>	<b>465.3</b>
<b>Inspector General</b>	<b>37.0</b>	<b>37.4</b>	<b>37.0</b>	<b>37.0</b>	<b>37.0</b>	<b>37.0</b>
<b>TOTAL</b>	<b>18,010.2</b>	<b>18,529.1</b>	<b>18,529.1</b>	<b>18,010.2</b>	<b>18,807.0</b>	<b>18,010.2</b>

Note 1: Columns may not add due to rounding. Numbers in *italics* are subsets. Numbers in *(italics enclosed in parentheses)* are sub-subsets.

Note 2: The bill (H.R. 2039) authorizes amounts for FY2016 and FY2017 under two scenarios. In a press release, the committee refers to them as “aspirational” and “constrained.” The higher “aspirational” levels assume that the budget caps in the 2011 Budget Control Act (BCA) are removed by Congress. The lower “constrained” levels assume the BCA caps remain in place.

Note 3: In the FY2015 appropriations bills, Congress broke out funding for education within the Science Mission Directorate (SMD) as a separate line item. The FY2016 request includes \$20 million in the Astrophysics line item for education and outreach for the entire directorate.



**Table 3: Funding for the Asteroid Initiative, Including the Asteroid Redirect Mission (ARM)  
(in \$ millions)**

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

**Notes:** Figures in this table are from a chart provided to SpacePolicyOnline.com by NASA on February 2, 2015. That chart listed only the FY2015 requested figure, not the FY2015 appropriated level. The final funding for FY2015 must be approved by Congress when it sees NASA’s operating plan. The figures in this chart differ somewhat from how NASA has described funding for ARM in the past, so is not directly comparable to the tables in earlier versions of this fact sheet.

For FY2016, NASA distinguishes 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.

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

**Table 4: Funding for the Space Launch System: NASA Request versus Congressional Appropriations  
(in \$ millions)**

Account: Subaccount	FY2014	FY2015		FY2016			
	Enacted	Request	Final	Request	House-passed	Senate cmte- approved	Final (P.L. 114-113)
Exploration: Exploration Systems Development/ SLS	1,600.0	1,380.3	1,700.0	1,356.5	1,850.0 (incl \$50M for EUS†)	1,900.0 (incl \$100M for EUS†)	2,000.0 (incl \$85 M for EUS)
Exploration: Exploration Systems Development/ Exploration Ground Systems	318.2	351.3	351.3	410.1	410.0	410.0	410.0
Exploration: Exploration Systems Development/ Program Integration	0.0	0.0	0.0	0.0	53.0	0.0	0.0
CECR: Exploration Construction of Facilities	*139.3	52.3	*not specified	10.0	**not specified	**not specified	** not specified
<b>TOTAL</b>	<b>2,057.5</b>	<b>1,783.9</b>	<b>2,051.3</b> (+CECR?)	<b>1,776.6</b>	<b>2,313.0</b> (+CECR?)	<b>2,310.0</b> (+CECR?)	<b>2,410.0</b> (+CECR?)

Notes: CECR = Construction, Environmental Compliance and Restoration.

\* The \$139.3 figure for FY2014 CECR is from NASA's FY2016 budget request and is slightly less than the \$142 million figure included in the explanatory statement accompanying the FY2014 Consolidated Appropriations Act. The FY2016 budget request does not show how much was appropriated for FY2015 in the CECR account.

\*\* The House and Senate appropriations committee reports do not specify how much, if any, of the CECR funding is for SLS.

† EUS is the Exploration Upper Stage, which is needed for certain SLS missions. NASA did not request EUS funding.