NATURE | NEWS

Obama makes risky bid to increase science spending

But many research advocates worry that the proposal could backfire in the face of political opposition.

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10 February 2016

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US President Barack Obama's budget plan is likely to face a rocky reception from Congress.

With less than a year before he leaves office, US President Barack Obama is making a strong push to increase spending on scientific research. His fiscal year 2017 budget plan, released on 9 February, calls for a 4% bump in research and development funding across the federal government.

But science advocates and lawmakers alike say that they're unhappy with Obama's decision to boost science by relying on 'mandatory' spending. Normally, research funding is 'discretionary', meaning that Congress decides how much money each agency will receive. But lawmakers have little leeway to adjust mandatory programmes, which must be supported by a dedicated revenue stream — such as the oil tax that Obama has proposed should go to fund some clean-transportation programmes. That makes them a tough sell to Congress, which must approve the government's budget.

Most major science agencies would receive some mandatory funding under Obama's proposed 2017 budget. In many cases, those mandatory spending proposals offset a reduced or flat discretionary budget, notes Matt Hourihan, director of the research and development budget and policy programme at the American Association for the Advancement of Science in Washington DC. "That in and of itself is problematic," he says. "Mandatory spending is often better seen as a supplement — not a long-term solution."

If Congress does not adopt the mandatory spending proposal for the US National Institutes of Health (NIH), for example, the NIH budget would drop by US$1 billion, based on the president's budget. The budget of the National Science Foundation (NSF) would increase by roughly 1%.

But science agencies may still escape cuts if — as expected — Congress rejects the mandatory proposals. "Over the past few years, Congress has done a good job of trying to prioritize science and technology spending as much as they can," says Hourihan, who notes particularly strong support in Congress for the NIH and NASA.

Lawmakers will not have as much freedom to boost science budgets as they did last year, however. A two-year budget deal struck last December increased discretionary spending by 5.2% in fiscal year 2016, but requires that it remain essentially flat in 2017.

Here, *Nature* breaks down how various agencies fare in the White House budget request.

- National Institutes of Health
- National Science Foundation
- NASA
- Department of Energy
- Coast Guard
- Food and Drug Administration

National Institutes of Health

Obama is requesting $33.1 billion for the NIH — $825 million, or 2.6%, over the 2016 level. But this total includes about $1.8 billion in mandatory spending that masks a major cut to the NIH's discretionary budget.

"It's an increase in the same way as saying 'I'm going to increase my household budget because I bought a Powerball [lottery] ticket," says Jennifer Zeitzer, director of legislative affairs at the Federation of American Societies for Experimental Biology in Bethesda, Maryland.

Yet NIH director Francis Collins is not worried. "It would be astounding if Congress approves a cut in NIH funding," he says, noting that lawmakers increased the agency's budget by 6.6% in 2016, compared with the previous year.

Moreover, he adds that Congress has shown some support for the concept of mandatory biomedical spending. In 2015, the House of Representatives passed a bill to reform the Food and Drug Administration (FDA) that also included $1.75 billion per year in mandatory funds for the NIH. Meanwhile, Senate lawmakers are developing seven smaller, related bills that may also include mandatory funding.

Within Obama's request, the National Cancer Institute would receive $680 million for the cancer 'moonshot', an effort to cure cancer that will focus on research areas such as genomics and 'big-data' analyses. Collins says that the agency has not yet decided whether the project will parcel its money out in small grants or pursue large initiatives. He says that the NIH will soon appoint an advisory panel to begin discussing the effort's structure.

The Precision Medicine Initiative, a longitudinal study to track the health of one million Americans, would receive $300 million. The project aims to begin recruiting participants this summer, Collins says.

And the NIH's portion of the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) initiative would receive $195 million.

National Science Foundation

Obama has requested $8.0 billion for the NSF, a healthy 6.7% increase over the 2016 estimate. But the bulk of that jump would come from $400 million in mandatory spending, a more difficult sell to Congress. Much of that extra money would go to support younger researchers, who face greater competition in winning research grants than more established scientists. Without that additional funding, the agency would see an increase of only $101 million, or 1.3%.

In a sign of the difficult battles the agency has had this year with Congress over funding for social sciences and geosciences, the NSF has made it a priority to sell itself as a key component in feeding economic growth and improving national security. "The money spent on basic resesarch is not optional in a successful economy," says agency director France Córdova. "It's a necessary investment that will insure the US remains the birthplace of new ideas and great discoveries."

Among its major priorities, the NSF would spend $512 million on research and education in renewable and alternative energy, and another $142 million on brain research — about half of which would support the BRAIN Initiative. The agency proposes to spend $176 million on research related to advanced manufacturing and $150 million for its ongoing programme in cybersecurity. A total of $43 million would go to research aimed at improving prediction and resilience in natural and human-caused disasters. Ocean science would benefit from a $106-million request to build two additional research ships.

The $8-billion funding request would provide enough for 10,100 new research grants, about 900 more than the 2016 budget supports. That would increase funding rates from 22% of proposals to 23%.

NASA

The budget request for NASA is $19 billion — $300 million less than Congress gave the agency in 2016. Funding for its science division would remain essentially flat, at $5.6 billion.

Within that, though, there are some clear winners and losers. Earth sciences would get a $111-million boost to $2 billion, to continue the development of missions such as the IceSAT-2 cryosphere-monitoring satellite and a follow-on to the GRACE gravity satellites that measure changes in groundwater and ice.

Notably, the request would accelerate plans for the next Landsat remote-sensing satellite. Landsat 8 suffered a problem with its thermal-infrared imager after its 2013 launch, and some had suggested launching an interim sensor, on a free-flying satellite, as a temporary supplement. Obama has instead bowed to congressional pressure to accelerate the launch of Landsat 9 by several years, to 2021. “Congress loves Landsat,” says Steve Running, a forest ecologist at the University of Montana in Missoula and chair of an Earth sciences panel that advises NASA.

Even as Earth sciences rise, planetary science would drop by nearly the same amount, to $1.519 billion. That’s still more than the White House has proposed in recent years, an apparent concession to Congress, which keeps tucking additional monies into the planetary budget. “We’re misaligned between how the administration wants to move forward and how Congress wants to move forward,” says Casey Dreier, director of space policy at the Planetary Society in Pasadena, California.

A perennial sticking point between the White House and Congress, a mission to Jupiter’s moon Europa, would receive $49.6 million. Last year, the White House requested $30 million for the programme; Congress instead showered it with $175 million and stipulated that it include a lander and be launched on the new heavy-lift Space Launch System (SLS) rocket no later than 2022. NASA has yet to figure out how the mission — an envisaged multiple fly-by of the icy moon — could also carry a lander. And the SLS rocket may or may not be ready in time for a 2022 launch.

For 2017, Obama proposes to slash SLS funding from $2 billion to $1.3 billion, a move that Congress will almost certainly ignore. “This administration cannot continue to tout plans to send astronauts to Mars while strangling the programmes that will take us there,” said Representative Lamar Smith (Republican, Texas), chair of the House committee that oversees NASA, in a statement.

As for NASA’s idea to bring an asteroid into lunar space for astronauts to study, the budget request allocates $217 million. A robotic spacecraft could launch in 2023or earlier to retrieve the asteroid, with astronauts visiting the rock in 2025, said the agency’s chief financial officer, David Radzanowski. But asteroid experts have questioned the scientific return and technical feasibility of such a plan.

Meanwhile, the NASA astrophysics budget continues development of the James Webb Space Telescope, due to launch in 2018, and the Wide-Field Infrared Survey Telescope, for launch in the following decade. The Stratospheric Observatory for Infrared Astronomy (SOFIA), a telescope-in-a-plane, would be fully funded at $84 million after the Obama administration attempted to kill it two years ago.

Department of Energy

Within the Department of Energy (DOE), the Office of Science would receive $5.7 billion, an increase of 6% over 2016. The largest increases in its portfolio would go to the advanced computing, basic energy sciences, and biological and environmental research programmes. The only significant decrease would be for nuclear fusion, which would see its funding cut by 9%, to $398 million. ITER, an international effort to build a fusion-energy plant, would receive $115 million.

The Advanced Research Projects Agency – Energy (ARPA-E) would get $500 million, a 72% increase over 2016 spending; $150 million of that would be new mandatory funds. The White House also proposes to increase the agency’s budget to $1 billion by 2021.

This year’s budget includes a multi-agency proposal to double federal spending on clean-energy research and development, from $6.4 billion in 2016 to $12.8 billion in 2021. The fiscal 2017 budget includes $7.7 billion towards this goal. Around 80% of that money would be funnelled through the DOE, although 12 agencies are included in the effort.

The DOE contribution to the initiative includes $880 million for research on vehicles and renewable fuels, $804 million for nuclear-energy programmes and $564 million for a range of fossil-energy research, including technologies to capture and sequester carbon dioxide.

Mark Muro, a senior fellow who studies innovation at the Brookings Institution, a think tank in Washington DC, says that the

Republican-controlled Congress may not reject the plan outright, despite its general opposition to Obama's climate policies. Innovation, technology and jobs are issues that have traditionally enjoyed bipartisan support, and they are key components of the clean-energy proposal.

But Obama's proposal for a new tax on oil, which would increase investment in clean-transportation infrastructure by roughly 50%, has already come under Republican attack. Oil companies would pay $10 per barrel of oil, to be phased in over five years. At current consumption rates, such a fee could raise up to $70 billion annually.

Coast Guard

In a move sure to be welcomed by polar scientists, the Coast Guard would get $150 million to complete the design of a new icebreaker. The US government has only two such vessels, the heavy but ageing *Polar Star* and the middleweight *Healy* that operates mainly in the Arctic. This limited fleet has sometimes forced the government to rent Russian icebreakers to clear a path to its McMurdo Station in Antarctica.

"We'd really like a heavy icebreaker so that, no matter what the season, even in midwinter, we have the capability to go where we need to go," says Julie Brigham-Grette, a palaeoclimatologist at the University of Massachusetts in Amherst who chairs a national polar research board.

In September, Obama said that he would accelerate the push to acquire a heavy-duty icebreaker to 2020 from 2022, at an expected cost of roughly $1 billion.

Food and Drug Administration

The FDA, which has responsibilities that range from approving new drugs to overseeing aspects of food safety, would receive $5.1 billion in fiscal year 2017 — an increase of 8% over the 2016 budget. The bulk of that increase, $269 million, would come from user fees collected from industry stakeholders, including food producers and pharmaceutical companies.

For Steven Grossman, deputy executive director of the Alliance for a Stronger FDA in Washington DC, the numbers are a disappointment. "The increase doesn't reflect what the agency does and how much more it's required to do each year," he says.

Grossman points to increased responsibility in monitoring drug production overseas, evaluating and approving 'biosimilar' versions of complex biological drugs and implementing the 2011 Food Safety Modernization Act as examples of the growing burden on the agency.

Nature | doi:10.1038/nature.2016.19316