

**Testimony before the
Senate Commerce, Science, and Transportation Committee
by
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Introduction

Chairman Rockefeller, Ranking Member Thune, and members of the committee, my name is Alan Leshner and I am the Chief Executive Officer of the American Association for the Advancement of Science (AAAS) and Executive Publisher of the prestigious, peer-reviewed journal *Science*. Thank you for inviting me to testify before you today on the subject of the effects of the current government shutdown on the conduct of scientific research.

Let me start with my overall conclusion and then provide the context and the evidence underlying it.

This government shutdown is coming as a serious blow to an already beleaguered American scientific enterprise. The shutdown is more than simply a temporary work stoppage for science. The shutdown, affecting both government scientists and many of those supported by Federal agencies, will interrupt many longitudinal studies and observations that depend on continuity over time for their success. Moreover, many kinds of data on which the nation depends will be lost.

Our community has already been hit very hard by the “sequester,” which comes as an overlay on Federal science budgets that already, pre-sequester, have been in decline. These realities are coming at the same time as other countries are dramatically increasing their research and development (R&D) investments, in spite of similar economic conditions, responding to the clear relationship between a nation’s research capacity, its economic strength, and the well-being of its people. The cumulative effects of these trends, now exacerbated by the shutdown, are threatening America’s standing in the global scientific community. Losing our eminence in science would likely result in fewer foreign scientists coming to study and work in the United States, fewer U.S.-based science and technology breakthroughs and fewer U.S. startup companies and jobs.

As background, since 1976, AAAS has analyzed and reported on the federal research and development (R&D) budget, as well as historical trends regarding funding by discipline, performer, and source. Scientific research thrives best when it can rely on steady and sustained growth across all disciplines. It is critical that Members of Congress understand the status of current funding trends and the effects of sequestration on federal R&D, before I discuss the effects of the shutdown on the U.S. research enterprise.

According to our current estimates, between FY 2010 and FY 2013 post-sequestration, federal R&D expenditures declined by 16.3 percent; the fastest decline over any three-year period since the end of the Space Race. At the same time, federal R&D as a share of gross domestic product has declined from 1.27 percent of GDP to roughly 0.82 percent today; it has also declined as a share of the federal

budget overall. Even under the best possible scenario, the direction that this year's appropriations have taken won't make a dent in these trends.

One twist is that, as currently written, the Budget Control Act (BCA) requires an overall discretionary spending level of \$967 billion in FY 2014, about 2 percent lower than in FY 2013, per Congressional Budget Office estimates. Even though the bulk of this decline is scheduled to take place on the defense side, agencies will likely constrain their spending anyway, even if a continuing resolution (CR) is agreed to that extends FY 2013 spending for a few months, due to uncertainty. The additional impact on research projects, grants, construction, and other such central activities remains to be seen.

It is this very uncertainty that is a growing threat to the federal research enterprise. The current government shutdown has placed a hard brake on an already shrinking effort.

As many of us who work and reside in the DC area know, the impact of the shutdown has had an immediate impact on a number of federal R&D agencies and its programs and employees. Some exceptions do exist; for example, employees and programs may be exempt in order to ensure the safety of human life or the protection of property. This would include selected NASA activities in support of the International Space Station, satellite missions, and probes currently in the operation phase.

Unfortunately for the federal science enterprise, the vast majority of staff and programs fall into the "non-essential" category, meaning that they are directly affected by the expiration of budget authority. Most federal R&D agencies had to furlough a significant portion of their workforce. For example:

National Institutes of Health:

- NIH employees that remain are continuing to provide in-patient and out-patient care for patients in its Clinical Center although new patients are generally not being accepted. About 200 patients typically register for clinical trials each week, and about 30 of those new patients are children. At least six new studies have been deferred.
- NIH furloughed 73 percent of its workforce, over 13,500, including intramural researchers who had to walk away from their labs. Some were forbidden to attend or speak at international conferences on subjects such as AIDS research.
- A Boston-area patient was initially denied a critical treatment because he could not access the ClinicalTrials.gov website, which was shut down. A Member of Congress had to intervene in order to give the database an exemption. NIH, however, will not be able to sustain other important online resources such as PubMed Central.
- Some NIH staff are working to maintain and protect their animal stock, research infrastructure, and data.
- There will be delays in approval of new grant awards, though researchers who have previously been awarded funding and have active grants may generally continue their work.
- For other parts of HHS, the FDA monitoring programs and CDC outbreak programs, including its seasonal influenza work, will shortly cease.

National Science Foundation:

- The majority of NSF funded research is extramural and conducted by scientists and engineers at universities and laboratories across the nation. That said, almost all of NSF's employees (99 percent) have been furloughed and are unable to provide any support to extramural researchers.
- This week the NSF announced it will be forced to cancel the U.S. Antarctic program's upcoming field season if the shutdown continues past October 14. This is a very complex logistical enterprise that could jeopardize the entire research season for hundreds of important projects. Researchers conduct a host of experiments in this unique and unspoiled continent in fields such as astronomy, particle physics, climate change, and biology, and the success of many of these is dependent on continuous or recurrent measurements season after season.
- Construction of a solar telescope, gravity wave observatory, and ecological and ocean-observing networks will be suspended if the shutdown lasts beyond Oct 31st.
- Three of four U.S. radio telescopes, which are largely funded by NSF, are off the air impacting several thousand intramural and extramural researchers who are now unable to access the data that those telescopes provided.
- The grant process has been disrupted; no funding opportunities are available. The FastLane database is closed so no information is available for new grants. However, as at NIH, university-based researchers who have already received their award may generally continue their work.

NASA:

- More than a year's worth of data that cost approximately \$500,000 to collect could go to waste due to the closure of radio telescopes. For example, scientists have been tracing the shape of the Milky Way using the Very Long Baseline Array, which is now shut down, and missing an observation means they will have to start over.
- The Stratospheric Observatory for Infrared Astronomy, a plane-based telescope based at Dryden Research Center, has been grounded.
- While many ongoing missions will continue, development of future missions, including the James Webb Space Telescope, will have to slow or stop. Further, if technical problems arise in ongoing missions, their resolution may be prevented or delayed.
- While many big-ticket items like the Hubble Space Telescope, and some research centers like the Jet Propulsion Lab, are contractor-based and thus can continue operating for now, they will be on a timeline, and the longer the shutdown continues, the more at risk they will be.

NOAA:

- Much of NOAA's scientific portfolio constitutes what might be called "environmental intelligence," involving continuous monitoring and interpretation of the state of the full array of environmental factors. Much of that monitoring will have been suspended, with consequences both in the long- and short-terms.
- Effective water management, such as in the Great Lakes, is dependent on understanding water quality issues, such as the presence and magnitude of algae blooms. That monitoring will be suspended as the relevant NOAA scientists have been furloughed. The same is true for drought managers.
- Nautical charts will not be updated.
- The winter king crab season for Bering Sea fishermen will be suspended because the scientists and other government workers needed to process information and develop the regulations for the season have been furloughed.

USGS:

- Research at USGS has stopped; for example, no one is reading seismographs.

Department of Energy:

- There are exceedingly few direct DOE employees in most R&D offices that would be exempt from the funding disruption. A handful of DOE staff would remain at the Office of Science, and at the offices for efficiency, renewables, nuclear power, and fossil energy; ARPA-E has been effectively closed.
- Most of the National Labs, which are managed under contract, would be shielded for a time given other resources and budget authority balances they can draw upon. However, as at NASA, contractor activities will be on a timeline. For instance, Sandia Laboratory in New Mexico plans to shut down October 21, and not long thereafter the Argonne National Laboratory in Illinois may have to begin powering down the Advanced Photon Source x-ray synchrotron.
- A few hundred direct DOE staff within the National Nuclear Security Administration are exempt in order to protect U.S. national security interests.
- In Oak Ridge, Tennessee, the Y-12 National Security Complex, a critical component in the nation's nuclear defense enterprise, has started partial shutdown. Oak Ridge National Laboratory, however, will likely continue operation into November.

USDA:

- Just about all of the staff at the National Institute of Food and Agriculture and the Economic Research Service are furloughed, although the Agricultural Research Service would retain several hundred staff to safeguard research animal populations, IT infrastructure, and other assets.

Extramural researchers, such as those in our great research universities across the nation, are somewhat shielded by the immediate impacts of the government shutdown. But like a pebble tossed into a lake, the effects of the federal government shutdown likely will soon reach their labs as grant renewals are disrupted and new grants are, at best, delayed in starting.

Those academic scientists currently operating under multi-year grant funding from FY 2012 or FY 2013 may continue their work. However, if they require participation, intervention or oversight from a civil servant, or are awaiting the disbursal of additional funding, their work may be disrupted and potentially halted if the shutdown lingers. Furthermore, if their research relied on access to a federal database or equipment—including some of the examples I have given above—then their research will be severely hampered. We learned recently that geneticists were unable to receive a shipment of fruit flies because the European supplier had suspended shipments to the United States because the closure of the USDA means the flies cannot clear customs.

Academic scientists whose current funding is slowly drying up are not able to submit new grant proposals to continue their research. Agencies such as NIH and NSF have suspended the reviews of the current cycle of grant proposals until the shutdown impasse has been resolved. This could be particularly troublesome for researchers who intend to conduct field research and have only a limited window in which to do it. More importantly, this negatively affects the ability of scientists to hire

graduate student researchers and post-doc students. What message does this leave our next-generation of scientists and engineers?

Economists know that more than half of all economic growth in the industrialized world since World War II has been driven by innovation and technological progress. Public research funding has helped plant the seeds that have spawned the Global Positioning System, the laser, Google, and countless other beneficial technologies in addition to medical advances that have helped save the lives of millions of heart disease, cancer, and diabetes patients among others.

Ironically, the shutdown is now affecting federal data sets on population, income and demographics that allow statisticians, economists, and other social scientists to analyze a range of data and to develop a better understanding of the state of the U.S. economy. For example, the Bureau of Economic Analysis within the Commerce Department hosts a vital, interactive site that provides official data on gross domestic product, income and other economic statistics.

Conclusion

Congress faces many fiscal challenges in the weeks ahead, from the government shutdown to the debt limit and from the final FY2014 appropriations to sequestration. AAAS and the millions of scientists and engineers in academia, small businesses, and large industries that we represent call on you to ensure sustained and robust support for scientific research.

The best conclusion I can give is a personal quote from a federal scientist who must remain anonymous because they are not allowed to speak publicly during the shutdown. This quote was posted in an article in [Wired](#) magazine:

“Scientific research is not like turning on and off an assembly line. Experiments are frequently long-term and complicated. They involve specific treatments and specific times. You can’t just stop and restart it. You’ve probably just destroyed the experiment.

“You also can’t necessarily recover. You can’t begin an experiment all over again. If you do, you’ll be set back months –even if there’s time and personnel to do it. But often, science moves rapidly, times change, and you can’t re-initiate the experiments. It’s an enormous loss to scientific research, an enormous loss of time and personnel.

“Scientists are hardworking people. They work long hours, on weekends, and they do that because it’s necessary. The schedules they follow aren’t like an industrial plant’s. If you interrupt them, they can’t pick up and start again. It’s an enormous waste of money and resources to interrupt this and have it abandoned.”

Undermining the nation’s support for research will not resolve our fiscal problem; instead it will exacerbate it, slowing down the engine of discovery that drives innovation and economic growth. We urge you to come together and resolve your differences over the budget agreement in order to provide a powerful legacy of scientific discovery and innovation for future generations.