NSF AGS Update
UCAR Members Meeting, October 2016

Paul B. Shepson
Director, AGS
Congress acts to avert government shutdown after striking deal on Flint aid

By Mike DeBonis  September 28

Congress staved off an Oct. 1 government shutdown Wednesday, passing a stopgap spending measure after House Republicans agreed to address the drinking-water crisis in Flint, Mich., removing a major obstacle in negotiations.

The bill extends current government funding levels until early December, giving appropriators time to negotiate 2017 spending measures. It also provides year-long funding for veterans programs, $1.1 billion to address the Zika virus and $500 million in emergency flood relief for Louisiana and other states.

The House approved the bill in a 342-85 late-night vote, hours after senators voted 72-26 to pass the measure. Lawmakers have now recessed until after the Nov. 8 election.

Both the Zika and flood funding were subject to long and painstaking negotiations between majority Republicans and minority Democrats, but it was funding for Flint that threatened to push matters past the brink with one month before Election Day.

Democrats made clear earlier this week they would not support the spending bill unless Republicans moved to guarantee Flint aid, while GOP leaders countered the Senate had approved such help earlier this month in a separate water projects bill.

The impasse was broken late Tuesday after House Speaker Paul D. Ryan (R-Wis.) and Minority Leader Nancy Pelosi (D-Calif.) struck a deal allowing a vote to include $170 million in Flint relief to the House version of the water bill. That amendment and the underlying bill both passed the House Wednesday evening on bipartisan votes.
AGS Budget outlook
May 26, 2016 | On May 24, the House Appropriations Committee met to mark up its version of the Fiscal Year 2017 Commerce, Justice, and Science (CJS) Appropriations Bill. This is the companion measure to the House Bill that was approved by the Senate Appropriations Committee on April 21. The Bill funds the National Science Foundation (NSF), National Oceanic and Atmospheric Administration (NOAA), and National Aeronautics and Space Administration (NASA) for FY17, which begins on October 1, 2016.

While the science portfolio received some attention, most of the discussion and debate at the Committee meeting focused on programs in the Department of Justice. Representative Honda (D-CA) offered amendments to increase the NSF research account and the NASA Earth Science Research Program by $500 million each to make the case for robust science funding. Having done so, he then withdrew the amendments, because they did not include required spending offsets.

The House CJS Bill totals approximately $56 billion in discretionary spending. While this is about $284 million below the Senate recommendation, it represents an increase of $279 million over FY16 and $1.4 billion above the Administration’s request. The House Bill targets increases to programs that the Committee notes are of national importance, such as Federal law enforcement, national security (including cybercrime and counter-terror activities), economic development, illegal drug efforts, trade enforcement, and space exploration programs.

**WHAT’S AHEAD**

The next step in the Commerce Justice Science Appropriations process is for each bill to be debated in their respective bodies — on the floors of the House and Senate — and then the two bills are negotiated into a compromise conference document. However, the FY17 Commerce Justice Science Appropriations conference is unlikely to happen until early 2017. The delay in finalizing appropriations is the expected course in a Presidential election year. Last year’s budget deal provided an additional $30 billion for FY17, paving the way for the federal government to operate under a continuing resolution without reductions in spending or significant delays.

The Washington Post recently discussed the overall Appropriations process. The full Committee Report, as well as Amendments, are available online.

Here is a breakdown by agency.

**NSF**

The House Bill funds NSF at $7.4 billion, which is $57 million below the FY16 enacted level and $158 million below the Administration’s request.

The House recommendation for the NSF Research and Related Activities account is an increase over FY16 of $46 million, and it is targeted to programs that foster innovation and U.S. economic competitiveness, including funding for research on advanced manufacturing, physics, mathematics, cybersecurity, neuroscience, and STEM education. This NSF Research account includes funding for the Directorate for Geosciences. The House Bill does not restrict directorate levels, allowing NSF to continue to make those allocations pending the final outcome of the FY17 process.

The Research account includes report language of interest to UCAR and NCAR, including:

Scientific Facilities — The Committee is mindful of the need to balance these investments with the need to ensure that research facilities are available to the scientific community.

The full House committee marks up the FY14 Transportation, Housing and Urban Development Appropriations bill on June 27, 2013. (Photo courtesy U.S. House of Representatives, Committee on Appropriations.)
NATIONAL CENTER FOR ATMOSPHERIC RESEARCH

2014 - 2019 Strategic Plan

October 2014
Geospace Sciences Portfolio Review and Motivations

• NRC’s Decadal Survey: *Solar and Space Physics – A Science for a Technological Society*, and the “DRIVE” initiative

• Changing needs, e.g. increased focus on Geospace System Science and modeling, and the observations that support that.

• Assessment of state of infrastructure

• Current flat budget and outlook
Recommended GS Portfolio: 2020 to 2025

2015
- Core Grants: 14.38
- Targeted Grants: 8.7
  - SWM: 1.5
  - CubeSat | FDSS: 2.1
- Class 2: 3.83
- Class 1: 13.05
  - Reserve: 0.43

2020
- Core Grants: 14.4
- Targeted Grants: 8.7
  - IGS: 3.0
  - CubeSat | FDSS: 1.6
- Class 2: 5.8
- Class 1: 7.4
  - Reserve: 0.4

2025
- Core Grants: 14.4
- Targeted Grants: 6.7
  - IGS: 5.0
  - CubeSat | FDSS: 1.6
- Class 2: 4.8
- Class 1: 8.4

Sections: Core 33%, Strategic 30%, Facilities 36%
THE FUTURE OF ATMOSPHERIC CHEMISTRY RESEARCH

Remembering Yesterday, Understanding Today, Anticipating Tomorrow

The National Academies of
SCIENCES - ENGINEERING - MEDICINE
Priority Science Areas

**Priority Science Area 1:** Advance the fundamental atmospheric chemistry knowledge that enables predictive capability for the distribution, reactions, and lifetimes of gases and particles.

**Priority Science Area 2:** Quantify emissions and deposition of gases and particles in a changing Earth system.

**Priority Science Area 3:** Advance the integration of atmospheric chemistry within weather and climate models to improve forecasting in a changing Earth system.

**Priority Science Area 4:** Understand the sources and atmospheric processes controlling the species most deleterious to human health.

**Priority Science Area 5:** Understand the feedbacks between atmospheric chemistry and the biogeochemistry of natural and managed ecosystems.
Atmospheric chemistry is an essential part of understanding the behavior of the atmosphere, so that a national center for the atmospheric sciences such as NCAR must include a vibrant program in atmospheric chemistry research.

**Recommendation 7:** NCAR, in conjunction with NSF, should develop and implement a strategy to make NCAR a vibrant and complementary partner within the atmospheric chemistry community. This strategy should ensure that scientific leadership at NCAR has the latitude to set an energizing vision with appropriate personnel, infrastructure, and allocation of resources; and that the research capabilities and facilities at NCAR serve a unique and essential role to the NSF atmospheric chemistry community.
PREEVENTS

Prediction of and Resilience against Extreme Events
Part of NSF Risk and Resilience Activity

Risk and Resilience Funding by Directorate

(Dollars in Millions)

<table>
<thead>
<tr>
<th>Directorate</th>
<th>FY 2015 Actual</th>
<th>FY 2016 Estimate</th>
<th>FY 2017 Request</th>
</tr>
</thead>
<tbody>
<tr>
<td>CISE</td>
<td>$5.50</td>
<td>$6.00</td>
<td>$6.00</td>
</tr>
<tr>
<td>ENG</td>
<td>12.00</td>
<td>12.00</td>
<td>14.00</td>
</tr>
<tr>
<td>GEO</td>
<td>-</td>
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<tr>
<td>MPS</td>
<td>-</td>
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<td>0.50</td>
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<tr>
<td>SBE</td>
<td>1.84</td>
<td>4.90</td>
<td>4.90</td>
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<td><strong>Total</strong></td>
<td><strong>$19.34</strong></td>
<td><strong>$41.15</strong></td>
<td><strong>$43.15</strong></td>
</tr>
</tbody>
</table>

Totals may not add due to rounding.

Overarching risk & resilience goals
- Improve predictability & risk assessment, increase resilience
- Reduce impact of extreme events on life, society, economy
PREEVENTS in a Nutshell

• Primary targets – must address both to be eligible
  • Enhance understanding of fundamental processes underlying natural hazards and extreme events
  • Improve capability to model and forecast such hazards and events

• Tracks
  • Track 1: Conferences to foster new communities & interdisciplinary approaches, proposals any time
  • Track 2: Projects addressing both goals, extending beyond typical for GEO programs, deadline 20 Sept for groups that submitted LOI in July
  • Also: Internal-only co-funding process

• Questions? See solicitation (16-562), email preevents@nsf.gov
INFEWS: Innovations at the Nexus of Food, Energy, and Water Systems

Growing populations, changes in land use, and increasing geographic and seasonal variability in precipitation patterns are placing ever-increasing stresses on the critical resources of food, energy and water (FEW).

Amy Landis studies the feasibility of restoring soils degraded by industrial wastes and other pollutants for growing bioenergy crops. 

Credit: Jessica Hochreiter/Arizona State University
INFEWS Goals

• Understand the FEW system (of systems) through integrated systems modeling;

• Create methodologies for effective data integration/cyber elements;

• Research innovative solutions and technologies; and,

• Support education, workforce, and community development.
Food-Energy-Water in FY16

• Research Traineeship Program ... $9M
• EPSCoR Track R2 (FEW)... $33M
• Community College Innovation Challenge
• DCL on N, P, H2O; ...$4M
• “Master Solicitation”
  – $40M, 17 projects

Food-energy-water nexus at the urban-agricultural interface

INFEWSquestions@NSF.GOV

How will integrated planning of food production and urban development decrease the overall water and energy footprint of our society and increase resiliency in agriculture

ERC for Re-Inventing the Nation’s Urban Water Infrastructure (ReNUWI)
NSF Director Córdova Proposes Nine Big Ideas for the Foundation

Publication date: 14 June 2016
Number: 72

At its May meeting, the National Science Board praised National Science Foundation Director France Córdova’s proposed set of nine new ideas for the agency – including six “research big ideas” and three “process ideas” that she believes will lead to transformative discoveries.
Navigating the New Arctic

Vision

The Arctic is warming at twice the rate of the rest of the Earth, with far-reaching consequences for Arctic residents, particularly indigenous peoples. Arctic change will fundamentally alter climate, weather, and ecosystems globally in ways that we do not yet understand, but which will have profound impacts on the world’s economy and security. Rapid loss of Arctic sea ice and other changes will also bring new access to this frontier and its natural resources like fossil fuels, minerals, and new fisheries which are already attracting international attention from industry and nations seeking new resources.

NSF proposes to establish an observing network of mobile and fixed platforms and tools across the Arctic to document these rapid biological, physical, chemical and social changes, leveraging participation by other federal agencies. Current Arctic observations are sparse and inadequate to enable discovery or simulations of the processes underlying Arctic System change on a wide range of spatial and temporal scales, and to assess their environmental and economic impacts on the broader Earth System.

Summertime heating at 71°N on the central Baffin Island plateau in 2009 produced deep convection with accompanying thunder and lightning...... nearly unheard of in earlier decades (NAS 2014). Other major environmental changes in the Arctic include a rapidly diminishing sea ice cover, altered freshwater cycling, greening of the tundra, thawing permafrost, coastal erosion, and widespread fires.

NSF Uniqueness and Readiness

Among the Federal Agencies, NSF is unique in its ability to fund bottom-up research driven by the U.S. academic research community across the physical, biological, social, engineering and computational sciences. Growing human capacity via education and training of the next generation of Arctic researchers can be undertaken. Arctic system science and creating an Arctic observing network are efforts that NSF has led. NSF also supports the most capable Arctic logistics infrastructure of any agency.

Some Key Questions

How will the dramatic changes in sea ice alter marine ecosystem structure and primary productivity? How will the new Arctic Ocean ecosystem function?

What new indicators and theory are needed to understand adaptive capacity of Arctic individuals and communities experiencing the unprecedented rate of Arctic environmental and social change?

How will permafrost thaw and the changing Arctic water cycle alter Arctic terrestrial ecosystems and greenhouse gas emissions?

What is are the linkages between Arctic warming and changing mid-latitude weather patterns?
Mid-scale Research Infrastructure

Rapidly changing patterns of research require a new approach to research infrastructure for NSF’s science and engineering activities because today they

- rely increasingly on cyberinfrastructure, broadly defined,
- use infrastructure that is diverse in space, cost, and implementation time, and
- require dynamic and nimble responses to new challenges.

We face a gap in the funding structure available at NSF to respond to this new reality. NSF funds relatively small research infrastructure projects through individual Directorates (up to about $20M) or through the Major Research Instrumentation (MRI) program (up to $4M). There are many important experiments and facilities that fall in the gap between these amounts and the roughly $100M threshold for Major Research Equipment and Facilities Construction (MREFC) funding. Missing that opportunity leaves essential science undone. The long-term consequences of that neglect will be profound for science as well as for our Nation’s economy, security, and competitiveness.

One example is collaborative cyberinfrastructure that is critical across all of science and engineering, an area that requires a more agile approach than currently provided by the MREFC process. Other examples are cosmic microwave background measurements, sensor networks, dark matter experiments, and nuclear astrophysics measurements. This range of “large mid-scale” funding is also potentially critical for existing major experiments and facilities such as the Laser Interferometer Gravitational-Wave Observatory (LIGO) or the National High Magnetic Field Laboratory. Funding projects that fall in the “gap” can propel a facility into an entirely new realm of capability. Importantly, mid-scale infrastructure potentially creates opportunities for parts of NSF beyond the traditionally “facilities-intensive” Directorates.

NSF must find a way to seize these important opportunities. One relatively simple approach is to lower the threshold for MREFC expenditures and develop a nimble, but carefully monitored, process for funding experimental research capabilities in the mid-scale range.
There is no shortage of ideas for Midscale Infrastructure, which can enable creative new discovery, but the resources are hard to come by. The “Big Ideas” initiative may help.
NATIONAL SPACE WEATHER ACTION PLAN

PRODUCT OF THE
National Science and Technology Council

October 2015
The CubeSat Revolution

NRC report 2016

• **Finding:** “A LEO constellation comprising several or dozens of individual small spacecraft could provide both global spatial and high temporal resolution. The understanding of many Earth processes benefit from this kind of observation, including severe weather, cloud formation and evolutionary processes, aerosols or air quality related measurements, atmospheric photochemistry, vegetation, ocean color, and Earth outgoing radiation. Constellations of lower-cost spacecraft also can provide for replenishment over time, allowing technology updates or replacement of failed spacecraft or instruments”.

• **Recommendation:** NSF should consider ways to increase CubeSat opportunities for a broad range of science disciplines going beyond solar and space physics.

[Link: http://www.nap.edu/23503]
CubeSats: Growth of an Industry

Annual number of US CubeSats launched by purpose

Source: NRC report 2016

http://www.nap.edu/23503

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INTRODUCTION

FIGURE 1.3

Top: The number of CubeSats launched per year by mission type.

Bottom: The cumulative number of CubeSats launched by organization. The sudden rise of CubeSat launches in 2013 is from all mission types and provider classes, and the rises in 2014 and 2015 are primarily for the imaging CubeSat constellation by Planet Labs (commercial provider). Data include 2000-2002 OPAL picosatellites characteristic of, but developed prior to, the CubeSat standard. SOURCE: Data from M. Swartwout, St. Louis University, "CubeSat Database," PistachioTables 2.6.3, February 2016, https://sites.google.com/a/slu.edu/swartwout/home/cubesat-database#refs, adjusted and updated by the committee.

Technology (140)
Science (41)
Imaging (151)
Education (78)
Communications (15)
University (131)
NSF (13)
NASA (34)
Military (55)
Commercial (177)
Other Civilian
Government (15)

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“CubeSats meet many of the characteristics of a disruptive innovation”

“Since 2010, the use of CubeSats for science has grown especially rapidly due to NSF’s program and because of an increase of interest within various NASA programs”
These are challenging, and yet exciting, times.
Questions?