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Summary and Analysis of Programs of Interest to the Applied Mathematics and Computational Science Communities in the President's FY 2015 Budget Request

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Introduction

Only a month removed from the final FY 2014 spending decisions in Congress and with the FY 2015 discretionary spending caps largely the same, President Obama released his FY 2015 budget request on March 4th, a month after the required February submission to Congress and with many on Capitol Hill already moving into the appropriations process.

The President proposes significant national investments in agencies and programs critical to the applied mathematics and computational science research communities:

- National Science Foundation (NSF) – $7.255 billion in FY 2015 (1.2 percent above the FY 2014 enacted funding level); DMS would see a decrease of 0.5 percent from the FY 2014 level.
- Department of Energy's Office of Science – $5.11 billion in FY 2015 (0.9 percent above the FY 2014 level), with Advanced Scientific Computing Research increasing 13.2 percent over the FY 2014 level;
- Department of Defense Basic Research – $2.02 billion in FY 2015 (6.9 percent down from the FY 2014 level), with DARPA Defense Research Sciences decreasing by 0.9 percent from the FY 2014 request level.
- National Institutes of Health – $30.4 billion in FY 2015 (0.7 percent over the FY 2014 level).

The budget request presents a very mixed picture in which the President reflects a forecast for research which is in part optimistic, while proposing new programs which appeal to his base in an election year. Based in part on bipartisan supported initiatives such as advanced manufacturing and exascale computing, the request continually touts the virtues of research and education to enable the economy of the future. In addition, the request proposes several new initiatives, such as a competitive graduate medical education program and incentives for colleges and universities which graduate large cohorts of Pell-eligible students, but bases these ideas on difficult offsets and at a time when many in Congress are unable or unwilling to accommodate new proposals. Finally, reflecting the continuing pressures on research, health, and education organizations, the request would squeeze defense basic research accounts in favor of more applied or translational initiatives, would make substantial cuts to provider payments such as indirect medical education, and includes the proposed college rating system trumpeted by the President during his annual State of the Union speech.

Overall, adhering to the two year budgetary framework (P.L. 113-67) passed in December 2013, the budget request includes $1.014 trillion in discretionary spending, a level which is largely consistent with FY 2014. The request also includes the continued partial offset to sequestration in FY 2015. While there is unlikely to be much debate over the overall spending levels, the total investment proposed for individual agencies, accounts, or programs will be adjusted by Congress in the annual appropriations process, especially in areas where substantial changes have been proposed from FY 2014 funding levels.

Regardless, the annual budget request, reflecting nearly nine months of planning and negotiations by the White House Administration, does provide a window into forthcoming plans and priorities. The proposed increases for research, assessment, education, and infrastructure reflect areas of emphasis for the remaining two and a half years of the Obama Administration and benchmarks for which congressional champions will advocate throughout the appropriations process.

Going beyond the budget requests for each agency and the statutory caps, President Obama proposes a new $55.4 billion Opportunity, Growth, and Security Initiative (Opportunity Initiative), which includes numerous spending priorities such as advanced manufacturing, renewable energy, early education, infrastructure, etc. Beyond this stimulus-like fund, the budget proposes an ending of sequestration in FY 2016 and beyond through a combination of spending cuts, nearly $650 billion in added tax revenue, and from deficit reduction resulting from enactment of immigration reform legislation. While none of these politically charged proposals are expected to be taken up by Congress in this election year, it does provide specific initiatives around which Democrats are expected to rally and reinforces the looming fight which must be waged by the next Congress for FY 2016 and beyond with respect to overall spending and the fate of sequestration.

Note: In each of the budget write-ups included in this document, specific funding, which would only be included as part of the Opportunity Initiative detailed above, is highlighted separately where appropriate.

National Science Foundation

The President's FY 2015 budget request includes $7.255 billion for the National Science Foundation (NSF), which is an increase of $83.1 million or 1.2 percent over the FY 2014 enacted level.

- Fundamental research along with strategic investments in areas such as neuroscience, advanced manufacturing and clean energy are highlighted as key components in the budget request that contribute towards building an innovation economy. However, investments in cross-agency initiatives are proposed to decline to allow for more flexibility for divisions to fund the best science in the current flat budget environment.
- The request emphasizes the importance of NSF in preparing a globally competitive workforce through education in science, technology, engineering, and mathematics (STEM), and Education and Human Resources, especially undergraduate education, would see the largest increases across NSF.
- While Congress remains supportive of the basic research supported by NSF and its importance to the U.S. economy, concerns remain over the balance between fundamental research and strategic investments that focus on more applied research.

Research and Related Activities

Research & Related Activities would remain essentially flat (down 0.03 percent) at $5.807 billion.

The Directorates within R&RA do not fare equally relative to the FY 2014 enacted level: from the high end to the low the proposed changes are Social, Behavioral & Economic Sciences (up 6.0 percent), Engineering (up 0.8 percent), Geosciences (up 0.1 percent), Computer and Information Science and Engineering (down 0.1 percent), Mathematical & Physical Sciences (down 0.3 percent), Office of International and Integrative Activities (down 1.6 percent), and Biological Sciences (down 1.8 percent).

Division of Mathematical Sciences

The Division of Mathematical Sciences (DMS) would receive $224.40 million in the FY 2015 budget request, which is a 0.5 percent reduction from the FY 2014 enacted level. DMS's proposed decrease is in the middle of the MPS divisions. The Divisions of Chemistry (CHE) and Materials Research (DMR) would receive small increases (up 0.6 and 0.3 percent respectively) while the Division of Physics (PHY) would decline 1.0 percent and the Division of Astronomical Sciences (AST) would decline 1.2 percent from the FY 2014 level. Looking back to FY 2012, DMS fares the worst of all MPS divisions, with a decrease of 5.6 percent below the FY 2012 level (other divisions range from a 5.0 percent decrease for PHY to a 1.6 percent increase for DMR).

NSF notes that 44 percent of DMS's FY 2015 request would be for new research grants. DMS would contribute to fewer cross-foundational initiative areas as part of an MPS-wide strategy to increase flexibility for individual divisions to fund the best research proposals in a flat budget environment. Initiative investments would still include Research at the Interface of the Biological, Mathematical and Physical Sciences (BioMaPS); Science, Engineering, and Education for Sustainability (SEES); and; support for interdisciplinary research around materials as part of the NSF-wide initiative Cyber-Enabled Materials, Manufacturing, and Smart Systems (CEMMSS). NSF notes that DMS continues to fund core research programs across a number of areas, including algebra and number theory, analysis, applied mathematics, computational mathematics, geometrical analysis and topology, mathematical biology, and various statistical areas.

Details of DMS's activities proposed for FY 2015 include:

- *Participation in BioMaPS:* DMS would contribute $3.0 million, which is a $900,000 increase from the FY 2014 level for innovative research at the interface of mathematical and biological sciences. This amount includes $980,000 for the BRAIN Initiative.
- *Participation in the NSF-wide SEES initiative:* DMS's contribution would be $2.5 million (up $1.5 million from FY 2014) to support development of potentially transformative mathematical, statistical, and computational methods needed for data analysis, modeling, and simulation related to climate, hazards, sustainability, and energy. The request notes that DMS investments would also support training and networking for collaboration between mathematical scientists and domain scientists.
- *Participation in the NSF-wide CEMMSS initiative:* DMS's contribution would be $4.0 million (up $2.0 million from FY 2014) to advance modeling, simulation, algorithms, data analysis, and data management to accelerate discovery in materials science.
- Mathematical Institutes would be flat funded at $29.5 million.
- DMS Contribution to the NSF-wide CAREER program would be $9.38 million (up $250,000 from FY 2014).
- Overall investment in Education programs would be down $4.39 million to $13.99 million as specific programs are ended and support for graduate students and postdoctoral researchers is focused in core programs.

Division of Advanced Cyberinfrastructure

The Division of Advanced Cyberinfrastructure (ACI) would receive $212.29 million in the FY 2015 request, equal to its FY 2014 funding. The ACI budget request no longer breaks out proposed research funding by thematic areas in software and data. Instead, ACI notes that research funding overall would

be down 2.1 percent to $94.15 million. ACI plans a new initiative with the Directorates for Engineering and Social, Behavioral, and Economic Sciences on challenges related to Critical Resilient Interdependent Infrastructure Systems and Processes (CRISP). ACI would contribute $3.0 million to CRISP in FY 2015. ACI will continue to lead the NSF-wide Cyberinfrastructure Framework for the 21st Century Initiative (CIF21), but its contribution would decrease 7.7 percent to $60 million.

NSF-Wide Programs of Interest

NSF would continue to support core research initiatives where basic research that cuts across traditional program boundaries is needed to advance the fields and address major societal issues.

Cognitive Science and Neuroscience
The budget request would support cross-NSF activity in cognitive science and neuroscience at $29 million (an increase of 109.4 percent over the FY 2014 level) as part of NSF's contribution to the Administration's Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative. The initiative focuses on four goals: develop innovative neurotechnologies, models, tools, and approaches to advance neuroscience; identify fundamental relationships among neural activity, cognition, and behavior; transform our understanding of how the brain responds and adapts to changing environments; and train a new generation for a competitive workforce in neuroscience and neuroengineering.

Research at the Interface of Biological, Mathematical, and Physical Sciences (BioMaPS)
BioMaPS would receive $29.3 million (3.2 percent below FY 2014 levels). BioMaPS is a collaboration between the Biological Sciences, Engineering, and Mathematical and Physical Sciences Directorates with the goal of integrating research to gain a better understanding of biological systems, and then use that understanding to develop new technologies, particularly in neuroscience, clean energy and advanced manufacturing.

Cyber-enabled Materials, Manufacturing, and Smart Systems (CEMMSS)
Funding for CEMMSS is proposed at $213.2 million, a decrease of 7.3 percent below the funding provided for similar areas of research in FY 2014. The CEMMSS program was introduced in the FY 2013 budget request to bring together existing NSF investments in smart systems, breakthrough materials, and advanced manufacturing. Through CEMMSS, NSF participates in the Administration's advanced manufacturing programs: Materials Genome Initiative (MGI), the National Robotics Initiative (NRI), and the Advanced Manufacturing Partnership (AMP). The budget request also includes $22 million for the NSF contribution to the Materials Genome Initiative (MGI).

Cyberinfrastructure Framework for 21st Century Science, Engineering, and Education (CIF21)
The budget request also includes $125 million, a 14.2 percent decrease from the FY 2014 level to support the Cyberinfrastructure Framework for 21st Century Science, Engineering, and Education (CIF21) initiative that would include new research networks, data repositories, and new systems to visualize data across disciplines. Through CIF21, NSF plans to continue the Big Data and Computational and Data-enabled Science and Engineering programs; support for software innovation through SI2; and a range of other data and cyberinfrastructure activities.

Clean Energy / Sustainability
Similar to previous budget requests under the Obama Administration, the FY 2015 budget request includes $362 million for fundamental research on clean energy technologies including solar energy and energy efficiency. The budget would also support the cross-agency Science, Engineering, and Education for Sustainability (SEES) initiative at $139 million for FY 2015, 14.1 percent below the FY 2014 level. In FY 2015, NSF plans to focus on existing SEES programs as the initiative moves to sunset in FY 2017. Moving forward, NSF plans to end most SEES programs with the FY 2017 sunset, instead supporting sustainability activities through core programs. One exception is a planned follow-on activity related to water and the water/food/energy nexus.

Secure and Trustworthy Cyberspace (SaTC)
SaTC would be supported at $99.8 million in FY 2015, 20.0 percent below the FY 2014 level. SaTC aligns NSF's investments in cybersecurity to the thrust areas identified in the National Science and Technology Council report, Trustworthy Cyberspace: Strategic Plan for the Federal Cybersecurity Research and Development Program, including inducing change, developing scientific foundations, maximizing research impact, and accelerating transition to practice . For FY 2015, NSF plans to continue SaTC investments while creating a new "large" size category for awards up to $3.0 million.

Integrated NSF Support Promoting Interdisciplinary Research and Education (INSPIRE)
INSPIRE would be supported at $28.0 million in FY 2015, an increase of 3.5 percent over FY 2014. The program was introduced in FY 2012 under former NSF Director Subra Suresh and has been deemphasized since his departure in 2013. INSPIRE will continue to support interdisciplinary research to address scientific problems at the interface of traditional disciplines, but will focus on awards under $1.0 million, eliminating the previous larger award category. INSPIRE is also undergoing a formative assessment in FY 2014 to determine its future.

Innovation
The Innovation Corps (I-Corps) program continues be supported by the Administration with $24.8 million proposed in the FY 2015 budget request, an 11.0 percent increase over FY 2014 enacted level. Through I-Corps, NSF seeks to catalyze technology transfer and entrepreneurship by identifying and fostering research capable of transitioning out of the laboratory, and linking it into a broader network of entrepreneurs, investors, and industry experts. In FY 2015, NSF plans to support up to 189 I-Corps Teams, 15 new I-Corps Sites, and two or more new I-Corps Nodes.

Continued Investment in Young Researchers
The request would provide $212.8 million for the Faculty Early Career Development (CAREER) program, an increase of 1.2 percent over the FY 2014 level. This amount would support 400 new CAREER awards in FY 2015.

STEM Education
NSF remains committed to advancing Science, Technology, Engineering, and Mathematics (STEM) education at all levels. For FY 2015, the Administration again proposed a government-wide reorganization of STEM education programs, with NSF spearheading federal investments in undergraduate and graduate education. In response, NSF would support the following programs:

- *Graduate Research Fellowship program (GRF):* GRF would be supported at $333.4 million, an increase of 11.1 percent over FY 2014 and 37.2 percent over the FY 2013 level. The additional

support would allow NSF to again support 2,000 new fellows in FY 2015 and allow a stipend increase from $32,000 to $34,000. For FY 2015, NSF will continue FY 2013 and FY 2014 efforts to enhance professional development opportunities for fellows through internships in government or industry labs and other experiences.

- *NSF Research Traineeships (NRT):* NRT builds on the Integrative Graduate Education and Research Traineeship (IGERT) program and seeks to be a mechanism for testing innovative graduate training programs and effective graduate education policies. NRT would be supported at $58.2 million in FY 2015, an increase of 5.7 percent over the FY 2014 level. NSF proposes an initial focus in Data-Enabled Science and Engineering. For FY 2015, the program will also provide $7 million for an Innovation in Graduate Education track on development and evaluation of new models for graduate education.
- *Improving Undergraduate STEM Education (IUSE):* IUSE began in FY 2014 as an umbrella program announcement for NSF investments in undergraduate education, replacing programs such as Transforming Undergraduate Education in STEM (TUES), Transforming Undergraduate Biology Education (TUBE), and STEM Talent Expansion Program (STEP), among others. IUSE would receive $118.5 million in FY 2015, 33.2 percent over the FY 2014 level. IUSE aims to maximize the impact of NSF's undergraduate education activities around three goals: improved learning and learning environments, broadening participation in STEM, and building the STEM workforce of tomorrow. The program funds a range of projects from foundational research to large impact studies.
- *Research Experiences for Undergraduates (REU) Sites and Supplements:* Total funding of $75.1 million is requested for FY 2015, a decrease of 0.13 percent from FY 2014, to continue support for enhanced research experiences for students.

Opportunity, Growth, and Security Initiative

The Opportunity Initiative would include $552 million for NSF to support fundamental research and innovation across all disciplines. The initiative would support an additional 1,000 new research grants and additional research and education activities in high priority areas, such as STEM education, neuroscience, cybersecurity, advanced manufacturing, and NRTs.

Sources and Additional Information: The complete FY 2015 NSF budget request can be found at http://www.nsf.gov/about/budget/fy2015/toc.jsp.

National Science Foundation

(In thousands)

	FY 2014 Enacted	FY 2015 Request	FY 2015 Request vs. FY 2014
NSF, total	**7,171,918**	**7,255,000**	**83,082 (1.2%)**
Research and Related Activities	**5,808,918**	**5,807,460**	**-1,458 (0.03%)**
Biological Sciences	721,270	708,520	-12,750 (1.8%)
Computer and Information Science and Engineering	894,000	893,350	-650 (0.1%)
Advanced Cyberinfrastructure	212,290	212,290	--

Engineering	851,070	858,170	7,100 (0.8%)
Geosciences	1,303,030	1,304,390	1,360 (0.1%)
Mathematical and Physical Sciences	1,299,800	1,295,560	-4,240 (0.3%)
Mathematical Sciences	225,640	224,400	-1,240 (0.5%)
Social, Behavioral, and Economic Sciences	256,850	272,200	15,350 (6.0%)
International and Integrative Activities	481,590	473,860	-7,730 (1.6%)
US Arctic Research Commission	1,300	1,400	110 (8.5%)
Education and Human Resources	**846,500**	**889,750**	**43,250 (5.1%)**
Major Research Equipment and Facilities Construction	**200,000**	**200,760**	**760 (0.4%)**
Agency Operation and Award Management	**298,000**	**338,230**	**40,230 (13.5%)**
National Science Board	**4,300**	**4,370**	**70 (1.6%)**
Office of Inspector General	**14,200**	**14,430**	**230 (1.6%)**

Department of Energy

The President's FY 2015 budget request includes $27.9 billion for the Department of Energy (DOE), which is an increase of 2.6 percent over the FY 2014 enacted level.

- The President's budget request would sustain the investment in basic research through the DOE Office of Science, while proposing significant new funding for DOE applied energy programs, including Energy Efficiency and Renewable Energy (EERE) and the Office of Electricity Delivery and Energy Reliability (OE). The Advanced Research Projects Agency-Energy (ARPA-E) would be increased to accelerate the commercialization of new energy technologies.
- The request places a major emphasis on exascale computing, proposing $141 million for the exascale initiative, including $91 million within the Office of Science and $50 million within the National Nuclear Security Administration (NNSA). This emphasis leads the Office of Advanced Scientific Computing Research (ASCR) to receive the largest proposed increase (up 13.2 percent over FY 2014) within the Office of Science.
- Congress has shown bipartisan support for sustaining the federal investment in the basic research programs of the DOE Office of Science and ARPA-E. Congress is less likely to support new investments in the applied technology programs of EERE under the assumption that this R&D is close to commercialization and should more appropriately be funded by industry. The emphasis on smart grid and cybersecurity activities through OE should be well received by Congress.

Office of Science

For the basic research programs of the Office of Science, President Obama would provide $5.11 billion, which is $44.8 million or 0.9 percent above the FY 2014 level.

Advanced Scientific Computing Research
The budget request would provide ASCR with $541.0 million for FY 2015, an increase of $62.9 million or 13.2 percent above the FY 2014 level. Compared to other programs within the Office of Science, ASCR has the highest proposed percentage growth over FY 2014. Other science divisions range from a 17.6 percent cut for Fusion Energy Sciences to a 5.5 percent increase for Basic Energy Sciences. High-energy Physics is also cut while Nuclear Physics and Biological and Environmental Research would receive small increases.

Support for the **Mathematical, Computational, and Computer Sciences Research** activity would increase by $10.4 million or 6.0 percent to $182.9 million compared to the FY 2014 level. DOE would increase funding for core research activities in Applied Mathematics (up 5.4 percent from FY 2014 to $52.2 million), Computer Science (up 6.8 percent to $58.3 million), and Next Generation Networking for Science (up 22.4 percent to $19.5 million). Computational Partnerships would be flat at $46.9 million. These gains would follow large gains in FY 2014 across ASCR, leaving all programs with double digit percentage increases between FY 2013 and FY 2015. Applied Mathematics would be up 20.3 percent from FY 2013.

Within Applied Mathematics, increased funding would support ASCR's focus on exascale and data-intensive science through efforts to develop models, algorithms, and methods for analyzing and

understanding data at extreme scale simulations and experiments. Computational Partnerships will continue its focus on data-intensive science through the Scalable Data Management Analysis and Visualization (SDAV) Institute and data-intensive Co-Design Center.

As in the FY 2014 request, no funding would be provided for the Computational Science Graduate Fellowships as part of the Administration's larger consolidation of STEM programs across the federal government. In FY 2014, Congress restored $10 million to DOE Office of Science STEM programs that were proposed for consolidation. Of this amount, CSGF received $8.7 million in FY 2014 ($2.7 million over the FY 2012 level, the last year for which there is funding information).

In contrast to the research side of ASCR, the **High Performance Computing and Network Facilities** activity would see a large increase of 17.2 percent to $358.1 million. Leadership Computing Facilities would receive $184.6 million, a 15.4 percent increase, while Research and Evaluation Prototypes would receive $57.9 million, 53.3 percent above the FY 2014 level. Following the additional large increases for the activity in FY 2014, High Performance Computing and Network Facilities in FY 2015 would be up 35.9 percent over the FY 2013 level.

Other DOE Programs of Interest

The largest program within the Office of Science is **Basic Energy Sciences**, which the President proposes to support at $1.81 billion in FY 2015, an increase of 5.5 percent above the FY 2014 level. Within BES, the budget request would continue support for the Fuels from Sunlight Hub and the Batteries and Energy Storage Hub as planned and support the Energy Frontier Research Centers (EFRCs) at the FY 2014 enacted level of $100 million. BES also plans to make new investments of $24.2 million in computational materials sciences to integrate modeling and experimental research as well as develop codes and software for materials design.

Consistent with the Obama Administration's support for transformative energy technologies that can be commercialized, **ARPA-E** is slated for an increase of 16.1 percent to a proposed $325 million, continuing its two primary thrusts of transportation systems and stationary power systems. ARPA-E plans for the third time to release an open solicitation for proposals from across the spectrum of energy technologies. Four to five additional focused programs are also planned.

Sources and Additional Information: DOE's FY 2015 budget materials can be found at http://energy.gov/cfo/downloads/fy-2015-budget-justification.

Department of Energy

(In thousands)

	FY 2014 Enacted	FY 2015 Request	Request vs. FY 2014
DOE, total	**27,224,810**	**27,940,428**	**715,618 (2.6%)**
Science	**5,066,372**	**5,111,155**	**44,783 (0.9%)**
Advanced Scientific Computing Research	478,093	541,000	62,907 (13.2%)

Mathematical, Computational, and Computer Sciences Research	172,447	182, 875	10,428 (6.0%)
Applied Mathematics	49,500	52,155	2,655 (5.4%)
Computational Partnerships	46,918	46,918	--
High Performance Computing and Network Facilities	305,646	358,125	52,479 (17.2%)
Basic Energy Sciences	1,711,929	1,806,500	94,571 (5.5%)
Biological and Environmental Research	609,696	628,000	18,304 (3.0%)
Fusion Energy Sciences Program	504,677	416,000	-88,677 (17.6%)
High-energy Physics	796,521	744,000	-52,521(6.6%)
Nuclear Physics	569,138	593,573	24,435 (4.3%)
Workforce Development for Teachers and Scientists	26,500	19,500	-7,000 (26.4%)
Science Laboratories Infrastructure	97,818	79,189	-18,629 (19.0%)
EERE	**1,913,441**	**2,321,962**	**408,521 (21.4%)**
Hydrogen and Fuel Cell Technology	92,928	92,983	55 (0.1%)
Bioenergy Technologies	232,290	253,200	20,910 (9.0%)
Solar Energy	257,058	282,300	25,242 (9.8%)
Wind Energy	88,126	115,000	26,874 (30.5%)
Geothermal Technology	45,775	61,500	15,725 (34.4%)
Water Power	58,565	62,500	3,935 (6.7%)
Vehicle Technologies	289,737	359,000	69,263 (23.9%)
Building Technologies	177,868	211,700	33,832 (19.0%)
Advanced Manufacturing (formerly Industrial Technologies)	180,471	305,100	124,629 (69.1%)
Federal Energy Management Program	28,248	36,200	7,952 (28.2%)

Electricity Delivery and Energy Reliability	**147,242**	**180,000**	**32,758 (22.2%)**
Nuclear Energy	**888,376**	**863,386**	**-24,990 (2.8%)**
Fossil Energy Research and Development	**570,431**	**475,500**	**-94,931 (16.6%)**
ARPA-E	**280,000**	**325,000**	**45,000 (16.1%)**
DOE Defense Activities	**16,962,000**	**17,738,538**	**776,538 (4.6%)**
Weapons Activities	7,781,000	8,314,902	533,902 (6.9%)
Defense Nuclear Nonproliferation	1,954,000	1,555,156	-398,844 (20.4%)
Defense Environmental Cleanup	**5,000,000**	**5,327,538**	**327,538 (6.6%)**

Department of Defense

In the FY 2015 President's budget request, the basic research (6.1) programs at the Department of Defense (DOD) would receive $2.02 billion, which is $149 million or 6.9 percent below the FY 2014 level.

- The President's FY 2015 budget request for the Department of Defense (DOD) reflects an ongoing debate about the size and direction of the nation's armed forces as the war in Afghanistan winds down. Constrained total spending levels force the Administration to propose a future military that is leaner, more agile, and more technologically advanced; President Obama's budget request for FY 2015 illustrates those goals.
- RDTE accounts, and particularly the S&T activities, would decline less than other areas of the defense budget. Within S&T funding, after years of robust funding for basic research championed by former Secretary Robert Gates, the budget would place a greater emphasis on applied research and advanced technology development accounts, indicating DOD's desire to push more technologies through the development pipeline.
- The President's budget request for DOD will be hotly debated during the FY 2015 defense appropriations and authorization processes. While many Members of Congress support defense research, some lawmakers have argued for prioritizing increased spending on training, operations, and readiness and may seek deeper cuts to research accounts as an offset.

Within the individual military branches, funding for basic research would see the biggest decrease within the Air Force, where it would fall 13.4 percent to $454.5 million. The **Air Force Mathematics, Information, and Life Sciences** account would fall 18.6 percent to $97.6 million. The Office of Naval Research also plans to decrease its investment in **Navy Mathematics, Computer, and Information Sciences** by 24.0 percent to $36.7 million.

Specific priorities for DOD S&T programs outlined in the President's budget request include cybersecurity, power projection, autonomy, space, electronic warfare, efforts to counter weapons of mass destruction, and advanced weapons development. These topics are consistent with the S&T priorities previously outlined by DOD, which Acting Assistant Secretary of Defense for Research and Engineering Al Shaffer has indicated will continue to guide the Department's investment strategy going forward. Other DOD research priorities identified in the President's FY 2015 budget request include mental health, renewable energy development, and neuroscience research through the interagency BRAIN initiative.

While DARPA overall would receive a 4.9 percent increase to $2.9 billion, the **DARPA Defense Research Sciences** basic research account would fall slightly to $312.1 million (down 0.9 percent from FY 2014). Even with the proposed decrease, Defense Research Sciences would still be 14.0 percent up from its FY 2013 level.

Within DARPA's basic research programs, increases would go to Math and Computer Sciences (up 25.6% to $114.3 million) and Cyber Sciences (up 8.7% to $28.6 million). Materials (down 0.3% to $85.5 million), Bio/Info/Micro Sciences (down 15.0% to $21.1 million), Transformative Sciences (down 24.4% to $32.2 million), and Electronic Sciences (down 31.6% to $30.3 million) would all see decreases.

Within the Math and Computer Sciences program, several new programs are proposed including: Transparent Computing ($10 million), Human and Computer Symbiosis ($10 million), and Cortical Processor ($2.3 million).

The **National Defense Education Program (NDEP)**, which previously included SMART scholarships and fellowships for undergraduate and graduate students in STEM fields critical to DOD, the National Security Science and Engineering Faculty Fellowships (NSSEFF), and K-12 STEM initiatives, would receive $45.5 million in FY 2015, a decrease of 41.1 percent from FY 2014. Much of this decrease would be the result of the movement of NSSEFF to a separate account under Basic Research Initiatives. NSSEFF would still be funded at $33.2 million, 7.4 percent above the FY 2014 level. K-12 STEM initiatives under NDEP were ended in FY 2014 as part of the government-wide STEM consolidation. SMART would continue at $45.5 million, a decrease of 1.8 percent.

In contrast to NDEP, the Navy is placing substantial emphasis on STEM education and proposes to fund its **Science and Engineering Education, Career Development and Outreach** account at $47.2 million, up 11.0 percent from FY 2014 and 42.4 percent over the FY 2013 level. Funding is planned for new efforts on teacher training, retention in STEM majors at Minority Serving Institutions, and computer science programs for undergraduates, among others.

Sources and Additional Information: Complete details of the FY 2015 DOD budget request are at http://comptroller.defense.gov/budgetmaterials/budget2015.aspx.

Department of Defense

(In thousands)

	FY 2014 Enacted	FY 2015 Request	Request vs. FY2014
RDTE, total*	**63,100,093**	**63,533,947**	**433,854 (0.7%)**
S&T, Total	**12,008,545**	**11,514,568**	**-493,977 (-4.1%)**
6.1, Total	2,166,598	2,017,502	-149,096 (6.9%)
6.2, Total	4,641,173	4,457,042	-184,131 (4.0%)
6.3, Total	5,200,774	5,040,024	-160,750 (3.1%)
Army RDTE	7,136,181	6,593,898	-542,283 (-7.6%)
Army Basic	436,493	424,176	-12,317 (-2.8%)
Army Applied	954,451	862,611	-91,840 (-9.6%)
Army ATD	1,063,636	917,791	-145,845 (-13.7%)
Navy RDTE	14,980,755	16,266,335	1,285,580 (8.6%)
Navy Basic	619,234	576,339	-42,895 (-6.9%)

Navy Applied	859,469	820,883	-38,586 (-4.5%)
Navy ATD	623,614	595,014	-28,600 (-4.6%)
Air Force RDTE	23,580,637	23,739,892	159,255 (0.7%)
Air Force Basic	524,770	454,490	-70,280 (-13.4%)
Air Force Applied	1,146,421	1,081,133	-65,288 (-5.7%)
Air Force ATD	636,442	593,817	-42,625 (-6.7%)
DW RDTE	17,156,429	16,766,084	-390,345 (-2.3%)
DW Basic	586,101	562,497	-23,604 (-4.0%)
DW Applied	1,680,832	1,692,415	11,583 (0.7%)
DW ATD	2,877,082	2,933,402	56,320 (2.0%)

*Includes Overseas Contingency Operations funding.

National Institutes of Health

The President's FY 2015 budget request includes $30.4 billion for the National Institutes of Health (NIH), which is a $211 million (0.7 percent) increase above the FY 2014 level of $30.2 billion.

- The Obama Administration has positioned certain NIH programs, such as the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative, Big Data, Alzheimer's disease research, and the new Accelerating Medicines Partnership (AMP), at the center of its Opportunity, Growth, and Security Initiative. The Opportunity Initiative would provide an additional $970 million for NIH, bringing it to a total level of $31.3 billion. However, this increase would require that Congress provide supplemental funding and breach the caps set in the budget agreement, which is unlikely to occur, particularly in an election year.
- A new emphasis in the FY 2015 budget request focuses on research to tailor treatments to patients' unique characteristics, known as "precision medicine." Included in this category is the National Center for Advancing Translational Sciences (NCATS) effort to reengineer drug discovery and development in collaboration with industry, academia, the Food and Drug Administration (FDA), the Defense Advanced Research Projects Agency (DARPA), and the Cures Acceleration Network (CAN), which has yet to receive funding sufficient to award extramural grants.
- In the wake of sequestration and the government shutdown, bipartisan support for NIH has seemingly grown as lawmakers decried the effect of cuts and funding disruptions on the nation's biomedical research enterprise. Despite the community's calls for at least restoration of the 5 percent sequestration cut, given the political and budget pressures of an election year, funding beyond the Administration's request for NIH is unlikely in FY 2015.

The **National Institute of General Medical Sciences** (NIGMS) would be essentially flat at $2.369 billion (up 0.3 percent from FY 2014). Funding for the division of Biomedical Technology, Bioinformatics, and Computational Biology (BBCB) would increase 0.4 percent from the FY 2014 level to $239.8 million. NIGMS would also add a new program called Innovative Programs to Enhance Research Training (IPERT) to support innovative training of the biomedical research workforce.

NIH Initiatives of Interest

The President's FY 2015 budget request highlights several new and continuing NIH initiatives of interest to the applied mathematics and computational science community:

"DARPA-like" Innovation Program
Placing additional emphasis on research innovation, the Administration is proposing a new $30 million Common Fund program modeled after DARPA's flexible funding mechanism that would allow the NIH program office or project leader to put together a team of extramural researchers to tackle specific biomedical challenges and achieve rapid technology development. At the Department of Health and Human Services budget briefing on March 4 and in the NIH Congressional Justification Overview, NIH Director Francis Collins cited as an example a Bioelectronic Medicines project that would seek to establish methodologies to control the function of physiologic systems, potentially leading to a new class of neural control devices.

BRAIN Initiative
The budget request would provide $100 million for the BRAIN Initiative at NIH in FY 2015. This would be a $60 million increase above the $40 million NIH is awarding in FY 2014 and would complement investments at the National Science Foundation (NSF) and DARPA, resulting in a $200 million total investment by the three agencies. The NIH portion of the multi-agency project aims to develop new tools to map brain circuits, measure activity within these circuits, and understand how they dictate human cognition and behavior. See the interagency section of this report for additional information.

Biomedical Workforce
The budget request highlights the need for a diverse and highly creative workforce and puts its support behind programs that provide support to the investigator rather than the project, such as the **NIH Director's Pioneer Award**, the **New Innovator Award**, and the **Early Independence Award**. The budget request document emphasizes NIH's efforts to recruit and mentor young people from traditionally underrepresented backgrounds interested in science careers. Additionally, the budget request would provide $767 million for the **Ruth L. Kirschstein National Research Service Awards (NRSA)** program and proposes a 2 percent stipend increase in FY 2015.

Big Data
The budget request highlights NIH's **Big Data to Knowledge (BD2K)** initiative and the Centers of Excellence that are slated to help solve Big Data problems and remove barriers that impede understanding of new diseases and development of new treatments. Through the Common Fund and contributions from institutes and centers, NIH plans to invest $88 million in the BD2K initiative in FY 2015.

Sources and Additional Information: NIH's FY 2015 budget materials can be found at: http://officeofbudget.od.nih.gov/br.html.

National Institutes of Health
(In millions)

	FY 2014 Enacted	FY 2015 Request	Request v. FY 2014 Enacted
NIH total	**30,151**	**30,362**	**211 (0.7%)**
National Cancer Institute (NCI)	4,923	4,931	8 (0.2%)
National Heart, Lung, and Blood Institute (NHLBI)	2,983	2,988	5 (0.2%)
National Institute of Dental and Craniofacial Research (NIDCR)	397	397	--
National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK)	1,881	1,893	12 (0.6%)
National Institute of Neurological Disorders and Stroke (NINDS)	1,586	1,608	22 (1.4%)
National Institute of Allergy and Infectious Diseases (NIAID)	4,393	4,423	30 (0.7%)
National Institute of General Medical Sciences (NIGMS)	2,362	2,369	7 (0.3%)
Institutional Development Award	273	273	--

(IDeA)			
Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD)	1,281	1,283	2 (0.2%)
National Eye Institute (NEI)	674	675	1 (0.2%)
National Institute of Environmental Health Sciences (NIEHS)	665	665	--
National Institute on Aging (NIA)	1,169	1,171	2 (0.2%)
National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS)	519	520	1 (0.2%)
National Institute on Deafness and Other Communications Disorders (NIDCD)	403	404	1 (0.25%)
National Institute of Mental Health (NIMH)	1,417	1,440	23 (1.6%)
National Institute on Drug Abuse (NIDA)	1,016	1,023	7 (0.7%)
National Institute on Alcohol Abuse and Alcoholism (NIAAA)	445	446	1 (0.2%)
National Institute of Nursing Research (NINR)	140	140	--
National Human Genome Research Institute (NHGRI)	497	498	1 (0.2%)
National Institute of Biomedical Imaging and Bioengineering (NIBIB)	326	329	3 (0.9%)
National Institute on Minority Health and Health Disparities (NIMHD)	268	268	--
National Center for Complementary and Alternative Medicine (NCCAM)	124	125	1 (0.8%)
National Center for Advancing Translational Sciences (NCATS)	632	657	25 (4.0%)
Cures Acceleration Network (CAN)	9.8	29.8	20 (204.1%)
John E. Fogarty International Center (FIC)	67	68	1 (1.5%)
National Library of Medicine (NLM)	375	381	6 (1.6%)
Office of the Director (OD)*	1,400	1,452	52 (3.7%)
Common Fund	533	583	50 (9.4%)
Building and Facilities	129	129	--

Interagency Program

Networking and Information Technology Research and Development Program

The President's budget request includes $3.79 billion for the Networking and Information Technology Development Program (NITRD), which is $114 million or 2.9 percent lower than the FY 2014 estimated level. NITRD is an interagency program that plans and coordinates individual federal research agency funding and initiatives in cyberinfrastructure and information technology. As in previous budget requests, the FY 2015 budget request would further support a focus on big data, to better capture, manage, and process large heterogeneous data sets, such as those produced by satellites, telescopes, genome sequencing technologies, and particle accelerators. Additionally, the budget request would continue to prioritize cybersecurity research, as outlined in *Trustworthy Cyberspace: Strategic Plan for the Federal Cybersecurity R&D Program*, a report on how to best coordinate federal cybersecurity research priorities across federal agencies. Other ongoing NITRD research areas include information assurance, health IT, wireless spectrum sharing, cloud computing, high-end computing systems, advanced networking, software development, and high-confidence systems.

Sources and Additional Information: The President's Budget Request for FY 2015 for NITRD can be viewed at: http://www.whitehouse.gov/sites/default/files/microsites/ostp/Fy%202015%20R&D.pdf. More information on NITRD is available at http://www.nitrd.gov/, and additional budget request details should be posted there within approximately 6 weeks under the FY 2015 NITRD Supplement to the President's Budget. The Trustworthy Cyberspace strategic plan is available at http://www.whitehouse.gov/sites/default/files/microsites/ostp/fed_cybersecurity_rd_strategic_plan_2011.pdf.

The table below outlines the proposed NITRD funding contributions for each participating agency:

Networking and Information Technology Research and Development Program

(In thousands)

	FY 2014 Estimate	FY 2015 Request	Request vs. FY 2014 Estimate
NITRD, total	**3,900,000**	**3,786,000**	**-114, 000 (2.9%)**
NSF	1,160,000	1,158,000	-2,000 (0.2%)
DOE	583,000	637,000	54,000 (9.3%)
DOC	146,000	151,000	6,000 (3.8%)
DOD	1,231,000	1,084,000	-146,000 (11.9%)
DHS	92,000	79,000	-13,000 (13.6%)
HHS*	566,000	560,000	-6,000 (1.1%)
NASA	116,000	109,000	-7,000 (5.6%)

All Other	8,000	8,000	--

NOTE: numbers in the chart are rounded to the nearest million, due to this rounding, numbers may not add up.
*HHS includes funds from offsetting collections for Agency for Healthcare Research and Quality (AHRQ).