

The comments are clearly meant for Congress, which has frequently meddled with NASA, mostly to protect the workforces at the agency's 10 centers. NASA's current authorizing legislation, enacted last year, prohibits the layoff of any of NASA's 18 000 employees through the end of the 2010 calendar year. According to the report, though, only a small fraction of NASA workers can be considered to possess critical skills that the space program must retain. But since the agency must keep its existing workforce and facilities configuration, at least for now, it is forced to produce in-house items that could be purchased commercially for less.

In an interview with *PHYSICS TODAY*, former NASA administrator Michael Griffin said he "couldn't agree more" with the report's admonitions about management, but he noted that a significant restructuring would require "finding a congressman to raise his hand and say it's okay to close the center in his district." Although "you could run NASA effectively with fewer centers," Griffin said, he would leave the federal workforce untouched. The agency operates the same number of facilities today, he said, as it did in the peak years of the Apollo program in the 1960s, when it had twice the workforce it has now and, in inflation-adjusted terms, twice the budget.

Griffin suggested that any

downsizing of NASA will require a process analogous to the Defense Base Closure and Realignment Commission (BRAC), which took decisions on post-cold war closings of military bases out

of the hands of lawmakers. Other civilian research facilities, including the Department of Energy's national laboratories, should be included in the exercise, he added.

John Logsdon, emeritus director of the Space Policy Institute at the George Washington University, agrees that congressional interference has been "a significant obstacle" to streamlining NASA. Some procedure outside the political arena will be needed to make the workforce and facilities adjustments, he says, but with only 10 NASA centers, a BRAC approach isn't likely to work. Given that downsizing has been needed for decades, Logsdon says he's not optimistic it will happen soon.

Other restrictions and practices impair NASA's ability to make effective use of US industry, the report says. Examples include the inability to use loan guarantees and mechanisms that other agencies, such as the Department of Defense, have used to create a market and attract private investment from commercial suppliers. The committee also was critical of the "spiral development" model that NASA has used for the procurement of some items. The report notes that the model, in which the requirements for an engineering project aren't known at the outset and are determined as the item is being built, "inevitably leads to a very expensive result."

David Kramer



A prototype of the Ares-1 rocket, which will carry astronauts into space in the coming decade, blasts off from NASA's Kennedy Space Center on 29 October. An advisory committee has recommended changes to NASA's human space exploration program.

DOE names winners of long-shot energy research grants

Billions of dollars will flow into 'smart grid' projects.

A broad portfolio of 37 risky concepts for the production of clean energy were selected on 26 October for funding by the Department of Energy's new Advanced Research Projects Agency (ARPA-E). The following day, President Obama announced that DOE will hand out a total of \$3.4 billion to 100 utilities and other energy companies to spur modernization of the US electricity grid.

In a speech at Google Inc's headquarters in Mountain View, California, Secretary of Energy Steven Chu said the \$151 million in ARPA-E awards comprises "a portfolio of bold new research

projects, any one of which could do for energy what Google did for the internet." ARPA-E was authorized in 2007 legislation but was not funded until this year. Its role is to support long-shot carbon-free energy concepts that could produce breakthrough technologies if successful. All the awards went to projects headed by academic researchers or companies both large and small; national laboratories were relegated to partnering with several of the awardees. The selected projects span renewable energy, energy storage, industrial and building efficiency, petroleum-free vehicles, and carbon capture. A

number of awards will support work on advanced battery concepts, such as a \$6.9 million effort by MIT researchers to make a low-cost, all-liquid, metal cell with the potential to store enough electricity to smooth out the inherent peaks and valleys in wind and solar energy generation.

Several ARPA-E grants will fund novel approaches to capturing carbon dioxide emissions from fossil power generation. One of those is a \$2.2 million project at United Technologies Inc to mimic an enzymatic process by which the body captures CO₂ from cells, transports it through the bloodstream,

and exhales it through the lungs. Other projects will attempt to transform sunlight directly into motor fuel; those include a \$2.2 million University of Minnesota effort to use two organisms in symbiosis to produce gasoline from sunlight and CO₂. An MIT spinoff, 1366 Technologies Inc., received \$4 million for a photovoltaic technology that could produce high-efficiency, single-crystal silicon wafers directly from molten silicon. The process offers the potential for cutting the cost of photovoltaic installations by half, the company says.

A team of companies led by Momentive Performance Materials in Albany, New York, will get \$4.5 million to develop a low-cost manufacturing process for LEDs for solid-state lighting applications. "The transition to LED-based SSL would have enormous impact on everyday life, from substantial energy savings to revolutionary design and applications in general illumination," said Eric Thaler, Momentive's chief technology officer.

Chu remarked on the "stunning level of interest" shown for the program and said ARPA-E had received 3700 concepts in response to an initial solicitation of interest last April. The agency then invited 300 of those hopefuls to submit formal proposals, which were then prior-

tized by 500 expert reviewers. ARPA-E will award its remaining \$249 million from fiscal year 2010 funds through a second solicitation in the coming months.

Big money for smart grid

Obama announced the smart-grid awards in a 27 October speech at a large solar-generating station in Florida. He said that once completed, the nation's more efficient electricity generation, transmission, and distribution system will save consumers \$20 billion over 10 years on their utility bills. The 100 grants, ranging from less than \$1 million to \$200 million, also should make the grid better able to accommodate new supplies of renewable energy.

Awards will finance installation of 18 million smart meters, for 13% of US homes. The two-way devices, already installed in some markets, give customers the ability to monitor their electricity use in real time and can eliminate the need for manual meter reading by utility companies. More important, as utilities shift to electricity pricing that changes with peak and off-peak demand, consumers will be able to choose when to buy power and can program new smart appliances to run when rates are low. The grants will also pay for the replacement of 200 000

transformers and the automation of 700 substations—5% of the US total. Hundreds of sensors called phasor measurement units are to be installed to improve monitoring of grid conditions and help prevent minor disturbances from cascading into power outages or blackouts.

The winning utilities, selected from 400 applicants, will put up another \$4.7 billion of their own capital for the grid upgrades. The Electric Power Research Institute estimates that the full implementation of smart-grid technologies could cut US electricity use by more than 4% from today's levels by 2030.

The grid awards were by far the largest single disbursement from the \$39 billion DOE received from the American Recovery and Reinvestment Act. They eclipse the \$2.4 billion in DOE grants announced in August for accelerating the development and manufacturing of electric vehicle components. In September Chu announced that \$144 million in ARRA monies would be distributed to pay for smart-grid workforce training programs and for state public utility commissions to hire new staff and retrain employees to review electricity project proposals.

David Kramer

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