

diagrams, and road maps. Obviously, only devoted science managers can keep track of the oversized research networks that the scientists feel obliged to create in order to compete in the funding game. These new professional groups decrease the total research budget available for scientists without improving the quality of science.

The increasing bureaucratic load also decreases the willingness of top scientists to volunteer for review panels of grant applications and for evaluations of research programs. Thus the reviews sometimes are not based on good scientific standards. Unfortunately, means to correct unfair decisions are practically nonexistent in EU funding, which clearly lags behind, for example, the US National Institutes of Health, where the applicants are advised on how to improve their application for the next round.

It might be wise to consider alternative and complementary funding approaches. One possibility is to improve methods for recognizing top research teams and scientists (not necessarily the ones who can, or have time to, write the best research plans) and to fund them with risk (similar to the venture capitalist model), as long as their productivity stays high. Previous achievements continue to be the best means to predict future success; according to our experience, looking in the rearview mirror works at all stages of research and thus is fair for scientists at all levels of professional maturity.

As considerable amounts of citizens' money are spent on research, everybody—including the scientist—has the right to expect that the money will be used wisely. Present funding practices should be examined and discussed openly. We propose that some large funding body study the effectiveness of different funding and evaluation approaches by applying both open-minded science measures and more strict R&D criteria, and then following the results for the long term. Such a study would also benefit national funding agencies.

To cite Richard Feynman: "The rate of the development of science is not the rate at which you make observations alone but, much more important, the rate at which you create new things to test." Such new things emerge only as research progresses; they are not known in advance. At each milestone, the scientist must study all possible directions, but doing

so requires freedom, continuity of funding, and time to think—without wasting energy on irrelevant tasks.

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Nuclear Pit Facility's Merits, Snags, and Timelines

In the June 2004 issue of PHYSICS TODAY (page 34), Jim Dawson reports on the American Physical Society (APS) discussion paper, published in April 2004, about a modern pit facility. That paper evaluates an MPF based on an overly optimistic combination of assumptions that obviate the need for planning such a facility. A parametric evaluation of the stockpile plan recently delivered to Congress and the current estimates of pit lifetimes by the National Nuclear Security Administration weapon laboratories show that continuous planning for an MPF is prudent risk management to meet national security needs.¹

The NNSA advocates managing the risks to national security by uninterrupted planning for an MPF while obtaining further information for acquisition decisions. For example, initial results from accelerated pit-aging experiments and from the inevitable aging effects of plutonium on weapon performance are expected in 2007. The APS position paper advocates a high-risk approach of deferring or curtailing the MPF project until such information is available. The NNSA plan for an MPF includes a series of major system-acquisition critical decisions in 2007, in 2009, and at the start of construction in 2012. Based on the current plan, the Secretary of Energy will not be making irreversible decisions on constructing an MPF until early in the next decade. That is well beyond the 2006 minimum date suggested by the APS position paper for making such decisions.

The APS paper is replete with examples of unrealistic optimism and factual errors. Some examples include discounting the challenges of upgrading production capacity to 80 pits per year at the Los Alamos National Laboratory TA-55 facility or rapidly enhancing production out-

puts in a future facility. Although a small capacity of 125 pits per year is the most likely path forward, the MPF environmental impact statement provides analyses for capacities of 125 to 450 pits per year, not because of a desire to maintain large stocks of undeployed warheads as suggested by the APS paper, but to ensure that the maximum potential environmental impacts of an MPF have been considered for National Environmental Policy Act compliance purposes. APS asserts that pits in storage at the Pantex plant in Amarillo, Texas, could be used as replacements and thus obviate the need for a new facility. However, that assertion lacks technical foundation because pits stored at Pantex will age similarly to pits that are stockpiled.

Deferral of MPF planning, which was suggested in the APS paper, would negatively affect plans for a responsive pit manufacturing infrastructure that may be pivotal to further reducing the number of stockpile warheads—a cost-saving move for the nation. Similarly, the capability to manufacture replacement pits eliminates weapon-performance uncertainties that result from plutonium aging and is consistent with maintaining the moratorium on nuclear testing.

Current plans afford numerous review opportunities until early in the next decade. National security for the US should be based on a prudent assessment of risks and not the overly optimistic and unrealistic evaluation contained in the APS position paper. Early planning and development are essential to avoid cost overruns and delays.

Reference

1. US Department of Energy, National Nuclear Security Administration, *Report to Congressional Defense Committees on "An Enhanced Schedule for the Modern Pit Facility"*, February 2004. Available at http://www.fcml.org/pdfs/nuc_mpfreport.pdf.

Everet Beckner

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Dawson replies: For comment, we contacted Steve Fetter, chair of the national security subcommittee of the APS Panel on Public Affairs, and Frank von Hippel, POPA's chair.

Fetter and von Hippel comment: Everet Beckner, the National Nuclear Security Administration's

deputy administrator for defense programs, addresses the issues of manufacturing capacity and pit longevity. The starting point for APS's Panel on Public Affairs (POPA) discussion paper *The Modern Pit Facility*¹ was NNSA's June 2003 draft environmental impact statement (EIS) on the proposed construction of a modern pit facility.²

The draft EIS specified an MPF with a single-shift production capacity of up to 450 plutonium pits per year and a construction schedule that assumed that the pits currently in the US stockpile will need replacement when they are 45 years old.

The APS panel questioned those assumptions and actively sought appropriate input. NNSA-supported scientists contributed significantly to our analysis and NNSA officials had draft copies of our report in October 2003. The report then underwent the APS approval process, while NNSA revised its analysis. In its February 2004 report to Congress, NNSA lowered the MPF base production capacity to 125 pits per year and raised the assumed pit longevity to 60 years. NNSA changed its capacity and longevity assumptions in a man-

ner consistent with the POPA report.

Beckner also criticizes the POPA recommendation for an outside feasibility study of increasing the capacity of the existing pilot pit production line in the TA-55 facility at Los Alamos National Laboratory. We made that recommendation because NNSA has backed away, without adequate explanation, from its own estimate that the single-shift production capacity at TA-55 could be increased to 50–80 pits per year and, with an added wing, to 150 pits per year.

Perhaps the most important contribution of the POPA paper was to point out that, although a production facility is necessary, its requirements need careful reexamination, and the possibility of early production of pits at TA-55 offers considerable leverage. Congress recently suspended fiscal year 2005 funding for MPF site selection and requested a report on production requirements. That wise course of action is recognition that the need for an MFP is not urgent and there is adequate time to explore key science issues relating to pit longevity.

References

1. *The Modern Pit Facility*, April 2004,

http://www.aps.org/public_affairs/popa/reports.

2. US Department of Energy, National Nuclear Security Administration, *Modern Pit Facility Draft Environmental Impact Statement*, NNSA, Washington, DC (4 June 2003). Available at <http://www.mpfais.com>.

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Cause and Effect in Global Warming

I read Phillip Morrison's review of Spencer R. Weart's book, *The Discovery of Global Warming*, in the June 2004 issue of PHYSICS TODAY (page 60). Weart's book contains four graphics and other evidence that apparently convinces Morrison of global warming's causes.

There is evidence of increasing global temperatures and increasing atmospheric carbon dioxide concentrations. Morrison is convinced that

PRECISION MEASUREMENT GRANTS

The National Institute of Standards and Technology (NIST) expects to make two new Precision Measurement Grants that start on 30 September 2005. Each grant is in the amount of \$50,000 per year and may be renewed for two additional years for a total of \$150,000. They are awarded primarily to faculty members at U.S. universities or colleges for research in the field of fundamental measurement or the determination of fundamental physical constants.

Applications must reach NIST by 4 February 2005. Details are on the Web at: physics.nist.gov/pmg.

For further information contact:

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