

monitoring and detecting underground explosions has been refined to the point where cheating is nearly impossible anywhere in the world, Browne said. The task force also called for serious negotiations with Russia toward a follow-on arms control agreement to replace the Strategic Arms Reduction Treaty, which expires at the end of 2009, with the goal of further reductions in their stockpiles.

Labs seek direction

With so little weapons work to do, the national laboratories and other weapons infrastructure are increasingly looking outside NNSA for work. "We have a vast amount of expertise that is not available anywhere else . . . including sensor and detection technology, high-performance computing, microsystems, chemical and biological detection technology, and explosives science," D'Agostino said.

The weapons design laboratories, LLNL and LANL, each have shed 2000 employees over the past two years, LLNL director George Miller said. Capabilities developed in the design of nuclear weapons frequently have applications elsewhere. One example is nuclear forensics, the science of pinpointing the origins of a nuclear device that terrorists might detonate. In that highly specialized field, he said, "it takes a nuclear weapons designer to find [another designer]." But lacking new weapons projects to design and build has made it increasingly difficult for the labs to recruit a new generation of scientists and engineers. As Chilton noted, "you can study rocket science for as long as you want, but if you don't build a rocket factory, you can't get to the Moon." The task force report calls for broadening the missions of the weapons laboratories to include energy security, a change that could help them recruit and retain new talent.

Miller said many policymakers mistakenly believe that the science-based stockpile stewardship program, which had brought billions of dollars in new experimental facilities and supercom-

puting capabilities to the weapons labs since the cessation of nuclear testing in 1992, has been completed. In fact, major new facilities such as the National Ignition Facility at LLNL and the Dual-Axis Hydrodynamic Radiographic Test Facility at LANL are just now coming on line, and years of experiments designed to spot potential flaws in the nuclear arsenal lie ahead.

Science on the cheap

The missions of the national laboratories have grown dramatically over the past several decades, said Frances Fragos Townsend, former homeland security adviser to President Bush; they now include increasing amounts of "work for others" performed under contracts with federal agencies such as Defense and Homeland Security. Townsend, who is cochairing a task force for the Henry L. Stimson Center that is looking into leveraging the national laboratories' S&T capabilities, said DOE has become the "landlord for a significant share of the national security S&T capabilities needed throughout the government." But she said the DOE labs "have provided science on the cheap" for those agencies, which haven't been required to share the cost of necessary long-term investments. And although customer agencies have been "comfortable" working with the labs, Townsend said, due to a shared history of R&D on sensitive security matters, she warned that the labs risk losing their customers to other research performers if they don't keep their costs down. "[The labs'] overhead is high, and if they care about their long-term viability, they're going to have to learn to compete better," she said.

LANL director Michael Anastasio said the labs could make a good case for a piece of Obama's economic stimulus plan, which the president-elect has said will include rebuilding the nation's infrastructure. "What higher-leverage investment is there than science and technology?" asked Anastasio.

David Kramer

Applying Title IX to university science departments

Some federal funding agencies are reviewing the treatment of female students and faculty members in university departments they fund. Can such spot checks lead the way to gender equity?

"Everything that needed to happen has happened," says Debra Rolison, a chemist at the US Naval Research Laboratory (NRL) in Washington, DC. By that she means that stirring the pot has paid off: Nearly a decade ago she suggested

applying Title IX to achieve gender equity in university science departments, and now it's not only the law but it's backed by mandates for enforcement.

In 2004 the Government Accountability Office said that universities and

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national laboratories receiving federal funding need to show they are in compliance with Title IX. "That's bedrock," says Rolison. "The federal funding agencies have a regulatory responsibility to audit their grantees with respect to Title IX. Now it's just a matter of doing it. We're in the early stages."

Not just sports

Enacted into US law in 1972, Title IX is known for opening up high-school and university athletics to women. But it makes no mention of sports:

No person in the United States shall on the basis of sex, be excluded from participation in, be denied the benefits of, or be subject to discrimination under any educational program or activity receiving Federal financial assistance.

In 2000, fed up with the persistent low numbers of women in her field, Rolison wrote an editorial for *Chemical and Engineering News*. In it, she asked: "Is it time to convince Congress to 'Title IX' U.S. chemistry departments for their entrenched inability to increase the number of women represented on their faculties? In other words, should federal funds be withheld from those universities that do not increase their faculty hires to reflect the pool of U.S.-granted chemistry Ph.D.s—one third of whom are women?" Rolison started giving talks around the country. She originally titled her talk "Title IX for Women in Academic Chemistry: Isn't a Millennium of Affirmative Action for White Men Sufficient?" It evolved to "Leading Professional and Institutional Change through Subversion, Revolution, and Meteorology."

"Lawsuits by individual women haven't been working," says Rolison, explaining why she advocates applying Title IX to university science, technology, engineering, and math (STEM) departments. She adds that when she talks to people, "the knee-jerk reaction is that you can't hire women because they don't apply. But a university fires a basketball coach if he isn't out on the road scouting for new talent. That is what department chairs need to do. Recruit." Another thing she hears a lot is, "We don't want quotas." To that she says, "Get over it! We've always had preferential hiring—it was just 90% white guys."

As for the climate—the "meteorology"—of physics and other male-dominated fields, Sherry Yennello, a chemist at Texas A&M University, says, "Physicists are the most creative prob-

lem solvers I know when it comes to designing a piece of equipment, addressing a piece of science. . . . If they decide to own this problem and put the same intellectual effort into making a more welcoming climate, leveling the field in terms of women and minorities, it is not a problem that can't be solved." Adds Bernice Durand, an emerita physics professor at the University of Wisconsin–Madison, "The first thing about changing climate is that the person who is at the very top has to be publicly, visibly, audibly, repetitively, consistently behind it and advocating for it." (See the article by Barbara Whitten, Suzanne Foster, and Margaret Duncombe in *PHYSICS TODAY*, September 2003, page 46, and the Opinion piece by Evalyn Gates in April 2006, page 64.)

"I call it the Pillsbury Doughboy of problems," says Rolison. "You think you are trying to work on one vector to make improvement, and you just complicate the problem badly somewhere else if you are not careful. So we have to come in with some isostatic pressure on the dude."

Untapped talent

After her editorial appeared, Rolison says, "I started hearing from people in all the STEM disciplines. They all had the same problem." In the ensuing years, Rolison remained the most visible advocate on the matter. At NRL, she explains, "I have my back protected in a way most scientists do not: I write fewer peer-reviewed proposals for my research." As a federal government employee she is not allowed to lobby Congress, and per an agreement with her employer, time she spends on the issue must be during non-work hours; *PHYSICS TODAY*'s interviews with her, for example, took place after 5:00 pm. "But I figured [the issue] would percolate up somehow, and indeed that is what happened."

Someone who testified before a subcommittee of the Senate's Committee on Commerce, Science, and Transportation in July 2002 mentioned "a woman in chemistry who suggests we apply Title IX," says Rolison. Subcommittee chair Ron Wyden (D-OR) "went into gear."

A few months later, Wyden convened a hearing of the subcommittee to discuss enforcement of Title IX in science. In an article the following year, he wrote, "America will not remain the power it is in the world today, nor will our people be as healthy, as educated,

or as prosperous as they should be, if we don't lead the world in scientific research and engineering development. . . . Women represent a largely untapped resource in achieving this vital goal. Encouragement through Title IX is more than the right thing to do; it is the smart thing to do." Together with Sen. Barbara Boxer (D-CA), Wyden requested the 2004 GAO study that determined agencies were not adequately enforcing Title IX.

Compliance reviews

The Department of Energy and NSF each conducted Title IX reviews at Columbia University in 2005. The departments—DOE looked at physics and NSF focused on mechanical and electrical engineering—were found to be compliant. Then, in 2007 the America Competes Act required DOE, among others, to conduct Title IX compliance reviews of at least two departments each year. NASA has also carried out two such reviews a year since Congress mandated them in

2005. So far, NASA has looked at a handful of physics and aerospace engineering departments. The amount of funding from an agency is among the factors determining which departments get reviewed. For its part, NSF hasn't conducted any further reviews. "It's a matter of resources," says an agency spokesperson. But, he adds, "it's a random check. It can effect change."

Last year, when Durand heard that DOE was reviewing her department for Title IX compliance, she thought, "They've jumped into the 21st century, which is good." The review involved data collection, an onsite visit, and interviews with graduate students and faculty members. DOE collected "a huge amount of information. There were 52 multipart questions," says Durand. Baha Balantekin, who later became UW–Madison's department chair, says the DOE draft report—as of press time, the final version was due out by the end of December—"tells us a number of areas we have done well in, and other areas where we can improve as a university."

The report notes that the university doesn't have "the number of women on the faculty or among the graduate students that we would like to have. It says that the low number of students reflects the low number of applicants," says Balantekin. It also found no gender bias in the assigning of teaching and research assistantships to graduate students. And it held up some practices as



examples to others—for example, during a recruiting weekend for students accepted for graduate study the physics department hosts a breakfast for females to meet with female faculty members. Another example is a problem-solving course that Durand and her husband, also an emeritus faculty member, developed to help students prepare for the qualifying exam. “Not a single woman who has gone through the course has failed,” says Durand. “Our experience is that each and every review has made a positive impact,” says a DOE spokesperson. “If deficiencies in a program have been found, the institutions have acted promptly on our recommendations.”

If a department were found to not comply with Title IX, “NASA would not move to impose the ultimate sanction of funding withdrawal unless all efforts to bring the school into voluntary compliance failed,” says Sharon Wagner, the agency’s Title IX program manager. And, although NASA has not found noncompliance, she adds, the reviews provide recommendations “for enhanc-

ing existing equal opportunity efforts.” For example, NASA has suggested that universities and departments publicize information about their Title IX coordinators; revise internal procedures for filing complaints about harassment and discrimination; determine whether complaints of alleged inappropriate behavior have merit; portray gender diversity on websites; and conduct ongoing self-evaluations on admissions, enrollment, graduation rates, financial aid, and treatment of students.

Are universities nervous about these reviews? “If a university is not in compliance, there is danger. But we were confident that our practices were along the guidelines,” says Balantekin. “While we are at it,” says Rolison, “the data need to be looked at across ranks—students, staff, faculty—and then disaggregated by sex, race, and ethnicity. Title IX has never not worked to make things more equitable. It can also be applied on behalf of men.” And, she notes, “no university ever lost money for sports” for not complying with Title IX.

Toni Feder

DOE invites partners in green technology

“Entrepreneurs-in-residence” aim to spin off labs’ energy technologies.

The US Department of Energy is more than doubling the number of its national laboratories that are partnering with venture capital firms to bring green energy technologies to market. While DOE is still waiting to see if any new businesses will be spawned by a first round of “entrepreneur-in-residence” agreements initiated earlier this year at three of the labs, the department in November invited venture capital firms to bid for the opportunity to place an EIR in five others. The winning firms will hire an entrepreneur to work at one of the labs for up to a year, looking for renewable energy and energy-saving technologies that are ripe to spin off into commercial businesses.

“The EIR program is fundamentally changing the way we conduct business by helping our innovations reach the marketplace much faster,” Energy Secretary Samuel Bodman said in a statement. Although the EIR has been under way since spring at Sandia and Oak Ridge national laboratories and the National Renewable Energy Laboratory (NREL), a DOE official says it’s too soon to tell if the program has worked as planned. Rather, says the official, who

asked not to be identified, the agency thought that a larger sample of labs was needed to adequately judge how well the program will work. Participating venture capital firms say they have made good progress in narrowing down the hundreds of lab inventions to a few spinoff candidates. Still, the process has taken longer than DOE had anticipated when the program got under way. It was expected then that entrepreneurs would need just a few months to find a technology and get the commercialization process going. That pace would have allowed multiple entrepreneurs, and multiple technologies, to leave the labs during the year-long contract.

According to DOE’s 19 November program announcement, the next batch of EIRs will be taking up residence at Argonne, Brookhaven, Lawrence Livermore, Lawrence Berkeley, and Pacific Northwest national laboratories. For the new round, DOE is offering \$50 000 to each entrepreneur to help defray salary and other expenses, and the awardees must at least match that amount. DOE’s share is only half the \$100 000 the agency agreed to pay each

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