that must be overcome to accomplish even simple tasks within technical programs or projects have reached the point that they have become unworkable for the scientists and engineers," said C. Paul Robinson, former director of Sandia.

Checklists versus outcomes

The former directors faulted the NNSA's "transactional oversight" model of operations, saying the agency specifies the precise steps to be followed in carrying out the work performed at the labs. Historically, they said, the labs operated through "process oversight," with DOE ensuring that the right processes were in place and allowing the work to proceed. The NNSA, said Anastasio, should oversee the outcomes of lab operations rather than monitoring each activity.

The NRC report cites a senior staff member at LANL who complained that three or four signatures were required for him to take a laptop home to continue working and that five approvals were needed for him to attend a meeting of the American Physical Society. Over time, the NNSA has provided funding to the labs in smaller chunks known as budget reporting categories. Whereas the agency once "delivered money in tanker trucks" to the labs, said Robinson, "today it's delivered in teacups."

Officials at the NNSA declined a request for an interview. In a statement, Joshua McConaha, NNSA director of public affairs, said, "We are already actively working to reshape the relationship between the laboratories, sites, and headquarters; engage in efforts to examine and reduce the number of budget reporting categories; enact a series of management reforms intended to both improve the way we do business and increase the efficiency of our operations; and maintain a safe, secure, and responsible security posture at our sites."

Former NNSA administrator Linton Brooks says that although everyone is against micromanagement in principle, "if you're the lab, everything looks like micromanagement. If you're a fed, you're adding value." Micromanagement, he says, develops over time as problems at the labs catch the attention of congressional overseers, who demand remedies. Some of the growth in paperwork, he adds, has been "self-inflicted" by the labs.

Independence an option?

Representative Michael Turner (R-OH), who chaired the Armed Services Committee hearing, said the NRC report and testimony affirmed "long-standing, well-documented, and fundamental concerns with the way NNSA manages its labs and plants." Turner cited the Congressional Commission on the Strategic Posture of the United States, which concluded in 2009 that the NNSA had "failed to meet the hopes of its founders" and "may have become part of the problem, adopting the same micromanagement and unnecessary and obtrusive oversight that it was created to eliminate."

A second 2009 report, *Leveraging Science for Security: A Strategy for the Nuclear Weapons Laboratories in the 21st Century,* by the Henry L. Stimson Center, said that the NNSA had failed to achieve its intended autonomy from DOE. "An excessively bureaucratic DOE culture has infiltrated NNSA as well," the report said. Both the commission and Stimson reviews recommended the creation of an independent agency to oversee the labs. But the NRC report stops short of calling for an independent NNSA; Congress established it as a semiautonomous agency in 2000. The commission said the NNSA should continue to report to the president through the secretary of energy, while Stimson did not specify whether the new agency should have cabinet rank.

Brooks agrees that the NNSA should become an independent agency. "Semiautonomous sounded like a great idea," he says. "But we tried it for 10 years, and most would agree that it didn't bring the changes we'd hoped for."

David Kramer

Taking steps toward the next big particle collider

Two candidate successors to the Large Hadron Collider are closing ranks, and a move is afoot for Japan to be the host.

In creating a single governance structure for two linear collider projects, particle-physics leaders hope to avoid redundant R&D, unify the broader community, and increase the odds that a next-generation collider is actually realized. The timing of the merger is driven by the impending expiration of the International Committee for Future Accelerators oversight body for the

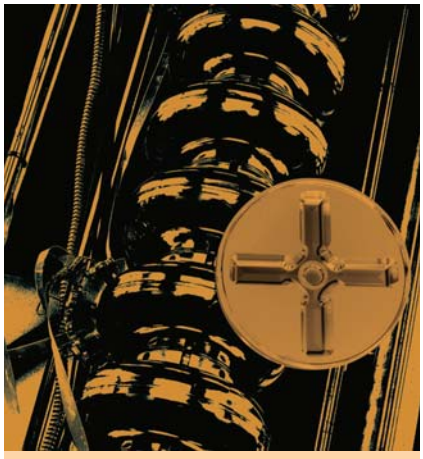
International Linear Collider (ILC); the merged governing body would also be chartered under ICFA.

The ILC, which is distributed among many labs, and the Compact Linear Collider (CLIC), centered at CERN, are both global projects that would smash electrons and positrons into each other at TeV collision energies. The two projects have the same physics goals, says Johns Hopkins University's Jonathan Bagger, who chairs the ICFA steering committee for the ILC. "But they have different technologies, different time scales, different energy extensibility, and different strengths and weaknesses." Ballpark estimates put either machine in the multibillion-dollar range.

For acceleration, the ILC uses high-gradient superconducting RF cavities powered by traditional klystrons, whereas CLIC relies on a novel dual-beam, room-temperature method in which energy is extracted from an intense beam of low-energy electrons to accelerate less-intense, higher-energy parallel beams of electrons and positrons. CLIC has the potential to get to about three times the energy for a given accelerator length, but technical development for the ILC is further along than for CLIC.

Steinar Stapnes, the CERN physicist who heads CLIC, expects some challenges in tightening the collaboration between the two projects. "It's a mixture of personalities, tradition, and work style. There is a long history of people being more committed to one project or the other." Still, he says, "It is hard to agree on a way forward, but it's impossible if we operate as two communities." Says Fermilab director Pier Oddone, "If we have one voice to speak to the world, and we choose one direction rather than have the two projects duke it out, we are much more likely to succeed and ultimately come up with a proposal that makes sense."

DESY



The closer rubbing of shoulders between the two linear collider collaborations is evidenced by this image from a poster for an upcoming conference. The International Linear Collider is illustrated by a superconducting RF cavity (bulging pipe), while the Compact Linear Collider uses stacks of copper disks (inset) in a novel acceleration mechanism.

Last year the Large Hadron Collider (LHC) observed hints near 125 GeV of what might be the Higgs boson, the sought-after particle that in the standard model endows mass to the fundamental particles (see PHYSICS TODAY, February 2012, page 16). More definitive data from the LHC—expected in the coming months—will be key to choosing between the ILC and CLIC. The question is, says CERN director general Rolf Heuer, "What is needed to get to the desired physics? If you only want to make a Higgs factory, it could well be the ILC today." But to study such things as supersymmetry, he notes, "you may need to wait for the LHC at full energy to know what ultimate energy and luminosity you want to reach." The LHC is scheduled to start running at its full collision energy of 13–14 TeV in late 2014. "Before we commit to construction of [either future] facility," says Stapnes, "we should make sure that it's an ambitious enough machine and expandable enough to cover the physics that will emerge."

Acceleration in Japan

European money for high-energy physics is largely tied up in the LHC for the next decade. President Obama's proposed fiscal year 2013 budget zeroes out funding for linear collider R&D. In Japan, meanwhile, efforts are getting started to try to build the ILC as the core of an international "science city" that could be part of rebuilding the northeastern area that was devastated by the tsunami, earthquake, and nuclear meltdown last year. The idea has been around since before the disaster, but now the hope is to fund a linear collider as part of the broader recovery plan.

The science city initiative is driven by scientists and local municipalities. "But the prime minister has announced that he is supportive of accelerator science and supports this project," notes Tohoku University physicist Hitoshi Yamamoto, who chairs an ILC study group that consists of representatives from universities, prefecture governments, and industry. Says Heuer, "If there is a region which wants to carry most of the funding, and there is a good physics case, then we should do it."

"For years we have been saying, 'When we have the LHC results, we will know the next step,'" says Bagger. "That has allowed us great freedom to dream about what to build. The real excitement is what is going on in physics."

Toni Feder

White House seeks to get a handle on "big data"

Scientific enterprise is "drowning in data but starving for understanding."

Five federal science and technology agencies announced plans to spend more than $200 million in total to develop new tools and techniques to process and analyze huge volumes of digital data. The initial cadre of "big data" R&D participants are the Department of Energy, NSF, the Department of Defense and its Defense Advanced Research Projects Agency (DARPA), the National Institutes of Health, and the US Geological Survey (USGS).

Presidential science adviser John Holdren said the initiative, announced on 29 March, responds to criticism from the President's Council of Advisors on Science and Technology that the government has been underinvesting in technologies needed to collect, store, preserve, manage, analyze, and share large quantities of data. The world is now generating 10^{21} bytes of data each year, and the volume is growing rapidly, Holdren said. The data are generated from such diverse sources as remote sensors, online retail transactions, text messages, email, video messages, computers running large-scale simulations, and scientific instruments, including particle accelerators and telescopes. Big data, Holdren said, "are critical to accelerating the pace of discovery in many different domains of science and engineering."

William Brinkman, director of DOE's Office of Science, said experi-