

DOE MOVING TO PRESERVE NUCLEAR WEAPONS KNOW-HOW

Hidden within the explosion of science and technology that began during World War II is a lethal legacy of hot- and cold-war physics: knowledge of nuclear weapons design and construction. The Department of Energy facilities responsible for this work are now making great efforts to archive as many different aspects of the know-how as resources will allow. These efforts dovetail with the Clinton Administration's overall plan for the US nuclear arsenal, "commonly described" (according to *The Bomb's Custodians*, a July paper by the Congressional Budget Office) "as science-based stewardship."

Several factors have led to these archiving endeavors, which will add to DOE's already-massive collection of weapons data. First, the end of the cold war means that the laboratories find themselves in tough competition for budget dollars, with the development of advanced nuclear weapons a low priority. Second, underground tests were the main source of new data, and although a limited number of tests are permitted until 1996 if they meet specific criteria, an amendment in FY1993 appropriations by Senator Mark Hatfield (a Republican of Oregon) effectively stopped US testing as of 1 October 1992. Finally, the people who designed and built the US's arsenal of nuclear weapons are retiring and dying.

Complex weapons

The weapons complex of the United States may be loosely defined as DOE's three nuclear weapons design laboratories—Los Alamos National Laboratory in New Mexico, Sandia National Laboratories in Albuquerque, New Mexico, and Livermore, California, and Lawrence Livermore National Laboratory in California—plus the three remaining active DOE production plants—Y-12 in Oak Ridge, Tennessee, Allied Signal Aerospace in Kansas City, Missouri, and the Pantex Plant in Amarillo, Texas. Although all have routinely documented, cataloged and videotaped many of their activities for



Tower at Los Alamos for the first atomic bomb, July 1945. What to remember, what to forget?

years, this summer Sandia became the first laboratory to institute a large-scale, formal process of videotaping interviews of "weaponers."

Weaponers are those who design and construct the components that transform a "physics package" into a "nuclear explosive device," explained Keith Johnstone, who oversees Sandia's Knowledge Preservation Project as a staff member of the National Security and Policy Planning Department. For FY1995 a "sizable amount of money" has been set aside for recording the technical experiences of about 180 longtime and former Sandia employees. Money has also been allocated for research into a state-of-the-art system to access the archived information. As was emphasized by all who spoke to us about projects of this type, accessibility is the key to successful archiving.

The huge scale of the Sandia project

alone may drive technological innovations in the field of information management. Johnstone and his colleagues would like to have automatic electronic audio indexing tied to the videotaped interviews. When turned into digital storage, they could then be manipulated like a computer encyclopedia on CD-ROM. "We want to do this right," Johnstone said.

The effort to document what Sandia calls the "craft of nuclear weapon design" began as a purely technical project to preserve "arcane information" that had never been written down. Those involved quickly realized that they would be hearing recollections of much more than just the technical details of weapons construction, and so the scope of the project expanded. As Johnstone told *PHYSICS TODAY*, "We're actually after technical information, as opposed to anecdotes, but we get both." Now, he said, they try to capture "culture" too.

Spencer Weart, director of the Center for History of Physics at the American Institute of Physics, thinks that Sandia's Knowledge Preservation Project holds great promise in the more academic realm of history and sociology. (Other smaller, purely historical projects do exist at the various laboratories.) Weart agrees, however, with the cautionary remarks of Robert Seidel, who for six years was in charge of Los Alamos's Center for National Security Studies before moving recently to head the Charles Babbage Institute at the University of Minnesota: "Execution is critical in these matters." Seidel notes that to generate the right questions, oral history has to be supplemented by much research into extant documents. Bart Hacker, Livermore's laboratory historian, wonders whether oral interviews can actually recover hands-on knowledge, which almost by definition may be difficult to express verbally.

Hacker told us that the Livermore archivists proposed something similar to the Sandia project about a year ago, but now that the weaponers

LOS ALAMOS NATIONAL LABORATORY COURTESY OF AIP NIELS BOHR LIBRARY

themselves are involved in preservation, their efforts to record history have more clout. This turn illustrates another concern of Seidel's: Because history isn't really a laboratory's mission, the next budget cycle can bring a premature end to historical archiving. People get excited, he said, and projects get funded—then they're not excited, and funding goes away. But the project at Sandia and similar ones at the other facilities are primarily technical, not historical. In addition to the oral interviews, they are designed to archive test data, computer codes, engineering drawings and so on.

As the person responsible for Livermore's entire weapons program archiving effort, William Bookless wants to coordinate the weapons archiving projects at the nuclear laboratories and plants. To that end, he organized a first workshop in late September, attended by representatives from the US weapons complex and the Atomic Weapons Establishment of the United Kingdom, "to address the overarching issues" shared by all. Bookless has been motivated strongly by technological reasons, namely the loss of the "tool" of nuclear testing, but when historian Hacker and assistant archivist Steve Wofford heard about the workshop, they "pushed" (Hacker's term) their way in. Bookless, who says he is pleased about the wider scope of the project, told us that attendees "discussed how we will discuss these issues" and how to "avoid duplicating efforts."

Worth preserving?

When the wheel is nuclear weapons, maybe having to reinvent it isn't such a bad idea. And as the US struggles with massive social problems such as crime, poverty and health care, how much effort (and how many dollars) should go into retaining this particular "arcane" know-how? When asked about these issues, the people at the weapons labs said they feel a responsibility to preserve the knowledge of science and technology generated by almost 50 years of intense military research.

Johnstone, who admitted that he was getting on a soapbox, told us: "It is not our decision whether or not to ever use this information again, but it is clearly our decision to see to it that it is at least archived and accessible." He sees the knowledge "as a resource that can either be drawn upon or buried forever—that's a decision that will be made by others, but at least they'll have the opportunity to make it."

Bookless too realizes that not everyone shares Johnstone's and his

views: "It's the whole argument about whether we should even have a nuclear deterrent. That's a philosophical thing, and people have honest opinions on both sides."

However, Bookless endorses the projects' *raison d'être*. "My own opinion is that the nuclear deterrent has

to be part of our national security strategy for some time to come, and given that, I think we would be, at this laboratory, irresponsible if we didn't ensure that that nuclear deterrent was safe, secure and reliable. That's our job."

—DENIS F. CIOFFI

COLLABORATORS AWAIT EUROPEAN APPROVAL OF LHC

Physicists hoping to participate in the European Large Hadron Collider are beginning to feel pretty testy about the question of when and indeed whether CERN's proposed project will receive definitive authorization. At an estimated cost of around \$2.5 billion, counting detectors, the proposed 14-TeV proton-proton collider would appear to be a bargain by comparison with the now-scrapped Superconducting Super Collider, the 40-TeV US machine that would have cost upwards of \$10 billion. But of course just because something is a bargain does not mean that one has to buy it if one does not want it.

In principle, approval of the project by the 19 member countries of CERN's council could occur as this article goes to press. But the times when leaders and spokespersons for CERN confidently predicted authorization "any minute" are long gone. Approval originally was expected at a council meeting last June. Then, when an impasse developed between the Federal Republic of Germany and Britain on the one hand and France and Switzerland on the other, the June meeting was technically held open until the end of September in hopes that differences could be bridged by then. Now the lab's leadership is saying that the June meeting could be extended until the next regularly scheduled meeting, on 17 December—and that authorization might not come even then.

The ostensible and very likely the whole reason for the repeated delays is a stubborn disagreement between Germany and the UK—Europe's most budget-conscious countries—and France and Switzerland, the so-called CERN host countries, over how big an extra contribution the hosts should make to construction of the LHC, given the special benefits they will reap from having the project built on their soil.

But the longer the delays go on, the more even those very close to the action worry that something else might be wrong. Members of the CERN council "don't seem to be get-

ting along as well as they should," confided one member of the lab's leadership in a recent interview with this magazine.

Physicists in the United States and Japan are eager to get some modest funding immediately to support work they want to do for the LHC, but they cannot hope to make any progress with their own governments until the Europeans have their act together.

Japanese particle physics leaders, having made a quiet but concerted behind-the-scenes effort to obtain support for the SSC, naturally are afraid of being burned twice. Hiro-taka Sugawara, the head of KEK, Japan's particle physics lab in Tsukuba, complained rather bitterly at a recent high-level meeting in Lausanne, Switzerland, that physics leaders outside Europe could hardly make convincing cases to their own governments if the Europeans continued to disagree—and he warned that interest in the LHC outside Europe might begin to flag.

Ultimately, as long as all this is unresolved, one cannot help having uneasy thoughts about whether the idea of building the biggest proton-proton collider ever in order to hunt for the Higgs boson and for first evidence of supersymmetry might be somehow jinxed. In *The God Particle*, a book written to make a case for the SSC or some similar machine, former Fermilab director Leon Lederman obsessively conjured up images of hubris—the Tower of Babel, Moby Dick.

Germany at the crux

According to Maurice Jacob, the CERN theorist who serves as the lab's secretary of state for member-state relations, Germany and Britain have demanded that the host countries kick in 290 million Swiss francs, an extra 10% of the LHC's machine cost, on the model of practices at labs like the European Synchrotron Radiation Facility at Grenoble, France, and the Joint European Torus at Culham, England. But, as France and Switzerland point out, ESRF and JET are not true international organizations