Four Years after SSC's Demise, US Reaches Agreement on 'Unprecedented' Collaboration in CERN's LHC

It was an auspicious occasion. Ambassadors, Nobel laureates and government dignitaries mingled with laboratory directors and particle physicists in the elaborate Indian Treaty Room of the Old Executive Office Building, next to the White House. Then, promptly at 11 am on 8 December, John H. Gibbons, President Clinton's science adviser, told the group crowded into the room that they were embarking on "an incredible exploration of one of the most fundamental questions of science—the nature of matter." Over the next nine years, he noted, the US will participate "in an unprecedented international collaboration" with more than 4000 scientists and engineers in 45 countries to construct the Large Hadron Collider (LHC), a 7 TeV-on-7 TeV proton–proton collider, and its two massive particle detectors, ATLAS and CMS, at CERN, the European Organization for Nuclear Research near Geneva.

The purpose of the gathering was to witness the signing of an agreement that pledges the US to provide $531 million in components and services for the construction of the machine and detectors—$450 million from the Department of Energy (DOE) and $81 million from the National Science Foundation (NSF).

The LHC is being assembled in an existing tunnel 16 miles (27 km) in circumference (housing the Large Electron Positron accelerator) under the Jura Mountains at the border between France and Switzerland. To be completed at a cost estimated by US authorities at $6 billion (but by CERN officials at $2.7 billion, because of salaries, benefits and other outlays that are paid by member governments), the machine is scheduled to be running experiments in 2005. It will then be the world's most powerful accelerator, generating about seven times more center-of-mass energy than the current record holder, the Tevatron at Fermi National Accelerator Laboratory, outside Chicago.

Reaching the day of the signing in Washington, said Gibbons, "was not nearly as simple as drafting an agreement," especially because the US had expected to have a large proton collider of its own, the Superconducting Super Collider (SSC), and had spent some $1.6 billion on it when Congress decided to cancel the project in October 1993. "Suddenly," Gibbons observed, "America found itself faced with the prospect of becoming an international partner in the LHC collaboration," which now includes 19 European countries and Russia, Japan, Canada, India and Israel, "or possibly losing the chance to join in the high-energy scientific frontier."

It took four years of complicated negotiations by physicists, bureaucrats and politicians to define an appropriate role for the US and to answer difficult questions such as whether the US would be obligated to pay more if the project experienced cost overruns and whether US researchers would be allowed to share in directing experiments. The US State Department, which normally runs interference for international projects, was curiously absent the whole time. Discussions snagged last year when Representative Joe Barton, a Texas Republican, threatened to line up opposition in Congress to defeat US participation in the LHC. Barton, whose home district was the site of the SSC, refused to approve any commitment and urged his colleagues to "walk away" from any agreement with CERN, because, he said, European countries had not come to the aid of the SSC in its hour of financial need (PHYSICS TODAY, May 1997, page 48). Some members of Congress interpreted this action as little more than Barton's revenge. But James Sensenbrenner, the Wisconsin Republican who chairs the House Science Committee, had other qualms. He found that the draft agreement lacked provisions covering overruns and guarantees on participation in research and operational decisions (PHYSICS TODAY, August 1997, page 43). When the agreement was changed to Sensenbrenner's satisfaction, Energy Secretary Federico Peña met with the congressman and got his endorsement.

"For the first time, the US government has agreed to contribute significantly to construction of an accelerator outside our borders," said Peña at the signing ceremony. "We have concluded that this is the most cost-beneficial way for the United States to participate. . . . I have no doubt that when the history of the next 50 years is written, the Large Hadron Collider and all of the science, new ideas and technologies it spawns will be a major chapter."

In his brief remarks, Luciano Maiani, president of the CERN council, expressed his "deep appreciation of the

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SHARING AN AGREEMENT: Energy Secretary Federico Peña (left) exchanges his signed agreement for one held by CERN council president Luciano Maiani to collaborate on the Large Hadron Collider and its particle detectors.

critical part played by the American scientific community" in backing the LHC. Maiani, along with Gibbons and Peña, heaped praise on Sidney Drell, deputy director of SLAC, for his work in leading DOE's High Energy Physics Advisory Panel to shift its allegiance to the LHC after the SSC debacle. The agreement, Maiani noted, "represents how scientific progress is made through international efforts."

"It sets an excellent precedent," observed Christopher Llewellyn Smith, CERN's director general. Not only is the cost of such projects "increasingly beyond the means of most countries," he said, but the geographical location of such facilities is "increasingly irrelevant. . . . Science knows no national borders or continental boundaries. Knowledge belongs to nobody and to everybody. Given this universality of science, it is only natural that we should enter this collaboration."

In fact, said Llewellyn Smith, "it's conceivable that the LHC could be run from a control room at Fermilab or Brookhaven." Given that the accelerator will still be operating well into the 21st century, he figured, "it's possible that the last graduate student who will take part in experiments on ATLAS or CMS has not yet been born."

At a press conference after the signing, Llewellyn Smith was self-assured in responding to questions on the cost and schedule of LHC construction. "We have a lot of experience in building such facilities," he said. "It's going to come in on time and on cost, and it's going to work." If it doesn't, he declared, with a hint of exasperation, "we will go back to our countries. That is not [the US] responsibility." Peña added: "From the US perspective, our contribution is capped."

"For about 10% of the entire cost," Peña told news reporters, "our contribution will enable about 25% of the US high-energy experimental physics community to take advantage" of the LHC's resources. For its part, CERN, said Llewellyn Smith, not only will get extensive access to American technical expertise, but enough of a financial commitment to "allow for much better experiments than would otherwise be possible" and to complete the machine three years earlier than would have been possible without the funds.

Asked about lessons learned from this experience, Peña answered that "the next time we do this, we'll be sure that we make contact with political leaders in Congress and that the project makes sense for US taxpayers." For Llewellyn Smith, whose five-year term as CERN's chief ends at the end of 1998, "it's been a crash course in the American political system. At times, it has seemed more complex than particle physics." **IRWIN GOODWIN**

DOE Chooses SUNY at Stony Brook and Battelle to Operate Troubled Brookhaven Laboratory

Six months into the management crisis at Brookhaven National Laboratory, the Department of Energy (DOE) selected a new contractor to operate the besieged facility. The choice went to a partnership of the State University of New York (SUNY) at Stony Brook and Battelle Memorial Institute, which takes oversight control of the lab in January. The new team, called Brookhaven Science Associates (BSA), takes over from Associated Universities Inc (AUI), which had functioned like a board of trustees since the lab's founding in 1947. AUI's contract was terminated by Energy Secretary Federico Peña last May following startling revelations of a long-standing tritium leak at the High Flux Beam Reactor (HFBR) and accusations that AUI didn't maintain proper vigil on environmental safety at the lab (PHYSICS TODAY, June 1997, page 65).

In the subsequent competition for the Brookhaven contract, Stony Brook and Battelle beat out another group led by IIT Research Institute of Chicago and Westinghouse. Another group, headed by Renssalaer Polytechnic Institute in upstate New York, had shown some interest in becoming a rival, but didn't enter the contest.

DOE's decision combines one of Long Island's most highly regarded educational institutions with one of the area's most troubled organizations. Stony Brook's close cultural and scientific relationship with the laboratory has helped raise its reputation as a research university in recent years.

NEW DIRECTOR OF BROOKHAVEN: John Marburger

The other half of the team, Battelle, a nonprofit foundation in Columbus, Ohio, has close ties with DOE. It manages the department's Pacific Northwest National Laboratory in Richland, Washington, adjacent to the polluted Hanford site, where radioactive wastes from nuclear weapons production are stored. Battelle also runs environmental and safety activities at DOE's Pantex nuclear weapons plant, located near Amarillo, Texas.

"I will look to [BSA] to fully integrate safety and environmental protection into scientific research, to accelerate and intensify recent efforts to rebuild community trust and to achieve overall excellence," said Energy Secretary Federico Peña in making the announcement on 25 November. Incorporated into BSA are six universities: Columbia, Cornell, Harvard, Princeton, Stony Brook and Yale.

Reflecting the added cost of cleaning up Brookhaven and making sure it is environmentally sound, the new five-year contract provides a higher annual fixed fee—$1 million more than the $4.2 million that DOE paid to AUI last year. "We expect to get more for our money" from the new contractor, says Martha A. Krebs, director of DOE's Office of Energy Research.

Also on 25 November, BSA, with DOE's approval, named the laboratory's new director: John Marburger, who was president of Stony Brook for 14 years and continues to be highly regarded in the Long Island surrounds. Marburger promises to make major changes to clean up environmental problems and to ease the concerns of the local population. "Job one is to establish contact with the community," he said at a press conference when Peña announced the award of the BSA contract. Marburger is a physicist who once headed another DOE contractor,