

Reagan endorses the SSC, a colossus among colliders

Few things give government officials such a feeling of accomplishment as undertaking a bold new venture, especially one sure to go into history books. For Energy Secretary John S. Herrington the chance to embark on an enterprise of this sort came on 30 January when he announced at a hastily called news conference that President Reagan had formally approved construction of the Superconducting Super Collider. The SSC is expected to be the crown jewel of high-energy physics at the start of the 21st century. It is designed to reopen the frontiers of particle physics and answer some of the most profound, exciting and intractable questions about the birth of the universe and the forces of nature. (See the editorial on page 136.) Upon its completion it also will bear the distinction of being the largest and costliest scientific instrument ever built.

Its characteristics are prodigious. It will hurtle two intersecting proton beams, each with 20 TeV, around a tunnel 52 miles in circumference, causing collisions with energies of 40 TeV in the center of mass. If it were built today, such a gargantuan machine would cost \$4.4 billion. However, the Department of Energy's latest calculation, based on a reduced inflation rate, suggests that by 1996, when the SSC is likely to be turned on, with all its particle detectors, cryogenic systems and other facilities in place, the machine will carry a price tag of \$5.3 billion.

Boosterism. Herrington was obviously exuberant at his news briefing to boost the SSC. "In high-energy physics," he declared, "the development of the Super Collider is the equivalent of putting a man on the Moon. . . . Once again this nation has said that there are no dreams too large, no innovations unimaginable and no frontiers beyond our reach. . . . The Super Collider holds the potential for a new generation and a new revolution in science, education, technology and commerce." He also indulged in some hyperbole: "It will



SSC briefing by Alvin W. Trivelpiece, director of Energy Department research, to President Reagan (foreground, with back to camera) at the White House on 29 January.

have spinoffs, discoveries and innovations that will profoundly touch every human being. This is a watershed for America's scientific and technological leadership and another clear sign that we are committed to keeping this nation at the cutting edge of world leadership and competitiveness. . . . By virtue of this decision we are embarking on an adventure of unlimited opportunity, tremendous promise and a new scientific world to be won."

Coming after months of suspense, the decision was greeted with much cheering. At the Lawrence Berkeley National Laboratory, physicists broke out champagne that had been bought weeks earlier in anticipation of Reagan's budget statement on 5 January. But the budget did not mention the SSC. Notwithstanding, true believers in the SSC banked on the President to

voice his support in the State of the Union message on 27 January. In the event, Reagan said nothing about the accelerator.

Ironically, when the SSC announcement finally came, some enthusiasts were mildly miffed that Reagan himself did not issue it with all the panoply and panache of the Presidency—the way President Kennedy had committed the US in 1961 to a manned mission to the Moon by the end of that decade.

Testimony. Herrington's support for the SSC grew slowly. When members of the House Science and Technology Committee asked last March about his plans for the SSC, saying they were reluctant to continue dribbling money into further studies and designs for the machine if it was not going to be built, Herrington's answer was that he did not want to say "maybe" just to please

Congress or appease scientists. "We are at a decision point," he said at the hearing. "To further fund any more studies or investigations into it, I think, would not be money well spent."

But when Herrington still had not reached a decision by July, an impatient House Appropriations Committee simply whacked \$20 million from DOE's request for high-energy physics in the 1987 budget. An Appropriations Committee staffer claimed that House members believed DOE had money for the SSC hidden somewhere in its budget to give it leeway to procrastinate. Anyway, \$20 million was exactly the amount the department was spending each year to support SSC R&D.

Physicists involved with the SSC were led to understand that Herrington would decide by September, when he was required to send his draft budget for fiscal 1988 to the White House Office of Management and Budget. Actually, the budget approved by OMB showed no funds for the accelerator or the SSC Central Design Group, which has been doing R&D work on the machine at Lawrence Berkeley since 1984. Budget officials argued that the country could not afford such an expensive research item at a time of huge fiscal deficits. What's more, they asserted, scientific research would get significant increases in the fiscal 1988 budget—particularly at NSF, which is earmarked for a 17% rise next year and for a doubling of its current budget to \$3.2 billion in 1992.

Enthusiasts. Neither the financial functionaries nor the accelerator's opponents had reckoned on the single-mindedness of Herrington and Alvin W. Trivelpiece, director of DOE's energy research office. Without Herrington's support the SSC would have stood little chance of getting through the White House. A former prosecuting attorney in California who came to Washington with Reagan, he serves on the Ronald Reagan Presidential Foundation and is one of the few Cabinet members who can pop into the Oval Office without much notice.

Their enthusiasm was countered by criticism from the scientific community. Some opposed the SSC on the grounds that its construction costs and then its annual operating budget would distort the nation's broadly based scientific enterprise in times of limited research funding. Conventional wisdom holds that research is a zero-sum game, in which Peter is shortchanged to pay Paul. Under such a rubric, building vast projects may make it harder to fund important but less glamorous scientific work.

Missionaries. Herrington was convinced he needed to do a great deal of

missionary work and Trivelpiece provided the scripture. Canonical arguments about the SSC's benefits to science, education and the nation's economy came from two Nobel laureates, Charles Townes and Steven Weinberg, and such prominent physicists as H. Guyford Steyer (who has been NSF director and President Ford's science adviser), Solomon J. Buchsbaum of Bell Labs and Roy Schwitters of Harvard during a lunch with Herrington. Top industrialists were enlisted to send letters on behalf of the machine to Reagan, Cabinet officers and members of Congress. Among the writers: Roger B. Smith of General Motors, Douglas D. Danforth of Westinghouse Electric, Edward G. Jefferson of duPont and John F. Akers of IBM.

Meanwhile, selling the SSC went on almost door to door. Trivelpiece met with dozens of delegations of scientists who expressed fears that the SSC would amount to a raid on the government treasury. Beginning last fall, he also visited members of Congress and their staffs to elicit support. Herrington, for his part, pitched his campaign to Cabinet members in informal discussions.

In early December, Herrington asked for a formal review of the project by the Domestic Policy Council. Papers were prepared on several courses of action—starting the project immediately as a strictly US undertaking, sharing costs and technologies with scientific (and political) allies, postponing a go-ahead for another year or so, and putting off any decision for several years in the hope that physicists would find cheaper alternative technologies to the current design and that another Administration would then make the choice.

Herrington had Trivelpiece present the case for the machine during an hour-long meeting of the Domestic Policy Council devoted exclusively to the SSC. Just before Christmas, another show-and-tell session was held before the Domestic Policy Council, and once more the result was inconclusive, though a White House source concluded from the kinds of arguments raised at the meeting that a slim majority opposed the project.

'One shot.' In their third try, though, Herrington and Trivelpiece triumphed. On 29 January, with Reagan in the chair for his first council meeting after his prostate surgery a few weeks earlier, Trivelpiece gave the main sales talk. "I knew I had only one shot at the prize," recalls Trivelpiece. After giving a short history of high-energy physics, he attempted to convey the connections between the field and the development of American science and technology.

To questions about disrupting DOE's research budget, Herrington replied that the first "heavy-duty" outlays would come in 1989, under Reagan's successor, when the funding profile is estimated at \$348 million, and that for the five years after that spending would amount to \$600 million to \$700 million per year. In fiscal 1987 DOE proposed to reprogram \$4 million to bring SSC R&D up to \$20 million—the same amount as in each of the previous three years. The 1988 request for \$35 million includes \$25 million for R&D and \$10 million for "construction," which means letting contracts for components that require long lead times, such as beam tubes, superconducting wire and magnet yokes.

A reading. After listening to the scientific justification for the SSC and the budgetary complaints against the project, the President told an anecdote about professional quarterback Kenny Stabler, who was once asked the meaning of a certain poem. The President pulled a card from his pocket and read the poem:

*I would rather be ashes than dust
I would rather that my spark
Should burn out in a brilliant blaze
Than it should be stifled in dry rot.*

*I would rather be a superb meteor
Every atom of me in magnificent glow
Than a sleepy and permanent planet.*

*The proper function of man
Is to live, not to exist
I shall not waste my days in trying to
prolong them
I shall use my time.*

The poem, Reagan explained, was the personal credo of Jack London, the American frontier writer and adventurer, given to the *San Francisco Examiner* six days before his death in 1916. According to the President, Stabler said London's credo meant, "Throw deep." In concluding the meeting, Reagan advised Herrington to "throw deep." James C. Miller III, director of the Office of Management and Budget, said, "You're going to make a lot of physicists ecstatic, Mr. President." Reagan laughed and observed, "That's probably fair because I made two physics teachers in high school very miserable."

Later that evening, Wendy Lee Gramm, administrator of information and regulatory affairs at the Office of Management and Budget, told her husband, Senator Phil Gramm, a Texas Republican, about the President's anecdote. Surmising that Reagan had approved the SSC, Gramm called a reporter at the Associated Press, which issued the news—though the White House denied a decision had been made. Next morning, after the Presi-

dent had officially approved building the giant accelerator, DOE quickly called a news conference to make the announcement.

The idea of a world-class particle accelerator was never modest. It was first discussed by the International Committee on Future Accelerators in the late 1970s. At each biennial meeting afterward, ICFA delegates raised their sights about the energy of a world-class machine. The concept goes back to a talk that Enrico Fermi gave before The American Physical Society in 1954, on the occasion of the 200th anniversary of Columbia University. Fermi's vision of the ultimate high-energy accelerator had beam tubes encircling the Earth, yet its energy would be exceeded by the 1 TeV in each of the Tevatron's colliding beams.

A concept. Beginning with a study sponsored by the APS Division of Particles and Fields in 1982 and continuing in reviews at Woods Hole in Massachusetts and Snowmass in Colorado, high-energy physicists conceived the concept that ultimately became the SSC (PHYSICS TODAY, January 1983, page 19). By the summer of 1983, DOE's High-Energy Physics Advisory Panel had committed the community to the machine (PHYSICS TODAY, September 1983, page 17).

Since 1984, when DOE established a Central Design Group at Lawrence Berkeley under the leadership of Maury Tigner of Cornell, Trivelpiece has coaxed \$20 million per year out of his budget for SSC R&D. Some 150 physicists and engineers took part in the project at four national laboratories and 50 universities. The sheer mass of information about it is overwhelming. The last report of its design group runs to some 800 pages, with another 2000 pages of technical documentation, its detail and complexity daunting (PHYSICS TODAY, July, page 21).

Support for the SSC by particle physicists and the President is not enough in itself. Congress will need to approve the project and its budget. Herrington and many physicists are convinced that the SSC requires funding from new allocations rather than from existing programs. DOE has requested for fiscal 1988 that money for it come from the high-energy physics budget—a move that ought to disarm opponents, at least the first year. Even so, the SSC's cost is expected to dominate the debate in scientific circles and Congress.

What is likely to help the SSC on its way through Congress is its political adherents in the 47 states that are expected to vie for the project. During construction as many as 4500 workers will be needed. Once the SSC begins

operating, it will employ some 2500, mainly technicians and maintenance workers. In addition, some 500 permanent scientists and another 500 visiting scientists will be doing physics there at any one time. More than 100 US universities are expected to use the facility, and annual operating budgets are expected to run about \$300 million.

Some states, such as Texas, Illinois, California, Colorado, Utah and Idaho, are already waging visible campaigns to win the machine, spending millions on their proposals, all of which include providing the site free of charge. At a press conference on 10 February, Herrington revealed how the competition would proceed (see box). Bidding will begin in April and Herrington pledges that political power plays will not be tolerated.

History suggests politics may play a part. In 1959, when President Eisenhower proposed the country's first \$100 million particle accelerator, at Stanford, the Democratic leadership in Congress was not enlisted to support the project. In consequence, approval was

held up until the Kennedy Administration took over. The story of the 200-BeV machine, which became Fermilab, supports Herrington's plan. Although some historians assert that the Fermilab site was chosen only after President Lyndon Johnson worked out a deal with Senator Everett M. Dirksen of Illinois, the Republican leader, to get his support for the Administration's foreign policy, Glenn Seaborg, who was chairman of the Atomic Energy Commission at the time, remembers that the decision was made on scientific and technical grounds. Johnson made only one request: When the 135 proposals were cut to 85 in meeting AEC site requirements, Johnson asked that both Texas entries remain in the running. From that point on, the President kept his hands off the selection process.

If the SSC gets Congress's support and is ultimately built, says Trivelpiece, "there will be a hundred heroes." The drama is just beginning, he observes. "The most exciting acts are still to come."

—IRWIN GOODWIN □

Timetable for SSC 'Judgment Day'

On 10 February Energy Secretary John S. Herrington issued the timetable that will operate during the 20-month period of what is already shaping up as a fierce competition among the states for the Superconducting Super Collider. According to Herrington's timetable, "Judgment Day" for the SSC will come before the Reagan Administration leaves office in January 1989.

While calling the SSC "a major plum" for the winning state, Herrington pledged that it will not necessarily go to the state that wages the most visible or expensive campaign and that the selection process will not be embroiled in political pork. He said the site selection process "is designed to be fair, equitable to all parties—absolutely open and above board."

The process began as soon as President Reagan endorsed the SSC, when DOE officials set about deciding on the minimum criteria for siting the machine. The complete process consists of the following sequence of major events:

April 1987. Requests for proposals published in *Federal Register*

The announcement will carry engineering and architectural descriptions of the SSC, site requirements, property ownership obligations and evaluation criteria. Letters of invitation will be sent to the governor of each state.

August 1987. Proposal deadline

Proposals will be screened by a special DOE SSC Site Task Force to see if they meet the qualification criteria.

September 1987. Qualified proposals sent to National Academies

DOE will refer all proposals meeting the site criteria to a blue-ribbon panel of the National Academies of Sciences and Engineering for review with respect to overall excellence as a world-class scientific research facility.

December 1987. Academies recommend best-qualified sites

Basing its judgment on scientific merits, the panel will recommend to DOE a small number of the best proposals, unranked.

July 1988. DOE designates preferred site

Proposals selected by the academies will be subjected to stringent geological and environmental examinations by DOE staff. Detailed analyses and environmental data will be evaluated by DOE staff and recommendations for the winning site will be given to the DOE secretary.

April 1987–January 1989. Safety and environmental review procedure

DOE will prepare an Environmental Impact Statement for the SSC in accordance with the National Environmental Policy Act. While preparation will begin shortly after the request for proposals is announced and the concerned public will be asked for comment, the final EIS will be part of the record of decision and made public in the last stage of the selection process.

January 1989. Final site selection and site preparation

The Secretary of Energy will announce the winning site. Final safety analyses will be issued during the design and construction phases.