

SURA accelerator redux: The scientific case is reexamined

Sometime in the next month or two, Secretary of Energy Donald P. Hodel and the President's science adviser, George A. Keyworth II, will have to come to grips with a scientific and political hot potato. At issue is the choice of a large continuous-beam electron accelerator proposed by a group of 35 Southeastern universities that was selected unexpectedly last year after a fierce competition. Now, some 18 months after the Nuclear Science Advisory Committee recommended that DOE should favor the plan submitted by Southeastern Universities Research Association for a machine in the energy range of 0.5 to 4 GeV, with the possibility of reaching 6 GeV eventually, the accelerator faces an increasingly uncertain future. Though DOE approved the project more than a year ago, it still lacks a definite design and detailed cost estimate. Without these, Congress refused last July to appropriate the full amount requested by DOE in its fiscal 1985 budget for the SURA accelerator. The project is in a "Catch-22" dilemma: it cannot attract machine designers and scientific staff until its construction is assured and it cannot obtain funding without a precise design and scientific program.

The troubles with the SURA project became conspicuous when two prominent senators, Mark O. Hatfield of Oregon, chairman of the powerful Committee on Appropriations and its Subcommittee on Energy and Water Development, and J. Bennett Johnston of Louisiana, senior Democrat on the Appropriations subcommittee and Committee on Energy and Natural Resources, raised questions about it: Is there a scientific need for such a machine? Is it the most cost-effective facility for nuclear science? Is its justification to satisfy a political or geographical constituency, because so many states and universities are involved and the Southeast is without a major accelerator?

Hatfield and Johnston insist they don't have an overwhelming case for the project, either from DOE or SURA. What's more, the machine has drawn fire from some nuclear scientists who have complained to members of Congress and officials at DOE that the NSAC choice is wrong, that technical problems must be solved and that new events and knowledge have overtaken the project. Congress is reluctant to

underwrite a costly scientific venture, say close watchers of Capitol Hill activities, unless the need and feasibility are endorsed enthusiastically.

The need for a continuous-beam electron accelerator is not in doubt. Its importance was described in *A Long-Range Plan for Nuclear Science*, a report prepared in 1980 for DOE and the National Science Foundation by NSAC when it was headed by Herman Feshbach of MIT. NSAC then called for a cw (rather than pulsed) electron beam accelerator to explore the forces and structure of nuclei at collision energies up to 2 GeV, with construction to begin in 1985 (PHYSICS TODAY, May 1980, page 20). Two years later, another NSAC group, the Subcommittee on Electromagnetic Interactions, led by Peter Barnes of Carnegie-Mellon University, went beyond the earlier idea and recommended an electron-beam facility capable of covering a variable range to 4 GeV. The Barnes panel was careful to note the difficulty of knowing the precise energy range for exploring the transition region between the nucleon-meson and quark-gluon descriptions of nuclear structure (PHYSICS TODAY, September 1982, page 18).

Bitter battle. In spring 1983, NSAC's Panel on Electron Accelerator Facilities, under the chairmanship of D. Allan Bromley of Yale, chose the SURA proposal by a vote of 9 to 3 over four rival plans for the accelerator. When the recommendation was endorsed by NSAC, it set off an acrimonious battle by the runner-up, Argonne National Laboratory, to prevent approval by DOE. The case for Argonne was taken to Congress and DOE's Hodel. SURA counterattacked by enlisting Southern congressmen and governors, led by Senator John W. Warner of Virginia, who went right to the White House (PHYSICS TODAY, July 1983, page 57).

The defeat of Argonne in the political war for the accelerator opened an era of bad feeling among some congressmen as well as among some nuclear physicists. On Capitol Hill, the machine was derisively called the "Warnertron," after its staunchest champion, Senator Warner. To some members and their staffs, the SURA machine is considered a political plum, not a scientific gem. Senator Johnston is especially touchy about it. He was chairman of the Senate committee that originally ap-

proved the Colliding Beam Accelerator known as "Isabelle" for Brookhaven. After it was killed late last year, with the concurrence of DOE and Keyworth (PHYSICS TODAY, December, page 41), the CBA was dubbed "Wasabelle." When Warner and Virginia's junior senator, Paul S. Trible, accompanied by SURA leaders Harry Holmgren of the University of Maryland and James S. McCarthy of the University of Virginia, testified before the Appropriations subcommittee in June, Johnston displayed his knowledge of physics acquired over the years in Congress and asked: "Are you giving us another Isabelle?"

Last December, another *Long-Range Plan* by NSAC, now headed by John P. Schiffer of Argonne, reaffirmed the committee's previous recommendations for the 4-GeV cw electron accelerator as "an essential forefront facility" that is "eagerly awaited by the nuclear science community."

Bold italics. Although the report states that NSAC assumes the electron accelerator will be built quickly as a "national user facility," it often gives a curious impression that the committee places more emphasis on a relativistic heavy-ion collider at about 30 GeV per nucleon. The collider is described in bold italic print as "the highest priority new scientific opportunity within the purview of our science" and recommended as "the next major construction project for nuclear science." It happens, as a quirk of history, that, since the cancellation of Isabelle, Brookhaven is the frontrunner for a heavy-ion collider to meet the specifications of NSAC.

To Congress and DOE, the Barnes committee and Bromley panel had seemed decisive enough. They conveyed the impression that nuclear physics needed a 4-GeV electron accelerator, but the Schiffer committee, by calling for a heavy-ion machine, had raised doubts.

"Is it any wonder, in view of what the Schiffer report says, that Congress is bewildered?" asks Proctor Jones of the Senate staff. "If push comes to shove, the SURA project may not be so important to science." This disposition has been conveyed to members of Congress by dozens of scientists, says Jones. "Some scientists are stirring up troubled waters," claims Enloe Ritter, director of nuclear physics at DOE. "They are trying to pervert the recom-

mentations of their own advisory groups." Ritter and other DOE officials say they have heard from scientists who want to bypass the SURF machine and go directly to a heavy-ion facility, to reopen the case for Argonne, support a higher energy for SLAC or upgrade the Bates accelerator at MIT.

"Some people are accusing us of waffling on the SURF accelerator," says Bromley, a member of the Schiffer committee. "We didn't pay a whole lot of attention to the accelerator because we were told at the outset by DOE and NSF that SURF was already approved and behind us." By scanting the accelerator in the NSAC report, argues another Senate staffer, Ben Cooper, "it left the committee's commitment to the machine somewhat fuzzy. That approach often causes problems on Capitol Hill."

Technical problems. Compounding the uncertainty are the technical problems that SURF needs to solve. The klystrons required to maintain the average current of the beam at 240 microamps are beyond the state of the art. The radio-frequency power system to recirculate the beam still needs to be perfected. The electrostatic septa used in extracting the electron beam from the accelerator ring must be proved. Moreover, in the last few months new questions have arisen about the energy range for exploring quantum chromodynamics. A paper by Nathan Isgur (University of Toronto) and C. H. Llewellyn Smith (Oxford) in *Physical Review Letters* (26 March) suggests an energy range based on their quark model far above that of the SURF machine. "This theoretical model is being used as an argument that not much will be seen by SURF," says Ritter.

To make matters worse, SURF is considered by some to be "something off the wall." As neophytes in the accelerator game, says a Johns Hopkins physicist, "they lack credentials for the project." His department voted to stay out of SURF, he claims, "because we didn't think the machine would ever be built and even if it were, we didn't think it would do the job of answering fundamental questions."

The absence of experience is a sensitive point. SURF offered the directorship to Paul Reardon of Brookhaven and to Tom Elioff of Lawrence Berkeley, but both turned it down because of the many uncertainties of the project. In July, McCarthy was appointed permanent director. Until then, SURF had only three people at the University of Virginia on its permanent staff. It operated on \$160,000 from the Commonwealth of Virginia and \$5000 from each of the member institutions. On 1 July, it received \$2.5 million from Virginia for the next two years. It has hired 20 staff members, and SURF



At Senate hearing on SURF, testimony is given by (left to right) Holmgren, the organization's president, Virginia senators Warner and Trible, and McCarthy, the accelerator's director.

schools are committed to hiring the first nine of 25 new physics faculty this year.

McCarthy, who had been acting director of the SURF project since it was "only a gleam in the eye of its beholders" seven years ago, says that last year's fight with Argonne gave the accelerator a "political visibility" that led to intense Congressional scrutiny. Instead of receiving a detailed cost estimate, Congress was told during last year's hearings that the project would cost about \$147 million. At hearings last spring the cost had risen through inflation to \$170 million, which includes some \$40 million for detectors, spectrometers and other additional equipment that had not been foreseen in 1983. Some scientific antagonists and Congressional staffers argue that costs will run to as much as \$230 million or \$240 million because of expected "escalation" and "contingencies" to build the machine and require \$20 million to \$30 million to operate each year.

The House of Representatives approved the administration request of \$5 million for organizational and R&D activities and another \$2 million for construction in fiscal 1985, but the Senate balked at such expenditures. It went on to express "concern about the direction of the program, particularly in view of future budget constraints and proposals for new accelerator facilities" and asked for a five-year plan for nuclear physics, including funding assumptions, to be submitted to it by 1 January for consideration with the DOE budget request for fiscal 1986. Meanwhile, it recommended cutting the House figures for SURF to \$2.5 million for R&D and nothing at all for construction. It did this, says the Senate bill, "to further consider...the purpose and need for this new accelerator facility and the possible establish-

ment of another national laboratory."

On 26 June, the House-Senate conference agreed "to defer, without prejudice, the construction of Project 85-R-203, the continuous electron-beam accelerator facility"—though it raised operating expenses to \$3.5 million to continue R&D and architect and engineering activities. On 3 August, DOE signed a contract with SURF providing \$1 million out of "reprogrammed" 1984 funds—the first Federal dollars to go toward the accelerator.

Another review. As a result, Keyworth and DOE asked NSAC to convene a subcommittee immediately to look at the SURF machine in the clear light of the arguments made by its detractors and to reassess the scientific issues. The charter given to the subcommittee, headed by Erich Vogt of the University of British Columbia, asks: "In the face of our latest scientific understanding, is the original recommendation to build a 4 GeV continuous wave electron accelerator still the most effective strategy for nuclear physics and, especially, for exploring this important frontier of the field?"

The Vogt subcommittee met on 16-17 July and on 4 August without coming to agreement on an answer. It intends to reach consensus by early September and submit a report for NSAC to deliberate before sending on recommendations to DOE and NSF for action in the fiscal 1986 budget cycle. SURF's McCarthy is philosophical about all this. "Nuclear physics is a diverse discipline with a large variety of viewpoints," he says. "I regret all the rehashing of arguments once the peer review system has conducted what we all consider a fair and open examination. At SURF, we are clearly aware that there are many motives for reopening the examination."

The debate is sure to keep SURF scientists twisting in the wind. —IG