Super Collider: Steps to reality

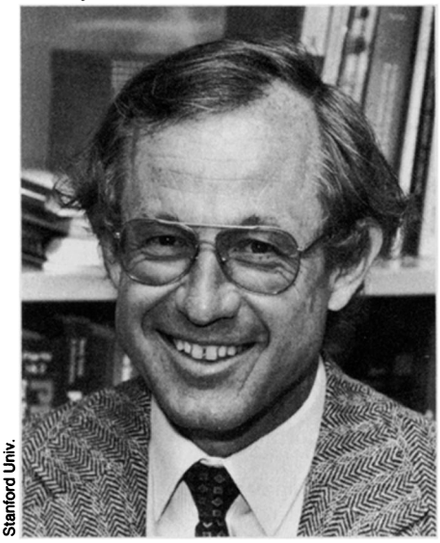
Long a dream, in recent years something of a plan, the Superconducting Super Collider (SSC) is now poised to take on a certain political, organizational and physical reality. The coming fiscal year, 1988, will be "crucial" for the development of the giant proton accelerator and collider, Stanley J. Wojcicki of Stanford University, a member of the SSC Central Design Group, told SCIENCE NEWS in a recent interview. Particularly important, he says, is an appropriation of $10 million in construction funds, which along with $25 million more in research and development funds, is contained in the Department of Energy's (DOE) budget request for fiscal 1988.

As of the beginning of August, the House had passed the appropriation bill with the $25 million in research and development funds but without the $10 million in construction funds. (DOE sources say the omission was due simply to a semantic misunderstanding and hope the construction money will eventually be reinstated.) The Senate budget committee, however, has approved the appropriation bill with the $10 million construction funds. Several further steps in the Senate consideration process remain, as the Senate recessed without finishing consideration of the bill. If the $10 million in construction funds survives the full Senate process, the difference will presumably be one of the items to settle in a Senate-House conference.

The $10 million construction money may not be the largest part of the SSC's proposed appropriation, but it is psychologically important to the people planning the apparatus as a sort of moral commitment to the project by Congress, and the next step toward making the SSC a reality. Wojcicki says it would allow the Central Design Group to increase its staff and carry the work forward at an optimum rate, and one more or less in tune with the DOE's site selection procedure. Last week more than 200 members of the House introduced a bill declaring support for the authorization of the initial $35 million for the SSC and for future appropriations.

The U.S. government has moved toward a commitment to the SSC by small steps, and has done so unilaterally. Foreign physicists have complained sharply that the U.S. government did not come out up front and invite them and their governments to form an international association for the SSC like the one that governs the European CERN laboratory. Nevertheless, the U.S. government has invited foreign participation, although under the circumstances those governments are waiting for a firm U.S. commitment to build the SSC before committing themselves. On the other hand, some people in Congress apparently would like to see firm foreign commitments before committing the United States.

If there is to be foreign participation, that will have to be coordinated with developments in the United States, and that coordination will require an authority capable of negotiating and deciding. Wojcicki does not expect that foreign governments will simply send checks for certain amounts of yen or lire—Japan and Italy seem to be most interested now — but will offer contributions "in kind." He envisions, for example, the manufacture of magnets or other components in Japan or Italy.



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Furthermore, experimenters are already designing the experiments they want to do at the SSC. As these will have to be built at the same time as the accelerator, there will soon have to be somebody empowered to decide what experiments will be done and in what order. For these and other reasons Wojcicki thinks DOE should soon set up a proper laboratory organization.

Completion of the SSC would cap 60 years of development of artificial means of energizing and accelerating subatomic particles in an effort to use them as probes of the microscopic structure of matter. Around 1930, scientists began developing means of accelerating probe particles, protons or electrons, so that they could penetrate and reveal the most microscopic structures of matter. As accelerators of greater and greater energy developed, they revealed ever-finer structures. In the search for the most basic level of all, the SSC will accelerate two beams of protons to energies of 20 trillion electron-volts each and collide them with each other.

Planning for the SSC began in earnest about five years ago. The planners have been concentrating on the large magnets that will bend the path of the protons so that they go around a circle about 52 miles in circumference. The protons get a little bit of energy each time around. The magnets come first in the design because they are the most numerous pieces of hardware — there will be several thousand of them — and the most innovative items technologically. Magnet work can also go forward before the designers know where the SSC will be located.

Three prototype magnets now exist, and a fourth is on the way. The third already reaches the magnetic-field design specifications for the SSC, Wojcicki says, although it may not be exactly what they would want for a final version. What they learn from instrumenting and testing these magnets will enable them to perfect the design. One of the important temporal milestones will be to start industrial production of the magnets by 1991.

The magnets use superconducting wires. There have been suggestions from persons outside the design group that the SSC ought to use some of the new high-temperature superconducting materials, rather than the conventional ones now in the plans and in the existing magnets. When they investigated the question, the Central Design Group found that the trade-offs required for the substitution would not allow them to save nearly as much money as one might at first expect. Furthermore, any such substitution would depend on having usable wire made out of the new materials, Wojcicki says, and that could be many years in the future. The Central Design Group doesn't want to wait.

The designers can work on the magnets more or less independently of the site selection, but when they come to the next step, the injector, they would like to know where the SSC will be. The injector will be a preaccelerator that will take the protons from their natural state as hydrogen nuclei and accelerate them until they reach an energy at which it is practical to put them into the main accelerating ring. One of the proposed sites, the Fermi National Accelerator Laboratory in Batavia, Ill., has an accelerator in place that could serve as the injector for the SSC; the others do not. Wojcicki says there are some things you can do in principle on an injector without knowing whether it will have to be built from scratch or not, but still, they have to know fairly soon.

Aug. 3 was the original deadline set by the DOE for states to make site proposals. A recent announcement extended the period to Sept. 2. Wojcicki now expects there will be at least 35 site proposals. The designers are concerned about further slippage of the deadline. If the site selection procedure is delayed by a substantial amount, as much as a year, for example, that could upset other parts of the timing, he says. — *D.E. Thomsen*