High Energy Physics

As one of the "four other eminent particle physicists" referred to in R. Jeffrey Smith's article (News and Comment, 14 June, p. 1295), I write to protest the distortions and imputed motives appearing in his story and elsewhere in the pages of *Science* in recent months about the project known as the SSC (Superconducting Super Collider). Far from being an organizer of a "hard sell" symposium at the annual AAAS meeting, I responded to a request from Rolf Sinclair, a functionary of the AAAS, to participate in a general interest symposium organized by him, with the assistance of Stanley Wojcicki. Despite the pressures as one of the physicists trying to carry out the R&D necessary to make the SSC a feasible scientific instrument at the lowest possible cost, I responded out of a sense of duty (as I do to similar calls from other scientific societies) to inform fellow scientists about recent progress in high energy physics and the scientific justification for the SSC.

Smith's account makes one question whether he actually attended the symposium, or only the AAAS-arranged press conference the previous day. If he did take the time to attend the symposium, he heard me and others discuss the status of our field, the progress of the SSC R&D program, and the challenges of doing experiments at such a facility. Among the audience of a 100 or fewer was a skeptical high school chemistry teacher who, after some early hard questioning, ended the symposium with thanks to the chairman and speakers for a clear and organized presentation of the scientific issues. Perhaps this is evidence of the efficacy of our "hard sell for the SSC," but I prefer to interpret it otherwise.

Smith refers to an earlier article by David Dickson (News and Comment, 24 May, p. 968) about the presently vague plans at CERN for a hadron collider in the Large Electron-Positron Collider (LEP) tunnel—a tunnel, incidentally, that is only now being dug. Dickson's uncritical reporting of European statements, repeated by Smith, on comparative costs of the so-called Large Hadron Collider (LHC) and the SSC is not what I expect of good science journalism. Neither is the use of such statements as the SSC's "estimated $4- to $6-billion cost." The only serious cost estimate of the SSC was made in the Reference Designs Study in the spring of 1984. There the cost of the accelerator and its central laboratory was calculated to be between $2.7 and $3.0 billion, depending on the style of magnet chosen, in fiscal-year 1984 dollars, including 25% contingency. No revision of those figures has occurred. Other costs have been quoted, but they refer to different things and in different currencies. For example, the often quoted $6 billion dollars is a figure in "then year" (cheaper) dollars, with an estimate for inflation over a ten-year period and refers to the accelerator plus all preconstruction R&D and other costs, a full complement of detectors, and computers. For Congress, such a number may well be appropriate and useful, but it is *not* an upward revision of the original $2.7 to $3.0 billion.

Dickson's piece distorted the U.S. position on international cooperation, stating that the Europeans received a chilly reception when they asked for our cooperation to build the LHC in the LEP tunnel. Since the LHC is still an idea being kicked around the European Laboratory for Particle Physics (CERN), and since, to my knowledge, no request for U.S. participation has been made in any official way, it is grossly unfair to imply a lack of willingness to cooperate. International cooperation is a complex, many-faceted issue. From our point of view, the Europeans' reply to our suggestions for cooperation on the SSC—"We are too fully committed for the next five years with LEP at CERN and HERA [Hadron-Elektron-Ring-Anlage] at DESY [Deutsches-Elektronen-Synchrotron] to give you more than moral support"—is disappointing, but reasonable. Let *Science* not say the Europeans refuse to cooperate!

The last paragraph of Smith's article is particularly offensive, with its sarcastic talk of "a long-running sales campaign" and its accusation of lobbying by the Universities Research Association. The URA is an association of 56 research universities, created in the mid-1960's to serve as the administrative umbrella for Fermilab and now entrusted by the Department of Energy to administer the R&D phase of the SSC, as its parameters and viability are established. The URA maintains a minuscule organization in Washington. The funds go to the science.

If articles like Smith's are the only thanks I get for responding to a request from the AAAS, I know what to do in the future. *Science* would serve the scientific community better if it addressed the scientific need for the SSC on its merits. The project *is* expensive. Scientists in other fields have legitimate concerns. Particle physicists understand those con-

cerns. They are enthusiastic about other fields of science and the aspirations of those fields. They do not want the SSC to be built at the expense of other sciences. But it is an instrument that the whole U.S. high energy physics community sees as the next necessary step. We ask that other scientists examine the fundamental science that the SSC will explore. We firmly believe that they can support the importance of that science and join us in exploring the energy frontier with the SSC.

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My article was based on remarks made by the principal SSC scientists at the symposium as well as the press conference, a stack of written material provided by the organizers, and a private interview with Leon Lederman.

During the press conference, Lederman stated plainly that the purpose of the seminar was to convince scientists in other fields that the program was worth its cost. As Jackson reports, a high school science teacher did say "you have our support" at the end of the session. But he does not mention that the response from the podium was an exultant comment by one of the organizers that "It worked! It worked!" (The remark is audible on side 2 of tape number 85AAAS-57, available from Mobiltape Company, Inc. in Glendale, California.)

Perhaps the most authoritative source of information on the SSC's cost is the Central Design Group's "Siting parameters document," issued on 15 June, which lists a total figure of $4 billion (in 1984 dollars). This figure has been frequently cited by Lederman, Sheldon Glashow, and Maury Tigner. As to Jackson's point about URA funds going strictly "to the science," $15,000 was also used to publish 10,000 copies of the pamphlet mentioned in my article—essentially a fancy sales brochure.

Finally, it should be noted that, although Rolf Sinclair serves as secretary of the AAAS physics section, he is employed full-time as program director of the division of atomic, molecular, and plasma physics at the National Science Foundation.—R. JEFFREY SMITH

My references to the costs of CERN's Large Hadron Collider (LHC) were not uncritical. The sum of "less than $1 billion" was described as an "informal estimate," and I explicitly stated that this depended on important factors such as the successful development of new superconducting magnets.

Nor have I "distorted the U.S. position on international cooperation," since I did not say, as Jackson implies, that Europe had made any formal request for U.S. participation in the LHC. The "frosty reception" referred to the atmosphere in informal discussions and was based on interviews with several CERN physicists. Jackson's words "grossly unfair" are therefore based on a misinterpretation of what I actually wrote.

—DAVID DICKSON

Hydroelectricity from Canada

The editorial "Electric power from the north," by Philip H. Abelson (28 June, p. 1487) sings the praises of use by the United States of relatively cheap hydroelectricity generated in Canada. Certainly there are benefits: less radioactive waste; fewer strip mines; fewer oil spills; less acid rain from hydrocarbon-fired utilities; less reliance on petroleum imports from abroad; and saving of hydrocarbons for future pharmaceuticals, plastics, and lubricants. If the electricity is less expensive than what can be produced in the United States, the United States saves, and Canada gets probable short-term profits and possible long-term problems.

In some places, dams are useful for hydroelectricity, navigation improvement, flood control, water supply, and recreation. The dams being built in Canada do not have locks, so river travel will become more difficult. There is little need for flood control, water storage, or additional recreation facilities in the areas where the dams are being constructed because of low population density and abundant glacial lakes.

Abelson states that Robert Bourassa of Quebec "emphasizes the hazards and environmental damage arising from nonrenewable sources of electricity while extolling the value of clean, renewable hydropower." All methods of generating electricity are hazardous to a degree and cause at least some environmental damage. Let us not forget the 1976 Teton Dam failure in eastern Idaho or the magnitude 6½ earthquake in 1977 that may have been caused by the weight of the Koyna Reservoir in India. The Canadian reservoirs drown riparian habitat, affect plant and animal communities, and may cause extinctions and climate change. Did we imagine the effect on salmon runs when we began damming the Columbia River before World War II? Will waves erode the reservoir shorelines? Will the reservoirs trap sediment that nourishes coastal beaches? If a reservoir fills with