

WIDENING THE FIELD OF SSC MAGNET COMPETITORS

We read your news story on the SSC magnet program (April, page 17) with great interest. We strongly support the SSC project, and indeed have done so since its conception. We would like to comment on three aspects of the magnet program that were raised in your news story.

The present cos θ magnet design for the SSC is an extrapolation of a design philosophy that has evolved over almost two decades in our national laboratories. The cos θ design was first employed in the projects ESCAR at Lawrence Berkeley Laboratory and Isabelle at Brookhaven National Laboratory, both of which encountered a variety of magnet problems and ultimately failed. It has been used with more success in the Fermilab Tevatron and the DESY HERA collider. Even in these latter projects, it has been necessary to provide a significant margin of performance between the design field of the magnet and the operating field of the collider. Thus Fermilab's magnets were designed to achieve 4.5-tesla field strength, but are operated at 4 T for collider operation, and 3.6 T for fixed-target operation, which requires much more frequent cycling. DESY has allowed a 20% margin between the HERA collider design and magnet specification. The SSC magnets provide no such margin and so far have not achieved design performance.

The development of superconducting magnets at our national laboratories has been conducted with little involvement by US industry. Except for the ill-fated Isabelle project, not a single superconducting accelerator dipole has been contracted to US industry by the national laboratories. By contrast, the laboratories elsewhere in the world (CERN, DESY, KEK) involve industry vigorously throughout the development of accelerator magnets, and as a result the industrial firms are capable of achieving design standards in production soon after a design is proven in test. Our nation pays a heavy price for its unfortunate policy, as illustrated recently when Brookhaven contracted

Brown-Boveri (a Swiss company) on a sole-source basis to provide prototypes of the superconducting magnets for the Relativistic Heavy Ion Collider. We note that three US firms successfully built models of the Texas Accelerator Center's superferric collider dipole, including three 28-meter-long two-in-one dipoles built by General Dynamics (see PHYSICS TODAY, July 1986, page 21).

There is a general perception that superconducting collider magnets are extremely complex and difficult to build. We agree that the design chosen by the SSC management is very difficult to build. On the other hand, last year the Texas Accelerator Center successfully tested a model magnet of a new superferric design, which achieved a 6-T field strength.¹ It is much easier to build than the SSC design, uses less exotic materials and achieved design performance on the first try. TAC is working with General Motors and Intermagnetics General to extend this design to 8-T performance, which would provide a 20% margin for the SSC design. Designs are also under development at CERN for a 10-T cos θ dipole and at Fermilab for an 8.8-T cos θ dipole, in each case employing improved collaring techniques and superfluid helium to enhance stability.

In light of these considerations, we suggest that the marginal performance, noninvolvement of US industry and complicated design of the SSC magnet are all matters of design choice to which reasonable alternatives may exist.

Reference

1. J. C. Colvin *et al.*, "The High Field Superferric Magnet: Design and Test of a New Dipole Magnet for Future Hadron Colliders," to be published in Nucl. Instrum. Methods.

F. RUSSELL HUSON
PETER M. MCINTYRE
Texas Accelerator Center
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MAURY TIGNER REPLIES FOR THE SSC CENTRAL DESIGN GROUP: We appre-

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ciate the opportunity to respond to the letter by F. Russell Huson and Peter McIntyre, as we feel that some of their statements may leave the reader with a confusing picture.

The design concept now being developed for SSC magnets was carefully chosen after a meticulous study of five different magnet styles, including two that were being worked on at the Texas Accelerator Center at the time. The study itself was of a year's duration and was based on information produced in studies spanning several years. That information had many components: model measurement and test results, engineering analyses, manufacturing process studies, cost studies and documented experience with operating accelerator magnets. The final recommendation to develop the current design was rendered by a panel of experts including senior scientists and engineers from the same companies, foreign and domestic, cited by Huson and McIntyre.

As a result of close collaboration among the DOE, the SSC magnet developers, university scientists and the US superconductor industry, US industry now produces the highest-performance superconducting cable in the world. This cable is the heart of any magnet and is now ready for application to a range of products, including manufacture of the SSC magnets in industry, as was foreseen from the beginning.

You will be interested to know that a full-length SSC dipole has now operated at 7.6 tesla, 1 tesla above the nominal SSC operating point.

MAURY TIGNER

*Superconducting Super Collider
Universities Research Association*

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Berkeley, California

Science Burdened by Bureaucrats

In his Reference Frame column "The Big, the Bad and the Beautiful" (February, page 9) Leo Kadanoff has opened our eyes to the realization that our tremendous investments in big-science projects are not beneficial to science as a whole. But this is not the only factor that is driving the development of the world of science in the wrong direction. A far greater and more disturbing factor is this:

Our world of science is predominantly staffed by huge professional bureaucracies. A thousand scientists on the staff of a major laboratory is quite common. The operation of these large bureaucracies is dominated by one principle—the first law of

bureaucracy. In these giant bureaucracies there are two types of people—the "promoters" and the "producers." The promoters dominate the managerial aspects of the agency. They make the budgets, allocate manpower and funds to particular tasks, and so on. The producers are the ones who produce the theoretical advances, create the research machines and make them work.

The first law of bureaucracy is this: As the years go by, the promoters get pushed up and the producers get pushed out. This goes on until there is such a pile of promoters riding on the backs of so few producers that the enterprise collapses. Then we have a disaster like the explosion of the space shuttle or the nuclear reactor catastrophe at Chernobyl.

Our nuclear weapons program is concentrated largely at the Lawrence Laboratory in Livermore. This laboratory started in 1952 with about 60 people. By about 1965 it had grown to a staff of several thousand, and it is currently running with a staff of 8500. This means that the first law of bureaucracy goes relentlessly on, and the promoters in our nuclear weapons programs have grown to great numbers while the producers have been reduced to a relative few. When that situation is reached, there are so many promoters riding on the backs of so few producers that the whole machine breaks down and a disastrous accident occurs. Therefore, for our nuclear weapons program this disaster cannot be far away.

HYMAN OLKEN

Livermore, California

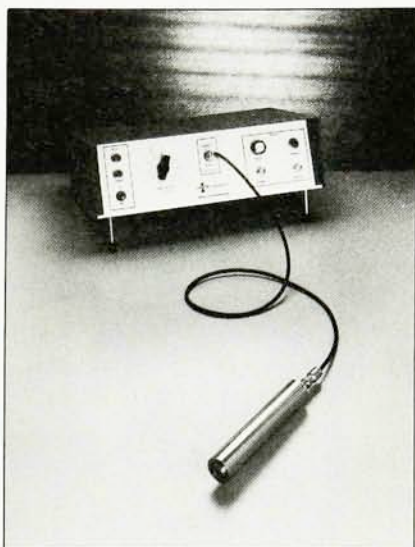
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THE ASSOCIATE DIRECTOR OF LIVERMORE REPLIES: In his letter Hyman Olken expresses his concern for "small science." At the Lawrence Livermore National Laboratory we strive for a balance of big and small. We have many small research contracts and grants that produce new results and new ideas on the scale of a single graduate student or postdoctoral researcher. We also have large-scale projects that qualify as big science. Each large-scale project includes many small-scale projects. But large or small, research projects at the laboratory depend on "producers," and LLNL is rich with producers in all parts of our organization.

While the laboratory as a whole has grown, its nuclear weapons effort is actually smaller than in 1965. The growth is due to new programs, including many small ones, in biology and medicine, energy and non-nuclear defense technology. We

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