

LETTERS

Superconducting Magnets

The article "Magnet failures imperil new accelerator" by William J. Broad (News and Comment, 21 Nov. 1980, p. 875) deals with the Isabelle project at Brookhaven, a cornerstone of the national program in high energy physics. Unfortunately the article contains many misleading statements and errors. The author did not visit Brookhaven, relying instead on phone calls and reports, nor did he refer any part of his article back to the laboratory for checking of facts. In a matter as complex and important as this, more careful procedures might have been in order.

I limit my comments to the parts of the article directly involving Brookhaven. In summary, it is true that getting the Isabelle superconducting magnets ready for production has presented us with serious and unanticipated difficulties and that we have had to mount strenuous efforts to overcome them. These efforts are very much still in progress. However, it is simply not true that, as asserted in the article, the Isabelle project is "teetering on the brink of a technological failure."

The article describes inaccurately the history of magnet development at Brookhaven and casts discredit unfairly on the many able people involved. Most important it denies the progress that has occurred since the magnets with Westinghouse coils were tested nearly a year ago. As a result of this progress we expect to be able to use magnets of the present basic design in Isabelle. Such use will entail some delay, and it is possible that it will require a reduction in the peak energy by as much as 10 percent. The article is wrong in asserting that these magnets could only be used up to 300 GeV, a 25 percent reduction in energy. At its last meeting in Washington (9-12 November), the High Energy Physics Advisory Panel, an independent group of distinguished scientists, reviewed the project and went on record with the conclusion that a reduction of 10 percent in energy would be acceptable because it would not significantly impair the capability of the machine to do its job.

The article states (on no authority) that the production of magnets could fall 3 to 4 years behind if a different magnet design is selected. A different design is the most extreme option, and we estimate that would involve a delay of 2 years.

The article refers repeatedly to "little model magnets" and leaves the clear impression that the Isabelle project was launched after only very small model

magnets had been built. This is a damaging assertion, and it is simply wrong. The size was increased by only about 10 percent in going from the Mark series of magnets, started in 1975, to the Isabelle design.

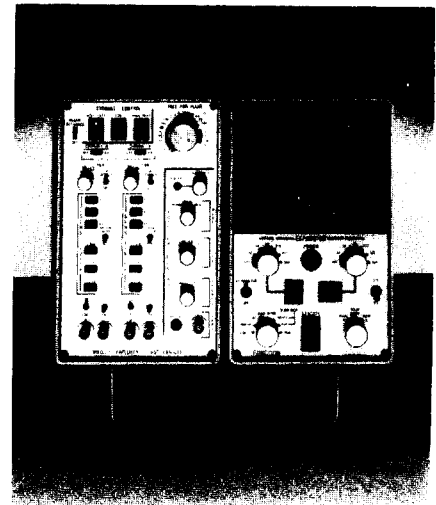
In discussing the Westinghouse magnets, the article says, "In addition, tests showed that the quality of the magnetic field was not suitable for use in a particle accelerator." In fact, it is well known that these magnets were meant to explore industrial production and the systematics of training and were never designed to have ultimate field qualities. The contract with Westinghouse was not canceled, as stated in the article, but extended from 6 magnets to 12.

The article states that "under federal pressure, Brookhaven officials this spring called together a ten-person panel of scientists and engineers not directly connected with the Isabelle project to evaluate the magnet problems." The fact is that the panel consisted of five persons; it was set up by the Project Head, James Sanford, in the summer of 1979; and it made its first report to him in November 1979. Sanford again activated the panel in the summer of 1980, asking, as a precaution, for specific evaluation of alternative magnet designs for Isabelle. The panel was not created because of federal pressure but because of decisions made entirely within the laboratory.

The article states, "In October 1978, just days after the start of the fiscal year, ground for Isabelle was broken." The implication is of reckless haste to get on with the project. In fact, Congress had authorized and appropriated \$5 million in the preceding fiscal year for the start of the project. Hence groundbreaking took place about 1 year after the initiatory congressional action.

The article avoids mentioning the many other aspects of this very large project, all of which are proceeding well. At this time there are no other major critical technical problems. In any state-of-the-art endeavor on the scale of Isabelle, unforeseen technical problems will arise; we expected this and are prepared to tackle them.

Although superconducting magnets for Isabelle are a problem, there is no reason to believe they are an "intractable problem." Successful superconducting magnets have been made at Brookhaven, at Fermilab, in Europe, and in Japan. We are pushing the state of the art, but that is appropriate for scientific projects and will allow us to achieve better performance and lower cost than if only well-understood and demonstrated technologies were employed.



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Moreover the advancement of superconducting magnets will benefit numerous areas of technology outside of high energy physics. The approach we used was a responsible one, as completion of the machine will show.

G. H. VINEYARD

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I have no detailed knowledge of the Isabelle or ESCAR projects, but statements made by William J. Broad concerning Fermilab are misleading.

Broad misrepresents the record of the Fermilab R & D program when he says that we built 130 superconducting magnets that were not "acceptable for use" in our accelerator and that "many went up in smoke." We indeed constructed about 100 full-scale superconducting magnets as part of an R & D program to learn how to mass produce these 7-meter-long, precision-wound devices. We started and aborted an additional 60 magnets in the various phases of uncovering and solving technical problems. Four magnets were deliberately tested to destruction in order to provide crucial data for the final design. It is appropriate to note that the Fermilab magnets differ from Isabelle magnets in several important design parameters because of the differences in injection energy and final field strength.

Our R & D program was obviously successful. Fermilab is now well underway in the construction of the Energy Saver Accelerator. We have assembled more than 250 magnets and measured their properties at room temperature; more than 95 percent have passed rigid tests for accelerator-grade magnetic field quality. More than 60 of these magnets have been assembled in cryostats, cooled to the superconducting state, and have undergone a rigorous set of mechanical and thermal tortures followed by more precise measurements of field strength and quality. We have conducted successful tests of strings of magnets—20 in an above-ground test facility and two strings of 40 magnets in the accelerator tunnel. More than 90 of the original R & D magnets are in use or scheduled for use in beam lines where the acceptance criteria are less rigid. Many of the incomplete magnets provide a stockpile of salvageable parts.

All of the above are ascertainable facts. Broad did not contact anyone at Fermilab about these issues.

It is certainly true that superconducting accelerator magnet technology has proved to be enormously difficult. In-

Johns Hopkins

SCIENCE AT THE WHITE HOUSE

A Political Liability

Edward J. Burger, Jr.
foreword by Don K. Price

Written by a former senior staff member in the White House Office of Science and Technology, this book examines the role of scientists as presidential advisers. Edward Burger argues that, because of a fundamental incompatibility between the goals and methods of science and those of politics, cooperation between the two is difficult, if not impossible. Burger illustrates his argument with examples drawn from his own White House experience concerning government planning in such areas as national health care, environmental regulation, and population and family planning. \$14.95

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Alexander Rosenberg

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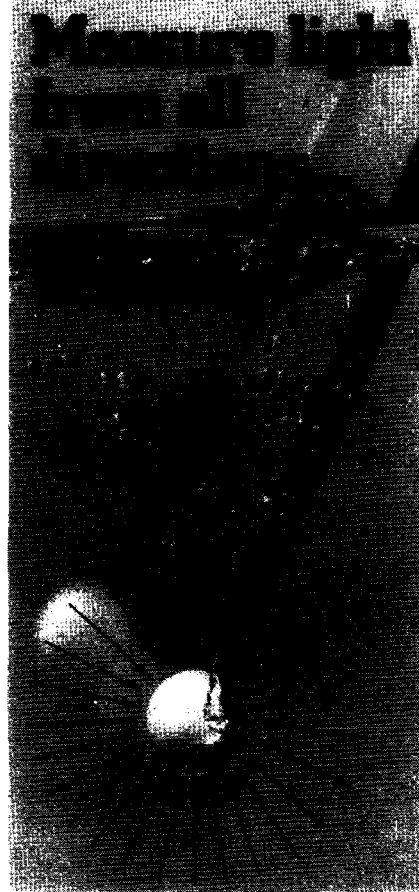
deed, the Fermilab approach to R & D through extensive production (devised by R. R. Wilson) was successful in permitting solutions to be found to a myriad of difficult and unanticipated technical problems—solutions which were compatible with mass production techniques. This is the essential reason why R & D is needed. As Broad states, the superconducting accelerator program is at the edge of novel technology, and we still face formidable obstacles such as the assembly, commissioning, and operation of very large cryogenic systems and of 4 miles of superconducting magnets carrying intense beams of high energy particles. The risks are high, but the scientific payoff is enormous.

The combined experience gained at Fermilab and Isabelle will provide the nation with a heritage of mastered superconducting magnet technology. This is one area where we are comfortably ahead of the Soviet Union, Western Europe, and Japan. The knowledge obtained in the accelerator laboratories has already played an important role (and will continue to do so) in a vast array of applications, not only to future generations of accelerators but also in fields as disparate as fusion, magnetohydrodynamics, motor generators, mass transportation, and power transmission. In this way the dedicated and anxiety-ridden labor of many scientists and engineers and the expenditure of large amounts of public funds will continue to pay off in large social as well as scientific benefits.

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... a few matters of record, in the order Vineyard raises them. I did not deny progress, saying instead "performance of the magnets is getting better." The Brookhaven panel itself urged a reduction to 300 GeV, calling such a move "sober and realistic." It also estimated that a new design could entail a 3-year delay, which added to the current 1-year delay comes to 4 years. The Westinghouse magnets were indeed meant for use in Isabelle, being called the "000" series (001, 002, and so forth), so that all 732 dipole magnets could be counted. It is true that the Brookhaven panel initially had five members, but for its second report (the only one I referred to) the panel had ten members. Lederman omits to mention that the field strength Fermilab is aiming for is not the 5 tesla needed for Isabelle but 4.3 tesla, a strength even the Isabelle Mark 5 surpassed in 1976.—WILLIAM J. BROAD



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