

building the LHC and doing research on this exciting new energy frontier.

In our study we did indeed address the challenge, the prospects and problems of upgrading the Fermilab Tevatron by doubling its energy and increasing the luminosity, as advocated by Orear. Suffice it to say that after analyzing that option seriously we came to the unanimous conclusion that US international collaboration with CERN on building and working at the LHC was the scientifically preferable option. Our conclusions and recommendations were also endorsed unanimously by the High-Energy Physics Advisory Panel, to which we reported our findings.

I should also add in response to Orear that my panel did not operate "under the rigid assumption that the next accelerator above the LHC energy *must* be an international enterprise." However, it is my personal view that international cooperation in scientific research, which has been prevalent in high-energy physics for decades, is appropriate when it comes to building billion-dollar accelerator facilities that will be unique research tools worldwide. It has long been my personal view that the SSC should have been initiated as a truly international design and construction project. It might still be alive today had that been the case!

Orear also alleges that not only is the report of my subpanel "being misused to promote the LHC over the physics that we *Americans* [emphasis added] would normally be doing at that time, but it is being used to promote linear colliders over hadron colliders." Orear is of course entitled to his personal view of what "we Americans would normally be doing at that time." It happens to be a view rejected by the subpanel on both practical and scientific grounds. However, I believe there are no substantive grounds to support his allegations of misuse of our report to promote future electron linear accelerators over hadron colliders. We expressed strong and clear support for a strong program in advanced accelerator R&D to create new technical possibilities for advancing the frontiers of high-energy physics. Prospects for continuing to probe for nature's elementary structures and forces at greater depths will depend on the inventiveness and creativity of accelerator physicists in developing practical new paths of progress, and of experimentalists and theorists in asking the right questions and advancing the sophisticated art of detectors. More power to them, and may the best ideas win! Past progress has made it abundantly

clear through the years that we are not wise enough to predict *a priori* whether the electron or hadron frontier will lead to the next big breakthroughs. Both frontiers have proved to be of critical importance, their mutual progress has proved to be of great value, and their active proponents deserve our encouragement.

Finally, it was of utmost importance that our subpanel report successfully built a broad consensus among a large number of American physicists around a future vision that includes the LHC. If we cannot agree among ourselves as a community, we will have little ability to persuade our society and government, who must pay the bills to provide the necessary support.

►SIDNEY DRELL

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Antiferromagnetism's Parisian Premiere

I wish to point out an error made by Barbara Goss Levi in her news story about the 1994 Nobel physics laureates, Bertram N. Brockhouse and Clifford G. Shull (December, page 17). Writing about Shull's work at Oak Ridge National Laboratory with Ernest O. Wollan, Wallace Koehler and J. Samuel Smart, Levi states, "In the course of this work they came up with the first experimental demonstration of the existence of antiferromagnetism, which had been predicted by Louis Néel."

Néel, in the award lecture he gave on receiving his Nobel Prize, acknowledged that the first experimental demonstration of the existence of antiferromagnetism was done by Henri Bézette, Belling Tsai (who were graduate students in Paris) and me (a post-doctorate fellow).¹ I followed our 1938 paper with a full-length article.² Shull was well aware of this earlier work, and he and I discussed it at Oak Ridge in 1948.

The 1938 publication was presented to the French Academy of Science by Aimé Cotton, director of the laboratory at Bellevue, Paris. In the spring of 1938, I was sent to the University of Leiden, the Netherlands, to discuss our antiferromagnetism work with Hendrik A. Kramers and Hendrik Casimir. They were delighted.

All of this history of antiferromagnetism, with credit to Shull and Smart for their neutron diffraction

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studies,³ is given in my book *Low Temperature Physics* (McGraw-Hill, 1953).

References

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2. C. F. Squire, Phys. Rev. **56**, 922 (1939).
3. C. G. Schull, J. S. Smart, Phys. Rev. **76**, 1256 (1949).

►CHARLES F. SQUIRE
Houston, Texas

Don't Hype Industrial Gains from Gov't Labs

Charles V. Shank's article "Recharging the Energy Laboratories" (July 1994, page 42) provides another opportunity to discuss industrial competitiveness and its relationship to government-funded and directed research. Although I believe the laboratories mentioned in the article do have a very important role to play in the economy over the long run, if unattainable goals are put forth for short-term budget gains, damage will be done to the entire research system. The issue is how much emphasis and justification should be placed on increased competitiveness as the reason for government funding and what damage might be done should the argument be unveiled as disingenuous.

To what extent can a \$6 trillion economy be affected by government research in the short term? In the case of the huge auto industry, for example, was the lack of government research to blame for the noncompetitiveness of the US industry a few years ago, and is government research now responsible for the increased competitiveness? The article does not put the role of research in perspective. Shank even states that he believes the laboratory scientists will be able to perform in the schedule- and cost-driven world of industrial partners. An alternative approach is to have each performer concentrate on that which it can do best, while assuring good communication and interaction.

Shank presents some very confusing information that points to a desire to rationalize existing conditions to satisfy the changing environment. For example, rather than discussing the process used for maintaining quality programs, he cites a controversial DOE review to demonstrate the high quality of work done by the labs compared with other research performers. He claims that that review, which

was found to be in violation of the Federal Advisory Committee Act,¹ showed a favorable comparison between university and laboratory research, when such a comparison is not the purpose of the current review process and Shank himself states that the two research performers are organized to produce different products. He also does not mention the review results on other programs, such as the energy technology and health and environmental programs.

Another confusing part of the article is the discussion of user facilities. Whereas Shank states that the article is focused on the energy science and technology laboratories, he mentions facilities beyond those particular laboratories, presumably to show fiscal pressure. But some facilities are identified as being helpful to industry. Is he suggesting the others be de-emphasized?

I am concerned that if the goals of government-sponsored research are exaggerated, other rational foundations for research will begin to disintegrate. Exaggerated claims can lead down a frustrating path similar to ones that have resulted in programs being terminated in the past. Armed with an accurate understanding of the role of research in the economy, I believe that program managers can convince politicians of the benefits of government laboratories and research if they present those benefits in a creative but balanced manner.

Reference

1. Science **264**, 1071 (1994).

►LOUIS IANNIELLO
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SHANK REPLIES: I appreciate the opportunity to respond to Louis Ianniello's comments on my article. During his leadership of the Department of Energy's Office of Basic Energy Sciences, Ianniello championed the cause of fundamental science in the DOE laboratories and won my respect and admiration. In particular, I share the concerns he expresses in the final paragraph of his letter. It is important to put the industrial partnership activities of the DOE laboratories in the proper perspective.

As I emphasized in my article, competitiveness is not a main, stand-alone mission of the DOE but rather a derivative mission. It comes from leveraging the investment made in the laboratories on behalf of our energy science mission to create value for the nation's economy. Our goal should be an increased awareness of the contributions we are making to the nation's industry in the process of pursuing our central mandate, not a redefinition of

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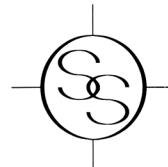
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