AIP

PHYSICS TODAY

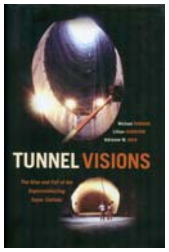
Tunnel Visions: The Rise and Fall of the Superconducting Super Collider

H. Frederick Dylla

Physics Today **69** (3), 52 (2016);
https://doi.org/10.1063/PT.3.3109

Tunnel Visions

The Rise and Fall of the Superconducting Super Collider



Michael Riordan, Lillian Hoddeson, and Adrienne W. Kolb

U. Chicago Press, 2015. $40.00 (480 pp.). ISBN 978-0-226-29479-7

"Super" is an apt description for the Superconducting Super Collider (SSC), the ill-fated particle accelerator that was well under construction near Dallas, Texas, before it was canceled by the US Congress in 1993. The project was super in size and energy—84 km in circumference, 20 TeV per beam—and it would have been the largest single application of superconducting magnets. If it had been completed, the SSC would now be the most powerful device of its kind, with more than double the energy of CERN's Large Hadron Collider.

However, the SSC got caught in a super mess: small science pitted against big science, pork-barrel politics, conflicting management styles, and changing views of the value of federal investments in science. Ultimately, the downfall of the SSC project was in large part due to rising construction costs, which made the project's budget estimate a moving target: In 1986 it was $3 billion; by 1990 it was $8 billion–$12 billion. The escalating cost became the story in popular and scientific publications during a time when Congress was looking for spending cuts to offset rising federal deficits.

The prospect of siting a multibillion-dollar capital project with a $330 million annual operating budget and more than 1000 permanent staff was a golden prize when the site-selection process began in 1988. The project's sponsoring agency, the Department of Energy, chose Waxahachie—just outside the Dallas suburbs—as the winning site from among 43 bids.

Tunnel Visions: The Rise and Fall of the Superconducting Super Collider, a nearly three-decade writing project, describes the birth and death of the SSC. The authors—Michael Riordan and Lillian Hoddeson, both science historians, and Adrienne Kolb, a retired Fermilab archivist—illuminate the serious problems that led to the 1993 congressional vote to terminate the SSC. Those included several failures in project management and a faulty transition in expertise from the original Central Design Group to the SSC Laboratory that resulted in the inability to attract and retain seasoned accelerator design staff.

The painful history of management pitfalls is laid bare through the authors' extensive interviews and perusals of official governmental records. For example, DOE allowed just three months for contracting teams to pull together a management proposal that included industrial partners. Only the Universities Research Association, which managed Fermilab, was able to respond fast enough. Over time, an increasingly dysfunctional relationship between project managers and DOE administrators responsible for oversight resulted in a cumbersome structure of four poorly communicating levels of management—two from the association and two from DOE.

Riordan, Hoddeson, and Kolb detail the project evolution from conceptual design, to establishment of the SSC Laboratory, to a series of increasingly layered management structures whose intricacies hastened the project's termination. Changes from the original design increased the size and complexity of the magnets, which led to a concurrent doubling of the front-end injector energy. Those changes would have accelerated commissioning and provided more confidence in attaining the full design energy—but they also added $2 billion to the cost. The authors suggest that it would have been better to site the SSC at Fermilab and to copy the CERN model, in which a series of new and larger accelerators could be concatenated using existing infrastructure and existing staff.

The escalating cost of the accelerator was a ripe target for certain members of Congress—for example, the New York delegation, which was already smarting both from losing the SSC site competition and from DOE's 1983 decision to cancel the Isabelle accelerator at Brookhaven National Laboratory. As the SSC's costs rose, other segments of the scientific community targeted it. If the SSC were to be completed and operated for several decades, opponents claimed, there would be less money for federal funding of the rest of science. The materials-science community was particularly vocal.

In the end, the House voted 282–143 to cancel the project. The US high-energy physics community has not yet fully recovered.

I observed the political drama while managing the construction of another superconducting accelerator at the Continuous Electron Beam Accelerator Facility, part of DOE's Thomas Jefferson National Accelerator Facility in Newport News, Virginia. That was a smaller project, but it featured aspects of the SSC project management model and executed them well. It had a strong, hierarchical management scheme, had ties to the national and international research communities, conducted outreach to fields other than nuclear physics that could use the laboratory's infrastructure, and carefully cultivated political support.

The only fault I find with the book is an occasional repetitiveness that tighter editing could have eliminated. Because of my personal ties to the field and to the national lab community, I enjoyed the play-by-play account in *Tunnel Visions*. Others without such connections may dispassionately read this retelling of the birth and death of a megaproject. The SSC has lessons for all who advocate the public funding of science.

H. Frederick Dylla
American Institute of Physics
College Park, Maryland

Thermodynamics, Kinetics, and Microphysics of Clouds

Vitaly I. Khvorostyanov and Judith A. Curry

Cambridge U. Press, 2014. $115.00 (782 pp.).
ISBN 978-1-107-01603-3

Thermodynamics, Kinetics, and Microphysics of Clouds, an ambitious text by Vitaly Khvorostyanov and Judith Curry, offers a timely update and extension of the indispensable *Microphysics of Clouds and Precipitation* (Springer, 1996) by Hans Pruppacher and James Klett. The new text is particularly notable for