

space Corporation was being continually delayed, I used to say, "I will retire only when I am convinced that the DOD could not stop its support of the GPS even if it wanted to!" I did retire in 1977.

In the meantime strong support for the GPS had been given by many civilian leaders in the DOD and military leaders of the Air Force, among them Gene Fubini, Al Flax, Gerald Dinneen and General Lew Allen. As the system evolved, compromises in satellite orbits were made, working relations with the NRL established, and so forth. Some of NRL atomic (rubidium) clocks were flown side by side with Air Force (cesium) clocks. Use was made, at first, of the Navy's TRANSIT computing facility. The Aerospace Corporation continues to supply the Air Force with systems engineering for the GPS. Many scientists and engineers from government, academia and industry, here and abroad, have applied ingenuity to improved user equipment for various applications.

The DOD has declassified the elements of the GPS applicable to civilian use; Congress and the President have assured continued and reliable access to the GPS by all nations for peaceful uses. The Department of Transportation and the Department of Defense have issued a joint plan to terminate various other radio-navigation aids and in the future rely on the GPS as the principal global positioning system and radio-navigation aid.<sup>2</sup> The GPS will also serve in establishing an accurate worldwide mapping grid and accurate worldwide time synchronization system.

## References

1. I. A. Getting, *All in a Lifetime*, Vantage, New York (1989); IEEE Spectrum, December 1993, p. 36. *The Aerospace Corporation, Vol. 1: Its Work, 1960-1980*, Aerospace Corp., El Segundo, Calif. (1980), Library of Congress no. 80-67774. B. W. Parkinson, GPS World, September 1994, p. 32.
2. US Dept. of Transportation and Dept. of Defense, 1992 Federal Radionavigation Plan, January 1993.

IVAN A. GETTING  
*The Aerospace Corporation*  
El Segundo, California

2/94

KLEPPNER REPLIES: I thank Ivan Getting for describing the early history of the Global Positioning System and regret not having known about the role of the Aerospace Corporation.

DANIEL KLEPPNER  
*Massachusetts Institute of Technology*  
9/94 Cambridge, Massachusetts

## Reassigning Blame for the SSC's Demise

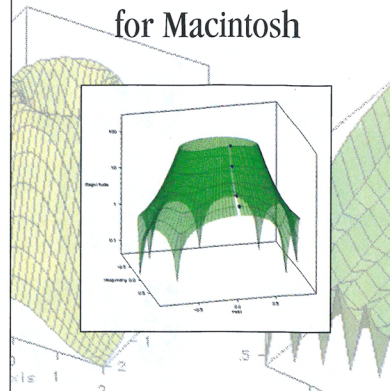
The February 1994 Washington Reports story by Irwin Goodwin (page 87) is an excellent review of the history of the Superconducting Super Collider project and the causes and consequences of its demise. In Goodwin's discussion of the "SSC as a procurement" former Energy Secretary James Watkins, SSC general manager Edward Siskin and DOE project director Joseph Cipriano come out as the villains of the piece in cutting the physicists out of the management loop. In point of fact the high-energy physicists were cut out of the loop long before, when Maury Tigner and his colleagues in the Central Design Group were dropped as the SSC design team and a controlling role was ceded by the Universities Research Association to aerospace and defense-related industries under alleged pressure from elements in DOE and Congress. This restructuring, which was facilitated by structural changes within DOE to remove the project from the normal Office of Energy Research chain, is noted by Wolfgang K. H. Panofsky in a letter to PHYSICS TODAY (March 1994, page 13). Edward Knapp, who was a principal in arranging the marriage, was removed as president of URA for his part. Subsequently Doug Pewitt, who also was an architect of the arrangement with these industries, tried to rein them in and became a victim of his own creation.

While Siskin and Cipriano certainly contributed to the debacle, it is easy to forget that they were brought in because the project was already in deep trouble as a result of these prior arrangements. Before Siskin arrived on the scene the original project manager had long since been removed because the project was in trouble, to be followed by a series of acting project managers, none of whom had experience in accelerator building. Technical focus and leadership were lacking. There had been multiple turnovers of the leadership of the administrative and conventional construction divisions. And there was no budget or schedule, in spite of the fact that Tigner had already had a cost-and-schedule system in place at CDG. But that system was discarded to make way for the defense-related industries to assume that aspect of the project.

There is indeed "enough blame for the death of the project for many people to share," as Will Happer, for-  
*continued on page 90*

Accelerated for  
Power Macintosh

## HiQ<sup>®</sup> Real-World Math for Macintosh



### Virtual Worksheet Interface

- Interactive analysis and data visualization
- Insightful 2D and 3D graphics
- Annotation for technical reports, journals, and presentations
- Publication-quality output

### Numerical Analysis Power

- More than 600 math, scientific, engineering, graphing, and utility functions
- Efficient algorithms with optimal convergence
- User-defined error tolerances

### Problem Solvers

- Intuitive GUIs for solving sophisticated problems
- Automatic math code generation

### HiQ-Script™

- A math language built for scientists, engineers, and mathematicians



Call for Your FREE Demo  
(800) 433-3488 (U.S. and Canada)

**NATIONAL  
INSTRUMENTS<sup>®</sup>**  
*The Software is the Instrument<sup>®</sup>*

6504 Bridge Point Parkway  
Austin, TX 78730-5039  
Tel: (512) 794-0100  
Fax: (512) 794-8411

#### Branch Offices

Australia 03 879 9422 • Austria 0662 435986  
Belgium 02 757 00 20 • Canada 519 622 9310  
Denmark 45 76 26 00 • Finland 90 527 2321  
France 1 48 14 24 24 • Germany 089 74 13 13  
Italy 02 48301892 • Japan 03 3788 1921  
Netherlands 03480 33466 • Norway 32 848400  
Spain 91 640 0085 • Sweden 08 730 49 70  
Switzerland 056 27 00 20 • U.K. 0635 523545

© Copyright 1994 National Instruments Corporation. All rights reserved. Product and company names listed are trademarks or trade names of their respective companies.

Circle number 15 on Reader Service Card



continued from page 15

mer head of DOE's Office of Energy Research, notes in Goodwin's report. But for those of us who slugged away for so long to try to make the SSC a reality it seems that an undue share of responsibility is being placed on the high-energy physics community. The one aspect of the project that had continuity with the CDG planning controlled by the physicists was the construction of the tunnels—the one great success of the project. The celebration of Bob Wilson's 80th birthday reminds us that physicists do know how to carry out major scientific construction projects, at a price and on a schedule that the country can afford, because our hearts are in it. If there is a lesson to be learned from the demise of the SSC, it is probably that basic research projects do not mix with a DOD-aerospace culture.

TIMOTHY E. TOOHIG

*Superconducting Super Collider  
Dallas, Texas*

3/94

The possibility that the Superconducting Super Collider was doomed even before it was born is evident from events that occurred in November 1978, at a meeting of consultants at the US General Accounting Office's Washington headquarters to discuss the future of high-energy physics accelerators.

I am a low-energy nuclear physicist, but I assumed I was invited to that meeting for my accelerator experience, and I gave the assignment my best shot. I recalled meeting Lew Kowarski shortly after World War II and being strongly persuaded by his vision of what turned out to be CERN as the only practicable way that Europe could stay in high-energy physics. I suggested to my colleagues and to the GAO that the plan for us in 1978, as we looked forward to the next generation of giant accelerators,

should be to create a CERN-like organization with international funding and management. (Later I amended my proposal to include particularly the Pacific Rim countries.) But the directors of high-energy accelerators around the table did not even want to discuss my proposal.

Eventually many in Congress came to the conclusion that at least the costs of the SSC should be shared with other countries. But foreign colleagues who might have been willing to join us as equal partners were understandably loath to be guests in someone else's house, with no voice in the many critical decisions that had already been made unilaterally, and the SSC died. But in doing so it provided clear warning of the need for internationalization of big science projects. And it provided a substantial basis for recovery from the Federal government by the State of Texas of its substantial investment in the SSC project.

LAWRENCE CRANBERG

*Austin, Texas*

3/94

## An Unfair Firing in Fargo?

Last spring the president of North Dakota State University, Jim L. Ozbun, served notice of termination to Manuel de Llano, a tenured professor of physics.

De Llano is an internationally recognized American theoretical physicist. He joined NDSU in Fargo as chair of physics in 1985 and reformed and revitalized the department during his five-year term. In recent years he has felt increasingly forced to disclose in public his deep concerns over a number of aspects of prevalent administrative practices at the university. He was troubled by what he perceived as a growing indifference

toward basic research and scholarship, deflection of instructional funds toward grant matches, unaccountable discretionary administrative spending and an ever widening gap between administrative and faculty salaries when compared with respective national average figures. De Llano expressed his views by publishing critiques in *The Fargo Forum* and the NDSU student newspaper and through communications with state legislators and with fellow faculty. For the latter activity he was *censured* by his department.

In January de Llano was invited to testify at a state legislative audit committee hearing. A few weeks after he gave testimony he received notice of dismissal from the university, effective at the end of the spring semester. Among the causes cited were "an utter lack of collegiality" and "refusal to present complaints through proper administrative channels." As this letter is being submitted an advisory faculty appeals committee is reviewing the charges and hearing de Llano's evidence in rebuttal.

As colleagues who have great respect for de Llano's accomplishments and his personal integrity, we strongly protest his dismissal as a violation both of the principle of academic freedom and of his Constitutional right of free speech. We join other physicists in engaging this issue: At the International Workshop on Condensed Matter Theories held this June in Valencia, Spain—the 18th of a workshop series that de Llano helped found in 1977—over 50 participants signed a letter protesting the NDSU president's action.

In speaking out, de Llano was motivated by a desire to help restore and maintain genuine understanding of and commitment to North Dakota State University's own mission statement. The university's punitive response is of grave concern to us.

JOHN W. CLARK

*Washington Universit  
Saint Louis, Missou.*

CHARLES E. CAMPBELL

*University of Minnesota, Twin Cities*

GEORGE A. BAKER

*Los Alamos National Laboratory*

*Los Alamos, New Mexico*

JOÃO DA PROVIDÊNCIA

*University of Coimbra*

*Coimbra, Portugal*

NORMAN MARCH

*Oxford University*

*Oxford, UK*

8/94

OZBUN REPLIES: I appreciate the opportunity to respond and the concern of Manuel de Llano's colleagues.

Let me assure PHYSICS TODAY's



"ONE HUNDRED MILLION NEUTRINOS ARE PASSING THROUGH OUR BODIES EVERY SECOND AND WE'RE WORRIED ABOUT THE PRICE OF COFFEE."