many people in Project Calc are unhappy for being forced to think."

At Duke next fall, all first term calculus classes will be in the Project Calc mode, which is expected to lessen the complaints. But even if the students can be coaxed into appreciating a new style of learning, calculus reform still faces resistance from some faculty who are not yet convinced that such radical changes are necessary. Also, Project Calc demands a considerable time commitment from instructors as well as students, plus resources such as computers, lab rooms, and extra teaching assistants. Other reform efforts, such as the Harvard Project, are less expensive because they do not require computers. Still, some reformers worry that the climate of retrenchment at universities may make reform a hard sell.

The big question is, of course, whether the reforms are worth the costs in effort and money. Although it's too soon for strong statistical evidence, students in the experimental courses do seem to have a better grasp of concepts, says evaluator Bookman, who plans to track the majors and grades of Project Calc students. On a preliminary test he gave to both types of classes, Project Calc students were much better at putting a word problem into the form of a differential equation, for example. Other project directors cite science professors who were pleasantly surprised by students' understanding of such things as logistic growth or the normal distribution curve. And after sitting in on both traditional and Project Calc classes, Bookman offers another snippet of anecdotal evidence: In the traditional class, someone dozed off every week. In Project Calc, students might be frustrated or confused, but at least they don't go to sleep. And students say they rarely miss class or lab. "It's the one class I never skip," says Duke freshman Greg Cancilla, who thinks Project Calc is okay but too much work. "You miss this class, you're clueless."

These sentiments are encouraging. But the experience so far with Project Calc underscores just how difficult the process of education reform can be—even for the best and brightest students. ■ ELIZABETH CULOTTA

U.S. R&D Spending: Half Full?

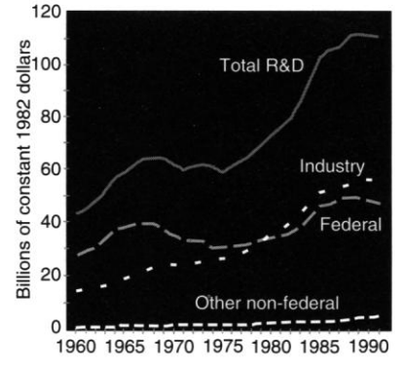
The tenth edition of the National Science Board's (NSB) biennial compilation of statistics on the U.S. research and development enterprise, *Science and Engineering Indicators*, provides further proof that nearly every point of view can be credibly supported with the same set of figures.

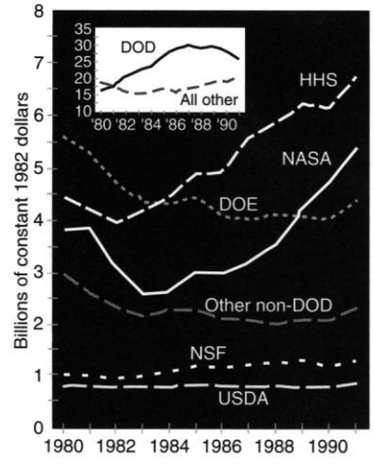
The report shows that inflation-adjusted spending on research and development, including both federal and industrial sources, has declined slightly in the last year or two after a decade of steady growth (see chart). "[A] slowdown in research expenditures in industry and academia and problems in education should give us real concern for the continued vitality of our research enterprise," says James Duderstadt, chairman of the NSB, in a statement that accompanied the release of the report.

But Leonard Lederman, who studies U.S. research performance at the National Science Foundation (NSF), notes that one reason for the decline is a drop in Pentagon spending. Moreover, in view of the global recession and continuing high deficits, "leveling off" is practically good news, says Lederman—especially when compared to other segments of the economy. "'We're holding our own' is a better perspective than, 'We're going to hell in a handbasket,'" Lederman says.

The report, produced by the NSF's Division of Science Resource Studies for the NSB, does depict some worrisome trends that should help officials from science agencies defend their proposed budget increases, however. It shows, for example, that while the United States spends more on nondefense research than any other country in the world, as a percentage of the gross national product it is below that of two of the nation's most important economic competitors—1.9% in 1989 (the last year for which data are available), compared to 3.0% in Japan and 2.8% in West Germany. The picture in the private sector is no better. Spending on R&D by industry also dipped recently, after 30 years of nearly constant real growth. That is sure to be highlighted this spring when the Administration tries to persuade Congress to support a permanent tax credit for industrial R&D.

Universities should also be able to use the report to bolster their claim that the federal government needs to do more to support academic research. Not only has the federal share of academic R&D costs been declining steadily for the past 20 years, but the report suggests that new spending money for capital expeditures has come primarily from nongovernment sources.





Leveling off. *Total R&D spending has plateaued* (above) *largely because Pentagon R&D outlays have declined* (left).

In addition to figures on R&D spending, the 487-page report surveys a wide swath of U.S. science and engineering activities:

■ **Output**. U.S. scientists still lead the world by a large margin in the number of scientific papers they produce.

■ **Education**. Pre-college math and science performance has not deteriorated, but still does not compare favorably with many other countries. In higher education there were declines in the number of baccalaureate degrees in the physical and life sciences but, overall, small increases in the total number of degrees in science and engineering over the past decade.

■ **Public attitudes toward science**. More than three-quarters of the public still supports federal spending on research "even if it brings no immediate benefit."

■ **Trade**. During the 1980s Japan increased its share of the global high-tech market from 18% to nearly 27%, while the United States and the European Community each saw its share of the same markets decline by 4%. ■ JOSEPH PALCA