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Today's News

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50 Years After Sputnik, America Sees Itself in Another Science Race

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Fifty years ago today, the Soviet Union launched the world's first artificial satellite, Sputnik 1, an event that transformed American higher education. Americans felt threatened by the "red moon" overhead and communist know-how, and Congress supported a flurry of federal spending that helped to greatly expand the number of American research universities and scientists.

Today the country sees a new challenge: that other countries are outpacing it economically through the production of technology-based goods. China in particular has rapidly increased its research spending and expanded the number of students earning science degrees.

"Fifty years after Sputnik, the United States is in another equally important race that will define our leadership," Sen. Michael B. Enzi, a Wyoming Republican, said in a speech this year.

During the past two years, academic and business leaders have called for the federal government to respond by increasing science spending on a scale comparable to what it did after Sputnik.

The federal government has now answered, enacting a law, the America Competes Act, in August (*The Chronicle*, August 2). Academic leaders and Congressional sponsors have called it a good start.

But the measure is a significantly smaller effort, in scale and scope, than the surge of money that followed in Sputnik's wake.

A centerpiece of the America Competes Act is a plan calling for a doubling of spending over seven years on physical-sciences research supported by the National Science Foundation and the Energy Department. (The bill provides no actual money and expires after three years, but Congress's Democratic leadership has vowed to find the dollars.)

After Sputnik, the growth was more meteoric. The NSF's budget doubled in the first year alone, and all federal support for academic research quadrupled in seven years. Actual growth in spending was also greater, after adjusting for inflation, than the increases authorized by the America Competes Act for research and science education.

The new law does share this with a Sputnik-era forebear: Its educational provisions do not emphasize training more college-educated scientists and engineers. Instead the act pushes for better-qualified science teachers in elementary and secondary schools, with a goal of improving the general public's scientific literacy.

That approach is sensible, experts say, because despite the alarm over growing numbers of engineers being trained in China and India, there is no shortage of college-educated American scientists. The challenge for

the federal government will be to find money to fully finance the act -- something it failed to do with the No Child Left Behind Act -- in a time of war and tight budgets. Chinese engineers do not seem to inspire the same fear and awe among taxpayers that Sputnik and its Soviet designers did. Some economists say, however, that the economic threat from other countries has been overblown, and that a cautious response is warranted.

A Massive Expansion

The explosive postwar growth of American universities started before Sputnik, with the GI Bill, but the satellite scare provided a major boost. Before that, only about 20 research-intensive universities received most federal research funds; today, about 100 such universities exist.

Following Sputnik, the number of doctoral degrees awarded skyrocketed, from 8,611 in 1957 to 33,755 in 1973. The National Defense Education Act, passed in 1958, helped students pay for their studies by providing graduate fellowships in science and a loan program that later became the Perkins Federal Loan Program. Both programs continue today.

Sputnik also helped make some of the nation's most elite institutions more meritocratic. To admit more students showing talent in science, Ivy League universities placed more weight on demonstrated intellect and less on "character," a factor they had historically used to admit children of alumni and exclude Jews, wrote Jerome B. Karabel, a sociology professor at the University of California at Berkeley, in *The Chosen: The Hidden History of Admission and Exclusion at Harvard, Yale, and Princeton* (Houghton Mifflin, 2005).

Federal spending for all academic research has steadily grown since Sputnik. But most of that growth has come for biomedical research financed by the National Institutes of Health. Money for all other scientific disciplines has stayed flat since 1970.

The new America Competes Act is an attempt to redress that imbalance. Supporters of a realignment say that research in chemistry, physics, engineering, and computer science has the potential to lead to valuable new commercial technologies, like the transistor and the Internet. However, science-policy experts say it is hard to justify Congress's decision not to double physical-sciences research financed by the Defense Department and NASA.

The plan also leaves out the NIH, which its supporters argue also contributes to America's economic competitiveness. The agency's budget, $29.24-billion in 2007, has contracted since 2003, when adjusted for inflation.

The act's provisions for science education are an answer to a series of recent reports warning that other countries are quickly catching up to the United States in the numbers of students studying science and in their test scores.

To name just a few widely cited statistics, about half of undergraduate degrees in China are awarded in the natural sciences, mathematics, and engineering, compared with about 15 percent of American degrees. If China continues increasing the number of Ph.D.'s it awards annually in science and engineering at current rates, it will surpass the United States' production a few years from now (as the European Union has already done.)

China's college-age population, about 100 million people age 20 to 24, is five times that of America's, so further growth is expected, especially as China has mounted a vigorous drive to improve science instruction in its primary and secondary schools. Almost all secondary students study calculus there, compared with about 12 percent in America.

American 12th graders have scored toward the bottom of the pack in international science tests. And on a domestic test of science understanding, the National Assessment of Educational Progress, almost half of 12th graders performed below the basic level of proficiency in 2005.

Quantity Vs. Quality

But the stark differences in numbers are not the end of the story.

"China will have more scientists and engineers than the U.S. What does that mean in terms of economic productivity?" says Michael S. Teitelbaum, a demographer who studies the scientific work force and is a vice president of the Alfred P. Sloan Foundation. "I don't think anyone knows the answer to that. But I wouldn't assume that China is going to be more economically productive."

Many other factors influence economic innovation, such as creative, independent thinking, which analysts say is not encouraged by many Chinese educators. What is more, the country needs improved corporate management and regulation, analysts say.

Still, several national reports about competitiveness -- including the National Academies' "Rising Above the Gathering Storm" from 2005 -- have suggested that to keep pace with China and other nations, Congress should set numerical targets for the production of more college graduates in sciences and education (*The Chronicle*, 2005).

Congress declined that call because lawmakers knew that attempts to project the number of jobs in science and engineering have been notoriously inaccurate, says a staff member on the House of Representatives Committee on Science and Technology, who spoke on condition of anonymity. What's more, wages for scientists and engineers grew no faster than for all workers from 1995 to 2005, according to the Commission on Professionals in Science and Technology -- not what you'd expect during a shortage.

Members of Congress concluded that rather than trying to produce more scientists and engineers, the clearest need was earlier in the educational pipeline, in schools, where a clear target for federal help exists. Nationally, about two-thirds of high-school chemistry and physics teachers lack a degree or certification in those fields. And studies have shown that that correlates with poor student performance on math and science tests.

The America Competes Act authorizes a new set of grants to colleges from the Education Department to set up undergraduate programs that will award both a degree in science or math and a teaching certificate.

Explaining that approach after the act's passage, U.S. Rep. Bart Gordon, a Tennessee Democrat who leads the House Committee on Science and Technology, argued that the United States' economy will need to accelerate technological innovation to keep ahead of developing countries that have an edge in attracting low-tech manufacturing jobs because of their abundant, cheap labor. As a result, he said, American workers across all skill levels, with and without college degrees, will need better quantitative skills.

The America Competes Act also lags behind Sputnik-era legislation in proposing new spending for science education. The new law proposes increasing spending by about $2-billion over three years for science-education programs in the Education and Energy Departments and doubling the NSF's education division, which received $807-million this year, over seven years. Those sums combined fall well short of the amount spent by the federal government on the Sputnik-era National Defense Education Act, about $7-billion, in today's dollars, over four years.

In spirit, though, the America Competes Act does echo the federal response after Sputnik, in its focus on broad scientific literacy and school education. And there is plenty of room for improvement: Nearly 30 percent of adults surveyed in 2004 for the National Science Foundation did not know that the earth revolves

around the sun.
