

# U.S. Losing Ideas Race

## Other Nations Chip Away at America's Technology Empire

By ROBERT C. TOTH

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WASHINGTON. — For decades, every new technology or its product seemed to have made-in-America stamped on it, from instant copying and instant photography to advanced computers, nuclear reactors, oral contraceptives, synthetic fibers and jet airliners.

Things have changed. There is concern in the White House and Congress, in industry and universities, that the United States is losing its technological lead in at least some fields.

In terms of the American international lead in developing new patents, in terms of lagging domestic productivity of workers, of falling research and development expenditures, perhaps even of basic research — there is the alarming prospect of the "loss of our scientific and technological empire," as one historian of science put it.

Among specific reasons for concern:

- The European A-300 Airbus is being bought by at least one major U.S. airline company (Eastern), an almost unprecedented reversal of historic U.S. dominance of this field. This and other developments, such as the collaborative effort by General Electric Co. and a French government-supported company, SNECMA, on the next generation jet engine, suggests that the U.S. aircraft industry is starting a steep decline.

- For the first time the Japanese are directly challenging U.S. computer supremacy in big as well as small computers, in U.S. markets as well as around the world. Backed by direct government subsidies, the aim is to eclipse U.S. dominance in advanced electronics much as was done in synthetic textiles a decade ago.

- The Germans, French and Soviets appear equal or ahead of the United States in breeder reactors, which make more atomic fuel than they burn. The Soviets are equal in the race to tame the hydrogen bomb's fusion reaction. Both types of reactors will be vital to provide energy, notably electricity, when oil becomes prohibitively expensive.

More than just pride is involved, although that is an element, too. It is humbling to discover how inefficient the American steel industry is compared with foreign producers: not only are high quality, specialty steels imported, but 44 percent of all the nuts, bolts and large screws holding American products together are made abroad.

"The harsh truth is that we are now very much locked into a dynamic system of global economic growth, and it is one based largely on technological change and innovation," said Dr. Frank Press, the president's science adviser. "There are enormous pressures ahead for us to innovate and improve productivity . . ."

"The crucial point is the need for innovation. And a principal basis of innovation today is research and development. This is one reason why we are concerned with the state of industrial R and D, and why the administration will be focusing much attention on it in the coming year."

The cost of falling behind in technology is greater than just the money needed to buy know-how overseas and the intangible decrease in national self-sufficiency, and thereby national security, that results.

Technological innovation demonstrably increases the number of jobs, the productivity of workers, the growth of the domestic economy, foreign trade balance and the international status of a country.

A recent study by Robert E. Brinner for Data Resources Inc. found that high technology industries such as electronics and chemicals grew almost three times faster, had twice the productivity per man and expanded their work forces nine times faster than low technology industries such as shoes and steel.

High technology industries also were anti-inflationary, raising prices only one-sixth as much as low technology industries, according to Brinner, who is now on the staff of President Carter's Council of Economic Advisers.

High technology industries regularly bring a surplus in foreign trade while low technology industries cause a deficit — \$29 billion surplus vs. \$15 billion deficit in 1976, according to a National Science Foundation compilation, "Science Indicators — 1976."

Another foreign trade benefit is payments for technical know-how, — patent royalties and the like. The United States received \$4.08 billion for such technology, while paying out only \$468 million, in 1976, according to Commerce Department statistics.

The fall-off in U.S. innovativeness is not so easy to measure. Trade statistics do not reflect it, perhaps because it is not an across-the-board decline. But evidence that such a decline is under way is available from the foundation's report:

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• Patents of international significance are being issued to foreigners more often than before. In 1963, patents were issued to Americans by foreign countries 4.5 times more often than patents were issued to foreigners by the United States. This U.S. patent advantage fell sharply in 1975, to only 2 times the number of significant patents given foreigners.

• Major innovations are originating abroad more often than in the past. A survey of the 500 most important ones (such as double-knit fabrics, electron beam welding, urethane foams) to enter the marketplace in six industrial non-Communist nations found that the United States contribution dropped from 80 percent in the 1950s to under 60 percent in the early 1970s.

• Productivity of workers has lagged most in the United States among the six countries. This has been true since 1967, if the same industries are compared from country to country, and since 1960, if the gross domestic product per employed civilian is compared between countries. (The nations, besides the United States, are Canada, France, West Germany, Britain and Japan.)

• U.S. research and development spending has dropped from 3 percent of the Gross National Product in 1963 to 2.25 percent in 1976. West Germany's R and D spending rose from 1.4 percent to 2.2 percent, Japan's from 1.5 percent to 2.0 percent in the same period. These governments contribute 50 to 60 percent of industrial R and D funds.

R and D fuels technological innovation. From research often come the inventions which become innovative breakthroughs.

It is disturbing, therefore, that even when federal R and D monies (for space, defense, and so forth) are subtracted from the U.S. total, the industrial R and D spending level also shows a steady decline from 2.1 percent of GNP in 1963 to 1.6 percent in 1975.

The slackening of American productivity in part can be attributed to the drop in fixed capital investment in modernizing plants and equipment. But the rest, Brinner found, is because of the R and D decline which has resulted in fewer new technologies with high productivity that can boost the national averages.

"It looks like the 1.6 percent R and D level, in fact, is just enough to keep a constant productivity rate," Brinner said in an interview. "That 1.6 percent level buys as much productivity rise as is lost annually through equipment obsolescence.

"This means we have to run that fast to stand still in productivity," he added. "To move ahead, we have to run faster," which means spending more for R and D.

Another major problem is that technological leads are highly perishable. Over time, the country that makes the breakthrough gets less and less return from it, while countries that import the technology are usually able to outstrip the initial leader.

In synthetic textiles, for example, the Japanese quickly exploited their cheaper labor and production costs to undercut American prices, according to Daniel V. DeSimone, deputy director of the Office of Technology Assessment of the Congress. Ironically, the Japanese are finding themselves undersold. The same fibers are now made cheaper in Taiwan, South Korea and Hong Kong.

It seems that wholly new technologies, not just adaptations and refinements of existing ones, must be created regularly to stay at the head of the pack.

New breakthroughs, in turn, usually depend on basic scientific research. So how good is American science today? Answers vary.

In Nobel Prizes, the United States is still far ahead in numbers and percentages. In fact, Americans have won 47 percent more of the awards since 1961 than in the 1946-60 period. Only in prizes per capita of a nation is the United States in second place, behind Britain.

But some historians of science, such as Prof. Derek de Solla Price of Yale, fear that a combination of several factors, including the fall in R and D spending, is ominous for the future of U.S. science. It was Price who spoke of the impending "loss of our scientific and technological empire."

He calculates that the U.S. contribution to "world science" in 1967 was 33 percent of the total from all nations. Now it is 25 percent, he said. As a result, "in 1967 we had about five times the average share of world affluence, or per capita GNP

"It is now, in 1978, about three-and-a-half times the average and, unless heroic measures are undertaken, we will have been reduced to only about double the world average before the year 2000 A.D.," he warned a meeting of the American Association for the Advancement of Science.

To Dr. Jerome B. Weisner, president of Massachusetts Institute of Technology, on the other hand, the chief problem is not any decline in U.S. science or even technology, but in taking the technological ideas into the market place.

"There are a lot of good things in laboratories now but it's hard to get venture capital," he said in an interview. "Maybe it's because the established companies on the stock market are such good buys, maybe because changes in the capital gains tax have created a tax disincentive. But the number of new starts of small, high-technology companies is very low today.

"The fact that the Japanese and West German governments are underwriting innovation, through R and D grants and subsidies, undoubtedly helps make up the minds (of industrialists there) in favor of risking money in new ventures.

"We need to be very concerned about this, I think," Weisner said. "The nations whose governments give such support will ultimately pass us, at least in some technological areas."

The basic question being asked by both the presidential and congressional studies now getting under way is how to spur innovation.

The prospects seem good or at least better than ever now for sympathetic action by Congress. Unemployment is already up and productivity down, the domestic economy gripped by "stagflation" and the trade balance in the red. And greater technological innovation holds the promise of improving all of these conditions eventually.

"Things like a tax credit for R and D or some other kind of federal help to high technology industries may be an idea whose time has finally come," said Congress' technology expert DeSimone.

A broader rationale was offered by economist Brinner of the Council of Economic

Advisers. "It's estimated that at least one-third, and up to two-thirds, of the benefit from R-and-D spending by a company goes outside that company, to the public as a whole, providing a social service in a real sense," he said. "That seems to me another reason for giving some kind of federal help to high technology companies at this time."