INSIDE: SCIENCE AGENCIES

Senior administration officials will try to end a row between government officials and universities over technological leaks to the Soviet Union and whether new secrecy rules are needed to curb them, according to **George A. Keyworth II,** head of the **White House Office of Science and Technology Policy.**

Keyworth said last week that he and other key defense and diplomatic officials wanted to switch the focus of the debate to their real concern: leaks from industry. He said a new policy statement "on the president's desk" states that the way to control the leakage of basic research is through the current classification system, not by creating a new category of "sensitive" but unclassified material.

Defense Department officials, reportedly including **Richard N. Perle,** assistant secretary for international security policy, and **Richard D. DeLauer,** undersecretary for research and engineering, have approved the policy.

"In general, the university environment does not represent an area of major leakage," Keyworth said. Of far more concern, he said, is Soviet spying and technology "leaks overseas through U.S. companies."

Keyworth said the president had spontaneously expressed his support for openness in research. "I would be extremely surprised if the academic research environment is in any way constrained" in the future, Keyworth said.

A key point in the debate over basic research came with the completion of a study by the **National Academy of Sciences,** now called the "Corson report" after the study committee's chairman, Dale R. Corson, former president of Cornell University. That report recommended that little or no action be taken to constrain scientific information, but instead that the United States stay ahead in the technology race.

Keyworth said it would be a good idea now to convene a similar panel to look at technology leakage in industry. The national academy's governing board, in fact, recently did just that.

Meanwhile, one key industry player said much work was going on behind the scenes to find common ground between Pentagon officials worried about the problem and industry officials



GEORGE A. KEYWORTH II
. . . backs university research

concerned that excessive secrecy will hurt U.S. companies in the marketplace.

☆ ☆ ☆

RECONSIDERING CYCLAMATE . . . In another step that is expected to help transform cyclamate to a legal artificial sweetener, the **Food and Drug Administration** has asked the National Academy of Sciences to check the FDA's preliminary finding that cyclamate is not harmful.

The sweetener was banned more than a decade ago because of evidence that it caused cancer in animals.

Since then, Abbott Laboratories and an industry group called the Calorie Control Council have filed new information and test results to try to get cyclamate back on the market.

The industry petition is still under review, but the FDA's Committee on Food Safety and Applied Nutrition has reviewed the scientific studies and found no reason why the cyclamate ban should continue, according to FDA spokesman **Jim Green.**

The academy will hold a public hearing this Tuesday.

Its committee is supposed to report to the FDA by December, and its findings are expected to play a crucial role in the FDA's decision.

☆ ☆ ☆

MEANWHILE . . . America's premier science journal, Science Magazine, which is published by the American Association for the Advancement of Science, has a new editor: **Daniel E. Koshland Jr.,** a biochemist at the University of California at Berkeley. Koshland succeeds **Philip H. Abelson,** the editor for 22 years.

—Philip J. Hilts

AN EDUCATOR'S OPINION



When Bureaucracies Rule, Learning Loses

By Mary Hatwood Futrell, President NEA National Education Association

The bell rings. The class enters—25 students, a kaleidoscope of personalities, all unique, each a bundle of idiosyncracies, different strengths, different attitudes and aptitudes, different *needs*.

You begin the day's lesson—and a day-long dialogue with yourself: Am I moving too quickly for Jonathan? Too slowly for Janice? Does Daniel need some remedial work? Would tougher homework assignments catch Alan's attention? Or is it time to ease up? Would Anna flourish in an Advanced Placement course?

For America's teachers, these are the sorts of questions that never stop. But there's another question that we as a society need to ask: Who is most likely to have the answers to the daily questions every teacher faces?

The obvious answer is, of course, the teacher—the person on the scene, in the classroom, in *touch*. I'm firmly convinced that, in this case, the obvious answer is also the right answer. Teachers have the experience, the insight, the training to know what works in the classroom—and when.

Unfortunately, our contemporary school systems seldom recognize this obvious truth. One of the baffling ironies of modern times is, in fact, the extent to which control over classroom decisions has been wrenched from the hands of teachers and principals. Teaching methods and materials, assessment tools, disciplinary codes, and even entire curricula are frequently dictated by officials sitting in district offices comfortably at a distance from the classroom and its challenges. Decisions drop down from on high. Teachers and principals lose autonomy. Learning is the casualty. Jonathan and his classmates are the victims.

The result: a tyranny of inefficiency that's been noted—and denounced—by virtually every major education reform report over the last two years. Ted Sizer, for instance, charges that "hierarchical bureaucracy" is "paralyzing American education." And when, in the concluding chapter of *Horace's Compromise*, Sizer lists five imperatives for better schools, his primary recommendation is that we "allow teachers and principals to adapt their schools to the needs, learning styles, and learning rates of their particular students. . . . *The decentralization of substantial authority to the persons closest to the students is essential.*"

Ernest Boyer echoes Sizer's view: Heavy doses of bureaucracy, he argues in *High School*, stifle creativity and block teachers and principals from exercising their best professional judgment on matters that should be decided at the school building level.

Boyer and Sizer's critiques reflect more than a decade of research on effective schools. Derrick A. Bell, dean of the University of Oregon Law School, succinctly summarized this teseatch when he observed that teachers at effective schools are "mavericks." They become forces for educational excellence precisely because they—like their principals—are "willing to give priority to a vision of education *even over policy decisions coming from a central board.*" They're rebels—with a cause. And the cause is an instructional program and school climate tailored to the needs of students—*not* to the demands of bureaucrats.

Surely teachers and principals should not have to risk insubordination in order to advance the cause of educational excellence. And the change that would render such rebellion unnecessary is in no way radical. Returning decision-making power to the local school is, in fact, consonant with the prescription for success put forth in Thomas Peters and Robert Waterman's *In Search of Excellence: Lessons from America's Best Run Companies.*

America's corporate leaders are learning the *decentralization* lesson that management analysts like Peters and Waterman strive to teach. They're beginning to understand that common sense demands treating employees as adults deserving of respect and capable of making intelligent judgments.

It's time centralized school district bureaucracies learned that lesson, too.

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Stronger ties between industry and university call for clear understanding of roles

AMERICA'S RISING RESEARCH ALLIANCE

by Lewis M. Branscomb

Wanted: University to set up lucrative partnership with business desiring research in new technologies. Millions in funding available. Contact director of corporate contributions.

The advertisement, from a recent article in *U.S. News & World Report*, is fictitious, but it dramatizes an expanding partnership between research universities and private companies.

This long and fruitful relationship has rested and continues to rest on industry's need for highly qualified new scientists and engineers, for the results of fundamental research in science and engineering—both of which are essential to a company's ability to innovate and increase its productivity.

Strong and dependable federal support for a broad spectrum of academic research is a major factor in making our universities fruitful places for industrial collaboration. On the other hand, since private investment in a competitive marketplace is the best means for allocating the scientific and engineering resources of industry, it is appropriate that government leave to industry the task of exploiting the knowledge base created by our universities.

The more effectively industry carries out this task, the greater the economic leverage of our public investment in university research. Further, exposure of professors and students to industry's knowledge needs not only helps prepare young scientists and engineers for careers and future technical leadership in industry, but also improves coverage by academic researchers of industrially relevant areas of investigation.

The National Science Board's 14th annual report to the president and Congress (on which this article is based) sets out to illuminate the complex but important processes whereby university scientists participate in the solution of important industrial problems and the industrial community avails itself of the vital public investment in academic science.

Quantitative assessment of the university-industry research connection is difficult, owing to the diverse mechanisms of exchange: contracts, grants, purchase orders, solicited and unsolicited gifts, loans of equipment or facilities, discounts on equipment purchases, personnel exchanges, scholarships

and consulting arrangements. These are just the principal forms and universities and corporations have kept track of only some, and then not necessarily consistently.

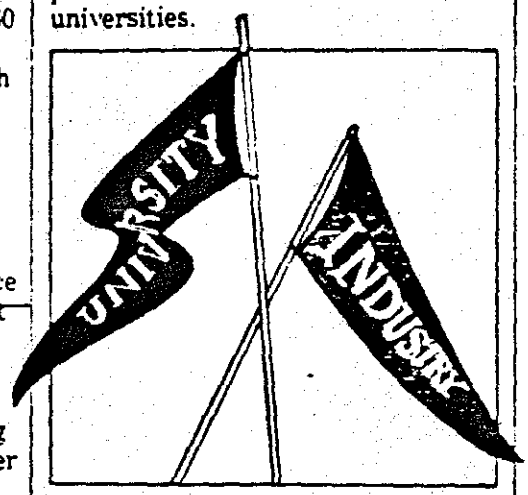
Data from National Science Foundation surveys on dollar support of research in universities—which are more or less limited to tracking grants and contracts—suggest that from 1960 (and probably from 1953) to 1965, the industrial share of university research and development support remained virtually flat in constant dollars. Industry's percentage share of support, however, fell sharply—from just over 6 percent in 1960 to below 3 percent in 1965—due primarily to rapidly growing federal support. Since 1965, industry's share has remained at 3-4 percent, but, in constant 1972 dollars, that support for university R&D has doubled.

Available data also suggest a strong variation in this support, by field. Over the past decade, for example, it appears that 6-10 percent of all academic engineering research was supported by industry.

The relative magnitude of academic research supported by corporate contracts, on the one hand, and by corporate philanthropy, on the other, is not clearly understood. An educated guess is that academic research supported by corporate gifts and grants roughly equals that supported by corporate contracts.

The signs of increased traffic between companies and campuses are numerous:

- Major chemical companies have established a Council for Chemical Research, aimed at funding academic research and forging new relationships between academic and industrial chemists and chemical engineers.
- The Semiconductor Industry Association has set up a nonprofit subsidiary, the Semiconductor Research Cooperative, designed to encourage increased efforts by manufacturers and universities in long-term semiconductor research and to add to the supply and quality of professional degree-holders in the field. Expenditures of $20 million over the next two years have been planned.
- A variety of consortialike programs in which several companies jointly provide support for focused academic research have generated a surprising amount of support. Caltech's Silicon Structures Project and Stanford's Center for Integrated Systems (*page 13*) were early examples. More recently, 12 U.S. firms joined together to form the Microelectronics and Computer Technology Corporation, a consortium that plans to pool the costs and share the results of advanced computer research, some of it conducted in universities.



- Another significant development is documented in a survey conducted by the National Governors Association. This survey of all 50 states looked for programs to spur technological innovation and productivity growth. At least 88 separate initiatives were found under way with state leadership, many involving public-private partnerships.
- In addition to these collective efforts, a number of individual companies are stepping up their support programs. IBM Corporation (an NAM member) for example, gave more than $22 million in grants to U.S. educational institutions during 1982, compared with $17 million in 1981. Our most important relationships with universities, however, arise through collaborative activities on technical problems of common interest. At last count, IBM had more than 400 such projects with 100 U.S. universities.

It seems clear, in recent times at least, that all administrations, regardless of their political and economic complexion, have viewed the university-industry research connection as a positive and desirable element in national economic policy. They have differed, however, in their concepts of the appropriate government role and in their degrees of emphasis on different means to encourage this relationship. The current administration's approach reflects the fact that effective long-term university-industry research interaction will be based on the perceived worth of the university work by the industry—not on initiatives originating in Washington by third parties.

While previous administrations had attempted to develop government-directed programs for the stimulation of research and development in general, or university-industry research interactions in particular, President Reagan's administration demanded a more limited view of government intervention in the private sector.

The principal thrust of the new policy involved provision of incentives for R&D investments through tax legislation. The Economic Recovery Tax Act of 1981 includes several provisions aimed at stimulating increased support for R&D by industry. Two sections provide specific tax incentives for gifts of research equipment to universities and for the conduct of research in universities sponsored by companies with growing R&D investments.

Why should universities and companies cooperate? Company representatives cite many reasons for their interest in establishing research interactions with universities. Mentioned most frequently in an NSB-commissioned study were

- access to manpower (students and professors),
- access to technology,
- problem solving or obtaining needed information,
- prestige or enhancement of the company's image,
- use of an economical resource,
- general support for achieving technical excellence,
- proximity, and
- access to university facilities.

Universities interact with industry mainly to acquire funding for basic research and graduate training, or to support the facilities that make research possible. In general, industrial funding is seen as involving less red tape, and reporting requirements are seen as less time-consuming than equivalent support from the federal government. Other motivating forces for a university to seek industrial support for its research are as follows:

continued

- access to scientific and technological areas where industry indisputably has special expertise,
- the opportunities through industrially sponsored research to expose students to new insights and practical research problems that may be of immediate importance to society,
- availability of some government funds for applied research where a university joins with industry, and
- job expectations for graduates.

Another potential role for university-industry relationships is improving the participation of minorities in research. Many companies, of course, are active in sponsoring minority fellowships, loaning employees to teach courses and help develop curricula, and otherwise encouraging minority enrollments in science and engineering. But only a handful so far have seized the abundant opportunity to collaborate in building research programs (of mutual benefit) at predominantly minority universities.

An historical perspective also teaches that, in different time periods, universities dominate some fundamental research areas and industry dominates others. Molecular biology and biotechnology were long creatures of academic research laboratories but are now being rapidly assimilated into industrial laboratories as their commercial potential unfolds. Research on polymers and catalysts was carried forward for years in industrial laboratories, and universities began to make contributions at a later stage. The same has been true in microelectronics and computer engineering. Thus, technical experience may flow in either direction and, more commonly, in both directions.

How do universities and companies cooperate? Assuming that the parties are sufficiently motivated, cooperation involves some key transfers:

Resources. General gifts in support of university research are highly valued because of their flexibility and because they provide benefits that greatly exceed the dollar percentage of support. Such funds, for example, may be used to begin new projects, help young scientists get started, or provide for travel to conferences.

Cooperative Research. Unlike donations of funds, equipment, research facilities or endowed contributions, cooperative research essentially involves interactions of people and offers the most creative movement. Three principal approaches are found in institutional agreements:

- The greatest dollar support to universities from industry is through individual research agreements involving university researchers. Industrial support in this mode is generally mission-oriented and specific to a research program or project, with fairly immediate benefits in mind.
- Another approach, more sweeping in scope—though not necessarily in total funding—is to broaden participation and, at the same time, create stable industrial support of university research by engaging firms through an industrial affiliates program or consortia arrangements. Emphasis is on individual contacts between the representatives of member companies and the faculty, staff and students in the program. Access to students is the prime motivation for companies to join such programs.
- A third approach to cooperative research involves the use of university facilities. Research centers and institutes, for example, help attract industry support by providing coordinated research and/or equipment in a central facility.

> "Private industry has neither the resources nor the intention to compensate for any substantial cuts in publicly funded academic research."

Personnel and Information Exchanges. Forging stronger ties between universities and industries is best accomplished by personal interactions among scientists. Informational contacts—seminars, speaker programs, consulting, personnel and publication exchanges—are the most frequent means by which a university-industry research link is forged.

The availability and desire for resources, personnel and information does not ensure that a flow in either direction will ensue from those who have to those who want it. Uncertainty, institutional sloth, rejection, disincentives of various kinds all take their toll of initiative in university-industry interactions.

Despite the fact that these exchanges are proceeding rapidly, academicians often attribute a lack of sophistication to industrial researchers, while company people are often skeptical of the capacity of academicians to produce useful and timely research. These negative stereotypes do not necessarily prevent the parties from "doing business" when mutual interests coincide, but they may inhibit seizing opportunities and unnecessarily protract negotiations.

There are also real limits to joint activity, including limits on available faculty time and industrial resources. Other limitations are imposed by the university's need to fit most research into pieces that meet the requirements for Ph.D. theses in terms of scheduling, depth, originality and sophistication of the work. Further, patent and license rights, the right to review manuscripts for possible proprietary information and other critical questions frequently cause difficulties in negotiating agreements. Fortunately, such problems can be resolved when mutually perceived needs are pursued in an atmosphere of trust and willingness.

In their pursuit of new sources of support for research and teaching, universities have been rightly concerned about protecting the freedom of inquiry that is at the heart of their real contribution to society. A critical issue for them is how to ensure that the professor's teaching and research agenda is enriched and informed by, yet not subordinated to, his contract research or his technical consulting.

What's important here is that university-industry partnerships must respect the needs of both partners. I don't believe, for example, that companies should use universities for near-term proprietary projects or for development. Generally speaking, universities should not be asked to do proprietary work and should remain free and open. Companies should control what must be controlled and not depend on universities to do it for them. The roles of industry and academia are different and we should not confuse them.

CLOSING THE GAP

NAM's agenda for high technology includes the following statement:

The advantages of increased cooperation between industry and the academic sector are most clearly seen in the rapidly burgeoning joint arrangements in commercial operations. These types of relationships have been most evident in the biotechnology, robotics and computer fields. The academic environment has led many high-tech firms to locate near a university to tap into the pool of expertise.

Yet, despite these obvious areas of common interests, the gap between university education and industry needs appears to be widening.

Funding. The major boon provided to universities in the 1960s and 1970s of increased federal support has, in a time of fiscal constraints, been eroded. At the same time, industry funding of basic research has declined on a percentage basis. This creates difficulties for universities striving to maintain standards and levels of activity.

Academic Freedom. The expanding role played by industry in academic affairs in funding and cooperative agreements has led to concern over the pursuit of knowledge and learning. Academic researchers entering into contracts with industry often are accused of violating ethical educational values, such as open communication, free dissemination of research results and independent choice of research topics.

Contractual Arrangements. Concern has also been expressed over commercial relationships governing disposition of corporate patent rights and licensing arrangements. Academic researchers feel such conditions may delay publication of research results, adversely affect the educational process and prevent promising lines of research from being pursued.

Solutions. NAM supported the passage of P.L. 96-480, the Stevenson-Wydler Technology Innovation Act, which established several cooperative programs within the Department of Commerce to improve industry-university relations. NAM supports funding of these programs at statutorily authorized levels.

☐ NAM supports tax, regulatory and other policy measures that provide incentives for limited research and development partnerships (promoted by the U.S. Department of Commerce) between industry and universities.

☐ NAM supports measures that seek to prevent disputes over the disposition of patent and licensing rights.

Despite the questions raised earlier, there is optimism about the likelihood of increased university-industry research interaction during the 1980s. Three general factors characterize this change:

First, product and process improvements in some industries have evolved to such levels of complexity that not only is an understanding of fundamental physical and biological phenomena required but also much higher levels of training in and use of basic science and engineering. Manufacturing is becoming process-oriented rather than assembly-oriented. And while this type of manufacturing is easier to automate and is more productive, it also calls for much greater involvement with the fundamental properties of the materials being worked. In microelectronics, for example, when puzzling phenomena occur, the manufacture of circuits is pushed down to ever smaller dimensions. These phenomena must be explained before further progress can be made.

Further, incremental advances in narrowly focused technical areas—characteristic of much industrial development in the past—are giving way to the use of a broad range of science and engineering disciplines on complex, often ill-defined problems, or exploitation of new analytical capabilities. Hence, it is becoming increasingly difficult for any one industrial laboratory to fully encompass the requisite expertise. A partial remedy for this situation is to seek out the pertinent skills wherever they may be found in the nation's universities.

And, finally, the rapid expansion of the nation's R&D system over the past three decades has diffused research capabilities over a much broader range of institutions—academic and industrial—than ever before. Thus, it is quite unlikely that any one company could hold and maintain a leading edge on technical advance in a given area.

It remains a fact of life that, should corporate contributions to academic research double or even treble, they would still support only a small portion of the total academic research effort, and such support would be concentrated in selected fields.

The implication is clear: If the present level of academic research is to be maintained, the principal burden will continue to fall on the public purse, federal and state.

The most essential contribution of state governments is to provide a support base for fundamental research through the expectation that professors on state salaries devote a significant portion of their work time to research. Teaching assignments should reflect this role.

The federal government supports the majority of fundamental research in the country, most of it in universities. Beyond this contribution to national strength, the role of the federal government is, and should be, limited to encouraging, not directing, university-industry relationships.

Clearly, the future paths for university-industry cooperation will depend on the way that each university and corporation perceives the essential role of the university. If the university moves nearer to a partnership with industry, more resources can become available. But the university may relinquish some of its unique freedom of action. There are no absolutes and the issues become matters of degree and common sense. The primary requirement, therefore, is not so much increased partnership, but increased understanding of each other's role. ■

Lewis M. Branscomb, vice president and chief scientist for International Business Machines Corporation (an NAM member), is chairman of the National Science Board and a member of President Reagan's National Productivity Advisory Committee. Copies of the board's 14th annual report (*see text*) may be obtained from the NSB at 1800 G Street, NW, Washington, DC 20550.

NEWS REVIEW

March 6, 1984

FROM: PUBLIC RELATIONS—F3EB

Monsanto

CHAPEL HILL, NC
NEWSPAPER
D. 5,715—S. 7,360
RALEIGH-DURHAM METROPOLITAN AREA

FEB 16 1984

Universities Help Fill Research Gap, Says Official

By MIKE McFARLAND
Staff Writer

Joint research ventures between universities and private industry create a national resource and allow the United States to remain on the cutting edge of technology, says an official of a major American research firm.

"Without it, the United States industries will lose leadership . . . and a large opportunity to develop major new industries and thousands of jobs," said Howard A. Schneiderman, Monsanto Co. senior vice preseident for research and development, in an address on the UNC campus Wednesday night.

America could face drastic setbacks in biotechnology without joint research, he told a Venable Hall audience.

By the turn of the century, America could discover cures for several diseases and even succesfully control and prevent degenerative brain diseases, Schneiderman said.

Scientists also could discover how to genetically engineer crops, which would increase crop yields, and might eliminate the need for the use of pesticides, he said.

But, Schneiderman said, such breakthroughs will never occur without the formation of research partnerships between universities and private industry.

AND SUCH JOINT efforts will be-

Research Gap

(Continued from page 1A)

come increasingly important as countries like Japan form huge research consortiums between major corporations, he said.

From 1977 to 1981, Japan held 60 percent of the patents in biotechnology compared to the United States' 10 percent, Schneiderman said.

Federal antitrust laws prevent such consortiums in the United States, he said, and that leaves the universities to help fill the gaps in this country's ability to remain commercially competitive with the rest of the world.

"The talents of America's research universities are unsurpassed in the world. It could keep America on the leading edge of scientific adventure. It could benefit American society in terms of useful producst and find ways to meet basic human needs throughout the world."

There are risks involved in joint research ventures, probably more for the universities than for the industries, he said.

"If in the interest of short-term rewards corporations damage the (universities) . . . they will kill the goose that laid the golden egg. I am convinced America's major corporations recognize this."

As an example of one partnership that has evolved recently, Schneiderman cited a joint research program between Monsanto, a St. Louis-based chemical compay that produces synthetic fibers, plastics and other products, and Washington University's Medical School there.

The agreement, which was reached in 1982 and carries a $23.5 million price tag, has two important conditions, Schneiderman said. The university owns the patents to any discoveries while Monsanto has the authority to license the patents.

There also is a joint advisory committee — made up of four representatives each from Monsanto and the university — that decides what research will be funded under the contract, he said.

THE CASE FOR the Monsanto-Washington University agreement is even stronger when funding support nationwide is examined, Schneiderman said.

Industry contributed only $250 million (4 percent) of the $6.6 billion universities received in support of research in 1981, he said. The rest came from federal and state sources. The maximum industry will ever be able to contribute to university research will be 6 percent, Schneiderman added.

"As a nation, we cannot continue to prosper in the long-term (if we keep) assembling imported goods and exploiting imported ideas," he said.

Schneiderman's visit here is sponsored by the UNC departments of biology and chemistry. In conjuction with his visit, biotechnology research conducted at UNC will be presented in a poster session today from 2 to 4 p.m. in the Coker Hall lobby. Schneiderman will deliver another lecture, "What Biotechnology Has In Store For Us," at 4 p.m. today in the Coker Auditorium.

THE GROVES OF SILICON



Stanford University

Stanford's community of technical scholars and how it grew

by Bob Beyers

What *Fortune* magazine has described as the world's leading center for new technology—Silicon Valley—was the handiwork of the late Frederick Emmons Terman.

Terman, who joined the Stanford faculty in 1925 and was its provost from 1965-1975, also set the stage for an era of unprecedented collaboration between that university and industry.

Even before World War II, Terman was instrumental in encouraging talented students to start their own business ventures. After the war, he explicitly recognized the potential for combining federal research funds, academic programs and industrial development. And Silicon Valley was born.

In 1937, Terman encouraged two of his graduate students, William R. Hewlett and David Packard, to build an audio-oscillator, a device to generate signals of varying frequencies. Starting in a Palo Alto garage, they proceeded to build a worldwide, multi-billion dollar electronics firm.

In the same year, at Terman's suggestion, a Stanford physics professor, William W. Hansen, gave Stanford graduate student Russell Varian and his brother, Bill, work space and $100 for materials. In return, they offered the university half the royalties from any inventions they made.

Their invention of the klystron tube played a key role in improved radar for Britain during World War II, provided the basic technology for the Stanford Linear Accelerator Center and now is used in cancer treatment. The univer-

continued

sity realized millions of dollars in royalties on the patent.

Working closely with Stanford's then-president, Wallace Sterling, and others, Terman played a central role in setting up the Stanford Industrial Park in 1951. Hewlett-Packard and Varian Associates were among early tenants. Today, the park's 90 firms employ about 25,000 people on campus lands adjoining faculty housing.

Terman deliberately sought to create a "community of technical scholars." He did so by picking promising areas for basic intellectual discovery, then seeking the best people to build what he called "steeples of excellence."

Faculty were free to spend one day in seven consulting. Some were instrumental in bringing firms directly to the industrial park. Chemist Carl Djerassi, the father of the contraceptive pill, brought Syntex and later became president of Zoecon.

Terman's recruitment of William Shockley, coinventor of the transistor, from Bell Labs in the mid-1950s, eventually led to the creation of 55 electronic firms in Silicon Valley.

Stanford's recruitment of Arthur Kornberg, Joshua Lederberg and others laid the intellectual foundation for the emergence of biotechnology in the Bay area.

The driving factor was intellectual, not industrial. But individuals were free to get their hands "dirty" developing their ideas, within guidelines that assured their basic academic responsibilities were met. Computer Curriculum, Telesensory Systems, Catalytica and Failure Analysis Associates were among the many firms springing up on the basis of faculty research or consulting.

Terman created an honors cooperative program, enabling hundreds of employees, regularly admitted as graduate students, to take courses direct from campus classrooms to more than 100 firms, realizing more than $3-million annually in revenues. Most of the proceeds are plowed back in support of professors' salaries.

An innovative technique, called tutored video instruction, pioneered by Prof. James Gibbons, extends further the reach of Stanford, using a combination of videotapes, regular course materials and local talent to keep professionals up-to-date.

[illegible]

ford's academic ties with industry for mutual benefit was the creation of industrial affiliate programs in more than 20 fields, ranging from applied math, chemistry and construction to synchrotron radiation and Northeast Asia policy.

Managed by faculty members, these affiliate programs enable sponsors to meet on campus and review research, obtain publications and discuss nonproprietary questions or key problems in advancing the state of the art in their field. Affiliate programs also give graduate students direct exposure to industry.

In the post-war period, both at Stanford and as general procedure elsewhere, a fairly standardized historical sequence of innovation has emerged.

The first phase is publicly funded and oriented toward the discovery and explanation of basic phenomena. It is characterized by loose, informal organization and very open communication (which includes quick publication of all details of an experiment).

The second phase is best called application. It is focused on processes and takes place in various settings: applied institutes, some university departments (of engineering, for example), nonprofits (such as SRI International or the Battelle Institute) and industrial laboratories. There is a mix of public and private funding and environments that are variable with respect to proprietary secrecy.

In the third stage—development—attention is given to practical application, including such matters as scale, rates and means of economical production. The innovation emphasis is on products; funding is by private risk capital, and the environment tends to be closed for proprietary reasons and tightly managed. All such work takes place in commercial laboratories.

Stanford President Donald Kennedy, a biologist and former commissioner of the U.S. Food and Drug Administration, points to a time of transition: "Now we are seeing a revolutionary compression of this three-stage process or innovation. The social sponsorship of discovery is being rearranged in a very fundamental way."

Kennedy believes the following factors contribute to this trend:

☐ A number of scientific disciplines are now being recognized as "ready" [illegible] pline matures in power and confidence, leaps from the laboratory to applications that once seemed intimidating become commonplace. This now appears to be the case, for example, in immunology and genetic engineering, as well as in microelectronics.

☐ There is a growing social awareness of the importance of scientific discovery to national productivity and a consequent impatience with the traditional time requirements for diffusing technology to the public.

☐ Concern is increasing in research universities—where more than two-thirds of the nation's basic science is done—about the retreat in public support for research. Federal funds for nondefense research have shrunk by about 33 percent in real dollar value since 1968. Half this decline took place in the first two years of this decade.

☐ Perhaps most unexpected of all, the venture-capital financing of small, research-intensive firms in fields such as biotechnology and microelectronics has been transformed. Since major changes were made in the capital gains tax, the investment funds available for such ventures have jumped from an estimated $70 million in the mid-1970s to about $1.5 billion in 1982.

The Stanford president tracks the developments: "Very large changes in value can take place with successive generations of private investment in high-technology firms and larger changes still when the firm goes public. At its initial public offering, for example, Genentech was valued at $38 per share. Then it soared to $80 before settling down.

"Despite some disillusionment about the soundness of biotechnology investment, Wall Street was quick to learn that in this new work, big potential is associated with early possession of an idea.

"The result is an entirely novel mixture of influences on university scientists and their institutions. For the university itself, there are new and challenging pressures on investment policy (Does the institution go into business with its own faculty?), on technology licensing (Should the university license inventions to faculty-led ventures?—to their competitors? And if yes, under what terms?), or research contracts with industry (What restrictions on communication are ac-

ceptable and should there be full disclosure of terms?), and on policies relating to consulting, faculty conflict of interest and the protection of graduate student interests."

As the Stanford president points out, "many of the problems are simply not solvable by the institution alone. For the scientists themselves, and the 'invisible colleges' that hold them together in national and international networks, there are other questions such as: How much can or should they guard against the withholding of information and exchange for proprietary reasons? How much involvement outside a faculty member's primary institutional affiliation is appropriate?

"In general, this new climate offers more opportunities than problems. What we must try to do is involve industry more productively and creatively with university research components and the division of faculty time between on and off-campus ventures."

Two promising industry-university collaborative ventures involving Stanford illustrate how these objectives can be achieved.

Stanford recently broke ground for a new Center for Integrated Systems (CIS), dedicated to fundamental explorations of what would popularly be called microelectronic chip development. Its purpose, however, is not to get a jump on the market by developing the next generation of integrated systems, but to advance the overall state of knowledge by orders of magnitude.

Without industry support, Stanford's Center for Integrated Systems would not exist. With industry support, Stanford has an exciting opportunity to discover fundamental knowledge in an area full of promise.

The basic arrangement is this: 19 leading industrial firms in microelectronics and physics each have pledged to contribute $750,000 for the construction of a building to house CIS. Once the building is completed, those firms will contribute annual dues to the center.

In return, those firms may participate in the CIS program by sending to the center one visiting scholar, approved by Stanford, to work with the CIS faculty on fundamental research.

The rules under which research is conducted at CIS are quite clear: A free and open flow of ideas and swift publications of results are a mandate.

"Industry in general gains from such ventures by assuring that fundamental work in this area will be undertaken," Kennedy emphasizes. "The particular affiliated firms gain through their exposure to new ideas in these fields and to the faculty leaders who are asking the new questions. Perhaps most important, the sponsors have a chance to become acquainted with bright students, whose education we also hope to enrich through the center."

A second arrangement, providing a rather different model for the development of new industry-university collaboration, is the new nonprofit Center for Biotechnology Research. It will fund research in genetic engineering and biotechnology, and is affiliated with a for-profit firm, Engenics Inc., which will seek to develop commercial opportunities in the same field.

> "The driving force was intellectual, not industrial. But individuals were free to get their hands 'dirty' developing their ideas."

Six major firms collaborated in financing the new entities. A unique feature of the arrangement is that the center will hold 30 percent of the equity of Engenics, and its charter provides that any capital appreciation and dividends realized on Engenics stock be devoted to the further support of basic university research as determined by the trustees of the center.

Stanford owns no equity in Engenics, nor will Stanford lay any special claim to research funds available from the center. The six sponsoring firms of the center and Engenics may have licenses to any patents developed in the center's funded projects, but these licenses will be offered at commercial rates and in accordance with existing policies at the universities.

"The novelty of the research agreements with the Center for Biotechnology comes not from any special conditions developed by the universities," explains Kennedy, "but from industry's willingness to form a new funding consortium for university-based research.

"These new forms of industry involvement in university research did not emerge easily; they evolved out of a process of hard negotiation.

"The condition under which university research flourishes—open and free exchange of ideas—is really quite different from the proper and necessary secrecy that shrouds end-product development."

Sponsoring research, Kennedy continues, "is not the same as making a charitable contribution. The same firms that make charitable contributions for philanthropic reasons, rightly insist on getting their return, even if long-term, from sponsored research.

"For their part, universities have no objection if their research benefits business. Indeed, they rather like the idea, but they are zealous about ensuring that the conditions essential to free inquiry for teaching and research are not compromised."

In congressional testimony on behalf of the Association of American Universities and the National Association of State Universities and Land Grant Colleges, Kennedy has backed tax credits for business firms that sponsor basic research at universities.

Besides providing an incentive for fundamental research that individual firms often cannot undertake alone, such tax credits would, as a critical by-product, train scientists and engineers more attuned to the needs of industry.

"We must find a way to increase the rather small proportion of industry contribution to university research—it is around 5 percent at Stanford and averages only about 3.5 percent for U.S. research universities—without launching a migration of the universities' best research talent into industry," Kennedy emphasizes.

While it cannot substitute for sustained, large-scale federal funding of basic sciences (*page 4*), increased industry support could help meet the critical need for instrumentation in university laboratories, buffer long-term research from sharp fluctuations in federal funds and further quality training of future researchers.

Hewlett-Packard recently announced a $6-million program to encourage promising graduates to continue teaching after completing their degrees—in essence, rewarding

continued

them for not coming to work on the company payroll.

If Stanford's experience is any guide, such long-term concern for academic quality—a concern that today extends far down into the primary and secondary schools—is vital for maintaining a strong, productive economy.

Innovation and entrepreneurship both remain vigorous on campus.

Stanford's faculty of 1,100 produces an average of nearly three inventions or processes a week that are reviewed for possible licensing. Gross income from technology licensing topped $2.5 million last year.

"We are in the third year of a very high rate of discoveries—two or three per week—which shows no sign of abating in the near term," notes Director Niels Reimers of the Office of Technology Licensing.

"Molecular biology and information sciences are the areas of greatest activity," he notes. In these areas, the technology often involves tangible research property (TRP), such as a piece of biological material or a computer software program. University rules make TRP promptly available to scientific colleagues while protecting its commercial value. A recently established Software Distribution Center helps meet these objectives.

Biological products of greatest research and commercial interest are hybridomas, DNA probes and plasmids. So far, researchers have made more than 100 disclosures of biological materials to the Office of Technology Licensing.

During 1981-82, Stanford received income from 56 separate technologies. Earned royalty income on sales came from such products as a biological cell sorter instrument, text-editing software, a chemical reagent, an infant hearing-detection system and an infant transporter, an insect attractant and hybridomas.

Advance payments were received on FM-sound synthesis for musical instruments, human hybridomas, acoustic microscopes, computerized axial tomography (CAT) technology, blood-flow detection systems, cryptology systems and computer-aided design software.

"The gestation period of a university discovery until significant income from sales is received is generally long," Reimers observes. "In 1981-82, more than 88 percent of the income came from cases disclosed to the Office of Technology Licensing in 1974 or earlier."

Unlike most industries and many other universities, Stanford permits individuals to retain a one-third share of net income from their inventions. Another third goes to their department and the rest to their school. While small, these funds are growing fairly rapidly and provide continued support for campus R&D.

Hundreds of students, both graduate and undergraduate, have attended student-organized conferences on entrepreneurship in the past two years, scores creating their own companies.

Computer software is the hottest single field. Other ventures range from fiber optics and new methods of drilling for oil to earthquake safety inspections for homeowners, books, chocolate-chip cookies and truffles.

There's no rigid, lock-step master plan involved.

As in Stanford's many relations with business and society generally, there's a concern for finding bright people, creating a climate where their talents can flourish in a wide variety of ways, and—hardest of all—having the patience to wait years, even decades, to see how it all comes out. ■

Bob Beyers is director of Stanford University News Service, Stanford, Calif.

SCIENCE HAS ITS DAY

by Theodore M. Hesburgh

Wouldn't the world really be a better place if we could replace the current leadership—the politicians, the philosophers, the lawyers, the humanists, and the theologians—with scientists and engineers?

I am sure that this question, on the surface, sounds somewhat preposterous, but there are scientists who profess to have an answer for everything, who have been disillusioned by political and legal forces, who often feel unduly inhibited by philosophy and theology, who legitimately bristle when they are portrayed by the humanists as the new savages, bringing the world to the brink of destruction.

One might make the point that the nonscientists acted mighty selfishly themselves when they had their day. I must resort to some oversimplification here, but I think the main point at issue will be evident.

The Greeks in their day reduced all knowledge to philosophy. A remnant of this remains, as many scientists today receive Ph.D.—doctorates of philosophy. The Romans brought to our civilization a heritage of law and political order. Many of our current legal principles were formulated long ago in the Code of Justinian, when science was fairly primitive. Renaissance man almost worshiped the arts. Science was simply a liberal art in those days.

In medieval times, theological synthesis was in highest vogue. The earliest universities turned around about the faculty of theology. The queen of the sciences was theology's most cherished title. No scientist or engineer would have had then the ascendency each enjoys today. In fact, the explosive beginnings of science and technology were most often met with resistance and misunderstanding.

Would it be any surprise then if history were to repeat itself, if those who hold the ascendancy today were to claim as their exclusive rights the center of the stage, as the philosophers, the lawyers, the humanists and the theologians did?

Would it be incomprehensible if scientists and engineers were to claim today that they, with their revolutionary new knowledge and power, could do a better job of running the world than those who preceded them in man's long history of intellectual developments?

There is historical precedent for those who answer in the affirmative and claim exclusive leadership today for scientists and engineers as the best the world may expect and need.

I could readily understand this stance, but again, in disagreeing, I would only underline one perceptive statement: that those who are merely children of their day, who do not understand history, condemn themselves to repeat all human errors of the past.

The Rev. Theodore M. Hesburgh is president of the University of Notre Dame and a former member of the National Science Board. Excerpted from *The Hesburgh Papers: Higher Values in Higher Education.* © 1979 by Rev. Theodore M. Hesburgh, C.S.C. Reprinted with permission of Andrews & McMeel, Inc. All rights reserved.

R&D WITH A TWIST OF HIGH TECH

The role of government is to expedite the process

The long tradition of industry-university cooperation in education and research has recently been even more closely cemented, particularly in heavily financed research agreements. How do you view this?

Skeen: I view the trend very positively. Every aspect of what we know about education and university-run research and development points to the need for greater cooperation between industry and universities. Over the past few months, we have all been alerted to the long-term decline in the quality of U.S. education, especially in the sciences. There is also the problem of a rapid change in the technologies used in the private sector—so rapid that few universities can be expected to keep up with the state of the art in training and research facilities.

Industry can benefit its own R&D operations and perform a tremendous public good by helping meet the instrumentation needs of universities and assisting in the improved quality of students' education. Everybody wins. The industry gets access to the best research capabilities in the world; the university gets financial and equipment support; and the student ends up better-educated and more qualified for the modern workplace.

Somerville: What current and future areas of industry-university cooperation do you see as most significant?

Skeen: Without doubt, I see high-technology development as the most significant area both now and in the future, specifically in the areas of education and research. My own state of New Mexico's Rio Grande Valley has become a prominent center of modern science and high-technology development, with large and varied assets in institutions of higher learning, government laboratories and industry staffed with professional and skilled personnel. To that end, I have supported the establishment of governing and administrative mechanisms to initiate and guide the active development of the Rio Grande Research Corridor (RGRC) to enhance the quality and quantity of employment in New Mexico by attracting high-technology industries.

One area where industry-university cooperation in education and research has resulted in dividends for the state is in explosives-technology research and application with emphasis on the areas of metallurgical and ceramics-materials processing, and ore-quality improvement and materials extraction for enhanced yields and reduced energy use.

New Mexico has for more than 40 years been the focus of high-technology activity in explosives applications by universities, defense-related national laboratories and industry. At the New Mexico Institute of Mining and Technology, these technologies reside side-by-side with active mining and metallurgical engineering departments and with explosives-related research in the institute's research and development division. Combining these individual efforts to develop high-technology applications of explosive energy to metallurgical and mining problems will result in an enhanced center of excellence with national and international significance.

Explosives technology is an unusual field that has been given little attention by private industry, yet New Mexico Tech now provides explosives-related research and testing services for many government agencies as well as industrial clients such as Boeing, Honeywell, Vought, McDonnell Douglas, Brunswick, Motorola, BDM, Hughes, Aerojet General and others. Four of these industrial clients have already expressed a keen interest in locating facilities in New Mexico Tech's research park area and in working cooperatively with the institute.

I feel strongly the proposed effort will provide the catalyst for combining current research efforts, in-place laboratory capabilities and industrial client relationships into a nationally important center for the application of explosives technology.

Somerville: If industry-university cooperation—in its many facets—is viewed as enhancing the U.S. research-and-development effort and providing benefits to education institutions, is there justification for government action to spur cooperation?

Skeen: Certainly—in a supportive manner. I have always felt that one of the roles of government is to assist the public good. Not to do the job in most cases, but to assist those better qualified and closer to the problem to solve it for themselves.

The most appropriate role for the federal government in this case is to remove any impediments to these cooperative agreements and then to provide as many incentives as good fiscal and public policy permit. Many bills have been introduced this session to that very end. The appropriate committees have to act on those bills before anyone can say exactly what is likely to happen.

The Reagan administration is certainly aware of and sensitive to the problem. There are, however, limits to what can be done as long as the deficit remains so large. I believe industry-university cooperation to be an important component in a program to increase our rates of innovation and productivity—leading to a stronger economy, so you cannot drop one issue to pursue the other.

Somerville: Antitrust laws have often been cited as providing a disincentive to cooperative ventures involving industry and universities. Should antitrust laws be changed to stimulate even greater cooperation? Or do you believe that antitrust limitations on research cooperatives could be changed administratively?

by Brendan F. Somerville

Skeen: I don't think current antitrust laws prevent these cooperative relationships at all. We see this same problem in joint R&D ventures among firms, especially in the high-tech area. It is easy to forget the important role antitrust policy, when first enacted, played in strengthening free enterprise in this country. Most of our industries, however, no longer compete in a national market. The international competition we now face necessitates a joining of certain industry interests—such as R&D—to better arm American industry for the market-share battle under way in world commerce.

Several major conferences have been held on the subject, one of the better ones, as a matter of fact, by the NAM in Boston last fall. The consensus seems to be that a clear policy from the Commerce Department—combined with the removal of treble damages in the antitrust regulations from the Department of Justice—might help a great deal. The Commerce Department held a high-level meeting in May on the subject and considerable progress was made.

Somerville: Several bills before the House and Senate address the capability of schools and universities to deliver more quality scientists and engineers. Do you believe that university-industry research relationships can generate new opportunities for quality education, particularly at advanced levels?

Skeen: Absolutely. In keeping with the administration's commitment to ensure our country's future strength, the director of the National Science Foundation and the secretary of education were instructed to examine the adequacy of science and engineering education for the nation's long-term needs. I highly recommend their report, "Science and Engineering Education for the 1980s and Beyond," which provides a comprehensive study of important and difficult issues facing the nation's science and engineering education system.

Somerville: Many of the issues the report raises have been partially addressed by the administration as part of its economic recovery program. The National Science Foundation, for example, is slated for an 18 percent budget increase by this administration. In addition, the president has initiated reforms in the tax system to stimulate investment and spur growth. I am hopeful these efforts will promote cooperation in research among industry, universities and government. These measures, taken together, will do much to stimulate new interest in science and engineering careers and strengthen the research-and-training base of the nation: the universities and engineering schools nationwide.

Somerville: More difficult problems than antitrust or taxes in the university-industry relationship have been raised. The ethics issue is one: take, for example, a professor's conflict between his academic responsibilities and his commitments to a company's research needs. Your subcommittee has held hearings to examine aspects of this in the biotechnology fields. What were the results?



Skeen: That depends on one's perspective, I'm afraid. Not all my colleagues on the subcommittee are as comfortable as I am with the growing trend in these agreements. Many have raised legitimate concerns, well-documented in the lay press and academic literature. Let me say that I do not think the problems are insurmountable, nor do they prompt a need for extensive government oversight. The issues are not new. Several institutions, like Stanford (*page 11*) and MIT, have a long and successful history of collaborative relationships.

The subcommittee recently held a hearing in New Mexico and examined the plans for the Rio Grande Research Corridor, which builds on the talents of the state's university system to attract industry in such fields as biotechnology and robotics. The development of the research corridor depends on a multitude of collaborative research relationships and can only improve university education, industry R&D and the local economy. Sure, there will be some problems but the benefits to all involved will prompt a quick solution. You can count on it.

Somerville: Another problem lies in data publication. Academic freedom demands extensive publication of research results, while industry is more protective of results until they are safeguarded (by patents, for example). Some believe that university-industry research cooperation is not likely to be so extensive that temporary limitations on open-data exchange would harm the overall academic need for free publication. What are your views?

Skeen: Academic freedom must be maintained. In our hearings on the decline in the quality of education in America, a number of witnesses felt that perhaps there has been too much pressure on professors to publish instead of educate. The balance between research and education is dynamic and shouldn't, in my mind, be toyed with. However, it may be that a little less emphasis on quick publication of *all* research findings and a little more emphasis on the educational advantages of collaborative research endeavors might do the universities and students some good. Again, many universities have worked out this issue with their industry partners. Both sides must make compromises; this just has to be accepted. ■

Rep. Joe Skeen (R-NM) is ranking minority member of the Science and Technology Committee's Subcommittee on Investigations and Oversight. Brendan F. Somerville is NAM director of innovation, technology and science policy.

COLLABORATION BASED ON TRUST

by Howard A. Schneiderman

The Monsanto way of forging ties with academia

Controversy provokes change. A current controversy that promises to significantly change the relationships between universities and industry stems from the increasing number of joint research contracts being developed by America's research universities and research-driven companies. What are the pros and cons?

Supporters of research collaboration between universities and corporations argue that the research talents of America's great universities are unsurpassed in the world. They suggest that these talents, coupled with the splendid technological and product development skills of American industry and our national entrepreneurial spirit, could accelerate both basic research itself and the application of basic research. They see hybrid scientific vigor emerging from such collaboration—a vigor that would keep America at the leading edge of scientific, technological and industrial change and ensure that it remains the leading scientific and economic power in the world. They also argue that without such university-industry collaboration, American industry may lose its technological leadership in key areas to industry—university-government consortia such as those established by the Ministry of International Trade and Industry (MITI) in Japan. As a consequence, key American industries may fail in the international marketplace. Finally, they point out that university-industry collaboration can provide important research funds to universities, which largely support basic research.

Detractors suspect that contracts between companies and universities threaten academic freedom by discouraging basic research and the sharing of knowledge. They believe that such collaboration will undermine our system for discovery of new knowledge and training the scientists and opinion leaders of the future. They question whether our universities are morally strong enough to withstand what is construed by some to be the corrupting influence of big business. In particular, they believe industry will encourage universities to pursue excessively utilitarian goals and to neglect long-term fundamental questions. And some of them question whether it is sensible for public companies to invest research dollars in university research, where the companies' control over conduct of the research is limited or nonexistent.

I understand the hesitation of some of my scientific colleagues in universities and their concerns about protecting academic freedom. I agree that the university must be protected and nurtured as a place for pure scholarship, a place to some extent insulated from excessively utilitarian goals.

If, in the interest of short-term rewards, corporations damage the basic intellectual structure of America's universities, they will kill the goose that lays the golden egg. I am convinced that America's major corporations recognize this and are sensitive to the importance of the university as society's main arena for the discovery of facts, explanations and ideas. Monsanto certainly understands the importance of great, independent, research universities. Yet we have become convinced that industry-university research collaborations can benefit academic institutions, industry and society.

Today, Monsanto is a participant in several research collaborations with U.S. universities. In 1982, the company announced a five-year, $23.5-million agreement with Washington University in St. Louis to conduct research on proteins and peptides that regulate cell function. Also in 1982, Monsanto signed an agreement with Rockefeller University for a five-year, $4-million basic research program in plant photosynthesis.

Since Monsanto creates and sells science and technology, our company has a vested interest in the future of the scientific endeavor in this country.

We see the nature and direction of science changing, primarily in its quickening pace—with sharp accelerations recently.

- The time between making a discovery and having it enter the commercial world is getting shorter, particularly in the life sciences.
- Technology transfer from the university is also quickening—more of what the university discovers can be applied by industry than was the case 20 years ago.
- The traditional boundary lines between basic and applied research—or between university and industrial research—are blurring rapidly.
- Funding patterns are changing. Nondefense federal research spending has slipped 38 percent in constant dollars since 1967, with nearly half this decrease over the past two years.
- International competition in high technology is becoming increasingly

intense. Japan, for instance, has legislatively created cooperative agreements among government, industries and universities.

All these factors are pushing industry and universities into a reassessment and redirection of their roles in science. We are finding ourselves becoming logical partners for scientific innovation and technology transfer.

Monsanto supports this concept of partnership because it is one means of adapting to competitive change. Market forces, for example, have led, or driven, an increasing proportion of American industry toward higher value-added products—products that rely increasingly on science and technology transfer. The lines between the chemical, agricultural, medical and drug, textile and computer industries are growing less and less distinct.

While this change offers us the opportunity for synergy between what have traditionally been different technologies and sciences, it also produces the problem of developing new and needed skills.

Molecular biology is an example. Chemical or drug companies cannot match the massive skills that have evolved in America's great research universities. But we need this science and technology to develop products that meet basic human needs. One way to accelerate this process is to work with universities.



Monsanto's association with Washington University is part of a plan to bring original science and technology to bear on problems of great social and commercial importance. By using and supporting the research skills of this distinguished academic institution, Monsanto enhances not only its own competiveness in changing world markets but also America's.

About 15 years ago, Monsanto and Washington University entered into an agreement with the Office of Naval Research to conduct scientific investigations on high-performance composite materials. That collaboration and a later association with Harvard University served as a precedent for the recent agreement with Washington University.

Neither Monsanto nor Washington University views the agreement as a formula for other companies and universities to follow. It was designed to suit the particular cultures of these two particular institutions. It may be useful, however, to enumerate the contract elements we believe critical for undertakings of this sort.

Negotiations started two years ago, when Monsanto scientists began talking with David Kipnis, chairman of the Department of Medicine at the Washington University Medical School, and his colleagues. In those two years of careful planning, Washington University and Monsanto developed a plan for bringing the benefits of important medical discoveries to the public faster than would otherwise be the case.

The goal of the Washington University agreement is to provide society with health-care products. Yet, at the same time, it specifies that 30 percent of the research conducted is to be allocated to the pursuit of fundamental biological questions. The other 70 percent is focused on cures for as yet incurable major diseases.

Provisions were made for specific project agreements. The Washington University contract not only builds a framework for these but also establishes a joint advisory committee made up of four Monsanto representatives and four from the university to decide what research will be supported.

The presence of this committee enables the undertaking of a broad variety of research as well as a competitive situation for the awarding of research funds. The university tells the committee what research it is doing or wishes

continued

Stephanie Mayo

...o do. The committee selects projects it believes offer the highest promise for solving important health-care problems. If the committee elects not to support a particular research endeavor, the university probably will seek other sources of funding.

Academic researchers retain their freedom to publish; the agreement establishes a 30-day period for Monsanto to review any manuscript.

The contract also calls for an independent oversight committee of leading citizens from the scientific and academic communities and public arenas representing society's stake in the research. There is a special requirement for a scientific peer committee to review the work after a certain time and to assess its scientific merit and impact on the two institutions.

This all leads to a mutual exchange of ideas among scientists. Because of the proximity of Washington University to Monsanto (only 15 minutes away) and because of the rapid growth of biological expertise inside the company, this will be a true collaboration. Monsanto scientists will work on each project with Washington University scientists, in their labs and our labs.

Monsanto has the exclusive right to license any patents that may come from the research. This important provision is basic to how effectively this research collaboration will serve the ultimate beneficiary: the public. The forte of academic research is fundamental investigation: the R, if you will of R&D. While industry is also capable of doing highly original research, the place where it excels is in the development phase, or the D of R&D. Development is an expensive, time-consuming, high-risk process. For every research dollar spent on discovery, it takes hundreds more to develop that discovery into a useful product that can be manufactured and sold in the marketplace.

No less significant is the time commitment. A rule of thumb is that it takes at least 10 years to go from the original discovery to a product on the shelf. That was true of the Lasso and Roundup herbicides as well as the AstroTurf stadium surfaces we developed. To develop plant-growth regulators that will enhance the yield of major crops, Monsanto already has spent well over a decade and tens of millions of dollars. Yet it still has not commercialized an important plant-growth regulator.

Obviously, a company cannot afford to invest shareholders' money in this kind of high-cost, long-term development process without some guarantees that success will provide an opportunity to recoup the investment.

In the future, we may expect to see more companies and more universities forging partnerships. Hopefully, each partnership will be tailored to the particular university and corporate cultures involved. But, in all cases, the keystone to the success of the partnerships will be the regard in which each partner holds the other. Integrity and mutual trust are essential. So is a deep conviction that the rights and interests of both parties must be safeguarded.

By accelerating the processes of discovery and technology transfer, these partnerships can help university researchers better understand some of society's important needs and enhance their ability to meet those needs. Conversely, industry stands to gain through an infusion of basic knowledge that will enhance its own applied research. New perspectives and new ways of thinking should emerge from both institutions.

The controversy over industry-university collaboration is resulting in change—positive change that can enable America to remain a technological leader in a world of increasing competitive challenge. To maintain that leadership, however, we must ensure that the rights of both institutions are secured; and we must demonstrate that society is the ultimate beneficiary of these relationships. ■

Howard A. Schneiderman is senior vice president of research and development at Monsanto Company (an NAM member) in St. Louis, Mo.

ROBOTICS RESEARCH

Researchers from five corporations are working with scientists at Purdue University, Lafayette, Ind., in a major effort to develop the first factory that will be computer-controlled—from product design to the loading dock.

The Computer-Integrated Design, Manufacturing and Automation Center (CIDMAC) is a cooperative venture organized by Purdue and sponsored by Cincinnati Milacron, Inc.; Cummins Engine Co., Ind.; Ransburg Corp.; and TRW Inc. (all NAM members); and Control Data Corp. It was established "to attack problems of productivity and innovation in American industry," explains John C. Hancock, dean of Purdue's Schools of Engineering.

While acknowledging that other universities and private firms have also teamed up to tackle the productivity dilemma, Hancock claims the CIDMAC approach is unique. Center researchers will seek to integrate the traditionally separated functions of computer-aided design (CAD), computer-aided manufacturing (CAM), robotics, group technology, and simulation of product processes and management techniques for production management.

Several research projects entail designing "more intelligent" robots:

- Improved tactile sensing would make robots capable of bringing objects together—a "must" in the fully automated factory of the future.
- Sight capability would especially improve the inspection process.
- Flexible fixtures would allow a robot to automatically adjust itself to parts. At present, "cradles" for holding the parts are not flexible and must be replaced each time a different or new part is manufactured.
- Cooperative work projects would improve work flow and efficiency. Currently, robots are capable of interacting with other machines, such as computers, but cannot work with other robots to share work tasks.
- Free-moving vehicles would improve flow-time and inventory by a factor of 10 and reap dramatic improvements in productivity. At present, robot vehicles that carry parts or pick up objects are guided by cables around the plant, making direct point-to-point trips impossible.

The industry-academic coalition does not expect instant results but is confident of significant increases in productivity—without sacrificing human values.

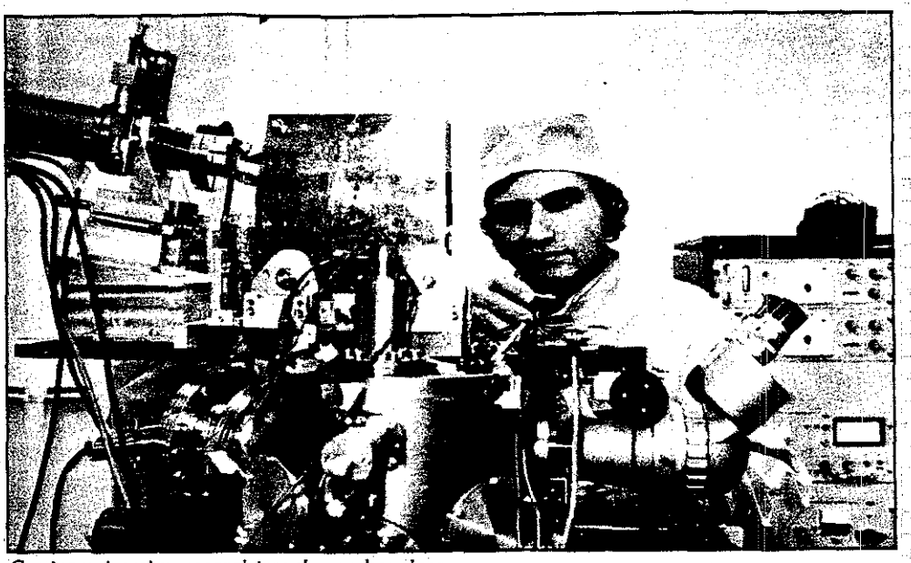
From research to reality

British universities are becoming rich hunting grounds for technology-transfer agencies. Now in the queue is the Research Corporation of the US. Laura Mazur reports

Now that the British Technology Group (BTG) no longer has the first choice of exploiting British academic research, our universities are becoming rich hunting grounds for technology-transfer agencies.

The latest to join the queue is the US's Research Corporation. It wants to apply techniques culled from 70 years experience in the US of translating academic research into market reality.

According to Dr Charles Desforges, chief executive of RCL, the part of the venture which will deal with commercial exploitation, "We will be looking for activities whereby an invention becomes innovation and then commercial reality." The surplus funds will then be circled back into Research Corporation Trust (RCT), the heart of the British organisation, which will, in turn, recycle the money into more research.



Getting university research into the market place

Steering research grants

RCT, which will steer the research grants, is being formed as a charitably-based joint venture between Investors in Industry (which is backed by a number of banks, including the Bank of England) and Research Corporation. It will kick off with £100,000, which will eventually be increased both by the growing commercial subsidiary, RCL, and (hopefully) by British commerce and industry.

The goal of RCL will be to sew up non-exclusive agreements with universities and other institutions of higher education — at first here, and then spreading to the Continent. Any tempting proposals it evaluates will become RCL's responsibility for patenting, licensing or handling in whatever way best suits the idea or invention: licensing, joint-ventures or seed-capital provision. Profits will then be split between RCT and RCL for overheads and grants, with the remainder going to the original institution.

Desforges points out that "Lots of inventions are really embryos, and they have to be nurtured toward survival or else die. Survival means funding — but they often fall into a commercial gap between research grants and venture capital. That gap needs to be filled."

Research Corporation was set up 70 years ago by a young physical chemistry professor who had made money from an invention and wanted to use it both commercially and to benefit society (see box). It has developed the twin roles of funding research on one hand, and exploiting promising inventions on the other — but does it mainly through universities to avoid getting entangled with individuals.

Desforges has already begun the round of universities here in search of agreements under which RCL will evaluate proposals sent to it. Desforges calls them "comfort agreements" — they are not onerous, and hard-pressed universities do not have to release precious funds on chancy ventures.

The British organisation will be based on its American model, which has agreements with 300 academic institutions. It feeds roughly $3 million of no-strings grants into research, while money from inventions brings in about $15 million. 60% of that goes back to the university coffers, while 40% pays Research Corporation's overheads and expenses and the $3 million of grants.

Desforges, who spent the last six years as research director for Engelhard Industries and has been a consultant to the EEC and the European Space Agency, stresses: "We want to see British academic inventions in science and technology turned into British exploitation". He believes that universities are under financial pressure, which, with the added burden of falling student numbers, has led to pressure for them to be more commercial. Moreover, because the BTG no longer has the right of first refusal over inventions from publicly-funded research, the field is wide open.

Proposal evaluators

Desforges is in the middle of hiring three people for proposal evaluation, to be raised to five by the end of the year and probably 10 within three years. Although he realises that "every inventor thinks their invention is the greatest thing ever", he looks at the US experience, where about 10% of the 300-400 disclosures a year get taken on board, with only 1% leading to significant commercial business — similar to the experience of most venture capitalists.

Desforges will also be looking for companies for licensing and exploitation. He prefers British companies, but, ultimately, licences will go where they are wanted. Target sectors include engineering and materials science, everything "bio" — indeed, "the sciences that will lead to the technology of the 21st century".

According to Desforges, the Research Corporation has been looking at Europe for some time, particularly since one-third of its income from licensing comes from outside North America. The ending of the BTG monopoly was the catalyst. Besides "Europe has so much potential, but is somewhat hidebound."

Desforges is guardedly optimistic about much-criticised attitudes here to science and technology exploitation. At the same time, it could be dangerous to future research to make universities market-driven. He maintains that Research Corporation's approach is one way to resolve the dilemma. □

Where it all began

The Research Corporation began in 1912, with money 34-year-old academic, inventor and philanthropist Frederick Gardner Cottrell made from exploiting his electrostatic precipitator. Of the 15,000 inventions evaluated over the years, 1,300 have made it and include items like cortisone, the maser-laser concept, cardiac pacemakers and a cancer detection test.

The foundation has always worked on a closed-loop principle: collecting patent royalties and licensing fees, which are in turn channelled back into the trust to fund academic research, particularly that being done by promising academics at the start of their careers.

There are about 500 projects at any one time, with about 400 inventions available for licensing to industry (government gets royalty-free licences when it has funded the original research).

From research to reality

British universities are becoming rich hunting grounds for technology-transfer agencies. New in the queue is the Research Corporation of the US. Laura Mazur reports

Now that the British Technology Group (BTG) no longer has the first choice of exploiting British academic research, our universities are becoming rich hunting grounds for technology-transfer agencies.

The latest to join the queue is the US's Research Corporation. It wants to apply techniques culled from 70 years experience in the US of translating academic research into market reality.

According to Dr Charles Desforges, chief executive of RCL, the part of the venture which will deal with commercial exploitation, "We will be looking for activities whereby an invention becomes innovation and then commercial reality." The surplus funds will then be circled back into Research Corporation Trust (RCT), the heart of the British organisation, which will, in turn, recycle the money into more research.



Getting university research into the market place

Steering research grants

RCT, which will steer the research grants, is being formed as a charitably-based joint venture between Investors in Industry (which is backed by a number of banks, including the Bank of England) and Research Corporation. It will kick off with £100,000, which will eventually be increased both by the growing commercial subsidiary, RCL, and (hopefully) by British commerce and industry.

The goal of RCL will be to sew up non-exclusive agreements with universities and other institutions of higher education — at first here, and then spreading to the Continent. Any tempting proposals it evaluates will become RCL's responsibility for patenting, licensing or handling in whatever way best suits the idea or invention: licensing, joint-ventures or seed-capital provision. Profits will then be split between RCT and RCL for overheads and grants, with the remainder going to the original institution.

Desforges points out that "Lots of inventions are really embryos, and they have to be nurtured toward survival or else die. Survival means funding — but they often fall into a commercial gap between research grants and venture capital. That gap needs to be filled."

Research Corporation was set up 70 years ago by a young physical chemistry professor who had made money from an invention and wanted to use it both commercially and to benefit society (see box). It has developed the twin roles of funding research on one hand, and exploiting promising inventions on the other — but does it mainly through universities to avoid getting entangled with individuals.

Desforges has already begun the round of universities here in search of agreements under which RCL will evaluate proposals sent to it. Desforges calls them "comfort agreements" — they are not onerous, and hard-pressed universities do not have to release precious funds on chancy ventures.

The British organisation will be based on its American model, which has agreements with 300 academic institutions. It feeds roughly $3 million of no-strings grants into research, while money from inventions brings in about $15 million. 60% of that goes back to the university coffers, while 40% pays Research Corporation's overheads and expenses and the $3 million of grants.

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Why inventors are frustrated

By Jervis G. Webb

Creativity in science and technology may be on the rise again in America. Based on the filing of patent applications, after a decade of declining interest, invention in the United States seems to be in the early stages of new growth. For a nation that has taken its technological preeminence for granted too long, any sign that such a revival is taking place is good news indeed.

It is also heartening that Congress appears to be nurturing this movement. Recent laws, for example, have been enacted to allow inventors to keep patent rights to inventions developed with federal funds.

Another law is currently under consideraton by Congress that will protect the inventor against time lost in getting government clearance for his inventions. Still another bill creates judicial machinery for bringing more uniformity in judging the strength of a patent. It has been said that more positive patent legislation has been passed in the past two years than in the previous twenty.

It is unfortunate, however, that this legislative effort, no matter how laudable, comes nowhere close to creating an environment for a real renaissance of technological innovation. At the heart of the matter is a half-century of neglect and, at times, a misguided attack on the patent system itself. A state of deterioration has set in — a generalized condition that cannot be corrected by a few narrowly focused laws.

Consider, for example, the problem of the cost of patent litigation, which has become, for many litigants, the most expensive in the business law spectrum. Many inventors simply cannot afford to challenge infringers. If the inventor chooses to go on a court odyssey to protect his patent, he may find himself at the mercy of those who know little about his technology and the process of invention, not to mention his risk of having his patent invalidated and being fined if he loses.

Consider also the problem of simply defining what an invention is. In the early days of the system, to be patentable an invention had only to be novel and useful. Just three years ago, however, a high court said invention is an "amorphous, ephemeral, impossible-to-define term." This has led the courts to set tougher standards for inventions that combine old elements than for completely "new" inventions. Unfortunately, though they may contribute strongly to man's dominion over his environment, in the real world few inventions are totally new.

It is easy to see how creativity can be stifled in an atmosphere like this. What the country sorely needs is to study the entire patent system from top to bottom and, in light of long-term national goals, enact a comprehensive patent reform law.

In today's competitive world it makes no sense to have a patent system that hinders the pursuit of excellence.

Jervis C. Webb is president and chairman of the board of the Jervis B. Webb Company, manufacturer of custom engineered conveying systems. He and his company hold many patents.

NEW ORLEANS, LA.
TIMES-PICAYUNE
& STATES-ITEM
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SUNDAY -316,428
OCT 13 1982

N.O. woman picked for trade board

Capital bureau

BATON ROUGE — A New Orleans woman has been picked to serve on the Industry Sector Advisory Committee on Wholesaling and Retailing for Trade Policy Matters, Gov. David C. Treen said Tuesday.

U.S. Commerce Secretary Malcolm Baldrige selected Naomi Damonte Marshall for the committee. She is chairman of the Louisiana State Arts Council and president of Madewood Arts Foundation. Marshall was Latin American Export Manager for Chemco Photoproducts from 1954 to 1965, and is a member of the Alliance for Arts Education of the John F. Kennedy Center for the Performing Arts.

Under President Nixon, she served on the President's Advisory Committee on the Arts.

"Your work with this program will enhance the ability of the U.S. government to pursue trade objectives which reflect the concerns and interests of the private sector," Baldrige told Marshall in his letter of appointment.

The committee is an advisory body of the Industry Consultants Program on Trade Policy Matters.

Also Tuesday, Treen said two New Orleans area doctors and one from Alexandria have been appointed to the Louisiana State Board of Psychologists.

Fred E. Davis of New Orleans, John Wakeman of Metairie and Gregory Gormanous of Alexandria were named to the board. Gormanous is an associate professor of psychology at LSU's Alexandria branch; Davis and Wakeman are in private practice.

The board is responsible for making rules for the practice of psychology and licensing and regulation of psychologists.

Treen also announced the appointments of Ronald P. Sawyer of Shreveport to the State Board of Election Supervisors and George Wilbert of Plaquemine to the Board of Commissioners of the Atchafalaya Basin Levee District.

EMBARGOED FOR RELEASE
UNTIL AFTER THE BRIEFING
WEDNESDAY, OCTOBER 31, 1979

October 31, 1979

Office of the White House Press Secretary

THE WHITE HOUSE

TO THE CONGRESS OF THE UNITED STATES:

Industrial innovation -- the development and commercialization of new products and processes -- is an essential element of a strong and growing American economy. It helps ensure economic vitality, improved productivity, international competitiveness, job creation, and an improved quality of life for every American. Further, industrial innovation is necessary if we are to solve some of the Nation's most pressing problems -- reducing inflation, providing new energy supplies and better conserving existing supplies, ensuring adequate food for the world's population, protecting the environment and our natural resources, and improving health care.

Our Nation's history is filled with a rich tradition of industrial innovation. America has been the world leader in developing new products, new processes, and new technologies, and in ensuring their wide dissemination and use. We are still the world's leader. But our products are meeting growing competition from abroad. Many of the world's leading industrial countries are now attempting to develop a competitive advantage through the use of industrial innovation. This is a challenge we cannot afford to ignore any longer. To respond to this challenge, we must develop our own policies for fostering the Nation's competitive capability and entrepreneurial spirit in the decades ahead. This Message represents an important first step in that direction.

I am today announcing measures which will help ensure our country's continued role as the world leader in industrial innovation. These initiatives address nine critical areas:

- o Enhancing the Transfer of Information
- o Increasing Technical Knowledge
- * o Strengthening the Patent System — S.414, S.1679, S.1477
- o Clarifying Anti-trust Policy
- * o Fostering the Development of Small Innovative Firms. S.I.D.'s - S.B.I.R.
- * o Opening Federal Procurement to Innovations
- o Improving Our Regulatory System
- o Facilitating Labor/Management Adjustment to Technical Change
- * o Maintaining a Supportive Climate for Innovation.

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INITIATIVES

1. Enhancing the Transfer of Information. Often, the information that underlies a technological advance is not known to companies capable of commercially developing that advance. I am therefore taking several actions to ease and encourage the flow of technical knowledge and information. These actions include establishing the Center for the Utilization of Federal Technology at the National Technical Information Service to improve the transfer of knowledge from Federal laboratories; and, through the State and Commerce Departments, increasing the availability of technical information developed in foreign countries.

2. Increasing Technical Knowledge. We have already made significant efforts to assure an adequate investment in the basic research that will underlie future technical advances. This commitment is reflected in a 25 percent growth in funding during the first two years of my Administration. I am taking some additional steps that will increase Federal support for research and development:

First, I will establish a program to cooperate with industry in the advancement of generic technologies that underlie the operations of several industrial sectors. This activity will broaden the $50 million initiative I announced in May to further research in automotive research. Second, in order to help harness the scientific and technological strength of American universities, I have directed a significant enhancement in support of joint industry-university research proposals. This program will be modeled on a successful program at the National Science Foundation, and I have set a target of $150 million in Federal support for it.

3. Strengthening the Patent System. Patents can provide a vital incentive for innovation, but the patent process has become expensive, time-consuming, and unreliable. Each year, fewer patents are issued to Americans. At my direction, the Patent and Trademark Office will undertake a major effort to upgrade and modernize its processes, in order to restore the incentive to patent -- and ultimately develop -- inventions. I will also seek legislation to provide the Patent and Trademark Office with greater authority to re-examine patents already issued, thereby reducing the need for expensive, time-consuming litigation over the validity of a patent.

For over thirty years the Federal agencies supporting research and development in industry and universities have had conflicting policies governing the disposition of pertinent rights resulting from that work. This confusion has seriously inhibited the use of those patents in industry. To remove that confusion and encourage the use of those patents I will support uniform government patent legislation. That legislation will provide exclusive licenses to contractors in specific fields of use that they agree to commercialize and will permit the government to license firms in other fields. If the license fails to commercialize the inventories, the government will retain the right to recapture those rights. I will also support the retention of patent ownership by small businesses and universities, the prime thrust of legislation now in Congress, in recognition of their special place in our society.

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4. Clarifying Anti-trust Policy. By spurring competition, anti-trust policies can provide a stimulant to the development of innovations. In some cases, however, such as in research, industrial cooperation may have clear social and economic benefits for the country. Unfortunately, our anti-trust laws are often mistakenly viewed as preventing all cooperative activity.

The Department of Justice, at my direction, will issue a guide clearly explaining its position on collaboration among firms in research, as part of a broader program of improved communication with industry by the Justice Department and the Federal Trade Commission. This statement will provide the first uniform anti-trust guidance to industrial firms in the area of cooperation in research.

5. Fostering the Development of Small Innovative Firms. Small innovative firms have historically played an important role in bringing new technologies into the marketplace. They are also an important source of new jobs. Although many of the initiatives in this Message will encourage such companies, I will also implement several initiatives focused particularly on small firms.

First, I propose the enhancement by $10 million of the Small Business Innovation Research Program of the National Science Foundation. This program supports creative, high-risk, potentially high-reward research performed by small business. Further, the National Science Foundation will assist other agencies in implementing similar programs, with total Federal support eventually reaching $150 million per year.

Second, in order to experiment with ways to ease the ability of small firms to obtain start-up capital, I will help establish two Corporations For Innovation Development to provide equity funding for firms that will develop and market promising high-risk innovations. These not-for-profit firms will be established with State or regional capital and the Federal government will provide each with matching loan funds up to $4 million.

6. Opening Federal Procurement to Innovations. The Federal government is the Nation's largest single purchaser of goods and services. Through its purchases, the Federal government can influence the rate at which innovative products enter the market.

For that reason, I am directing the Office of Federal Procurement Policy to introduce procurement policies and regulations that will remove barriers now inhibiting the government from purchasing innovative products. Special attention will be given to substituting performance for design specifications and, wherever feasible, selection will be on the basis of costs over the life of the item, rather than merely the initial purchase price.

7. Improving our Regulatory System. During my Administration, I have already taken a number of actions to help assure that regulation does not adversely affect innovation. Working with the Congress, I have moved successfully toward deregulation of airlines and other industries, and I expect the pressure of competition to trigger innovative new ways to cut costs and improve service. In environmental, health and safety regulation, I have emphasized the use of cost-impact analysis, where appropriate, to take account of the burdens on industry in the regulatory process. To provide better

coordination between the regulatory agencies, I have created the Regulatory Council, composed of the heads of 35 regulatory agencies. This Council is working to reduce inconsistencies and duplications among regulations, to eliminate needless rule-making delays, to reduce paperwork, and to minimize the cost of compliance.

I am today proposing additional steps to improve our regulatory system. First, the Administrator of EPA will intensify his efforts, wherever possible, to use performance standards in regulations, specifying only the required goal, rather than the means of achieving it. Second, all Executive Branch environmental, health and safety regulatory agencies will prepare a five-year forecast of their priorities and concerns. This information will give industry the time to develop compliance technology. Third, all administrators of Federal executive agencies responsible for clearance of new products will be directed to develop and implement an expedited process for projects having a strong innovative impact or exceptional social benefit, and to do so without jeopardizing the quality of the review process.

8. Facilitating Labor and Management Adjustment to Technical Change. Although innovation can increase the number of workers employed within an industry over the long term, or even create an entire new industry, individual innovations may occasionally cause workers to be displaced.

In order to assure adequate time for workers and management to adjust to changes caused by innovations, I am directing the Secretaries of Labor and Commerce to work jointly with labor and management to develop a Labor/Technology Forecasting System. The System would develop advance warning of industrial changes and permit timely adjustments.

9. Maintaining a Supportive Federal Climate. The initiatives announced in this Message are only the first steps in our efforts to ensure American technological strength. We must also develop and maintain a climate conducive to industrial innovation. The Federal government must take the lead in creating that climate. And the Federal government's efforts must be continuing ones. I am committed to these goals.

I am charging the National Productivity Council with the continuing tasks of monitoring innovation, developing policies to encourage innovation and assisting the Departments and agencies in implementing the policies announced today. I am also establishing a Presidential award for technological innovation to make clear to this Nation's inventors and entrepreneurs that we place the highest national value on their contributions.

Each of the initiatives I have just proposed supports an important component in the innovation process. In combination, these initiatives should make a major difference in our Nation's ability to develop and pursue industrial innovation. However, these incentives will not by themselves solve our current difficulties in encouraging needed innovation. In our economic system, industrial innovation is primarily the responsibility of the private sector. The manager of the firm must decide whether to develop and market innovative new products or whether to find and employ new ways of making existing products. Although the Federal government can establish a climate that encourages innovative activity, it is the private sector that finally determines whether innovation will take place.

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In addition, the steps outlined in this Message must be viewed in the context of our current severe inflation problem. With costs rising at an abnormally high rate, managers naturally have a disincentive to spend the sums needed for adequate industrial innovation. I understand and fully appreciate that changing certain of our tax laws could provide additional incentives for investment in innovation. Indeed, my approval of adjustments in the capital gains tax in the Revenue Act of 1978 has alleviated some shortages of venture capital. Many of the suggested alterations of our tax system are intertwined with other economic challenges -- such as fighting inflation. While it might be possible to make changes in the tax code that would promote innovation, these changes should not be viewed in isolation from other aspects of our economy. I will therefore evaluate tax laws affecting industrial innovation at the time that I consider my fiscal policies for Fiscal Year 1981.

CONCLUSION

Innovation is a subtle and intricate process, covering that range of events from the inspiration of the inventor to the marketing strategy of the eventual producer. Although there are many places in the chain from invention to sale where we have found modification of Federal policy to be appropriate, there is no one place where the Federal government can take action and thereby ensure that industrial innovation will be increased. We have therefore chosen a range of initiatives, each of which we believe to be helpful. In aggregate, we expect them to have a significant impact. Nonetheless, they represent only an early skirmish in what must be a continuing battle to maintain the technological strength of the American economy. I pledge myself to this task and ask the Congress to join me in meeting our common challenge.

JIMMY CARTER

THE WHITE HOUSE,

October 31, 1979.

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EMBARGOED FOR RELEASE
UNTIL AFTER THE BRIEFING
WEDNESDAY, OCTOBER 31, 1979

October 31, 1979

Office of the White House Press Secretary

THE WHITE HOUSE

FACT SHEET

THE PRESIDENT'S INDUSTRIAL INNOVATION INITIATIVES

BACKGROUND

The President initiated a "Domestic Policy Review" in April 1978 to identify appropriate government actions in connection with innovation. The President asked the Secretary of Commerce to lead the Review. The charge given the Commerce Department was: "What actions should the Federal government take to encourage industrial innovation?" During the course of the Review members of the Administration consulted with hundreds of groups and individuals from industry, labor, academia, and public interest organizations. Suggestions embodied in task force reports were rendered by 150 of these people. Their recommendations have been reviewed and analyzed by the President. In essence, recommendations ultimately selected by the President are designed either to develop a missing resource or influence decisionmakers in the direction of innovation

Other industrial countries, recognizing the importance of innovation, are extending their competitive advantage through industrial policies, programs, and institutional structures aimed at selected technologies. To respond to this challenge to our economy and the competitive position of U.S. industry, the review developed policy options intended to foster the Nation's competitive capability and entrepreneurial spirit for the decades ahead.

The initiatives announced today are considered by the President as first steps in meeting the Nation's commitment to innovation and the continuing challenge to maintain the technological strength of the American economy.

The President's actions provide a signal to the private sector that innovation is valued and that it is Federal policy to preserve and promote it in the years ahead. The Administration hopes this will improve the rate of innovation and will establish, over time, a climate in which it will flourish.

There are nine areas where the President has made specific decisions regarding innovation:

-- Enhancing the Transfer of Technical Information

-- Increasing Technical Information

-- Improving the Patent System

-- Clarifying Anti-trust Policy

-- Fostering the Development of Smaller Innovative Firms

-- Improving Federal Procurement

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-- Improving Our Regulatory System

-- Facilitating Labor/Management Adjustment to Innovation

-- Maintaining a Supportive Attitude toward Innovation

ENHANCING THE TRANSFER OF INFORMATION

Scientific and technical information is created largely by universities, government laboratories, industrial laboratories and by similar activities abroad. It becomes the knowledge needed in industrial innovation when it is relevant to industry's problems or opportunities and when it is effectively transferred to the industry user. New actions deal with improving the transfer of existing, potentially relevant information; and improving the rate at which we create such information. To facilitate the transfer of existing information, the President is taking action in two areas.

1. The NTIS Center for Utilizing Federal Technology

The Federal government annually undertakes approximately $10 billion of R&D at Federal laboratories and Federally-funded R&D Centers. The National Technical Information Service (NTIS) provides a channel of communication with industry concerning these research results. It has a broad understanding of industry needs, and Federal laboratory activity. It is in position to help inform industries of technological opportunities of which they might otherwise be uninformed.

- The President has decided to enhance the NTIS program by creation of a Center in NTIS with the mission of improving the flow of knowledge from Federal laboratories and R&D Centers to industries outside the mission agencies' purview. The FY 1981 cost of the program will be $1.2 million and subsequent year costs will not exceed $2 million per year.

2. Foreign Technology Utilization

Foreign technological and scientific advances are an untapped source of technological information for American innovation. An inadequate ability exists within the Federal government and within industries to gather, analyze, organize, and disseminate information regarding foreign research and development activities that bear on the competitiveness of U.S. industry. Other countries gather such information on the U.S.

- The President has decided to have the NTIS include extensive foreign technical literature collection and translation in its present activities. This move will make relevant foreign literature available to industry. The first year program cost will be $1.8 million.

- The President intends to have the Departments of State and Commerce interview volunteer returning U.S. overseas visitors about observed foreign technological developments, collect reports from our science counselors, and collect photographs, and other unpublished information. This information will be merged with the NTIS data base on foreign technical literature to make it widely and easily available to industry. The 1981 cost of this program will be $2.4 million.

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INCREASING TECHNICAL KNOWLEDGE

The Federal government supports a broad range of R&D activities from basic through applied research, development and demonstration in areas of interest to industry. Most of this work is to meet some specific social or national need, as in the case of future development or defense, or to provide a foundation for future advance, as in the case of basic research. Unlike many foreign countries the U.S. does not make major direct governmental investments in the development of technologies. The President will take actions in three areas aimed at enhancing the technical knowledge base in the United States.

1. Generic Technology Centers

The President believes there is a Federal role in the development of generic technologies -- that is, technologies that underlie industrial sectors. Examples include welding and joining, robotics (automated assembly), corrosion prevention and control, non-destructive testing and performance monitoring and tribology (science of lubricants). Because the benefit from advances in generic technology to any one firm (or even one industrial sector) may be small, there is less investment in the development of generic technologies than would be justified by the benefits that flow from these activities.

- o The President has decided to establish non-profit centers -- at universities or other private sector sites -- to develop and transfer generic technologies. Each of the centers will be targeted on a technology that is involved in the processes of several industrial sectors, and has the potential for significant technological upgrading. It would not supplant efforts in the private sector that are designed for specific product development.
  - -- Each center will be jointly financed by industry and government, with the government's share dropping to 20 percent or less of the center's cost in the fifth year.
  - -- Four centers will be established in FY 81 at a cost of $6-8 million. Three will be sponsored by the Department of Commerce and one by the National Science Foundation.
  - -- In future years, the size of the program will depend on the proposals received, and the experience gained from this initial effort.

2. Regulatory Technology Development

One major cause of the modification of industrial processes in recent years has been the obligation to assure compliance with environmental, health or safety regulation. Innovation is important in making these changes so that the new processes meet regulatory objectives at the least cost. Federal investment in the development of compliance technology already is substantial There are very large Federal expenditures on technologies for the clean burning of coal or to improve the safety of mines. But there are instances in which the affected sector is unable to perform the work or to assure speedier compliance than the market can provide.

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- The President will ask the Office of Management and Budget, in the course of its crosscut of regulatory activities in developing the FY 81 budget, to examine closely the nature and extent of expenditures on compliance technology and to bolster the Federal effort.

3. Improved Industry-University Cooperation in R&D

The scientific and technological strength of American universities has not been harnessed effectively in promoting industrial technological advance. In order to achieve this end, in FY 1978 the NSF established a program for the support of high quality R&D projects that are proposed jointly by industry-university research teams.

- The President has decided to provide $20 million of new funds at NSF in FY 1981 for this purpose with subsequent year support at a similar level.

- In addition, the President plans to extend the NSF program to other agencies. NSF will work with DOD, DOE, EPA, and NASA in FY 1980 and with other agencies in subsequent years to initiate such university-industry cooperative R&D programs and to establish quality-control procedures as effective as the NSF peer review system. Each agency will formulate plans for building its support for this program with the objective of reaching an aggregate of $150 million.

STRENGTHENING THE PATENT SYSTEM

Patents serve several important functions in the innovation process. First, they provide an inventor with an incentive -- a monopoly limited in time. Second, the exclusive rights provided by a patent can stimulate a firm to make the often risky investment that is required to bring an invention to market. Finally, a patent provides an important method for disclosure of information about inventions and their uses to the public.

1. Uniform Government Patent Policy

The Policy Review identified strong arguments that the public should have an unrestricted right to use patents arising from Federal sponsorship. These patents were derived from public funds and all the public have an equitable claim to the fruits of their tax dollars. Moreover, exclusive rights establish a monopoly -- albeit one limited in time -- and this is an outcome not favored in our economy.

Several competing considerations, however, urge that exclusive rights to such patents should be available. First, government ownership with the offer of unrestricted public use has resulted in almost no commercial application of Federal inventions. Without exclusive rights, investors are unwilling to take the risk of developing a Federal invention and creating a market for it. Thus, ironically, free public right to use patents results, in practical terms, in a denial of the opportunity to use the invention. Second, many contractors, particularly those with strong background and experience with patents, are unwilling to undertake work leading to freely available patents because this would compromise their proprietary position. Thus, some of the most capable performers will not undertake the government work for which they are best suited.

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As a result of the strength of these considerations, most agencies have the authority in some circumstances to provide exclusive rights. But because of the difficulty of balancing the competing considerations, this issue has been unsettled for over 30 years and the various agencies operate under different and contradictory statutory guidance. The uncertainty and lack of uniformity in policy has itself had a negative effect on the commercialization of technologies developed with Federal support. As a result, there is an active interest in the Congress and among the agencies to establish a clear and consistent policy.

The President considered a range of options, from always vesting title in the contractor, to maintaining the status quo. In arriving at his decision, the President considered the following factors:

-- Uniformity. The agencies are currently governed either by an array of different statutes or, in the absence of statute, by Presidential guidance. Indeed, some agencies have different statutory guidance on patents governing different programs. In light of this, there is substantial confusion among contractors who perform R&D for several agencies or programs.

-- Impact on Innovation. Exclusive rights to a patent may be necessary to ensure that a firm will make the often risky investment that is required to bring an invention into production and to develop a market for it. Exclusive rights provide protection from other firms that might skim the profit from the market by copying the invention after the risk and cost of introduction are reduced by the first firm's efforts.

-- Administrative Burden. Any policy that requires an agency to make decisions imposes some administrative costs.

-- Uncertainty. A clear and easy-to-apply rule is preferable to an ambiguous rule for the guidance it offers to both industry and government officials.

-- Contractor Participation in Government Programs. Firms with strong proprietary positions are unwilling to accept government contracts that would result in freely available patents.

-- Competition. Exclusive rights foreclose competition in the marketing of the invention covered by the patent and serve, in some cases, to enhance the recipient's market power.

o The President has decided to seek legislation that would establish a uniform government policy with exclusive licenses in the field of use. Title to the patent will be retained by the Government, but the contractor will obtain exclusive licenses in fields of use that he chooses to specify and in which he agrees to commercialize the invention. There will be an exception where the agency determines that such a license would be inconsistent with either the agency mission or the public interest. In most cases, the allocation would be after the invention has been identified, rather than at the time of contracting. The Government would license in all fields of use other than those claimed by the contractor. The Government would retain march-in rights that can be exercised in the event the licensee does

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- The President also supports the retention of patent ownership by small businesses and universities, the prime thrust of legislation now in the Congress, in recognition of their special place in our society.

2. Other Reforms

The achievement of the objectives of the patent system depends in large part on the strength of protection a patent provides. Today a U.S. patent has less than a 50 percent chance of surviving a court challenge. Uncertainty as to the validity and continued reliability of a U.S. patent creates the threat of lengthy and expensive litigation with an uncertain outcome.

- To improve the presumptive validity of an issued patent, and to reduce the cost and frequency of defending it in court, the President is proposing several significant steps. First, the quality of issued patents will be significantly upgraded by major improvement of the Patent and Trademark Office's filing and classification system. Second, he is urging the Congress again to establish a single court to deal with patent appeals. This court would establish nationwide uniformity in patent law, make litigation results more predictable, and eliminate the expensive and time-consuming forum shopping that characterizes patent litigation. Finally, to minimize the cost and uncertainty of litigation patent validity in the courts, the President will submit legislation to provide for voluntary reexamination of issued patents by the Patent and Trademark Office at the request of any person or the court.

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- One of the world's greatest stores of technical information is in the Patent and Trademark Office files, which include more than four million U.S. Patents. However, the current state of access to the information in these files renders their technical content inaccessible to anyone but patent examiners. The President is asking the Patent and Trademark Office to undertake efforts to provide greater ease of public access and use to these files. These reforms will be undertaken without an increase of public expenditures by adjusting the fee schedule of the patent office so that those who benefit will pay for the services they receive. Legislation supporting these reforms will be submitted to the Congress.

- The Administrator of the Small Business Administration will establish an Office of Small Business Patent Counsel to assist inventors in the transition from invention to small business by providing the ancillary business advice that attorneys rarely provide. To encourage the development of technologically-based minority businesses, a similar office will be established in the Office of Minority Business Enterprise and its activities will be coordinated with the SBA. All costs will be met by reprogramming.

CLARIFYING ANTI-TRUST POLICY

Anti-trust laws play a specific role in promoting innovation. Vigorous enforcement of anti-trust laws spurs competition -- and the pressure of competition is a stimulant to the development of innovations that provide a competitive edge. However, anti-trust laws are often and mistakenly understood to prevent cooperative activity, even in circumstances where it would foster innovation without harming competition.

The Domestic Policy Review revealed such misunderstanding in industry, universities, and government in instances where cooperative research is permissible, or where cooperation is not permissible.

- Industry underinvests in longer-term basic research, largely because the pay-back is difficult to achieve. In long-term research particularly, the President believes some industry cooperation is desirable. This premise led to the cooperative automotive research program, announced by the President and auto industry executives following their meeting at the White House in May 1979.

The President is taking two actions that will clarify anti-trust policy and should spur greater research activity by industry:

- The President is asking the Department of Justice to prepare a guide to clarify its position on collaboration among firms in research and development.

- The President is requesting the Attorney General, the Chairman of the Federal Trade Commission, and the Secretary of Commerce to initiate discussions with industry about innovation, anti-trust policy formulation, and enforcement. The purpose is to dispel the perception that anti-trust policy inhibits innovation and to improve communication between industry, the Justice Department and the Federal Trade Commission.

FOSTERING THE DEVELOPMENT OF SMALL INNOVATIVE FIRMS

Small, high-technology firms provide the majority of the new innovations in our economy. The major problems facing entrepreneurs in new firms have been identified as: start-up capital, second-round financing, and early management assistance. The new capital gains structure has loosened the flow of second-round venture capital from private sector sources.

In addition to other actions that generally will benefit smaller R&D firms, the President is taking four specific steps to foster innovation in small, high-technology firms:

1. National Science Foundation Small Business Innovation Research Program

The National Science Foundation Small Business Innovation Research Program provides funding to small companies to permit development of a venture analysis for new projects and demonstrate technological feasibility. The program has operated for two years at $2.5 million. It is applauded by both the small and big business communities. It has resulted in projects for which follow-on private-sector funding has been pledged.

- The President has decided to expand the NSF program through an increase in FY 1981 of $10 million. In addition, the President is directing the NSF to work with other agencies to determine whether similar programs should be established. The Office of Management and Budget will coordinate development of plans and goals for the expansion of these programs, working toward a goal of approximately $150 million annual funding.

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2. Corporations for Innovation Development

States or multi-state regions can join in the Federal government's efforts to spur innovation by establisbing State or regional "Corporations for Innovation Development" (CID's). The goal is to help alleviate some of the difficulty an entrepreneur confronts in obtaining start-up capital. These CID's would be modeled partly after the successful National Research and Development Corporation in Great Britain and existing state corporations, such as the Connecticut Product Development Corporation. Their functions would include:

- -- Direct equity funding for the start-up of firms wishing to develop and bring to market a promising, but high-risk, innovation.
- -- Guidance to potential applicants to the National Science Foundation Small Business Program, including serving as the second-round guarantor in appropriate cases.
- -- Early management assistance to firms that are funded.
- -- When otherwise qualified, acting as the recipient of Economic Development Assistance funds for the State or region.

o To lead the way for States or regions to establish CID's, the Federal government (tnrough the Department of Commerce) will support two regional CID's in FY 1981. To provide breadth, one of these CID's will be in an industrial region, and the other in a less industrialized State or region. The Federal support will be in the form of loans of $4 million per center, on the condition that the region provide matching funds.

3. Federal Support for Small R&D Businesses

Funding for new R&D is a problem for small firms. The small business community correctly believes that given their number, and the significance of their role in the innovation process, they receive a disproportionately low percentage of Federal R&D dollars. To deal with this, the President is directing each agency that contracts for R&D services to:

- o Develop policies ensuring that small businesses are not unfairly excluded from competition for contracts
- o Publicize, through the SBA and the State or regional CID's, opportunities for bidding that are especially appropriate to small businesses.
- o Report their progress toward increasing small business participation annually to OMB.

4. General Venture Capital Availability

As the number of new start-ups increases, the demand for second-round financing will increase. While the capital gains tax changes have increased the flow from taxable private sector investors, the flow will be further encouraged by the following actions the President is taking:

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- The President is directing the Administrator of the Small Business Administration (SBA) to change Part 121.302(a) of the SBA regulations to permit Small Business Investment Companies (SBIC's) and private sector venture capital firms to co-invest in a small firm. The changes are subject to restrictions. There must be an identifiable independent entrepreneur in control of the firm. And there must not be a provision for acquisition by the private sector firm as part of its financing.

- The Administration already has changed the Employment Retirement Income Security Act (ERISA) regulations to make it permissible for fund managers to invest in small, innovative businesses. In addition, the President will request the Administrators of ERISA and the SBA to establish an interagency committee to examine what regulatory changes or other means are needed to stimulate investment in small and medium-endowment funds. This will foster further availability of venture capital.

OPENING FEDERAL PROCUREMENT TO INNOVATIONS

New technology plays a critical role in promoting innovation. In a free enterprise system, however, marketplace incentives are the crucial motivators. This fact bestows a special responsibility on the Federal government, because it is the Nation's largest single purchaser of goods and services.

In the past, the Department of Defense and the National Aeronautics and Space Administration have shown convincingly the impact that Federal purchasing power can have as a marketplace stimulus. A pilot program at the Department of Commerce -- known as the Experimental Technology Incentives Program -- has demonstrated that the government can use its purchasing power to spur innovation in areas other than major systems development and high technology. The President will take actions intended to extend this experience to all Federal purchasing.

- The President is directing the Administrator for Federal Procurement Policy in the Office of Management and Budget to introduce reforms in Federal procurement practices by establishing uniform procurement policies and regulations so as to remove barriers that inhibit the government from realizing benefits of industrial innovation. Special attention is to be given to the most innovative small and minority businesses.

  -- Heads of executive agencies and establishments are being asked to designate senior officials to expedite implementation of new reforms.

  -- Special attention is to be given to substituting performance specifications in place of design specifications, and, wherever feasible, selection will be on the basis of costs over the life of the item, rather than merely the initial purchase price.

- The President is asking the Administrator, General Services Administration, to expand the New Item Introductory Schedule to publicize, within the Federal government, the existence of new items. To accomplish this, GSA will take steps to inform the business community -- particularly small businesses -- of the New Item Introductory Schedule and of its benefits.

IMPROVING OUR REGULATORY SYSTEM

Government regulations often influence industrial innovation, stimulating it in some cases and discouraging it in others. For example, some regulations provide incentives for inventing totally new processes to meet regulatory requirements. Other regulations can cause industry decisionmakers to divert resources from exploratory R&D into defensive research aimed only at ensuring compliance with government regulations.

The Carter Administration has a record of being sensitive to the need for a balanced approach to regulations, independently of the Domestic Policy Review on innovation. Previous actions the President already has taken that will have a favorable impact on industrial innovation include:

-- Deregulation of airlines and other industries. The President expects the pressure of competition to trigger innovative new ways to cut costs and improve service.

-- In environmental, health and safety regulation, the Administration is emphasizing cost-impact analysis to take account of regulatory burdens on industry. The President has formed the Regulatory Analysis Review Group and sent to Congress last spring the Regulatory Reform Act to make regulations more efficient and effective.

-- Last month, OMB reported substantial progress in the implementation of Executive Order 12044, which sets goals for improving Federal regulatory practices.

-- The President created the Regulatory Council to provide better coordination between the regulatory agencies. The Council is made up of the heads of 35 regulatory agencies. The Council is working to reduce inconsistencies and duplications between regulations, eliminate delays, reduce paperwork and generally keep the cost of compliance down. The Council publishes the Calendar of Federal Regulations which contains information about major regulations under development. This is intended to reduce uncertainty about future regulations. All of these reforms show the Administration's continuing efforts to offset negative effects of regulation on societal objectives.

In addition to these actions already taken, the President is announcing today several decisions specifically in connection with improved innovation:

o The Administrator of EPA will review the agency's programs to determine what further opportunities exist to substitute performance standards for design or specification standards within statutory authority. Specification standards should only be used when they are clearly justified. Regulatory agencies will also be encouraged to explore the possibility of providing dual criteria for either performance and specification standards, thereby allowing individual firms to choose the mode best suited for them.

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- In conjunction with their semiannual regulatory agenda, executive health, safety, and environmental regulatory agencies will prepare five-year forecasts of their priorities and concerns. Better knowledge of agency plans will allow industry to plan its research and development.

- The EPA Administrator will develop and publicize a clear implementation policy and set of criteria for the award of "innovation waivers." He will assess the need for further statutory authority.

- Federal executive agencies responsible for reviewing the safety and efficacy of products will develop and implement a system of priorities. Under these systems, the agencies will identify those products that are most innovative and/or have exceptional social benefits, and expedite their clearance reviews to the extent permitted by applicable statutes. These systems will affect the speed, but not the quality, of the agency's review.

- To expedite the introduction of new drugs marketed in foreign countries and to expedite the U.S. drug review process, the President is asking the Administrator of the Food and Drug Administration to take steps to assure that our drug clearance process benefits from the foreign experience.

FACILITATING LABOR/MANAGEMENT ADJUSTMENT TO TECHNICAL CHANGE

Labor plays an important role in industrial innovation. Perceptions by investors of labor attitudes toward innovation influence the investors' willingness to move ahead. Labor, on the other hand, recognizes the importance of innovation and technological change, realizing that innovations that improve productivity commonly increase the number of workers employed within an industry over the long term. Labor also understands that entirely new industries have been created through innovation. Nevertheless, individual innovations often are perceived as a threat to labor because shifting skill mixes result.

The key to successful adjustment is warning time. Thus, a labor-technology forecasting system, supported cooperatively by labor and management, could be very valuable. Its purpose would be to attempt to forecast technological change within specific industries and to assess the implications for labor of such change. These forecasts and assessments could provide the basis for retraining and other adjustment activities by industry and labor. Labor has been advocating this approach for twenty years. It is long overdue. Therefore:

- The President is directing the Secretary of Labor and the Secretary of Commerce to work jointly with labor and management to develop a national Labor/Technology Forecasting System. The President is requesting that they implement this new system in the context of ongoing labor-management activities, in conjunction with agencies responsible for adjustment assistance, and in cooperation with labor/management teams.

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MAINTAINING A SUPPORTIVE CLIMATE FOR INNOVATION

The results of the Domestic Policy Review stressed the importance of a favorable climate in the U.S. receptive to new innovation and of perceived public attitudes toward innovation. Accordingly, the President plans three actions aimed at making a clear public commitment to ensure that innovation in this country thrives in the future.

- Recognizing that future enhancements in industrial innovation lie primarily in the management/engineering area, the President is asking the Commerce Department and the National Science Foundation to host a National Conference for Deans of Business and Engineering Schools to stimulate improved curriculum development in technology management and entrepreneurship.

- The President is establishing an award for technological innovation. The existence of this award will provide explicit encouragement to U.S. industry, symbolizing a national commitment to innovation. The awards will consist of a Presidential plaque given to companies in six areas: transportation, communication, health, agriculture and food, natural resources (including energy). The selection criteria will include both technical excellence and commercial impact. The Department of Commerce will be responsible for presenting the President with a list of nominees each year. The awards will be presented annually by the President's Science and Technology Advisor.

- The President is asking the Productivity Council to form a committee charged with monitoring innovation, developing policies to encourage it, assisting the agencies in implementing these policies, and pursuing the removal of legislative or administrative barriers to the innovation process.

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News Feature

White House innovation plan off and running

Called meager by critics, Administration's technology policy spans several agencies, integrates programs; more legislation and newer policies planned, but does new program meet today's realities?

Wil Lepkowski
C&EN, Washington

Everyone who followed the Carter Administration's 18-month Domestic Policy Review on technological innovation knows that Uncle Sam declined to bring industry the gifts it most wanted.

Indeed, as one official in the Office of Management & Budget put it to C&EN, the President opened up his technology policy bag and out ran a mouse. The consensus around Washington has been that the "initiatives" were philosophically and fiscally pale—in fact, minor.

"The Administration," said former assistant Commerce Secretary Betsy Ancker-Johnson to a Senate hearing in November, "has thoroughly discredited itself as a leader in the development of technology policy." Now vice president for environmental activities at General Motors, Ancker-Johnson says that Carter failed to deliver on the issues that mattered most to big and small business—reform of antitrust policy to make joint ventures easier, restructuring tax policy to loosen investment capital, and redesigning regulatory policy so industry can spend more time doing research and development instead of paying excessive compliance costs.

On regulatory policy, Ancker-Johnson wasn't quite right, but she can hardly be blamed for chomping at the bit. When she was assistant secretary for science and technology four years ago, she put together a framework for technology policy, and her successor, Jordan J. Baruch, proceeded to act as if it had never been done.

But successive Administrations often act that way, especially if the political parties differ.

Nevertheless, the severest of the critics say that Frank Press, White House Science Adviser, and Baruch wasted valuable time. They believe that Baruch, whose assistants Theodore Schell and Frank Wolek ran the review, focused on making his own unique contribution rather than on the work of simply delivering a synthesis of studies done before, plus an agenda for a Presidential action program.

Thus, these critics say, the review revealed nothing new, and even the claim that the national consciousness was raised over the importance of the issue held only drops of water. Indeed, the backing of the Chrysler loan by the Administration was testimony enough that noninnovative, poorly productive companies, when big enough, will be propped up and bailed out when about to die a natural death. Some critics wonder whether Carter was listening to his own science and technology message.

Furthermore, the critics say, Press and Baruch failed to put the issue of innovation in a global and strategic perspective. They feel the program should have been more dramatically tied to an articulation of problems facing the country in the 1980's—trade crises, fuel shortages, raw materials scarcity, financial and monetary stresses affecting technological and raw materials investments, capital shortfalls, and increasing social malaise. Innovation for an economic system undergoing basic structural change, they say, was the kind of message the more thoughtful were waiting for. But they didn't get it and they felt cheated.

But the facts are that the Domestic Policy Staff, which is to say Stuart Eizenstat, didn't really want anything too broad or too fiscal. It wanted a limited debate. It ranged across agency programs but it was in reality a study along a narrow waveband, narrowed even further by leaving out important policy options.

The gaps led Rep. Charles A. Vanik (D.-Ohio) to comment: "The Administration plan gives no incentives that are going to work. I'm concerned about our tremendous erosion of our technological base. In the 1980's technological leadership will be essential for survival on all fronts, domestic and foreign."



Vanik: no incentives that will work

Vanik is the third-ranking member of the House Ways & Means Committee, where all tax legislation begins. He appears to have gotten innovation fever and is sponsoring a bill, H.R. 5881, that would establish tax credits on portions of an industrial fund that would go to research and development in universities. His bill is one of several innovation bills floating around Capitol Hill.

"The whole [Domestic Policy Review] thing was overblown," says a staffer at the office of Management & Budget. "We just didn't have a hell of a lot to offer these people. We all know Charlie Schultze [chairman of the Council of Economic Advisors] has been concerned a long time about making tradeoffs between environmental regulation and economic

The Administration's technological innovation effort has 15 major programs

Program	Center for Utilizing Federal Technology	Foreign technology utilization	Generic technology centers	Regulatory technology development	Better industry-university cooperation in R&D	Uniform government patent policy	Upgrading of Patent & Trademark Office
Agency	National Technical Information Service, Department of Commerce	NTIS	Department of Commerce (three centers); National Science Foundation (one center)	Office of Management & Budget, overseeing regulatory agencies or Productivity Council	National Science Foundation	Office of Science & Technology Policy	Patent & Trademark Office
Contact	Melvin Day (703) 557-4636	Melvin Day (703) 557-4636	Commerce: Francis W. Wolek (202) 377-3966; NSF: Robert Colton (202) 634-6204	Undecided but try Phillip Smith, OSTP, (202) 395-6244	Robert Colton (202) 634-6204	Phillip Smith (202) 395-6244	Patent Commissioner Sidney A. Diamond (703) 557-3071
Purpose	New, improved ways of informing industry of inventions in federal laboratories	Collect and disseminate information on foreign, potentially innovative technologies	Industry/government-funded centers to upgrade broad, basic technologies	Improve innovation in regulatory compliance technology	Help universities understand style and scope of industrial research, train students better for careers in industry	Give companies exclusive licenses to develop government-owned inventions. Would be governmentwide policy	Further automation of filing, classification; establishment of single count only for patent appeals; re-examination of issued patents on request
Fiscal 1981 funding	$1.2 million	$4.2 million	$6 million to $8 million	—	$20 million	—	Not determined
Comment	NTIS will hire several writers and analysts to produce interpretive material. Effective implementation, extension, could cost much more than proposed $1.2 million	Translations of foreign literature ($1.8 million). Funding probably insufficient. Part two ($2.4 million) involves federal debriefing of visitors to foreign countries. Could take years to produce relevant information	Generic technologies include welding, corrosion prevention, lubrication. NSF supports several such centers and reports success. A favorite scheme of Jordan Baruch	Most agencies (OSHA, FDA, EPA) have long been made conscious of promoting best and most efficient technology. Big need is experienced staff of agencies	Said to be one of best-run NSF programs. Plans to extend program to other agencies with goal of $150 million total	A long-sought program often thwarted by public interest groups and populist politicians. Outlook fair, but opposition will fight. Will require legislation	Chances good. Senate and House behind proposals. Legislation already introduced in Senate

growth. We're already doing something about that. Taxes we couldn't do anything about because the Administration didn't want innovation to get mixed too heavily too early with next year's tax package."

It is generally felt that Baruch did not get all he wanted after his document went up to the White House Domestic Policy Staff last summer. Al Stern, the Domestic Policy staff aide in charge of administering the review, says Baruch initially wanted some commitments at least to altering tax policy for releasing a flow of funds that presumably would go to innovation. But DPS wanted a narrower focus, Stern tells C&EN, fearing that any commitment to tax policies would branch out into fields outside innovation.

"We just don't think tax measures are a major stimulant to innovative activity at this junction," he says. "We think there's going to be a downturn, we don't know when, and we certainly don't feel we want to accelerate the inflation problem."

There is the possibility, Stern believes, that much of the innovation lag industry complains about may be self-induced, too. "Industry has a great deal of conservatism in its own house," he says. "There's a large amount of restraint on the management side, and that could depress innovative activity. When I hear industry complain about our lack of action, I simply tell them to go out and innovate."

Stern says that when one tries to discover whether there actually has been a dropoff in American industry's ability to innovate, then the measurements become less convincing. This makes the steps, even to the policy's architects, more than a little dubious.

"I have no doubt that accelerated depreciation would have an impact on innovation," Stern says. "But it would have much larger consequences elsewhere. The reasons for accelerating depreciation have to do with much more than innovation. We want to make sure there are no negative impacts elsewhere. We looked at venture capital. And the early returns tell us that venture capital is more plentiful than ever. But it seems to be high only for second stage financing. Seed money is hard to come by. 'Petromoney' isn't used for venture capital because it seems the more there is of it, the less it is used for risky ventures. So the question came down to finding some mechanism for producing seed money for initial financing without making government finance every scheme in the world."

Much of the final Presidential wording was chiseled out by Stern and by Philip Smith, a top aide to Frank Press. Smith, quite naturally, is enthusiastic about the product. He

Office of Small Business Patent Counsel	Clarifying antitrust policy	Small business innovation research program	Corporations for Innovation Development	Federal support for small R&D businesses	Venture capital availability	Opening federal procurement to innovations	Improving government regulations
Small Business Administration	Justice Department, Federal Trade Commission, OSTP	National Science Foundation	Department of Commerce (some NSF help)	Small Business Administration	Small Business Administration	Office of Management & Budget, General Services Administration	Environmental Protection Agency, Food & Drug Administration, Occupational Safety & Health Administration
Milton Stewart (202) 653-6533	Justice: Ky Ewing (202) 633-2562, FTC: Robert Reich (202) 523-1447, OSTP: Phillip Smith (202) 395-6244	Roland Tibbetts (202) 634-6204	Philip Goodman (202) 377-3914	Milton Stewart (202) 653-6533	Milton Stewart (202) 653-6533	OMB: Fred Dietrich (202) 395-6810 GSA: Gerald McBride (202) 566-1043	Call Phillip Smith at OSTP for referral (202) 395-6244
Help inventors convert activities to small businesses by entrepreneurial counseling	Explain antitrust policy to industry more systematically; publish guidebook on antitrust/ innovation for industry	NSF provides venture analysis and feasibility testing support to new firms	Help states give support to new businesses	Give small R&D firms bigger slice of federal grant and contract business	Changes in Small Business Investment Corporations/ Employment Retirement Security Act policies	Policy changes to ease entry of innovative products into government purchases. Small business will be given preference	Substitution of performance for design standards; five-year forecasts of priorities. Clearance based on innovativeness of product
Negligible	Negligible	$10 million above current $2.5 million	$8 million ($4 million per center)	Negligible	—	—	—
Universal approval	Industry chronically complains that antitrust policies are vague and inconsistent on joint ventures. Wants more flexibility. Justice says it is flexible enough. No policy changes expected	Goal to establish same program in other agencies to goal of $150 million total funding	Legacy of old, defunct State Technical Services Act. Some state programs good, some not so good. British model experience mixed, since British innovation record poor of late	OMB will monitor progress. Will require vigor and verve by Stewart, or whole thrust could be forgotten. Small business groups will need to maintain pressure	Possibly significant. ERISA change was recommended by several industry panels. Much depends on decisions by pension fund managers	Experimental Technology Incentives Program in National Bureau of Standards paved way for this program. Was product of Nixon science and technology message of 1972	Further steps in Administration policy for cutting regulatory red tape, giving industry better means of anticipating regulatory policies, actions

says implementation of even this first step will take two or three years but that the initiative is integrated and long lasting.

Right now, he says, the most spirited activity is around the structure of the bill needed to modernize the patent office.

"For example," Smith says, "we're aware of the inequities of the patent system for chemical and pharmaceutical companies where regulatory compliance holds back the introduction of a new product many years. The patent life by the time the product is introduced is half exhausted, thus reducing the profit rewards the company would get for disclosure of the invention.

"We may come to the point of proposing extension of the patent life," he says, "but we're not at that point yet. Other things need to be done first. An even more fundamental issue is developing legislation to extend the patent system to developments in the life sciences and to computer communication systems."

In six months Baruch is scheduled to deliver to the Domestic Policy Staff a progress report on each of the programs proposed by the President. Meanwhile, technology policy framers in Commerce, the Office of Science & Technology Policy, and DPR will be stepping up what already will be going on.

"We intend to enlarge the generic technology area, provided the four experiments we are proposing don't fall flat," says Stern. "We will look further at the research and development interplay between industry and universities. We'll also be doing work on the tax front, with the good possibility that innovation will claim a whole section of the Administration's omnibus tax bill. We also will want to look at whether there is a regional falloff in innovation patterns, such as between New England and the Sun Belt states. We'll be looking further into the international flow of innovation."

Other possibilities could include a sweeping assessment of innovation needs in what the Administration euphemistically calls a "constraint economy," which means serious recession or depression. "Commerce should be the agency examining that," Stern says. A National Technology Institute along the lines proposed in Sen. Adlai E. Stevenson's (D.-Ill.) innovation bill, S. 1250, is remote but still a possibility. But Stern says that while Stevenson's bill would establish a big overall technological institute, the Administration might tend to envisage institutes of a much narrower focus, such as development of engineering manpower for national needs and technological goals.

The subject is almost too complex

to handle piecemeal much less in an integrated way because of the way innovation covers all aspects of an industrial economy. For example, OMB is nowhere clear on the right type of balance that should exist between federal and private sector funding of new technologies. Some OMB elements doubt whether the government should be involved in any development projects.

"We are now experiencing growing cynicism about the contribution of federal research and development to the economy," says an OMB manager. "By that I mean the idea that if we only tried harder government R&D would solve our problems. We're also again feeling that what we are spending in energy the private sector after all should do by itself. It's hard to know the difference between money for demonstrations and outright subsidies."

It is clear, then, that the debate over innovation will sizzle through the turbulent eighties. Groups at such far poles as the American Enterprise Institute, which speaks for a conservative capitalism championed by Ronald Reagan and John Connally, and the Center for Economic Alternatives, which wants an economy more geared to meeting the needs of the common man, are both developing programs on the subject.

One figure who hasn't been officially heard from in some time is Commerce Department senior economist Michael Boretsky. It was Boretsky who sparked the debate over America's technological competitiveness during the early 1970's, when previous Commerce Secretaries were proposing to then President Nixon a program not far removed from what Carter announced last Oct. 31.

Though ignored by Baruch, Boretsky continues to assemble data and analyses on such matters as productivity, technological economics, and inflation. He is especially concerned about the strategic consequences of a continued U.S. decline in international technology markets and delivered his perceptions on the subject in a speech last year to the Army War College. At the moment, Boretsky's views are not popular among Administration economic policymakers because he believes that U.S. corporations, through their export of technology abroad, are contributing to the erosion of the country's balance of trade and overall strategic balance in the all-important high technology industries.

Transfers of technology—either through the multinationals or through licensing to foreign firms—have a detrimental impact on national security, he says. The net impact, he says, "is adverse effect on the balance of payments and external value of the dollar. This, in turn, affects the country's economic, political, and military posture abroad, including the many strictly defense-oriented installations which the nation maintains overseas," he told his military audience.

Boretsky helieves the decline in the country's technological competitiveness contributed to the 1971–73 dollar devaluation "much more than all other factors combined."

He adds, in fact, that "based on my calculations and analysis, I came to a firm belief that had the U.S. done nothing more than it has actually done in promoting new technology at home, but had fostered exports of its products with the same vigor as it fostered export of licensing technology, the kind of deterioration of U.S. trade and balance of payments that we have been witnessing since 1971 might have come eventually, perhaps in the twenty-first century. But not in 1971."

His views are those of Boretsky, the individual, rather than as policy analyst for the government. But they are well-known throughout the Washington technology policy community. He wants Washington's current technology establishment to make an objective assessment of the national security implications of "either the transfers of technology or the emergence and growth of the Eurodollar markets."

Boretsky's views are rather holistic, and here and there rather hawkish in terms of the technological power balance between the U.S. and U.S.S.R. But he believes the U.S. is in deeper trouble than the current science and security advisory apparatus realizes and this has everything to do with innovation.

He would like to see a more strategic analysis of technological balance data provided to the White House. Technology, economics, and security need combined analysis, he says, and the Administration is currently not getting it. "On some developments critical to U.S. long-term security, apparently nothing is supplied at all."

But on the domestic side of technology policy, Boretsky has several suggestions, including:

- Substitute one half of the present investment credits for tax credits and apply them to research and development aimed at technological innovation that would either enhance labor productivity, save materials, develop substitutes for raw materials, save energy, or develop truly innovative new processes and products.
- Reduce or preferably eliminate the capital gains tax on gains stemming directly from investments that go into new enterprises. The secondary gains would be taxed at the present 28% rate. "Such a policy would provide the additional incentives needed in the environment of progressively scarce capital to induce investors to take the larger-than-normal risk of investing in new technical enterprises."
- Besides having the Census Bureau publish its usual data on employment, man-hours worked, value added, etc., for various industries, add to the service data on best and worst performing industries. This would be a managerial monitoring tool leading to steps to improve performance in lagging industries.
- Establish a new Office of Industrial Technology & Productivity Enhancement in the Commerce Department. The office would do technology policy planning, measure the country's technology policy planning, measure the country's technology needs vis-a-vis level of effort, administer a network of university-affiliated centers for industrial technology, and support a network of regional productivity enhancement centers.

It wasn't Baruch's assignment to delve into the national security aspects of technological innovation—broadly or narrowly. The military aspects are left, understandably, to the Defense Department, National Security Council, and the intelligence community. But the nonmilitary aspects of security are fair game, and, in fact, strict focus on "domestic policy" may miss the point entirely.

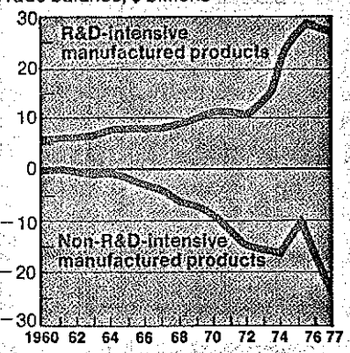
Indeed, William Winpisinger, president of the International Association of Machinists & Aerospace Workers, says the innovation study was a smoke screen. In testimony in November, he said, "The glut of corporate profits—21.2% this quarter—provides unlimited resources for lavish political contributions, extraordinary lobbying expenses, political and business bribery and kickbacks on an international scale, propaganda campaigns, front groups' foundations, and institutional advertising. Yet with all these extracurricular activities, we are asked to believe that the corporate state is having great difficulty financing industrial innovation. The truth is that the corporate state has difficulty financing what the corporate state chooses to have difficulty financing, and it has exactly as much innovation as it wants."

For every Boretsky there's a Baruch. And for every Baruch a Winpisinger. The innovation debate is so complex that its watchers and as-

Why U.S. technology needs a shot in the arm

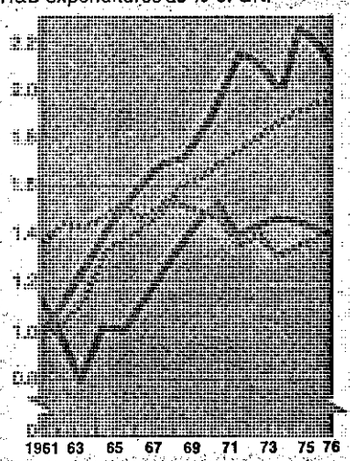
Export of research-intensive products begins to decline...

Trade balance, $ billions[a]



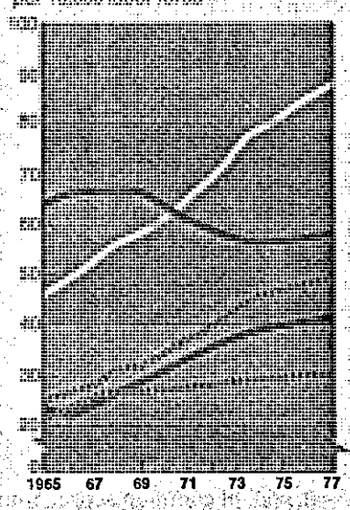
... while the R&D/GNP ratio falls below rest of industrial world...

R&D expenditures as % of GNP[b]



... and number of scientists and engineers also falls

R&D scientists and engineers per 10,000 labor force



U.S.S.R. Japan West Germany
France U.S.

a Exports less imports. b Excluding government funds for defense and space R&D.
Source: Science Indicators—1978

sorted fans are turning now to Capitol Hill and a big Congressional Research Service (CRS) study that is slated to sum up everything known and believed about the subject. The study is being coordinated by CRS's Walter Hahn and is part of a voluminous study on economic change commissioned by the Joint Economic Committee.

The study so far indicates that there is no central theory of innovation. Thus, the search usually centers on scapegoats as prime causes for the so-called "lag."

One draft says, "Each finger-pointer has at least one other group to blame: too much government, irresponsible business, big labor, a consumer society, inflation and a faltering economy, or just plain 'them'—anyone from environmentalists to OPEC and from political opposites to foreigners."

Only one group in the country has tried to achieve a holistic perspective on innovation policy. It is the Center for Policy Alternatives under J. Herbert Hollomon at the Massachusetts Institute of Technology. Some ideas generated through that group are important to include because nowhere else is innovation studied more intensely than there.

The aim of innovation, the group contends, is not so much a growing economy but one that responds to change and challenge. It does not believe that government should intervene in the marketplace by supporting technological development in the civilian industrial sector. It believes that government should not brace up firms like Chrysler Corp. that cannot compete any longer. It believes that antitrust law should be enforced so that companies are penalized for not innovating. It believes the U.S. should learn from Japan.

"In no other developed country is there such a complete array of programs to encourage innovation," the center's Christopher T. Hill and James Utterback say in "Technological Innovation for a Dynamic Economy." These include grants-in-aid for the implementation of inventions, special development contracts and grants, arrangements for commercialization of new developments, support for capital equipment for new ventures, rapid tax writeoffs for new developments, low-interest loans for high-technology firms, special analysis and advice for small firms, special procurement policies for small businesses, 'open' research laboratories in all prefectures for the use of new and small firms, and no-interest loans for modernization of small firms. "The U.S. should consider adopting new programs of the kind now found in Japan." they say, adding: "Frequently, it is claimed that the risks of technological innovation are too great today, and that government should take actions to reduce that risk by, for example, subsidizing development of new technologies, weakening the antitrust laws, or rolling back environmental health and safety standards.

"The main message is just the opposite—government should take steps to encourage innovation by increasing the risks that firms face—not by increasing the risk of failure of new technology, but by increasing the risk that a firm will fail if it does not innovate."

The MIT plan, although bold, wouldn't hold much political water. Protectionism is expected to increase, not decrease, during the 1980's. And despite what the studies say about the comparative economies of Japan and West Germany, their stability is far more shaky than that of the U.S. Their own insecurities and their need for the U.S. market is the main force behind the flow of foreign investment capital to the U.S. Foreign technology, as some observers point out, is diffusing quickly to the U.S. But how the system shakes out during the 1980's, especially in the face of the rising tide of the Moslem world and the internal troubles besetting the Soviet Union is really anyone's guess. The very idea of competition over commercial property and profits may be going out of style in a world more and more interdependent. One doesn't trade in order to compete.

For example, foreign investment capital is practically surging into the U.S. from abroad. The U.S. semiconductor industry, once a scattering of relatively small companies bent on taking risk simply for the excitement of pushing back frontiers, is now being swallowed up by big foreign equipment makers. The consensus seems to be that the trend is bad for innovation in semiconductors but good for the information processing and computer industries. Equipment costs will continue to go down and technology will continue to spread across borders in healthy amounts as a consequence. Foreign countries are buying into U.S. know-how and are beginning to set up manufacturing facilities in the U.S..

In surveying global industrial activity, in fact, one comes away with the feeling of the awesome speed and volume of international technological investment. Some examples:

- International Telephone & Telegraph plans closing two unprofitable color television plants in Britain.
- Boeing plans to spend $300 million in Britain during the 1980's.
- Fujitsu, Japan's leading com-

Technological intensity of U.S. industry has declined from 1957–73 period to 1974–78

	1957–73			1974–78		
	Technology-intensive industries[a]		Nontechnology-intensive industries[b]	Technology-intensive industries[a]		Nontechnology-intensive industries[b]
	Total[a]	Chemicals and allied products		Total	Chemicals and allied products	
INDICATORS OF TECHNOLOGICAL INTENSITY						
Expenditures on R&D, all sources of funds as % of gross product originated (value added) average	14.4%	9.4%	1.3%	13.2%	9.6%	1.5%
Employment of scientists and engineers in functions other than R&D as % of total employment, average	3.5	5.6	0.8	2.8	4.5	0.8
Employment of craftsmen as % of "operatives and laborers" (census terms)	52.5[c]	42.8[c]	33.5[c]	49.8[d]	53.6[d]	38.0[d]
ECONOMIC PERFORMANCE						
Average annual growth in real output, % per year	5.5	6.0	3.8	2.7	2.4	1.1
Average annual growth in employment, % per year	1.5	1.5	0.8	1.1	1.0	−0.3
Average annual growth in real output per person employed (productivity), % per year	4.0	4.5	2.9	1.6	1.4	1.4
Average annual increase in inflation (increase in implicit price deflator), % per year	0.9	−0.3	1.6	7.4	7.9	7.9
Average annual foreign trade balance, $ billions	−$8.1	+$1.7	−$4.0	+$23.1	+$4.2	−$15.8

a Includes chemicals, nonelectrical machinery, electrical machinery and equipment, transportation equipment and missiles, and instruments and controls. b Comprises all industries not listed as technology-intensive, most notably textiles, apparel, iron, steel and nonferrous metals, and furniture. c Average for 1960–70. d 1976. Source: Prepared for C&EN by Michael Boretsky of the Department of Commerce. Based on data from the Bureau of Economic Analysis, Bureau of Census, Bureau of Labor Statistics, and National Science Foundation

puter manufacturer, studies the feasibility of a joint-marketing venture with TRW.

• Philips of the Netherlands expands and restructures its Japanese marketing operations to prepare for introducing its video-disk equipment there in 1981.

• Kuwait and Bahrain establish Bahrain-Kuwait Petrochemical Industries Co. in the first joint industrial venture between two Persian Gulf states.

The sheer volume and diversity of such news is dazzling and one cannot help but conclude that the competition is overpowering.

Whatever the merits of the Baruch exercise, the federal system, which is to say the people of the U.S., seems poised to draw on that reservoir of U.S. inventiveness—a force author Max Lerner labeled "The Underground River," in an essay written almost two decades ago. It is at once a corporate Main Street and counterculture phenomenon—goals for the era of international technology transfer as well as for the Age of Aquarius. The common theme is somehow a pairing of economics and the true nature of wealth.

So what should we make of all this stirring? What sort of a technology policy is being born in laboratories as well as in farms, towns, and co-ops? How can the notion of private intellectual property—technology under capitalism—be reconciled with the free flow of knowledge in a world at the brink of panic? Baruch hasn't addressed this. His theme, in a way, is to stem the tide of competition. Maybe author Gary Wills says it best in his book, "Inventing America," about Jefferson's philosophical groundings.

Jefferson felt, according to Wills, that all new gadgets simply re-exemplified the great Newtonian laws, that all "curious" mechanisms were little orreries (mechanical models of the planetary system) of nature.

"This explains," says Wills, "Jefferson's opposition to long or rigorous patent rights. No one can truly 'own' the 'invention' of things that work, since no one can own Nature, and all things work by the laws of Nature and of Nature's God. Jefferson was opposed to the individualist vision of private enterprise. All enterprise is public, is common. Not only does the earth belong to the living. So do all the forces driving the earth."

All this may appear far afield from the meager beginnings of national innovation policy that could die in months. But the notion of Jefferson's idea of mechanical gadgets being orreries and thus belonging to nature bears curious resemblance to the theology of Islam, a religion causing so much trouble for the U.S. today, and perhaps the Soviet Union tomorrow.

Baruch and Press would sound hollow to even the most moderate of ayatollahs, or to a more neutral sect of more spiritual Moslems known as Sufis, who believed technology was to be used not to master nature but to live with it. But one would have hoped that Baruch and Press would have paid attention to tides instead of waves. One suspects that much bigger things are going to drive human technics than a Press/Baruch perception of wealth and machines born somewhere in Victorian England.

A 3M Co. executive told C&EN recently: "We're becoming a have-not nation by our own hand. I'm not worried about 3M because we're already 46% offshore. But here in this country we're afraid to take risks for fear of being penalized by the regulators. Or take Three Mile Island. If that is a risk, I'll take that kind any day of the week.

"But you know, somewhere in the body of the American people there is a great pool of common sense. Somewhere down the line I'm hoping it will emerge again." □

White House innovation plan off and running

Called meager by critics, Administration's technology policy spans several agencies, integrates programs; more legislation and newer policies planned, but does new program meet today's realities?

Wil Lepkowski
C&EN, Washington

Everyone who followed the Carter Administration's 18-month Domestic Policy Review on technological innovation knows that Uncle Sam declined to bring industry the gifts it most wanted.

Indeed, as one official in the Office of Management & Budget put it to C&EN, the President opened up his technology policy bag and out ran a mouse. The consensus around Washington has been that the "initiatives" were philosophically and fiscally pale—in fact, minor.

"The Administration," said former assistant Commerce Secretary Betsy Ancker-Johnson to a Senate hearing in November, "has thoroughly discredited itself as a leader in the development of technology policy." Now vice president for environmental activities at General Motors, Ancker-Johnson says that Carter failed to deliver on the issues that mattered most to big and small business—reform of antitrust policy to make joint ventures easier, restructuring tax policy to loosen investment capital, and redesigning regulatory policy so industry can spend more time doing research and development instead of paying excessive compliance costs.

On regulatory policy, Ancker-Johnson wasn't quite right, but she can hardly be blamed for chomping at the bit. When she was assistant secretary for science and technology four years ago, she put together a framework for technology policy, and her successor, Jordan J. Baruch, proceeded to act as if it had never been done.

But successive Administrations often act that way, especially if the political parties differ.

Nevertheless, the severest of the critics say that Frank Press, White House Science Adviser, and Baruch wasted valuable time. They believe that Baruch, whose assistants Theodore Schell and Frank Wolek ran the review, focused on making his own unique contribution rather than on the work of simply delivering a synthesis of studies done before, plus an agenda for a Presidential action program.

Thus, these critics say, the review revealed nothing new, and even the claim that the national consciousness was raised over the importance of the issue held only drops of water. Indeed, the backing of the Chrysler loan by the Administration was testimony enough that noninnovative, poorly productive companies, when big enough, will be propped up and bailed out when about to die a natural death. Some critics wonder whether Carter was listening to his own science and technology message.

Furthermore, the critics say, Press and Baruch failed to put the issue of innovation in a global and strategic perspective. They feel the program should have been more dramatically tied to an articulation of problems facing the country in the 1980's—trade crises, fuel shortages, raw materials scarcity, financial and monetary stresses affecting technological and raw materials investments, capital shortfalls, and increasing social malaise. Innovation for an economic system undergoing basic structural change, they say, was the kind of message the more thoughtful were waiting for. But they didn't get it and they felt cheated.

But the facts are that the Domestic Policy Staff, which is to say Stuart Eizenstat, didn't really want anything too broad or too fiscal. It wanted a limited debate. It ranged across agency programs but it was in reality a study along a narrow waveband, narrowed even further by leaving out important policy options.

The gaps led Rep. Charles A. Vanik (D.-Ohio) to comment: "The Administration plan gives no incentives that are going to work. I'm concerned about our tremendous erosion of our technological base. In the 1980's technological leadership will be essential for survival on all fronts, domestic and foreign."



Vanik: no incentives that will work

Vanik is the third-ranking member of the House Ways & Means Committee, where all tax legislation begins. He appears to have gotten innovation fever and is sponsoring a bill, H.R. 5881, that would establish tax credits on portions of an industrial fund that would go to research and development in universities. His bill is one of several innovation bills floating around Capitol Hill.

"The whole [Domestic Policy Review] thing was overblown," says a staffer at the office of Management & Budget. "We just didn't have a hell of a lot to offer these people. We all know Charlie Schultze [chairman of the Council of Economic Advisors] has been concerned a long time about making tradeoffs between environmental regulation and economic

The Administration's technological innovation effort has 15 major programs

Program	Center for Utilizing Federal Technology	Foreign technology utilization	Generic technology centers	Regulatory technology development	Better industry-university cooperation in R&D	Uniform government patent policy	Upgrading of Patent & Trademark Office
Agency	National Technical Information Service, Department of Commerce	NTIS	Department of Commerce (three centers); National Science Foundation (one center)	Office of Management & Budget, overseeing regulatory agencies or Productivity Council	National Science Foundation	Office of Science & Technology Policy	Patent & Trademark Office
Contact	Melvin Day (703) 557-4636	Melvin Day (703) 557-4636	Commerce: Francis W. Wolek (202) 377-3966; NSF: Robert Colton (202) 634-6204	Undecided but try Phillip Smith, OSTP, (202) 395-6244	Robert Colton (202) 634-6204	Phillip Smith (202) 395-6244	Patent Commissioner Sidney A. Diamond (703) 557-3071
Purpose	New, improved ways of informing industry of inventions in federal laboratories	Collect and disseminate information on foreign, potentially innovative technologies	Industry/government-funded centers to upgrade broad, basic technologies	Improve innovation in regulatory compliance technology	Help universities understand style and scope of industrial research, train students better for careers in industry	Give companies exclusive licenses to develop government-owned inventions. Would be governmentwide policy	Further automation of filing, classification; establishment of single count only for patent appeals; re-examination of issued patents on request
Fiscal 1981 funding	$1.2 million	$4.2 million	$6 million to $8 million	—	$20 million	—	Not determined
Comment	NTIS will hire several writers and analysts to produce interpretive material. Effective implementation, extension, could cost much more than proposed $1.2 million	Translations of foreign literature ($1.8 million). Funding probably insufficient. Part two ($2.4 million) involves federal debriefing of visitors to foreign countries. Could take years to produce relevant information	Generic technologies include welding, corrosion prevention, lubrication. NSF supports several such centers and reports success. A favorite scheme of Jordan Baruch	Most agencies (OSHA, FDA, EPA) have long been made conscious of promoting best and most efficient technology. Big need is experienced staff of agencies	Said to be one of best-run NSF programs. Plans to extend program to other agencies with goal of $150 million total	A long-sought program often thwarted by public interest groups and populist politicians. Outlook fair, but opposition will fight. Will require legislation	Chances good. Senate and House behind proposals. Legislation already introduced in Senate

growth. We're already doing something about that. Taxes we couldn't do anything about because the Administration didn't want innovation to get mixed too heavily too early with next year's tax package."

It is generally felt that Baruch did not get all he wanted after his document went up to the White House Domestic Policy Staff last summer. Al Stern, the Domestic Policy staff aide in charge of administering the review, says Baruch initially wanted some commitments at least to altering tax policy for releasing a flow of funds that presumably would go to innovation. But DPS wanted a narrower focus, Stern tells C&EN, fearing that any commitment to tax policies would branch out into fields outside innovation.

"We just don't think tax measures are a major stimulant to innovative activity at this junction," he says. "We think there's going to be a downturn, we don't know when, and we certainly don't feel we want to accelerate the inflation problem."

There is the possibility, Stern believes, that much of the innovation lag industry complains about may be self-induced, too. "Industry has a great deal of conservatism in its own house," he says. "There's a large amount of restraint on the management side, and that could depress innovative activity. When I hear industry complain about our lack of action, I simply tell them to go out and innovate."

Stern says that when one tries to discover whether there actually has been a dropoff in American industry's ability to innovate, then the measurements become less convincing. This makes the steps, even to the policy's architects, more than a little dubious.

"I have no doubt that accelerated depreciation would have an impact on innovation," Stern says. "But it would have much larger consequences elsewhere. The reasons for accelerating depreciation have to do with much more than innovation. We want to make sure there are no negative impacts elsewhere. We looked at venture capital. And the early returns tell us that venture capital is more plentiful than ever. But it seems to be high only for second stage financing. Seed money is hard to come by. 'Petromoney' isn't used for venture capital because it seems the more there is of it, the less it is used for risky ventures. So the question came down to finding some mechanism for producing seed money for initial financing without making government finance every scheme in the world."

Much of the final Presidential wording was chiseled out by Stern and by Philip Smith, a top aide to Frank Press. Smith, quite naturally, is enthusiastic about the product. He

Gary Gloyer 653-6216 (12.00)

Office of Small Business Patent Counsel	Clarifying antitrust policy	Small business innovation research program	Corporations for Innovation Development	Federal support for small R&D businesses	Venture capital availability	Opening federal procurement to innovations	Improving government regulations
Small Business Administration	Justice Department, Federal Trade Commission, OSTP	National Science Foundation	Department of Commerce (some NSF help)	Small Business Administration	Small Business Administration	Office of Management & Budget, General Services Administration	Environmental Protection Agency, Food & Drug Administration, Occupational Safety & Health Administration
Milton Stewart (202) 653-6533	Justice: Ky Ewing (202) 633-2562, FTC: Robert Reich (202) 523-1447, OSTP: Phillip Smith (202) 395-6244	Roland Tibbetts (202) 634-6204	Philip Goodman (202) 377-3914	Milton Stewart (202) 653-6533	Milton Stewart (202) 653-6533	OMB: Fred Dietrich (202) 395-6810 GSA: Gerald McBride (202) 566-1043	Call Phillip Smith at OSTP for referral (202) 395-6244
Help inventors convert activities to small businesses by entrepreneurial counseling	Explain antitrust policy to industry more systematically; publish guidebook on antitrust/innovation for industry	NSF provides venture analysis and feasibility testing support to new firms	Help states give support to new businesses	Give small R&D firms bigger slice of federal grant and contract business	Changes in Small Business Investment Corporations/Employment Retirement Security Act policies	Policy changes to ease entry of innovative products into government purchases. Small business will be given preference	Substitution of performance for design standards; five-year forecasts of priorities. Clearance based on innovativeness of product
Negligible	Negligible	$10 million above current $2.5 million	$8 million ($4 million per center)	Negligible	—	—	—
Universal approval	Industry chronically complains that antitrust policies are vague and inconsistent on joint ventures. Wants more flexibility. Justice says it is flexible enough. No policy changes expected	Goal to establish same program in other agencies to goal of $150 million total funding	Legacy of old, defunct State Technical Services Act. Some state programs good, some not so good. British model experience mixed, since British innovation record poor of late	OMB will monitor progress. Will require vigor and verve by Stewart, or whole thrust could be forgotten. Small business groups will need to maintain pressure	Possibly significant. ERISA change was recommended by several industry panels. Much depends on decisions by pension fund managers	Experimental Technology Incentives Program in National Bureau of Standards paved way for this program. Was product of Nixon science and technology message of 1972	Further steps in Administration policy for cutting regulatory red tape, giving industry better means of anticipating regulatory policies, actions

says implementation of even this first step will take two or three years but that the initiative is integrated and long lasting.

Right now, he says, the most spirited activity is around the structure of the bill needed to modernize the patent office.

"For example," Smith says, "we're aware of the inequities of the patent system for chemical and pharmaceutical companies where regulatory compliance holds back the introduction of a new product many years. The patent life by the time the product is introduced is half exhausted, thus reducing the profit rewards the company would get for disclosure of the invention.

"We may come to the point of proposing extension of the patent life," he says, "but we're not at that point yet. Other things need to be done first. An even more fundamental issue is developing legislation to extend the patent system to developments in the life sciences and to computer communication systems."

In six months Baruch is scheduled to deliver to the Domestic Policy Staff a progress report on each of the programs proposed by the President. Meanwhile, technology policy framers in Commerce, the Office of Science & Technology Policy, and DPR will be stepping up what already will be going on.

"We intend to enlarge the generic technology area, provided the four experiments we are proposing don't fall flat," says Stern. "We will look further at the research and development interplay between industry and universities. We'll also be doing work on the tax front, with the good possibility that innovation will claim a whole section of the Administration's omnibus tax bill. We also will want to look at whether there is a regional fall-off in innovation patterns, such as between New England and the Sun Belt states. We'll be looking further into the international flow of innovation."

Other possibilities could include a sweeping assessment of innovation needs in what the Administration euphemistically calls a "constraint economy," which means serious recession or depression. "Commerce should be the agency examining that," Stern says. A National Technology Institute along the lines proposed in Sen. Adlai E. Stevenson's (D.-Ill.) innovation bill, S. 1250, is remote but still a possibility. But Stern says that while Stevenson's bill would establish a big overall technological institute, the Administration might tend to envisage institutes of a much narrower focus, such as development of engineering manpower for national needs and technological goals.

The subject is almost too complex

to handle piecemeal much less in an integrated way because of the way innovation covers all aspects of an industrial economy. For example, OMB is nowhere clear on the right type of balance that should exist between federal and private sector funding of new technologies. Some OMB elements doubt whether the government should be involved in any development projects.

"We are now experiencing growing cynicism about the contribution of federal research and development to the economy," says an OMB manager. "By that I mean the idea that if we only tried harder government R&D would solve our problems. We're also again feeling that what we are spending in energy the private sector after all should do by itself. It's hard to know the difference between money for demonstrations and outright subsidies."

It is clear, then, that the debate over innovation will sizzle through the turbulent eighties. Groups at such far poles as the American Enterprise Institute, which speaks for a conservative capitalism championed by Ronald Reagan and John Connally, and the Center for Economic Alternatives, which wants an economy more geared to meeting the needs of the common man, are both developing programs on the subject.

One figure who hasn't been officially heard from in some time is Commerce Department senior economist Michael Boretsky. It was Boretsky who sparked the debate over America's technological competitiveness during the early 1970's, when previous Commerce Secretaries were proposing to then President Nixon a program not far removed from what Carter announced last Oct. 31.

Though ignored by Baruch, Boretsky continues to assemble data and analyses on such matters as productivity, technological economics, and inflation. He is especially concerned about the strategic consequences of a continued U.S. decline in international technology markets and delivered his perceptions on the subject in a speech last year to the Army War College. At the moment, Boretsky's views are not popular among Administration economic policymakers because he believes that U.S. corporations, through their export of technology abroad, are contributing to the erosion of the country's balance of trade and overall strategic balance in the all-important high technology industries.

Transfers of technology—either through the multinationals or through licensing to foreign firms—have a detrimental impact on national security, he says. The net impact, he says, "is adverse effect on the balance of payments and external value of the dollar. This, in turn, affects the country's economic, political, and military posture abroad, including the many strictly defense-oriented installations which the nation maintains overseas," he told his military audience.

Boretsky believes the decline in the country's technological competitiveness contributed to the 1971–73 dollar devaluation "much more than all other factors combined."

He adds, in fact, that "based on my calculations and analysis, I came to a firm belief that had the U.S. done nothing more than it has actually done in promoting new technology at home, but had fostered exports of its products with the same vigor as it fostered export of licensing technology, the kind of deterioration of U.S. trade and balance of payments that we have been witnessing since 1971 might have come eventually, perhaps in the twenty-first century. But not in 1971."

His views are those of Boretsky, the individual, rather than as policy analyst for the government. But they are well-known throughout the Washington technology policy community. He wants Washington's current technology establishment to make an objective assessment of the national security implications of "either the transfers of technology or the emergence and growth of the Eurodollar markets."

Boretsky's views are rather holistic, and here and there rather hawkish in terms of the technological power balance between the U.S. and U.S.S.R. But he believes the U.S. is in deeper trouble than the current science and security advisory apparatus realizes and this has everything to do with innovation.

He would like to see a more strategic analysis of technological balance data provided to the White House. Technology, economics, and security need combined analysis, he says, and the Administration is currently not getting it. "On some developments critical to U.S. long-term security, apparently nothing is supplied at all."

But on the domestic side of technology policy, Boretsky has several suggestions, including:

- Substitute one half of the present investment credits for tax credits and apply them to research and development aimed at technological innovation that would either enhance labor productivity, save materials, develop substitutes for raw materials, save energy, or develop truly innovative new processes and products.
- Reduce or preferably eliminate the capital gains tax on gains stemming directly from investments that go into new enterprises. The secondary gains would be taxed at the present 28% rate. "Such a policy would provide the additional incentives needed in the environment of progressively scarce capital to induce investors to take the larger-than-normal risk of investing in new technical enterprises."
- Besides having the Census Bureau publish its usual data on employment, man-hours worked, value added, etc., for various industries, add to the service data on best and worst performing industries. This would be a managerial monitoring tool leading to steps to improve performance in lagging industries.
- Establish a new Office of Industrial Technology & Productivity Enhancement in the Commerce Department. The office would do technology policy planning, measure the country's technology policy planning, measure the country's technology needs vis-a-vis level of effort, administer a network of university-affiliated centers for industrial technology, and support a network of regional productivity enhancement centers.

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For every Boretsky there's a Baruch. And for every Baruch a Winpisinger. The innovation debate is so complex that its watchers and as-

Carter Plan to Spur Industry Innovation Remains Almost Invisible After 6 Months

APR. 30, 1980 WSJ

By ARLEN J. LARGE
Staff Reporter of THE WALL STREET JOURNAL

WASHINGTON—Last Oct. 31, President Carter proudly announced the beginning of a program that "will significantly enhance our nation's industrial innovative capacity and thereby help to revitalize America's industrial base."

Six months later, the "program" remains almost invisible. Most of the proposals have yet to be put into effect as the bureaucracy ponderously tries to give them specific shape.

Some elements of the plan have been scaled back by the budget cuts ordered in March; other points in Mr. Carter's October message to Congress have been dropped as bad ideas to begin with. The proposals making the most progress so far are a couple of patent-reform bills that have been passed by the Senate and are being favorably received in the House.

"I have the impression that things are going pretty slowly," says Howard Nason, president of the Industrial Research Institute's Research Corp. in St. Louis. The organization, formed by 250 companies to spur innovative technology, has been advising the Commerce Department on ways to put parts of the President's program into effect.

Mr. Carter's October message was itself the climax of a massive 18-month government-wide study on ways that federal agencies could encourage industries to put more innovative products on the market. Early in the Carter administration, presidential science adviser Frank Press and other officials began deploring what they considered an "innovation lag" in the U.S. compared with the volume of new products being marketed by Europe and Japan.

Mr. Carter's October message disappointed many businessmen and Capitol Hill lawmakers who had been following the innovation study closely. Critics especially complained that the message didn't contain any new tax breaks for business aimed specifically at spurring innovation, such as credits for private research and development spending. The Carter administration insisted any such tax incentives would have to be considered later as part of a general tax bill, yet to be proposed.

Business groups that took part in the 18-month study predictably complained that government regulations are stifling innovation. Mr. Carter's October message expressed sympathy for this view, but didn't promise any specific regulatory letup. The message called for regulatory agencies to prepare five-year forecasts of their "priorities and concerns" to give business a better idea on how to plan its future research. Six months later, the agencies themselves are still in something of a fog on how to execute this command.

"I don't recall receiving any specific requirement" on how specific the five-year forecast should be, says an official at the Department of Labor's Occupational Safety and Health Administration. At the Environmental Protection Agency, plans are under way to put out the required five-year forecast, but a regulation drafter confides, "I don't think it's going to be terribly useful." So far, little guidance has come from higher-ups in the administration on how the forecasts should be written. "This hasn't been one of the highest priority items on our list," says a staffer in the President's science adviser's office.

Business groups also have criticized antitrust-law enforcement as a barrier to cooperative, multicompany research on common technological problems. Mr. Carter didn't propose any changes in antitrust law on this point, but did instruct the Justice Department to write a guide clarifying ways that cooperative research projects can be performed legally. The department is working on the fourth draft of a 40-to 50-page statement, due for possible publication this fall.

Mr. Carter's message called for establishing in the coming fiscal year four "generic technology centers," where the government and various industries would jointly finance research on such topics as better welding techniques and reduction of friction and wear. However, sites for the centers haven't been picked yet, and the list of research topics isn't ready. Similarly, sites haven't yet been selected for two proposed "corporations for innovation development," which would loan federal and state money to small companies wanting to put high-risk new products on the market. The 50 governors soon will be asked by the Commerce Department to submit ideas on what the corporations should do.

In recent years, the National Science Foundation, a government agency charged with dispensing grants for basic research, has been financing joint industry-university research projects in chemistry and other sciences that may lead to innovative marketing breakthroughs. In October, Mr. Carter said he wanted the foundation to spend more money for this program and to see the idea used by the Defense Department, the Energy Department, the EPA and the U.S. space agency. However, the balance-the-budget spending cutbacks ordered in March canceled much of the proposed financial expansion in the NSF's innovative research programs. There's to be a multiagency meeting to discuss the spread of industry-university research grants, but it hasn't been held yet.

Mr. Carter called for an office in the Commerce Department to step up its monitoring of government-financed research projects that could lead to market innovations. The same office, he said, should monitor foreign technologies for applications in the U.S. One idea was for federal officials to interview Americans returning from abroad on what interesting new technological wrinkles they'd seen, a notion that smacks of distasteful snooping to some people. "If anything's done on that, I'd be surprised," says a Commerce Department spokesman.

The President asked the Small Business Administration to be more receptive to requests for loans by small high-technology concerns, and to hire a patent expert to coach the concerns. The SBA has, indeed, filled the patent job with an "acting" director.

One of the major achievements of the innovation study was to hammer out for the first time a consistent government-wide policy on exclusive marketing rights for products invented with government research funds. Marking something of a retreat by the Justice Department, the policy says that a company can get exclusive marketing rights for putting such a product on a specified market. Currently, some agencies insist on giving nonexclusive licenses to all comers, which critics say makes them attractive to nobody.

Small business seeks new innovation policy

Small business R&D groups organize, press for innovation legislation against White House resistance; Small Business Administration aims at lead role

Wil Lepkowski
C&EN, Washington

To hear it told these days, unless the government gets serious, technological innovation in small, creative businesses is headed down a path to oblivion.

Uncle Sam sustains big business with fat procurement contracts on such things as cruise missiles, M-1 tanks, and synthetic fuel plants. It favors universities with billions of dollars in research grants while closing its eyes to fast and loose academic accounting practices. And through inequitable tax, regulatory, and investment rules, it stifles the entrepreneurial air around inventive people. Only the big will survive, small business fears in its darkest moments.

Elmer Fike, president of Fike Chemical Co. in Nitro, W.Va., says he has had to lay off his whole research staff over the past two years because his profits collided with government safety, health, and environmental regulations. "We're doing no innovation at all now," he broods.

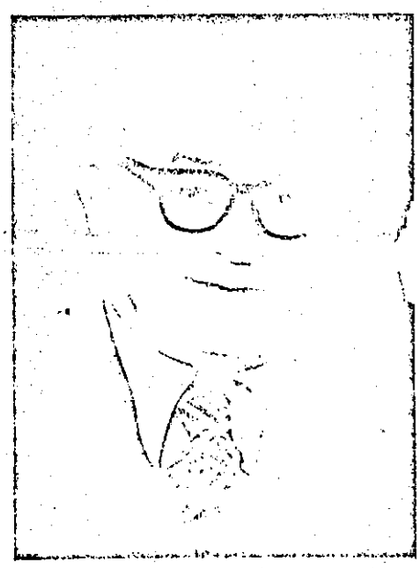
Fike is one kind of innovator, more or less out of the older chemical process industry school. Another kind is Charles Garber, president of Structure Probe Inc., in West Chester, Pa., which provides purely research and analytical services.

Garber is discouraged because of unfair competition from nonprofit institutions. "When an academic scientist uses an instrument given to him at government expense for his own profit, I call that white-collar crime," he says. The practice of academics doing commercial analytical services on the side with government equipment is widespread, he says, and he wants something done.

Stories abound of small laboratories shut out of contracts because a university researcher has a bigger name. Others receiving applied science grants from agencies complain that when a budget squeeze hits, the applied science budget gets whacked worst—as happened to the National Science Foundation's $10 million Small Business Innovation Program, cut back to $6 million during the recent budget revision. A third problem is that government contract officers hate to be bothered with what they see as piddling amounts going out for small business projects, regardless of their innovative value.

Meanwhile, small companies' problems with larger companies also weigh on the small business person. Especially infuriating to small companies is their big brothers' habit of dallying over a decision after a small business sales pitch. "The company will show interest at first, even enthusiasm. It might send a whole team of people to look at your idea," says one entrepreneur left dangling too often. "You wait and wait and wait and you often never hear from them."

More serious, though, is litigation over patent rights. Large companies can afford to spend hundreds of thousands of dollars in legal fees to win a patent case and secure an invention. Small companies cannot and usually give up. New patent legislation certain to pass, however, will change that. It will allow the patent office to do searches that will settle most claims at hardly any cost at all.



Stewart: waving small business flag

A third problem is a little more benign to companies, but still lethal to innovation. It is the old-fashioned merger. Big companies are buying up little companies instead of buying from them. The fear in the semiconductor industry, for example, is that innovation will wither now that small companies are being absorbed by the international electronic giants.

As corporate reorganization attorney Arthur Burke puts it in the spring issue of *Business and Society Review*, "Starved of capital, deprived of incentives, submerged in bureaucratic red tape, and surrounded by the burgeoning bigness of the corporate giants, the small business sector has become a victim of the upheavals of the 1970's."

But small business is fighting back, declaring that the 1980's will be a decade it can call its own. What it will be, too, is a decade of decision over the whole subject of innovation in a world suffering through painful economic change, the forecasters say. Good parsimonious ideas from all directions will be needed to pull the system out of chaos caused by shortages of energy, materials, and capital.

Even the American Chemical Society is being forced to give some notice to the many small chemical innovators within its membership. For a long time, the small chemical manufacturer and research laboratory pretty much ignored activity in the society, believing it to be oriented in leadership and policy priorities to big business and academic research.

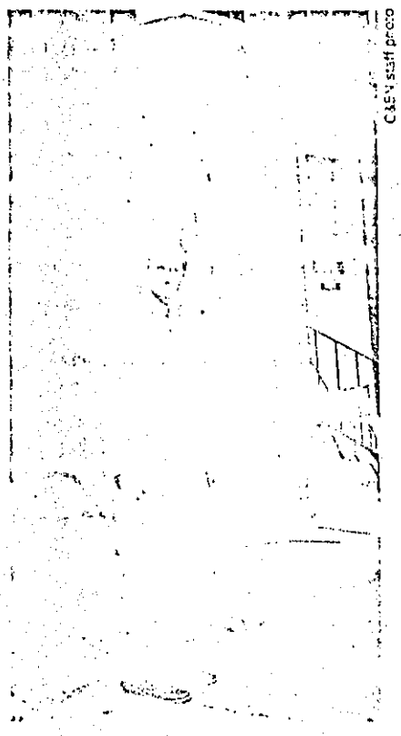
As a result, these people threw their energies into such smaller organiza-

Arthur Obermayer—portrait of one small business entrepreneur

The one thing about small business innovators is that they are individualists, and in one form or another idealists—for free enterprise, the "American dream," the thrill of risk taking. They live lives of hope, determination, and attraction to hard, vital work. They don't want to be caught up in institutionalized bigness. Obermayer is 48 and was born in the Philadelphia area. His Ph.D. in physical organic chemistry is from Massachusetts Institute of Technology, and after a short stint at the now-defunct Itek Laboratories near Boston, he founded Moleculon Research Corp. This is the way he sees himself as a small entrepreneur:

"I think it's most important for the individual to do his own thing. If I went to work at some big chemical company, would they let me testify at a public hearing on something I care about? I could support a lot of the things the company could support, such as attitudes about government. But I couldn't say anything that would offend the company. I'd hate to be put in a position where I would have to be restrained.

"Something happened to me a couple of years ago which marked a turning point in my life. Someone called me to ask if I could take part in an outside project that really interested me. My first impulse was to say no, the company needed me. But I started thinking about it and I told myself that the company had been running me too long and it was time I ran the company. If I do all the things the company needs, I get pushed too far.



C&EN staff photo

"When it comes right down to it, I'm interested in this small business innovation issue more than anything. I feel I have a responsibility to other small businessmen who have been swimming against the tide with me for many years. And I hope that what I put together doesn't look like an ego trip.

"I'm concerned about the little fellow, about everybody having a chance, about our own society becoming overinstitutionalized. This is not a country of cottage industries and I don't think it should be. But I am concerned about people in large organizations who don't speak out when they should. I care about what happens to whistle-blowers. They almost never end up on top anywhere."

tions as the American Council of Independent Laboratories, the National Council of Professional Service Firms, or the American Association of Small Research Companies.

Now ACS has a Division of Small Chemical Business. It is probationary because it is new. But founder Alexandra Melnyk of Chemical Abstracts Service expects it to receive full status by the end of 1981. Already the division has 300 members—up from only seven a year ago—and an active program. It also publishes a sprightly newsletter.

Another organization recently born is the National Council for Small Business Innovation whose co-chairman is chemist Arthur S. Obermayer, president of Moleculon Research Corp. of Cambridge, Mass. Obermayer travels all over the country on behalf of the small innovative company movement, making speeches, testifying before Congress, and cheering his colleagues, besides laboring to market his cellulose triacetate membrane material Poroplastic. About a year ago, NCSBI opened a small office in Washington, D.C., in hopes of influencing federal programs and Congressional legislation on behalf of the 10,000 or so small business innovators.

A great deal is going on to establish a national small business innovation policy—almost too much for anyone to integrate. The politics is heavy; the issues are complex; and the feelings run high. But a revolution does seem to be occurring around technological innovation and the central question seems to involve how well big and small will serve each other.

Which of course they need to do. Small business largely supplies big business, and the little companies need those customers. Particularly in the high-technology field, it is only the large companies—in the U.S. or abroad—that have the funds and the manufacturing wherewithal to license small business inventions. It's a love-hate relationship that must be reconciled.

Many large companies understand the problem. Earlier this month in Baltimore, AASRC sponsored a meeting to help link up small high-technology companies with 10 big firms. The conference was largely underwritten by the big companies—General Electric, Monsanto, Control Data, and Procter & Gamble among them—and conference organizer Samuel Cardon of General Technical Services of Upper Darby, Pa., seemed pleased. "Everyone said they made useful contacts," he says. "We'll have to wait a few weeks to know better. But at least this conference showed that the big companies are out there looking."

In the Washington bureaucracy, small business's chief promoter is Milton R. Stewart, the peppery director of the Small Business Administration's Office of Advocacy. Stewart's job is to drum up zeal for small business everywhere. He certainly waves all the right flags.

"Big business is not innovating," he tells C&EN. "What fundamental overpriced material has been replaced by big business at one half to one third the price? What major corporation is *not* engaged in administrative pricing? Big business is no longer in price competition. It doesn't want to jeopardize the market. The real issue for the next decade is between big business and government bureaucracy on the one hand and the entrepreneurial sector on the other. The President has opened the door. Now we have to keep the bureaucracies from shutting it again."

Innovative small companies are only part of his mandate but clearly the main one. Stewart has even hired an "entrepreneur-in-residence," Andrew Luff, who in August will return to his small consulting firm in Kalamazoo, Mich. Luff indicates, though, that he will stay if the mood is right because he clearly sees the need to maintain the momentum that has been gathered so far.

Small business innovation advocates have considerable distrust for the Administration. They believe the White House, Office of Management & Budget, Presidential Science Adviser Frank Press, Department of

Commerce assistant secretary Jordan Baruch, and the various agencies are taking less than a half-hearted interest in the small business plight. They complain that the Small Business Administration was mentioned only once in the innovation initiatives organized by Baruch and announced by the White House last October. They point to Administration efforts to remove the innovation issue from the agenda of the White House Conference on Small Business held in February. And they charge that the Administration suppressed release of a report prepared in 1978 by Jacob Rabinow of the National Bureau of Standards for the Office of Management & Budget.

The OMB report was a powerful buttress for arguments favoring a strong federal small business innovation program. Yet, it was never featured and seldom mentioned as background material during the 18-month Domestic Policy Review leading up to the Administration's modest innovation program. The report says that half of the major U.S. innovations developed between 1953 and 1973 came from small businesses. It also says that the innovation-to-sales ratio for small companies is 33% better than that for large businesses.

Especially telling were data showing that although small firms produce four times as many innovations per R&D employee as large firms, the cost of supporting each person is about half, accounting for an eightfold advantage in productivity. Such data and their interpretation are always open to challenge and obviously research-intensive companies such as 3M, Dow Chemical, or Du Pont couldn't easily allow them to go unanswered. But these data are provocative and were convincing enough to lead the Rabinow panel to recommend a series of steps designed to give small business a bigger part of government business.

Small business innovators are banking heavily on Administration followup to the January White House Conference on Small Business.

The conference ringingly endorsed passage of twin innovation bills currently pending before the Senate and House: S. 1860 and H.R. 5607. The bills are sweeping in scope, ranging all the way from special R&D funding set-asides (opposed by the academic research world) to tax revision and patent reforms.

Baruch, technological innovation's crown prince in Washington, has privately told the small business innovation lobby that it is correct to push for passage of the legislation. But he does not say so publicly. He told both committees that the White House innovation initiatives put forth last fall are all that are needed for the moment, saying many of the provisions in the new bills "would be detrimental to other important national goals."

The small business community is ambivalent at best about Baruch. Alexandra Melnyk calls him a "charmer." A Capitol Hill staffer bitingly refers to him as "a snake oil salesman." Whatever his personal motives, he is still Washington's Mr. Innovation, Stewart or no Stewart. What is certain is that no one would want SBA to be running the innovation show, given SBA's overall reputation as a meddling, paper-shuffling agency.

Stewart, though, wears the whitest of hats. But he and Baruch do not get along, partly because of personality differences, and partly through the age-old antipathy between SBA and Commerce. One observer believes that if the breach between the two isn't healed, "it could tear the movement apart."

This raises the issue of SBA's anemic clout within the Administration. SBA is not and probably will not be the lead agency for coordinating small business innovation policy, although an argument can be made that it

Highlights of small business innovation bills S. 1860 and H.R. 5607

- The Small Business Administration would give management assistance to small research and development firms.
- SBA would be the government's chief R&D funding advocate of small R&D firms. Each federal agency would raise the level of R&D funding of small firms 2% a year up to an overall target percentage of 20%.
- Each federal agency with an R&D budget exceeding $100 million a year would establish a small business innovation research program of competitive grants modeled after the one pioneered at the National Science Foundation. Each agency would set aside 50% of its small business contract money specifically to fund the activity.
- The Office of Federal Procurement Policy in the Office of Management & Budget would give small firms "maximum practicable opportunity" to acquire federal R&D procurement contracts.
- Regulatory agencies would look for ways to make it easier, simpler, and less costly for small firms to comply with safety, health, or environmental laws.
- The Securities & Exchange Commission would conduct annual reviews of securities markets to determine if, where, and how small firms are excluded from such markets. It would report its findings every year and suggest any needed legislative or administrative changes.
- Taxes on capital gains realized on the sale of an equity interest in a small business would be deferred if the gains were rolled over or reinvested in another small business within 18 months after the sale.
- For any small business spending at least 3% of its gross revenues on R&D in each of three consecutive taxable years, or 6% in any one taxable year: restoration of qualified stock options, with maximum period for exercising such options extended from five to 10 years; taxation at half the normal capital gains rate on gains realized from investment in their firms, as long as the investment is held for a minimum of five years; extension of capital loss carryover period from seven to 10 years; and granting of a one-year write-off for otherwise appreciable R&D equipment and a 10-year write-off for R&D facilities.
- A small business would be allowed to establish a tax-free cash reserve for future R&D expenditures. The reserve would not exceed 10% of gross income, $100,000, or the actual amount of R&D expenditures, whichever is smallest.
- Subchapter S corporations would be permitted to have 100 shareholders instead of the present 15, and corporations of any size could be shareholders.
- Small business and nonprofit organizations would be allowed to retain patent rights on inventions developed under federally sponsored research, according to certain specified guidelines.
- The government retains the right to use any invention resulting from its funding of R&D projects.
- The government could require the licensing of inventions if the invention has languished without commercialization, has important health or safety applications, or is required by federal regulations.
- For a commercially successful invention, the government would recover its original funding commitment.
- The Patent & Trademark Office would be authorized to re-examine contested patents rather than requiring settlement in court. This would vastly reduce the cost of litigation to small business.

could be. Luff sees SBA as a wheel hub, with policy spokes running out from it. But SBA may not even be ready for that. It is too divided. "What is needed," says one source, "is strong leadership and SBA doesn't seem to have it. Milton has his hands tied and as a result you have Jordan running off on his own in his condescending, obsequious attitude toward small business."

The positive aspect to all this is that, with Baruch and Stewart making their own panzer thrusts, the innovation policy movement could move ahead anyway.

There are several programs for small business support ongoing in the federal government. The Minority Business Development Agency in the Commerce Department operates a $1 million "technology broker" program in nine regions that helps small minority firms get started with loans and licensing arrangements with larger companies. Agency director Theodore Lettes says 50 to 60 companies are being helped around the country.

Similarly, SBA in its traditional garb helps finance innumerable small businesses with high, low, or no technology at all. Sometimes the agency does it well, sometimes badly. The General Accounting Office has published dozens of reports over the past five years specifying the mismanagement of one program or another at SBA. Still, the process goes on because more companies are helped than are hurt.

Moreover, public law has required that every agency establish a small business support office. The motive isn't technological innovation and so the consciousness isn't so high as the innovation community wants. Both small business committee chairmen, Sen. Gaylord Nelson (D.-Wis.) and Rep. Neal Smith (D.-Kan.), want more visibility for innovation through the R&D funding set-asides, calling for at least a 2% yearly increase in small business grants and contracts, stopping when the small business percentage reaches 20%. The Administration objects to such a policy on grounds that it would tie the hands of agencies looking for simply the best know-how to meet their missions.

John A. Hewitt Jr., chief financial officer for the Department of Energy, acknowledges the department's "tendency to rely on other than small businesses for our research and development." But he says DOE's senior managers now have the message. As it is, he told the Senate Small Business Committee, DOE spent $1.32 billion with small firms, and in fiscal 1980 they will get 18.9% of the agency's total obligations.

The figures becloud the real picture around innovation, however. DOE is notorious for ignoring new R&D ideas emanating from small companies. And the great proportion of Hewitt's figures pertain more to services than to R&D.

Hewitt's response to S. 1806 fairly well typifies the Administration stance, given that it already has established its own innovation policy through the President's program. Hewitt says that DOE is trying to encourage more small business activity in its programs. DOE has several programs already in motion under existing law. It frowns on any mandated fixed percentage targeted solely for small business. It would be willing to try an NSF-modeled Small Business Innovation Research program, and the Solar Energy Research Institute already is devoting 23% of its R&D budget to small business proposals.

"If the invention doesn't have the potential of a $50 million market in five years, [big companies] aren't really interested"

There is almost universal agreement that the agencies would do well to adopt programs identical to NSF's touted Small Business Innovation Program run by Roland Tibbetts. He and Robert Colton, who runs the somewhat less scintillating university-industry innovation centers program, are practically the lone small business lights in the entire $1 billion agency.

"Bright ideas come to all people in all places," Tibbetts says. "But they can't be exploited well except in a small business environment. Academia is not a good place because there innovative ideas frequently go nowhere. Except in small business, the radical idea has very little chance of successful transformation into a product. Another reason why small business has to struggle is that to most people innovative ideas look as if they have small markets. As far as the big companies are concerned, if the invention doesn't have the potential of a $50 million market in five years, they aren't really interested."

Tibbetts' program works in three phases. Phase one is an initial $25,000 grant to help the company develop the product concept. Then comes phase two to expand the base through research funding. Phase three involves development financing from private capital sources. Initial grantees begin phase three this fall.

"The program forces technology transfer from the beginning of the planning process. And we give patent rights to the developer-recipient," says Tibbetts.

It may well be that small is becoming beautiful. But one should be cautious. The overall trend remains in the direction of bigness. Facts show it—through the decline of the small farm, the accelerating merger movement, the international flow of capital and technology, the replacement of the corner grocery store with chain stores. Small business champion Arthur Obermayer says he wants to get as big as he can get. It may all come down to that purely western philosophical concept that you don't progress if you don't grow. Even the Soviets, with their different view of social evolution, envy old-fashioned Yankee ingenuity.

One small business innovation movement does question the direction of things. It is the "appropriate technology" community, led by those who believe that the economic and resource system is under such strain that communities must learn to become more self-sufficient and detach largely from large-scale technological, corporate and bureaucratic systems.

Its advocates have their venture capital cares, too. One Boston group called Accion works worldwide among the poor but also has a "microbusiness" project in Maine to seek small loans to develop community-based enterprises in depressed areas.

This "community technology" movement is highly distrustful of such activities as Control Data's program of nurturing small high-technology firms. The movement believes that Control Data, a big data technology company, is simply out to control the information on technology small firms are developing. But at the same time, the community groups seek the help of the business and banking community for the philanthropic support to keep going.

Because of coming clashes between "high" and "appropriate" technology, the eighties could be the decade when the nature of wealth will have to be reconsidered through some combination of business and community values. With less material goods to go around but with information flowing freely, something new seems bound to emerge. Milt Stewart may have the best definition of wealth. "The true wealth of this country," he says, "is between the ears." And with that, we're back to the uncertainties around small entrepreneurs. □

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