Maxwell Measures Up

After explosive growth through rapid-fire acquisitions, the process of assimilation continues.

The ads are big with bold statements across the spread. "Maxwell Dispenses with Red Tape," they read. "Maxwell is Pressure Sensitive." This is the moment printers were hoping wouldn't happen: Britain's Maxwell Communication Corporation plc has come to the U.S. marketplace.

For a company that didn't even exist here two years ago, Maxwell Communication sure is big. Counting all subsidiaries, the North America entity presently accounts for $1 billion in sales and more than 6,000 employees. The printing group alone, with more than $700 million in sales and 5,000-plus employees, is the second largest U.S. commercial and publication printer and making a credible argument for itself as "the Donnelley alternative." Its sister divisions include publishing, telecommunications, and database management.

The building of the U.S. printing division began in earnest in October 1986 with the acquisition of The Webb Company. Other large and famous printing establishments followed: Providence Gravure, Diversified Printing, Alco Gravure. In all, Maxwell spent almost $700 million to acquire 18 printing facilities, pumping in an additional $130 million for capital improvements.

All this "heave-ho, let's go" contrasts sharply with most of Maxwell's U.S. competitors. Decisive, dramatic, and speedy action is not the standard operating procedure for printing giants this side of the Atlantic. But Maxwell, a huge, diversified company, is marching to the beat of a different drummer these days, preparing its U.S. print apparatus to grow even bigger as part of an international print and communications conglomerate—deadline 1990. This will provide plenty of time to capitalize on the opening days of freewheeling trade scheduled to commence in Europe in 1992. At that time, firms like Hachette, Elsevier, Bertelsmann, and Mondadori aim to straddle the Atlantic—to be world-class firms able to compete both at home and abroad. Maxwell's aim is to be a $9 billion global firm within five years.

"The European market is very limited," says Neil Perlman, publisher of *Publishers Weekly*, a magazine covering book publishing. "In Germany and England, companies can only grow so much: they are landlocked. So there is no place else for them to go except to the next biggest market, which happens to be here in the U.S. There are no boundaries anymore. It's be-



From left: Bob Smith, Jan Sullivan, Wayne Angstrom, and Marc Fors, familiar Donnelley names now at Maxwell.

By Bill Esler
Midwest Editor

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54 graphic arts monthly August 1988

come a transnational business."

Domestically, Maxwell's closest print competitors are found in three categories: magazines, inserts, and catalogs. Maxwell is number three or four in each segment, competing with R.R. Donnelley & Sons, Meredith/Burda, World Color Press, W.A. Krueger, Treasure Chest, and Greater Buffalo Press. When you put all the bulls into one pen, however, only Donnelley shows up larger overall than Maxwell. In a fourth category, Sunday rotogravure magazines, Maxwell is far and away the leader, printing 80% of *Parade* and *USA Weekend*'s combined 46 million circulation, plus other Sunday magazines as well.

There have been mixed reactions to the speed of Maxwell's ascendancy. For a while, Donnelley management must have been unnerved when first Donnelley group president Jim Sullivan moved to Maxwell, soon followed by finance whiz Bob Smith; later, Mark Ryan left Donnelley's Selectronic unit to head

"CUSTOMERS GET NERVOUS IF THEY BELIEVE (THEIR WORK) MAY BE IN ANOTHER PLANT NEXT MONTH."

Maxwell's mail/list division, and Wayne Angstrom gave up his post as VP division director at Donnelley's Glasgow and Danville, Ky., plants to become executive VP–manufacturing.

In sales, familiar Donnelley names include Marc Fors, executive VP–sales and marketing; Bob Russell, senior VP–sales; Michael Hickerson, VP–western sales; Paul La Cerda, VP–northeast sales; Judy Kula, VP–eastern sales; and most recently, Patti Klinge, VP–human resources. Aside from the brain drain of talent at Donnelley, that's a lot of people familiar with corporate strategy to be working the other side of the street. However, most personnel, line and management, have been assembled from the ranks of acquired companies.

There were also fears that Maxwell would do such unmannerly things as build giant "greenfields" printing plants, as it did in England, and add dangerously to capacity. Or that Maxwell would use its deep pockets to keep marginal plants open past their prime. Instead, Maxwell went the acquisition route, and for a few brief moments even contracted.

"I'm not sure if they can't best be described as rationalizing and consolidating their U.S. operations right now," says Joe Abbott, vice-president of the press engineering firm, E.R. Smith Associates, Pawcatuck, Conn., and a long-time industry observer during his 23-year career at Harris Graphics. In fact, two plants did close; Standard Colorprint, Morristown, Tenn., part of Providence Gravure, was combined with the Diversified plant in Dickson, Tenn., late last year, and willing employees were transferred. And Diversified's color shop in King of Prussia, Pa., was consolidated with Providence Compucolor in Cary, N.C. But this retreat was really shortlived, and the current operating base is in a growth pattern once more.

There have been accusations that Maxwell overpaid for some of the businesses it acquired, and that it bought a lot of "old iron."

"We feel we can make an economical unit out of what we have purchased," responds Smith, whose formal title is executive VP–finance. "We have plans and are on target for those plans, so we are not concerned about it."

So many former Donnelley people in executive positions might be expected to give the firm the flavor of another Donnelley rather than a Donnelley alternative, but this is not the case, according to Klinge. "The way people are approaching it here is that we are not trying to create another Donnelley; there are a number of things that wouldn't work, not in a company like this making so many acquisitions. The management group that came from Donnelley brought some of the solid values and concepts that were applied there, but they avoid some management styles because they wouldn't be effective in this organization." In her position as human resources VP, Klinge faces a challenge in integrating the management styles from the successful, well-entrenched companies Maxwell bought, what she calls three or four major corporate cultures.

Integration of the cultures into a single unit has to be a dominant theme at Maxwell these days as acquisitions in printing cool and the firm expands in publishing and data services.

A national corporate identity program has supplanted such familiar names as Kable Printing, Texas Color, Diversified, Alco Gravure, Compucolor, and Providence; now they are known simply as Maxwell, qualified with the name of the town in which they are located. A 50-person sales staff has been consolidated under Marc Fors and the nation divided into six regions with 10 sales offices. Eliminating redundancy allows various capabilities to be marketed nationally.

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60 graphic arts monthly August 1988

Building a Printing Empire

October 1986—Acquired four plants of The Webb Company ($180 million sales) for $117.7 million

Webb Company, St. Paul, Minn.
Webb/Midwest Printing, St. Paul
Webb/Midwest, Fridley, Minn.
Volkmuth Printers, St. Cloud, Minn.

November 1986—Acquired six plants of Providence Gravure ($220 million sales) for $152.5 million

Providence Gravure, Providence, R.I.
Kable Printing, Mt. Morris, Ill.
Texas Color, Dallas
Virginia Gravure, Richmond, Va.
Compucolor International, Cary, N.C.
Standard Colorprint, Morristown, Tenn.*

June 1987—Acquired three plants of Diversified Printing (estimated $100 million sales) for approximately $350 million

Atglen, Pa.
Dickson, Tenn.
King of Prussia, Pa.**

January 1988—Acquired six plants of Alco Gravure ($150 million sales) for $75.5 million

Broadview, Ill.
Glen Burnie, Md.
Memphis, Tenn.
North Hollywood, Calif.
Arlington Heights, Ill.
Orlando, Fla.

*Combined with Dickson, Tenn. **Closed and combined with Compucolor.
Result to Date—Sales revenue of $550 million for fiscal 1987; estimated gross sales revenue of approximately $800 million for fiscal 1988.

As head of production, Wayne Angstrom must establish consistency and nationwide standards throughout the company's four manufacturing groups—three print and one prepress. "Angstrom has a hell of a job to get these plants to work together," says one observer. "Consolidation and rationalization is like an iceberg—a lot of it takes place below the surface." Meanwhile, getting work off the press continues on a grand scale, with the added challenge of bringing former competitors into one fold.

Despite the two plant closings, "By any measurement we are expanding the business," says Angstrom, pointing to the enormous capital expenditures since the acquisitions began. Another $50 million is likely when current projects are completed. "Of the plants we operate, there are really very few not involved in expansion and improvement. We are very serious about being a quality service unit to our customers. It goes without question that you have to be technologically advanced to do that."

Engineering has been reorganized to match the needs of the prepress and printing groups that handle Maxwell's production. "The engineering force that exists is within the body of these groups, not within corporate headquarters," says Angstrom. "That was by design."

Among the targets of capital expenditure are prepress and press room. In prepress, the goal is to be able to turn over more pages, and "to bring the work into a true electronic mode, and come even further away from conventional prepress and stripping," according to Angstrom.

In the press room, applications of flexo are being examined, and a new gravure press—an eight-unit, 94"-wide Albert—is being installed in the Richmond plant. "We are upgrading all our presses to state of the art," says Angstrom, "so we will increase our capability and our capacity as well." Other additions include an eight-unit APV Baker G-14 web offset press in the Dallas plant, $18 million for added gravure units in Richmond and Dickson, and $2.2 million for a Harris M-300 eight-unit web and a 50,000-sq-ft addition.

With Texas Color and especially The Webb Company came exceptional mailing and in-line personalization capabilities, along with skilled personnel. According to print mail specialist Fred Seymour, the additions of Barbara Petersen from Webb and Mark Ryan from Donnelley give Maxwell a decided edge in the field of selective gathering and addressing. The ability to process list information and personalize printed pieces is an important key for Maxwell's growth, the capabilities marketed under the brand name Target Bound.

The acquisition of Pub/Data and Worlco, plus another data base processing firm pending announcement, will form the core of computer capabilities for offering a high value-added capability in mailing list management and in-line addressing and personalization. It's one example of the type of "product" capability that can be marketed nationwide.

"We will expand Target Bound to all our facilities where we have finishing capabilities," says Angstrom. "There's no question that it is the wave of the future." The process of target binding also allows two totally different publications or catalogs to be assembled, stitched, addressed, and mailed in the same bindery run, a feature especially valuable to catalogers and direct mail firms in light of recent postage hikes.

Another question comes up on the matter of load leveling: If bigger is better due to economies of scale, mustn't there be opportunities to move work from overloaded locations to underutilized

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ones? Angstrom answers, "There's not as much as you might think. Placement of work is more a market-directed effort as far as production control is concerned. Customers get nervous if they believe they may be in another plant next month." One exception, he says, could be freestanding inserts; with Maxwell's electronic integration—based on Ad/Sat, the satellite link-up of 114 U.S. dailies—such a system is halfway established.

"We're positioned to transmit images," Angstrom says. "Most of our plants have direct engraving capability. Once having digitized the information, and secondarily having direct engraving, it's just a matter of deciding where to transmit the images."

Today, printing accounts for most of Maxwell Communication's U.S. sales; the rest stems from publishing (Webb agricultural magazines, Headway Publications, Science Research Associates, Pergamon, and data services such as Ad/Sat, Independent Network Systems, Orbit InfoLine, and Pub/Data). But this will change as Maxwell seeks to broaden its publishing base to 50% of revenues.

"We're not de-emphasizing print," says CEO Jim Sullivan. "The facts are we have been less successful in acquiring publishing companies than we have in acquiring printing companies. And there's a good reason: the multiples asked for publishing companies today are enormous." Nevertheless, print as well as publishing acquisitions are continuing.

"We are in contact with most of the major printing companies that we're interested in, if the right situation were to present itself," says Smith, who has engineered many of the acquisitions. "We are more selective than we were. We are not falling all over ourselves [to buy] but we are certainly not out of the market." Smith notes that there is a "whole host" of publishing acquisitions on the horizon. "Some have substantial printing contracts tied to them, that we don't presently print."

"WE ARE IN CONTACT WITH MOST OF THE MAJOR PRINTING COMPANIES THAT WE'RE INTERESTED IN."

This sounds like other multinational communications firms that follow the European model of vertical integration, following through to distributing, then selling the data online. Bertelsmann, with its publishing and manufacturing divisions, is a classic example of the European approach to U.S. publishing. Is this the Maxwell style?

"It stems from the European approach," says Sullivan. "But Europeans publish and print their own materials, then sell their extra press time in the open market, usually at disadvantaged prices. They create a huge amount of overcapacity. We in this country print very little of what we publish. We don't have the capabilities to produce for SRA [Science Research Associates, the technical publishing firm acquired from IBM for $150 million in June], and we have no intention of buying it—unless I could find a good book printing operation of some size.

"The strategy we apply in our printing operations here is to be the market leader or at least the number two or a strong number three position. If you print only what you publish, you're probably not going to accomplish this goal. I am very firm on that strategy. It is becoming more a game of scale and having a large presence in the market in order to win. It's a kind of a semi-European approach."

While shy in book capacity, another area Maxwell might be interested in is commercial production of newspaper printing, an extremely successful business for Maxwell's British Newspaper Printing Corporation in England. The market is ripe here, too, as daily publishers wrestle with the incredible expense of tooling up for the now-requisite four-color front page. Reportedly R.R. Donnelley is approaching newspaper publishers now. The strategy serves two purposes: it presents a big new business, and it keeps newspapers from buying color capacity and low-balling commercial and insert work.

"We have contacts with customers who have approached us," says Smith. "But we haven't made any firm commitment for that. Most of the newspapers are friends of ours, since we're the largest printer of Sunday magazines."

Where to next? There aren't many printers left big enough to interest Maxwell, but there are certainly a few—World Color, Treasure Chest, Arcata, perhaps?

"We do have a couple of printing acquisitions in the works," notes Sullivan. "You'll undoubtedly see at least one more acquisition on the print side this year."

Adds Angstrom, "We're a large player in the business, and we intend to get larger." Meanwhile, expect Maxwell to sell a lot of printing to its customers—and to remain a fierce competitor in this industry.

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64 graphic arts monthly August 1988

N.Y. Times
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Maxwell Adds a Twist To Offer for Macmillan

By GERALDINE FABRIKANT

The financier is willing to pay $1.1 billion for part of the company.

Robert Maxwell, the British entrepreneur, stepped up his efforts to gain control of Macmillan Inc. on two fronts yesterday.

Mr. Maxwell announced a tender offer of $80 a share, or about $2.1 billion, for the New York-based publishing and information services company. And in a letter to Edward P. Evans, the chairman of Macmillan, Mr. Maxwell said he would be willing to end his tender offer and bid $1.1 billion for just the information services operations of the company.

Bankers Estimate Unit's Value

Macmillan's bankers had valued the information services unit at between $800 million and more than $1 billion. Mr. Maxwell said the offers were contingent upon his having access to the financial information that Macmillan has provided its bankers and others.

The Robert M. Bass Group of Fort Worth has offered $75 a share in cash for Macmillan. The offer has been aggressively resisted by Macmillan's management, which has proposed a restructuring plan that has been blocked by a Delaware court.

Mr. Maxwell had announced the Macmillan bid several weeks ago, but it was met with some uncertainty because it was conditioned upon his right, among others, to see the company's financial data.

"That is their mistake, not ours," Robert S. Pirie, the chief executive of Rothschild Inc., Mr. Maxwell's investment bankers, said of the initially skeptical reaction. "People who don't take Maxwell seriously generally find out they are wrong."

A Distinct Difference

Investment bankers said that a crucial difference existed between simply making a takeover proposal and starting a tender offer.

A tender offer is a direct, legally binding offer to purchase stock from shareholders. Generally, once an offer begins, significant legal consequences occur should the bidder not be prepared to proceed.

But Mr. Maxwell did restrict the tender offer, saying that it was contingent on the company's redeeming its "poison pill" anti-takeover defense, withdrawing its restructuring plan and having the offer approved by the Macmillan board.

Mr. Maxwell said that the board of the Maxwell Communications Corporation had approved the Macmillan bid and that his proposal was not conditioned upon obtaining the necessary financing. He added that his company planned to retain Macmillan's management.

In trading yesterday on the New York Stock Exchange, Macmillan's shares rose $1.50, to $83.25, indicating that Wall Street investors expect a higher bid to emerge.

Bass Group Begins Effort

The Bass Group began the battle for control of Macmillan when it offered $64 a share in cash for the publishing company. Macmillan then countered with a restructuring plan that would have given each shareholder $52.35 in cash and a subordinated note with a face value of $4.50. In addition, Macmillan would be split into the Macmillan Publishing Company and the Macmillan Information Company. Each shareholder would receive a share of stock in Macmillan Publishing and a half share in Macmillan Information.

The restructuring, as proposed by Macmillan's management, would have allowed its top-level management to convert its stake in Macmillan Inc., which totals less than 5 percent, into a 39 percent stake in Macmillan Information. That brought a negative response to the restructing plan from Wall Street.

The Bass Group then sued to stop the restructuring in Delaware Chancery Court in Wilmington and won. Macmillan has appealed the decision to the Delaware Supreme Court.

University Patents Unit Is Acquired by Maxwell

University Patents Inc., one of the first for-profit companies established to market university inventions, announced this week that it had sold its licensing business to a new company controlled by the British publisher Robert Maxwell.

Based in Westport, Conn., University Patents has had contracts with seven large universities, including Princeton, the University of Illinois and the University of Colorado. Typically, the universities have given the company exclusive commercialization rights in exchange for a share of royalties.

But results have been disappointing. The company has not shown a profit since 1982. For the nine months ending last April, it lost $2.36 million on revenues of $2.4 million.

"They didn't have the resources they needed," said Donald Fruehling, president of the Maxwell Pergaman Publishing Group, a unit of the London-based Maxwell Communications Corporation. Mr. Fruehling said he wanted to use the acquisition to build a new data base on available scientific research. The terms of the deal were not disclosed.

Maxwell Communication Corp.

British Publishing Company To Buy London House Inc.

Maxwell Communication Corp. said it agreed to buy London House Inc. for $13.25 a share, or $17.4 million.

London-based Maxwell is British financier Robert Maxwell's printing, publishing and communications company. The purchase will be made through Maxwell's U.S. unit, based in Greenwich, Conn.

London House, Park Ridge, Ill., is a personnel-testing company. Mr. Maxwell said in a statement that the acquisition "is a natural fit" with another recent acquisition, Science Research Associates, which is involved in educational and vocational testing.

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Level of Service \ Customer	Universities (Technology Sources)	Industries
Service Level 1	Fee Target: $25,000/yr offer: - National Advertising: Reach+2 Million - Distribute Leads (inquiries from industry) - Listing of Technology in data base - Listing of University in Directory - Free Software for Technology Administration - National buy/sell Conference	Fee Target: $125-300/yr offer: + Magazine of Technology Opportunities (Review of Area + Specific Opportunities) - Directory of University Contacts + Profiles - National buy/sell Conference - Discount. - Access to Technology bulletin board
Service Level 2	Fee Target: Contingent 60/40% offer: - All of Service level 1 - Screen File Patent Applic - Direct Market Client Technology - Negotiate licenses - Audit Royalties	Fee Target: $15,000-20,000/yr offer: - All Services Level 1 - Designated USET contact person - Semi-custom technology sector reports - Discount on Full-custom research - Full access to Technology Data Base

1/4/89

USET

OUTLINE OF STRATEGIC PLAN

USET

- Two Business's
  - Technology Exchange (UPI-UTC)
  - On-Line Technology System (TIC)
- Technology Exchange Business
  - Goal - Improved Results over past - results experience with UPI-UTC - Profitable end of 3 years

    Reasons
    - Licensing environment has changed - new law government RE; Technology Exchange.
    - Government emphasis on achieving Technology Exchange - (huge resource going to waste - U.S competitive position).

government RE; Technology Exchange.

- Government emphasis on achieving Technology Exchange - (huge resource going to waste - U.S competitive position).

- Internal Network Electronic System (TIC)
  - Easy identification of Technologies
  - Universities, GKSS, BTG, INRA, DTE

- Identification of Possible Licensees
  - SBIR Companies
  - Wootten Data Base
  - UPI's Contacts
  - Others (Corptech, other Maxwell Companies (Orbit, BBI, BRS)

The Electronic Internal System would allow licensing executives easy access to technology available for licensing and possible licensees.

- Review stream line existing processes must find more efficient method of identifying, contacting, securing licensees.

- Expand the Out Research System which exposes licensable technology to industry.

licensable technology to industry.

- The following are some possibilities which should be considered:

  - NERAC
  - Inside R&D
  - Dvorkowitz
  - BBI - BRS - ORBIT
  - Patterson
  - Agents
  - Cottage Industry - Other Technology Exchange organizations (J.V. - Royalties Splitting Agreement)



  (Would provide the executive summary, coded for Technology creator, USET contact).

- <u>New Clients</u>

  - Air Force, Florida, etal

The expansion of the Technology Data Base by the addition of new clients dictates that Internal Data Base System and an improved licensing process is implemented.

implemented.

3

Other Technology on Data Base

- o NTIS
- o California (Wootten)
- o Government Labs
- o Alliance Universities
- o Other Universities
- o NTIS - etc.

This is a major consideration and requirement for entering the Technology Data Base business. Latker feels we are in best position to access University Technology. The additional technology will give us a critical mass which would provide an attractive saleable product. (See Chart).

- o We must work out compensation basis with non client universities. (Some how industrial inquires must flow back thru USET in order to get credit. Is coding practical?) Ideally the compensation would be a percent of the licensee fee. (Wootten has indicated that the California universities would be interested in this approach).

4

- Also, if the alliance is successful, we could have three categories of university licensable technology (regular clients, alliance and other, all which could have different compensation formulas.

- Data Base Business

  - The size of Data Base + $1.0B from UPI - UTC universities + $1.0B California Schools + $1.0 billion other universities, government labs, GKSS, INTRA, etal) plus NTIS information would allow USET to;

  - Change an annual retainer for location specific technology for various companies. (1,000 - 2,000 corporations at ± $7,500 per year $5,000,000 - $10,000,000).

  - Other USET Services

    - SBIR - this "Service" would provide three significant opportunities for Business Improvement;

      - Universities are pleased because SBIR chances enhances the possibility of their technology being licensed.

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5

- Enhances our chance of a "Big Hit" as we could get equity position for our services.

- Cost reductions - patent cost would be funded thru SBIR versus USET.

- Directory University - would enhance our image plus generate some income.

- Magazine - News Letter (must be investigated - lots of competition).

- Conferences - (BBI &- BRS could be involved).

TIC - On-Line System

- Government Lab System

  - Off-line technology management system (Ala-Hart)

    - Must get 4-5 more government labs committed.
    - Pricing must be developed for off-line service.

6

- On-line Technology Exchange - the off-line system would provide the technology information for inclusion in the TIC - Technology Exchange System.

- Alliance - Universities

- Corporate Subscription's - This would gravitate from the off-line data base service.
- Foundations
- Vendors

A detailed strategic plan must be developed which would run parallel to and would inter-relate to the Technology Exchange Business (continuation of UPI-UTC business).

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Technex (est. 1972)
The Annual World Fair For Technology Exchange

Dr. Dvorkovitz & Associates

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Balancing the Science-Funding Equation

12/20/88 WSJ

By FRANK H.T. RHODES

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Yet, in view of the political uproar precipitated by the decision to build the superconducting supercollider in Texas and of the multitude of other megaprojects waiting in the wings, there is one limited but vital way in which the U.S. must begin to manage research. The U.S. must develop a rational system for choosing among worthwhile projects and determining appropriate levels of funding if the nation is to reap maximum benefit from the $62 billion the federal government is now spending on science and technology.

Is the superconducting supercollider, at a total cost of $4.4 billion, as important as a more modest expenditure on research fellowships for graduate students? Is the space station more valuable than an effort to map the human genome? How do you balance the need to upgrade university research facilities, the total cost of which might be as much as $20 billion, against expanded programs to combat AIDS, which might carry an almost identical price tag? Making choices is never easy; yet, given the wealth of research ideas and the paucity of funds in federal coffers, we can ill afford not to choose.

President-elect Bush acknowledged the priority of science and technology during his campaign. In putting his own stamp on the new administration during the transition period, he has a golden opportunity to bring coherence to the nation's science and technology policy, a coherence that has been lacking for much of the past 20 years. His appointment of MIT-trained engineer-turned-governor John Sununu as chief of staff may help him reach that goal.

As a contribution to what I hope will be a continuing debate in Washington over the next few months, let me suggest a three-pronged approach that could provide a mechanism for choosing among the many worthwhile science and technology projects now competing for federal funds:

First, President-elect Bush should follow through with his campaign promise to upgrade the president's science adviser to assistant to the president and give that person an active role in economic policy and national-security planning. Such a move would again give science and technology the priority in the White House it once enjoyed.

A strong assistant to the president for science and technology is a necessary component of effective national science policy, but not all that is needed. The second element should be a standing advisory commission on science and technological priorities, whose members would be drawn from the scientific, academic, industrial and defense communities and would be chosen for the breadth of their knowledge and experience in science and science policy. The group could serve as a Presidential Council on Science and Technology, as the president-elect has suggested.

Such a commission would solicit the opinions and insights of all interested groups, devise criteria for selecting among various types of science and technology projects, and recommend priorities.

Finally, Congress should form a House-Senate Joint Coordinating Committee to expedite congressional deliberations on science and technology policy, which now fall within the jurisdictions of some 100 different committees and subcommittees. A Joint Coordinating Committee could work out differences in funding priorities with more objectivity and knowledge than is now the case, and its reports could provide Congress as a whole with concise and informed advice on which to base a national science and technology funding plan.

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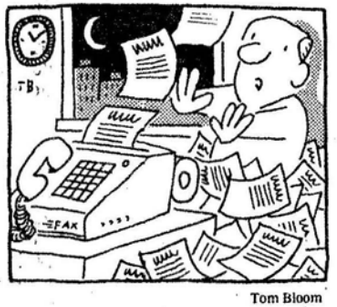

Tom Bloom

High-Tech Junk Mail

After installing a facsimile machine, many offices soon discover a byproduct of this high-tech communications form — junk fax mail. When a facsimile machine is left on, anyone with access to the machine's telephone number is free to send documents to the machine, just as anyone with access to a postal address can send mail there.

Now Digital Publications of Norcross, Ga., has come up with a program and a data base that can be used with a specially equipped personal computer to send press releases en masse by facsimile machine. Late at night, when telephone long-distance rates are lowest, the computer and its facsimile-machine circuit board will automtically dial telephone numbers all over the country, sending out news releases.

Executives of Digital Publications contend that after 11 P.M. their system can deliver a news release for 10 cents. They said that a news release sent through the mail costs about 80 cents. Mail rates keep going up, of course, and delivery can take two or three days, or longer.

The Digital Publications system data base has 5,000 names and addresses of newspapers, broadcast stations, trade magazines and writers. Also — and this is crucial — it has each outlet's fax number.

But the new technology must still overcome the same hurdle that confronts the old technology of sending an envelope through the mails — getting the recipient to read the material.

Hopkins Spurs Economic Development

By Nancy Myers
STAFF WRITER

The Dome Corp., the real estate and new venture development subsidiary of Johns Hopkins University and the Johns Hopkins Health System, is working hard to promote economic development for the university and in the technology community.

Last month, Dome formed Triad Investors Corp., a company to transfer and commercialize technology, and Cartermill Inc., a joint venture with a British company to market a data base of U.S. university research resources. Dome is seeking a higher profile for its programs and the university in the local and international technology communities.

Founded in 1984, the Dome Corp.'s mission is to strengthen the financial position of Johns Hopkins University and Health Systems through real estate development and for-profit business ventures. The company's biggest project until now has been development of the Bayview Research Campus in Baltimore, a 130-acre mix of office, research and production space for biotechnology firms and JHU programs. But the two latest spin-offs have shown Dome's interest in branching out beyond the university into the technology community.

"I think we're becoming a lightning rod in a sense that will help attract and nurture business...in the area in other ways," says Triad President and Chief Executive Leigh Abts.

Triad will be funded by $10 million, including at least $8 million from private industry partners and $1 million each from the university and from the Johns Hopkins Health System. Triad will then invest up to $1 million to commercialize research conducted by researchers from JHU, other universities and small companies. About one-third of Triad's projects could be outside the university, Abts says.

"We're a for-profit entity that is sensitive to the academic environment," he says. Historically, university researchers and small business scientists are reluctant to work on commercialization, but Triad's resources will help ease the transition.

"In this area...there's been a need here for a more proactive role by the Johns Hopkins family," Abts says. "Triad was conceived to be a bridge between the academic and corporate communities."

Federal technology-transfer legislation over the past few years gave impetus to Triad's founders, he explains, because of the innovative ways federal laboratories are encouraged to commercialize technology.

Research projects expected to be commercialized first include development of a vision enhancement system with a video screen instead of lenses for those with seriously impaired vision; erasable optical disc switch technology, a less costly process to erase and rerecord videos and compact discs; and a jet-injector system to replace hypodermic needles.

Triad's projects will be managed by Abts, a business team, and a scientific advisory group, as well as industry leaders and Dome officials.

Another recent Dome Corp. venture is the BEST America data base, modeled after a successful British data base, to maintain information from most of the 300 to 500 research-oriented institutions among the 3,000-plus U.S. universities. The data base will be produced by Cartermill Inc., a joint venture of the Dome Corp. and Addison-Wesley Longman Group Ltd., London, which founded the BEST Great Britain data base in 1985.

"There's a need for this because there's nothing like this," says Kenneth Blaisdell, Cartermill president and CEO. "There's a need to understand what resources are available."

Blaisdell, who was most recently assistant provost for research development at Johns Hopkins, says the data base is different from the networks connecting many universities: the BEST America data base expects to be a comprehensive listing of all research-oriented universities; and the service will be available to users outside the university, including corporations and federal laboratories.

When agreeing to become part of the data base, each university receives a copy of its data base of faculty and staff expertise, special facilities and services and doctoral-student resources. Hopkins and Rensselaer Polytechnic Institute are two of the first to join. Information from the universities will be marketed throughout Europe, the United States and Asia.

The BEST data base, which offers more than 22,000 records representing every British university and polytechnic, boasts a 90 percent resubscription rate. That's largely because of the data base's unique service, says Michael Tobert, Cartermill managing director and a founder of the BEST data base.

Corporate subscriptions allow unlimited on-line access to either or both data bases. In Great Britian, a year's unlimited subscription to the British data base is about 10,000 pounds; rates would be comparable for the U.S. data base, and higher for both data bases.

Initiative Sights Maryland Manufacturing

By Nancy Myers
STAFF WRITER

Maryland's new initiative to revive the state's flagging manufacturing industry will build on the resource base of area universities, says a top state official.

The initiative, announced at a

"We've got to use the existing higher-education resources to make this work," said Randy Evans, Maryland secretary of economic and employment development. "The decline in manufacturing has got to stop today, here and now."

research centers and productivity and quality analyses for state businesses conducted by the University of Maryland.

Also, the initiative creates an executive response team of state and industry officials to address

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The trade groups that created such a ruckus when the bills were last introduced are likely to speak up this time around, too. But "given the public mood, it should be no surprise if protectionist legislation spreads on both state and federal levels," says Edward N. Constantino, a real-estate partner with accountants Arthur Andersen & Co. in New York.

WASH. POST 12/30/88

Rising Sales for U.S. Industry Predicted for 7th Straight Year

Commerce Dept. Says Export Boom Aiding Firms

By Martin Crutsinger
Associated Press

U.S. industry should enjoy a seventh consecutive year of rising sales in 1989, although at a slightly slower pace than this year, according to the government's annual assessment of winners and losers in American business.

The Commerce Department said that many manufacturing industries, particularly those producing electronics and other advanced technology and capital equipment, will do well in the new year as American producers continue to benefit from a boom in export sales.

"Overall, we expect another good year, the seventh straight of increasing output by both goods- and service-producing industries," said Deputy Commerce Secretary Donna Tuttle.

The projections were made in the 556-page "U.S. Industrial Outlook," which the government has compiled for 30 years. It provides a detailed analysis of 350 manufacturing and services firms.

Tuttle said that more than 70 percent of U.S. manufacturing industries were expected to enjoy rising sales in the new year, with the median growth rate, after adjusting for inflation, projected to be 2.3 percent.

These projections are down slightly from the current year, when the government estimated that a decade-high 82 percent of manufacturing companies enjoyed higher sales, with the median increase put at 2.4 percent.

Tuttle said that the slightly lower figures for 1989 reflected the belief that the nonfarm economy, while not in danger of a recession, will not grow quite as rapidly as it did in 1988.

Overall growth will be held back by some slowing in automaking, steel production and industries that provide goods for construction, which is projected to decline in the new year because of the effects of previous widespread overbuilding in the office and hotel sector.

The services sector of the economy has been experiencing the biggest growth in recent years. That was projected to continue in 1989.

Some of the service standouts will be in the fields of data processing, computer services and electronic data bases, where revenues are projected to rise by between 13 percent and 20 percent, the report said.

The services category with the biggest projected percentage increase is space commercialization, where revenues are forecast to rise by 50 percent to $2.7 billion as the commercial launch industry in the United States begins its first year of operation.

Computer software sales are expected to rise by 24 percent, giving it the No. 2 spot in the services category, followed by sales of electronic databases, up 20 percent; and com-

See OUTLOOK, B3, Col. 1

Rising Sales for U.S. Industries Expected for 7th Consecutive Year

OUTLOOK, From B1

puter professional services up 15.5 percent.

In the manufacturing sector, the star performer is expected to be the metal-cutting segment of the machine tool industry, with shipments projected to rise by 13.9 percent.

This reflects the push by U.S. industry to expand and modernize production facilities to meet rising demand from a boom in export sales, Tuttle said.

The No. 2 manufacturing industry will be semiconductors, with a projected 13.4 percent rise in shipments, followed by a 13 percent increase in papermaking machinery, reflecting a rush to expand facilities in an industry operating at 95 percent of capacity.

Many of the manufacturing sectors expected to perform the most sluggishly were tied to the construction industry. Sales of chemical preparation were projected to drop by 14.6 percent, the biggest overall decrease. Sales of household cooking equipment were forecast to decline by 7.9 percent, reflecting an expected decline in construction of new homes next year.

Demand for steel products are forecast to fall by 6.9 percent in 1989, reflecting a drop in demand for steel girders in construction.

Among the other points made by the report:

- Aerospace, one of the largest manufacturing industries, will show a modest overall growth rate as demand for civilian aircraft goes up while deliveries of military aircraft taper off.
- Car sales will decline by about 1 percent to 10.6 million units with the share of sales held by manufacturers in Canada and the United States holding steady at about 72 percent.
- The banking industry, despite continued problems with international debts and stiff competition from nonbanking financial companies, will show good growth with assets rising by about 7 percent.
- Airlines will have another strong year with revenues rising by more than 14 percent. Trucking revenues will rise 7 percent while revenues earned by railroads will increase 2 percent.
- Health and medical services will show a sharp 10.7 percent increase to an estimated $618 billion in 1989, as this sector continues to be one of the fastest growing in the services industry.

Business Day

The New York Times

A Supercomputer in Every Pot

Network Is Planned For Broader Access

By JOHN MARKOFF

Computer scientists and Government officials are urging the creation of a nationwide "data superhighway" that they believe would have a dramatic economic impact, rivaling that of the nation's interstate highway system.

This highway would consist of a high-speed fiber-optic data network joining dozens of supercomputers at national laboratories and making them available to thousands of academic and industry researchers around the country.

Vital Competitive Tool

A national research network is vital, backers of the concept say, because it will help protect an important area where the United States now has a clear technological advantage over Japan and Europe.

America's lead in computer networking is largely a result of Pentagon financing in the mid-1970's for Arpanet, a system that linked universities, corporate research centers and military laboratories.

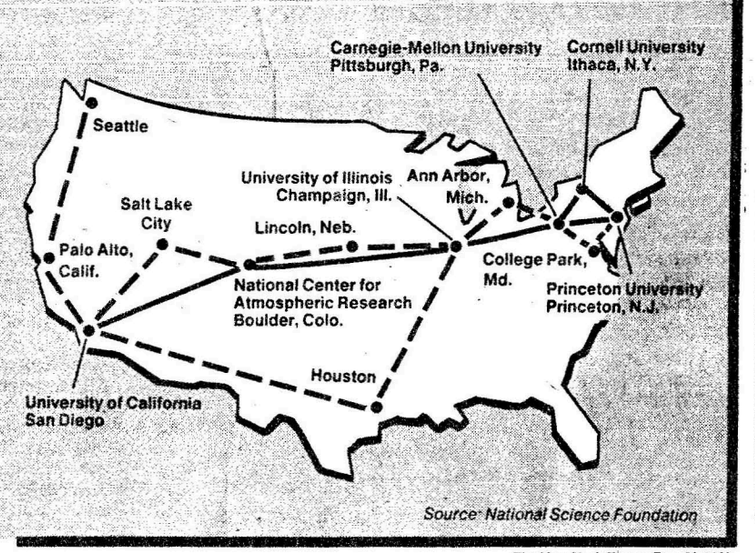
The new network would cost about $400 million and could be in place by the mid-1990's, its proponents say. Many existing high-speed networks can send 1.5 million bits of data a second, equivalent to one good-sized novel every five seconds. Each second the new network could carry 3 billion bits of data, or 3 gigabits — about 500 copies of that hefty novel.

New Kind of Research

Legislation introduced in October by Senator Albert Gore, Democrat of Tennessee, included initial financing for development and construction of a National Research Network. Backers of the measure say that Federal financing for the project is necessary to develop the technology and convince industry that vastly speedier computer networks are commercially viable.

A Proposed Data Superhighway

Existing and proposed supercomputer network. The network will link supercomputers and regional networks.



The New York Times/Dec. 29, 1988

The network would pave the way for a new kind of scientific research in which thousands of scientists around the country could use the most complex and expensive equipment as if they were seated right in front of it.

Officials at the National Science Foundation envision computerized "collabatories" in which scientists using computer work stations could directly view and control the output of complex machines, such as particle accelerators, wind tunnels, telescopes and nuclear reactors, even though they were thousands of miles from the actual apparatus.

"I believe we can make an electronic laboratory in which people can collaborate and access information, effectively independent of location," said William Wulf, an assistant director of the National Science Foundation. "You'll never replace eyeball-to-eyeball communication, but you can substitute a lot."

For example, a fiber-optic computer network would permit astronomers using a radiotelescope array in California to process the images on a Cray supercomputer in Illinois and then view pictures instantly, while at the same time controlling the telescope remotely from locations in both California and Maryland.

However, proponents of the idea note that putting it in place requires development of new fiber-optic communication links that are thousands of times faster than today's commercially available networks. All this could take as long as five years.

Fiber-optic networks, based on glass strands roughly the size of a human hair, use pulses of laser light

Continued on Page D4

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Continued on Page D4

A Supercomputer in Every Pot

Continued From First Business Page

instead of electricity to send computer data. They permit hundreds or thousands of simultaneous computer conversations by packaging each message into small packets consisting of 1's and 0's.

Because messages are broken up into packets, many of them can be simultaneously interwoven onto a single fiber cable and then recombined as separate messages at the other end. High-speed fiber-optic cable is already used widely for voice and video applications, but data applications have lagged until now because further technological developments are still necessary.

Electronic 'Handshakes'

Researchers say they still need to develop special computer switches capable of handling the high rates of data and perfect the necessary high-speed electronic "handshakes" that one computer must make with another when data are exchanged. But the experts believe these tasks will not be difficult to accomplish within five years.

When the Pentagon's Defense Advanced Research Projects Agency built the Arpanet network, it paved the way for the industry that links commercial computers.

However, many researchers point to big government-financed high-speed computer networking projects now under way in both Japan and Europe. They are concerned that without a coordinated response United States industry will be in danger of losing its lead in developing the next generation of technology.

"It's possible that if we simply let a completely self-motivated marketplace develop our data communications infrastructure for the future it will be either inferior to what is being developed in Japan or Europe or owned by companies in Japan and Europe," said Russell Neuman, a political scientist at the Massachusetts Institute of Technology Media Lab.

Difficult to Put to Use

One continuing problem that worries researchers is that in the past it has proved difficult to put the technology to use.

"Many times the technology has been there but there doesn't seem to be a path for transferring it from the research laboratories to the commercial market," said David Farber, a computer scientist at the University of Pennsylvania. "We want to show the commercial side that there is a use for this technology."

The proposed network would serve as a demonstration project to encourage private industry to develop similar super-fast commercial data links.

"The infrastructure we will need in the 21st century goes beyond traditional public works projects," Senator Gore said. "I envision a national computer network linking academic researchers and industry, using the nation's vast data banks as the raw material for increasing industrial productivity and creating new products."

Until now, supercomputers — which are increasingly essential for scientific and technical progress — have largely functioned as computing oases, isolated from thousands of potential users. The idea underlying the construction of a high-speed network is based on what economists refer to as the "turnpike factor." Modern highway interchanges have been found to attract traffic simply by their existence.

"We want to eliminate distance as a factor," said Robert Haber, a mechanical engineer who directs a high-speed networking project at the National Center for Supercomputer Applications at the University of Illinois at Urbana-Champaign. "You can compare this to the kind of things that happened in the 50's in the United States. We need a project of the scale of a National Highway Project for computer information."

Thousands of researchers could share a nationwide network.

Researchers also believe that an initiative to build a national system is essential because existing networks are badly overloaded, causing the equivalent of computer traffic jams.

"We have 2,000 users who need to transfer huge amounts of data, and the current networks aren't set up for that," said Steven Christensen, an astrophysicist at the National Center for Supercomputing Applications. "There is already a large bottleneck for many of those who want to use our machines from remote cities."

During the last two years the National Science Foundation has attempted to alleviate some of the worst overcrowding by establishing a new research network known as Nsfnet. In July, a 1.5-megabit-per-second expansion of that network, which links the five national supercomputing centers with about 200 universities, was installed.

Stopgap Measures

However, such incremental increases in speed are viewed as only stopgap measures. Senator Gore's bill provided for a network that sat at the top of a hierarchy of existing networks now operated by different Government agencies, like the Energy Department, the Defense Department and the National Aeronautics and Space Administration. The smaller branches would feed into the faster N.S.F. network just as smaller streams feed into a large river.

Once the gigabit network is in place, researchers will be able to begin developing new applications.

For example, Hellmut Golde, a computer scientist at the University of Washington, is beginning to work out a way to control complex instruments over a high-speed network. He is working with a nuclear physicist at the University of Washington who is interested in permitting students at different campuses to share a training reactor. These training systems are scarce, and Mr. Golde's idea is to re-create the control room for such a system at several locations.

He acknowledged that advances in computer security would have to be made before a nuclear reactor would be accessible on a computer network.

Researchers at campuses around the country have already begun planning regional high-speed networks that will offer a preview of some of the services of the future gigabit network. Scientists at the University of Pennsylvania and Princeton and researchers at I.B.M.'s Watson Research Laboratories have proposed a fiber-optic network to link the three research centers. Named the Hourglass Project, the network would permit medical specialists at Princeton and Penn to share high-resolution X-rays or other radiological images.

'Video Wall'

The network would also make possible a "video wall," a video conference system with extraordinary resolution. Such a system would in many ways permit researchers to interact as if they were seated in the same room even though they were actually separated by hundreds of miles.

Another proposal by the Corporation for National Research Initiatives in Reston, Va., calls for the creation of a digital library, a computer data base that would permit vastly improved access to information for researchers and students. "From any work station you should be able to specify a document if it exists anywhere in the country and then view it directly," said Robert Kahn, president of the corporation. Mr. Kahn, a former director of the Defense Advanced Research Projects Agency, has been a key sponsor of the idea of creating a gigabit network to link research centers and universities.

Technology for creating such a national library is one area where Japan may be ahead of the United States. Researchers at Japan's National Center for Science Information Systems are well on their way toward putting the entire scientific literature of the country on-line.

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Tom Bloom

High-Tech Junk Mail

After installing a facsimile machine, many offices soon discover a byproduct of this high-tech communications form — junk fax mail. When a facsimile machine is left on, anyone with access to the machine's telephone number is free to send documents to the machine, just as anyone with access to a postal address can send mail there.

Now Digital Publications of Norcross, Ga., has come up with a program and a data base that can be used with a specially equipped personal computer to send press releases en masse by facsimile machine. Late at night, when telephone long-distance rates are lowest, the computer and its facsimile-machine circuit board will automtically dial telephone numbers all over the country, sending out news releases.

Executives of Digital Publications contend that after 11 P.M. their system can deliver a news release for 10 cents. They said that a news release sent through the mail costs about 80 cents. Mail rates keep going up, of course, and delivery can take two or three days, or longer. .

The Digital Publications system data base has 5,000 names and addresses of newspapers, broadcast stations, trade magazines and writers. Also — and this is crucial — it has each outlet's fax number.

But the new technology must still overcome the same hurdle that confronts the old technology of sending an envelope through the mails — getting the recipient to read the material.

Hopkins Spurs Economic Development

By Nancy Myers
STAFF WRITER

The Dome Corp., the real estate and new venture development subsidiary of Johns Hopkins University and the Johns Hopkins Health System, is working hard to promote economic development for the university and in the technology community.

Last month, Dome formed Triad Investors Corp., a company to transfer and commercialize technology, and Cartermill Inc., a joint venture with a British company to market a data base of U.S. university research resources. Dome is seeking a higher profile for its programs and the university in the local and international technology communities.

Founded in 1984, the Dome Corp.'s mission is to strengthen the financial position of Johns Hopkins University and Health Systems through real estate development and for-profit business ventures. The company's biggest project until now has been development of the Bayview Research Campus in Baltimore, a 130-acre mix of office, research and production space for biotechnology firms and JHU programs. But the two latest spin-offs have shown Dome's interest in branching out beyond the university into the technology community.

"I think we're becoming a lightning rod in a sense that will help attract and nurture business...in the area in other ways," says Triad President and Chief Executive Leigh Abts.

Triad will be funded by $10 million, including at least $8 million from private industry partners and $1 million each from the university and from the Johns Hopkins Health System. Triad will then invest up to $1 million to commercialize research conducted by researchers from JHU, other universities and small companies. About one-third of Triad's projects could be outside the university, Abts says.

"We're a for-profit entity that is sensitive to the academic environment," he says. Historically, university researchers and small business scientists are reluctant to work on commercialization, but Triad's resources will help ease the transition.

"In this area...there's been a need here for a more proactive role by the Johns Hopkins family," Abts says. "Triad was conceived to be a bridge between the academic and corporate communities."

Federal technology-transfer legislation over the past few years gave impetus to Triad's founders, he explains, because of the innovative ways federal laboratories are encouraged to commercialize technology.

Research projects expected to be commercialized first include development of a vision enhancement system with a video screen instead of lenses for those with seriously impaired vision; erasable optical disc switch technology, a less costly process to erase and rerecord videos and compact discs; and a jet-injector system to replace hypodermic needles.

Triad's projects will be managed by Abts, a business team, and a scientific advisory group, as well as industry leaders and Dome officials.

Another recent Dome Corp. venture is the BEST America data base, modeled after a successful British data base, to maintain information from most of the 300 to 500 research-oriented institutions among the 3,000-plus U.S. universities. The data base will be produced by Cartermill Inc., a joint venture of the Dome Corp. and Addison-Wesley Longman Group Ltd., London, which founded the BEST Great Britain data base in 1985.

"There's a need for this because there's nothing like this," says Kenneth Blaisdell, Cartermill president and CEO. "There's a need to understand what resources are available."

Blaisdell, who was most recently assistant provost for research development at Johns Hopkins, says the data base is different from the networks connecting many universities: the BEST America data base expects to be a comprehensive listing of all research-oriented universities; and the service will be available to users outside the university, including corporations and federal laboratories.

When agreeing to become part of the data base, each university receives a copy of its data base of faculty and staff expertise, special facilities and services and doctoral-student resources. Hopkins and Rensselaer Polytechnic Institute are two of the first to join. Information from the universities will be marketed throughout Europe, the United States and Asia.

The BEST data base, which offers more than 22,000 records representing every British university and polytechnic, boasts a 90 percent resubscription rate. That's largely because of the data base's unique service, says Michael Tobert, Cartermill managing director and a founder of the BEST data base.

Corporate subscriptions allow unlimited on-line access to either or both data bases. In Great Britian, a year's unlimited subscription to the British data base is about 10,000 pounds; rates would be comparable for the U.S. data base, and higher for both data bases.

Initiative Sights Maryland Manufacturing

By Nancy Myers
STAFF WRITER

Maryland's new initiative to revive the state's flagging manufacturing industry will build on the resource base of area universities, says a top state official.

The initiative, announced at a "We've got to use the existing higher-education resources to make this work," said Randy Evans, Maryland secretary of economic and employment development. "The decline in manufacturing has got to stop today, here and now."

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WSJ 12/21/88

Research Spending in U.S. to Slow in 1989

Group Forecasts 3.4% Rise To $129.2 Billion Level After a 6% Jump in 1988

By RALPH E. WINTER
Staff Reporter of THE WALL STREET JOURNAL

The growth in spending on research and development in the U.S. is slowing at a time when intensified foreign competition suggests a need for accelerated research investment.

Total domestic R&D spending will rise only 3.4% in 1989 to $129.2 billion, the Battelle Memorial Institute estimates in its annual forecast to be released today. Spending will rise 6% this year to an estimated $125 billion, says the technology organization based in Columbus, Ohio.

After adjusting for projected R&D inflation, real outlays will increase about 2% next year, down markedly from the 10-year average of 3.58%, Battelle says.

Corporate R&D executives, however, don't appear overly concerned. They contend that U.S. industry increasingly is using R&D funds and researchers more effectively, compensating for slower growth in actual dollars spent.

Furthermore, most of the slowdown is in government spending, mainly in defense outlays. Company R&D funding will rise 4.5% next year to $63.3 billion, Battelle says, while federal support will edge up only 1.9% to $60.3 billion. Universities and other nonprofit organizations will provide the remaining nearly $5.2 billion.

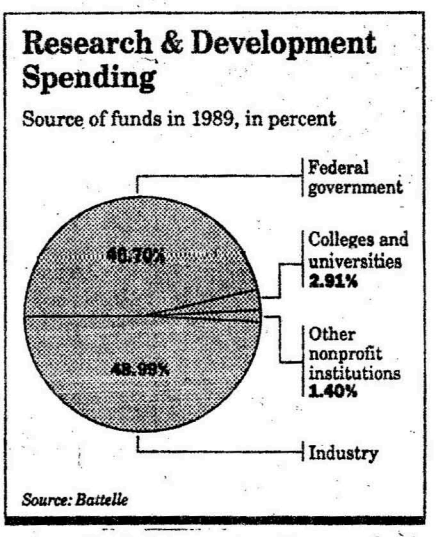
Defense department research spending will decline slightly next year because of pressures to reduce the federal deficit. Nonetheless, the defense department will account for 28% of total U.S. R&D spending next year, and will get 60% of federal research funds.

Spending by the business community is being held down by corporate restructurings and buy-outs, report Battelle researchers and corporate R&D executives. Long-term research frequently is an early casualty when management concentrates on cash flow to pay interest on the heavy borrowing that invariably accompanies a buy-out or major restructuring.

"The rate of increase is lower than we'd like," acknowledges Douglas E. Olesen, Battelle's president and chief executive officer. Still, he maintains the planned spending level for 1989 represents "a healthy level of investment in technology" and shouldn't trigger "any great cause for concern."

Some other executives express concern. "We in North America clearly are losing the technological race," asserts David J.H. Smith, vice president, research, for BP America Inc., the North American unit of British Petroleum Co., London.

Corporations will perform 71.7% of all the research next year, including a major share of government-funded work. Battelle



of the nation's R&D work, colleges and universities will perform 14.1% and other nonprofit organizations will do 2.8%.

Because of their increased R&D efficiency, U.S. businesses say they expect to offer a broader stream of new products in the next few years despite the spending slowdown. One principal effort under way at most companies is shortening the time—and usually the researcher hours—required to develop a new product.

B.F. Goodrich Co., for instance, is building teams of research, marketing and manufacturing people to push a new product from concept to significant commercial sales in three to four years, instead of the typical seven-to-eight-year cycle. "Each member of the team realizes that his principal responsibility is to get the product out into the market in a timely fashion," says David C. Bonner, vice president, R&D, for the plastics, specialty chemicals and aerospace concern.

"We're more focused," says William D. Wilkerson, vice president and technical director for Parker Hannifin Corp., a Cleveland-based producer of hydraulic and other motion control products.

Accelerated use of computers also is helping to increase productivity of R&D staffs. "A lot of the drudgery work is done on personal computers and workstations," says Alben Warf, vice president, engineering and manufacturing, for Diebold Inc., Canton, Ohio, a maker of automatic teller machines and other equipment.

At Eastman Kodak Co., scientists use computer simulations in place of certain experiments, says Roger Cole, director of research management resources. "Sometimes we can run a fourth of the experiments and let computer calculations do the rest," he says.

Further, companies are getting more R&D for their buck by applying to the research department some of the just-in-time inventory and quality-control concepts developed in the manufacturing plant. Says Parker Hannifin's Mr. Wilkerson: "We can design a new product with some assurance that it will work the first time," eliminating a lot of trial and error.

a better job of transferring technology, both within their own organizations and in seeking solutions from outside the company. A huge amount of research time in any company is spent solving problems that someone in another division or company has already solved. TRW Inc., for example, employs in its world-wide automotive parts operations a significant amount of technology developed by its West Coast electronics and aerospace units, says Arden Bement, vice president, technical resources.

Corporate R&D specialists say these improvements in efficiency would come more easily if more Americans would train to be scientists and research engineers. Difficulty in finding chemical engineers, especially those with a Ph.D., limits Goodrich's ability to increase R&D programs, says Mr. Bonner of B.F. Goodrich.

The shortage is understandable, says Mr. Bement of TRW. "Our society is giving greater recognition and rewards to people managing assets than to those creating value" through innovation. As a result, more talented young Americans head for business schools instead of pursuing advanced science or engineering degrees.

Mr. Olesen of Battelle is philosophical about R&D efforts in the U.S. and foreign competition. "Technology is coming from more places than it did formerly," he says. Japan has greatly increased its R&D efforts, he says, adding that Europe will be more of a factor in the future.

Balancing the Science-Funding Equation

12/23/88 WSJ

By Frank H.T. Rhodes

"Managing research" is a contradiction in terms, even worse in its way than "Postal Service" or "airline cuisine." One might as well talk of managing Mozart's composition or Monet's painting or Milton's writing. A basic scientific discovery is just as much a creative masterpiece—unpredictable and unmanageable—as works by these great artists.

Yet, in view of the political uproar precipitated by the decision to build the superconducting supercollider in Texas and of the multitude of other megaprojects waiting in the wings, there is one limited but vital way in which the U.S. must begin to manage research. The U.S. must develop a rational system for choosing among worthwhile projects and determining appropriate levels of funding if the nation is to reap maximum benefit from the $62 billion the federal government is now spending on science and technology.

Is the superconducting supercollider, at a total cost of $4.4 billion, as important as a more modest expenditure on research fellowships for graduate students? Is the space station more valuable than an effort to map the human genome? How do you balance the need to upgrade university research facilities, the total cost of which might be as much as $20 billion, against expanded programs to combat AIDS, which might carry an almost identical price tag? Making choices is never easy; yet, given the wealth of research ideas and the paucity of funds in federal coffers, we can ill afford not to choose.

President-elect Bush acknowledged the priority of science and technology during his campaign. In putting his own stamp on the new administration during the transition period, he has a golden opportunity to bring coherence to the nation's science and technology policy, a coherence that has been lacking for much of the past 20 years. His appointment of MIT-trained engineer-turned-governor John Sununu as chief of staff may help him reach that goal.

As a contribution to what I hope will be a continuing debate in Washington over the next few months, let me suggest a three-pronged approach that could provide a mechanism for choosing among the many worthwhile science and technology projects now competing for federal funds:

First, President-elect Bush should follow through with his campaign promise to upgrade the president's science adviser to assistant to the president and give that person an active role in economic policy and national-security planning. Such a move would again give science and technology the priority in the White House it once enjoyed.

A strong assistant to the president for science and technology is a necessary component of effective national science policy, but not all that is needed. The second element should be a standing advisory commission on science and technological priorities, whose members would be drawn from the scientific, academic, industrial and defense communities and would be chosen for the breadth of their knowledge and experience in science and science policy. The group could serve as a Presidential Council on Science and Technology, as the president-elect has suggested.

Such a commission would solicit the opinions and insights of all interested groups, devise criteria for selecting among various types of science and technology projects, and recommend priorities.

Finally, Congress should form a House-Senate Joint Coordinating Committee to expedite congressional deliberations on science and technology policy, which now fall within the jurisdictions of some 100 different committees and subcommittees. A Joint Coordinating Committee could work out differences in funding priorities with more objectivity and knowledge than is now the case, and its reports could provide Congress as a whole with concise and informed advice on which to base a national science and technology funding plan.

Such a tripartite system for rational decision-making in science and technology would not diminish the present prerogatives of the executive and legislative branches. The president would still propose, and Congress would still dispose. Public comment could be solicited by the Presidential Council or later in the legislative or executive review process.

But national policy on science and technology would at last be developed from a foundation of thoughtful, informed and impartial advice. Given the growing influence of science and technology on our daily lives and our future prospects, that would be no trivial contribution.

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