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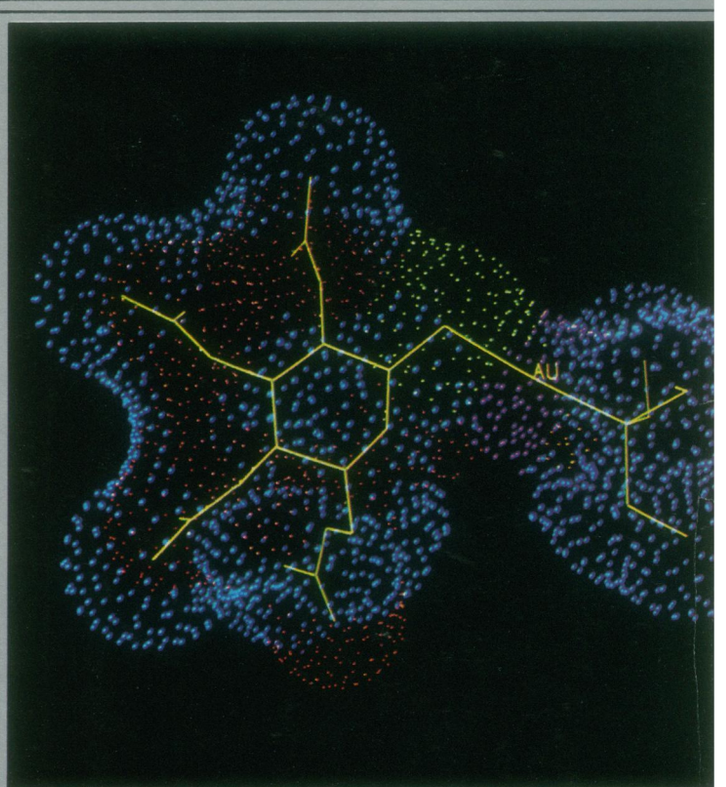
SmithKline

SmithKline Beckman Corporation/World Headquarters



Before SmithKline united with Beckman Instruments to become SmithKline Beckman Corporation, those two world leaders in technology had made independent advances for diagnosis and treatment of rheumatoid arthritis. We now continue our complementary efforts.

Immunology and Therapeutics. The SmithKline research program that yielded our promising oral gold agent now under investigation (above, a computer model of the auranofin molecule) has been extended to study on the molecular level how the body's immune system operates and how changes in immunity may affect autoimmune diseases and alter susceptibility to infection.

Expanding our research programs in

Converging

Beckman

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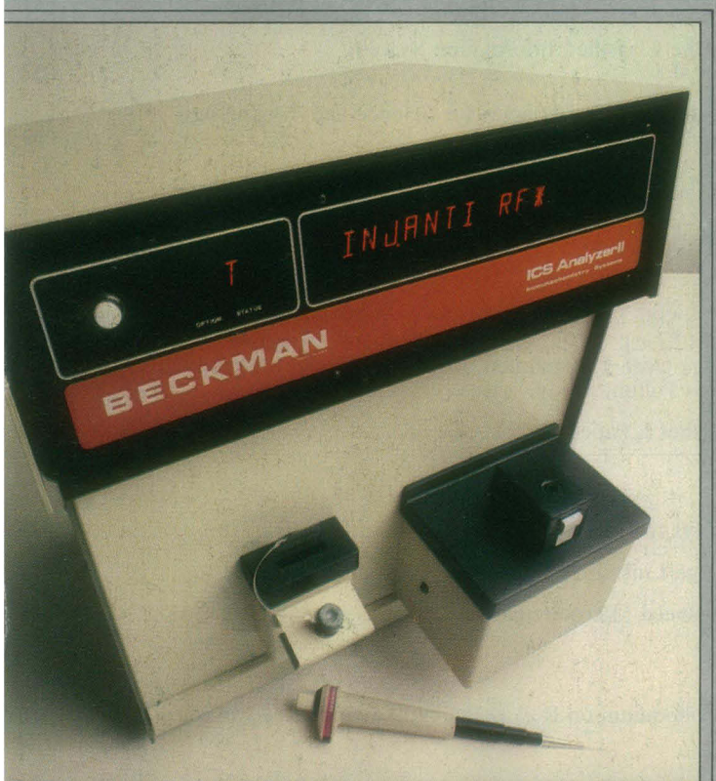

cellular and molecular biology, we are also investigating new aspects of gene regulation and function to develop new therapeutic agents targeted to key cellular macromolecules.

Immunochemistry and Diagnostics. The capabilities of the Beckman rate-nephelometric Immunochemistry System (above) now include precise analysis of the RF protein marker correlative with rheumatoid arthritis.

Advances in our understanding of similar biochemical markers in other diseases promise new opportunities for development of sensitive assay methods and sophisticated instrumentation.

Look into SmithKline Beckman. And look into the future.

Technologies

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SCIENCE

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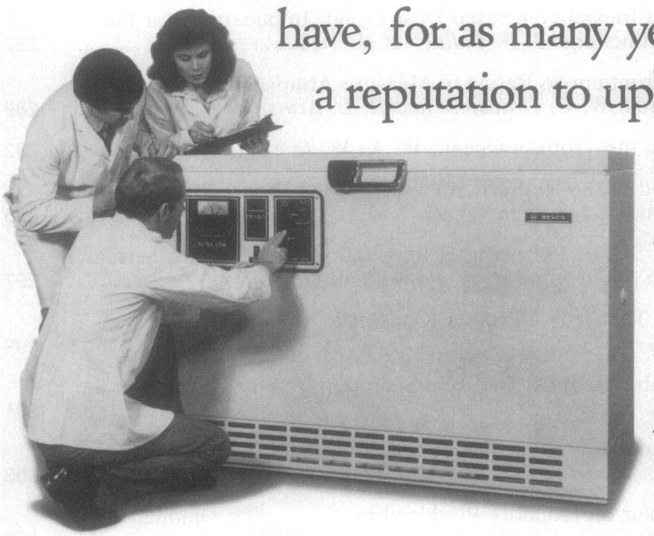
COVER

Tesuque watersheds near Santa Fe, New Mexico, are covered by forests of coniferous Engelmann spruce and deciduous aspen. The spruce apparently quadruples the atmospheric input of strontium to the watersheds by trapping strontium-bearing aerosols, but the trapping by aspen is unmeasurably small. See page 289. [William C. Graustein, Yale University, New Haven, Connecticut 06511]

Our freezers are so much in demand because we demand so much of our freezers.

Only a Marine recruit in boot camp goes through more inspections than a Revco laboratory freezer.

After all, when you've been building as many freezers as we have, for as many years as we have, you've got quite a reputation to uphold. Which may explain why our quality control people take their jobs so seriously.



In addition, Revco is the only company in the industry whose *products* — not just a few electrical components — are listed by Underwriters Laboratories, Inc.

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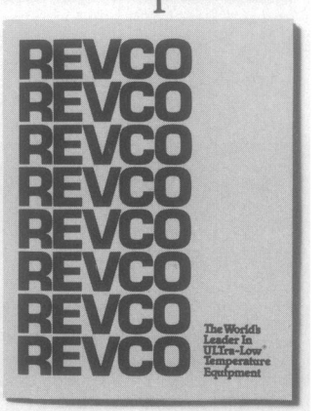

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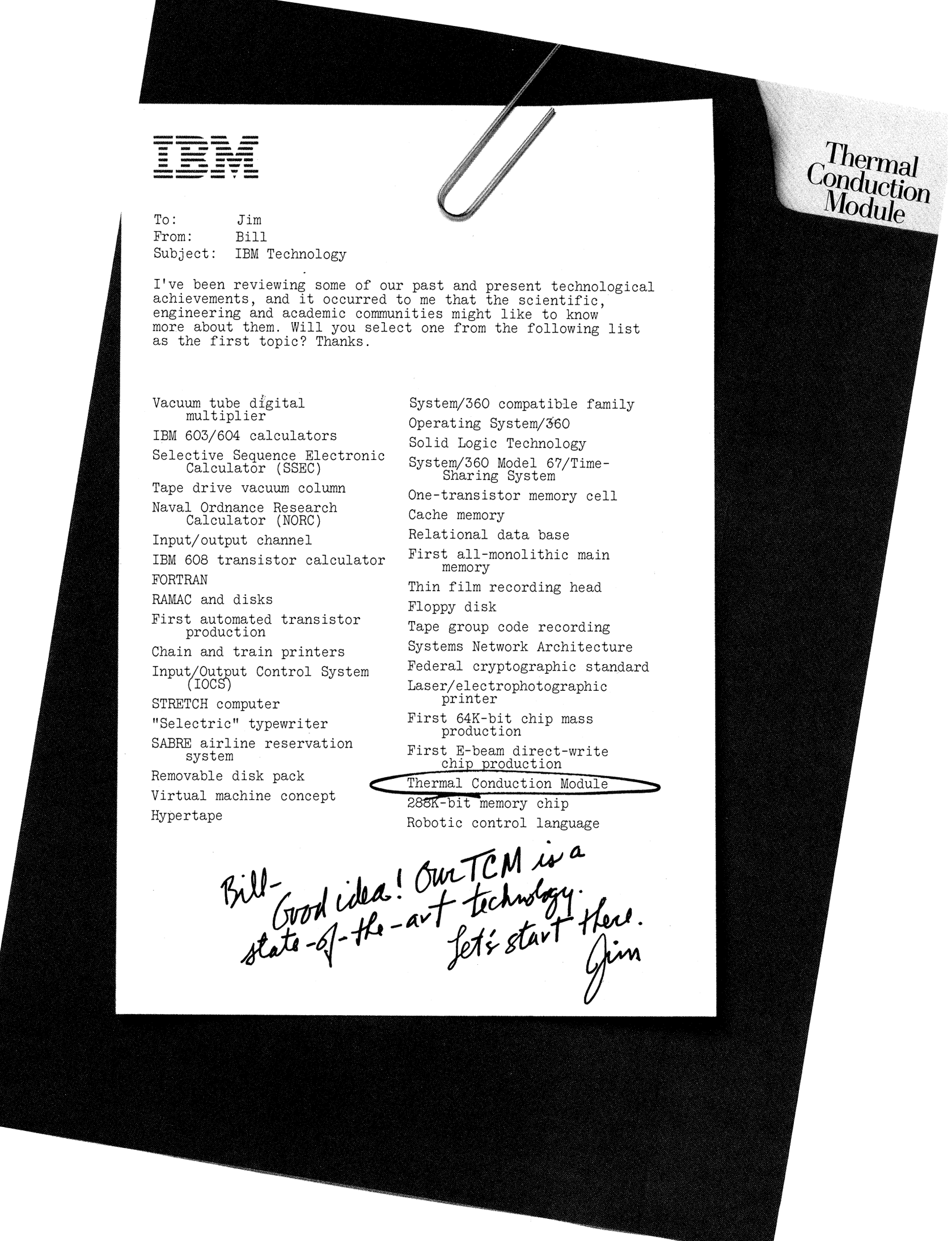


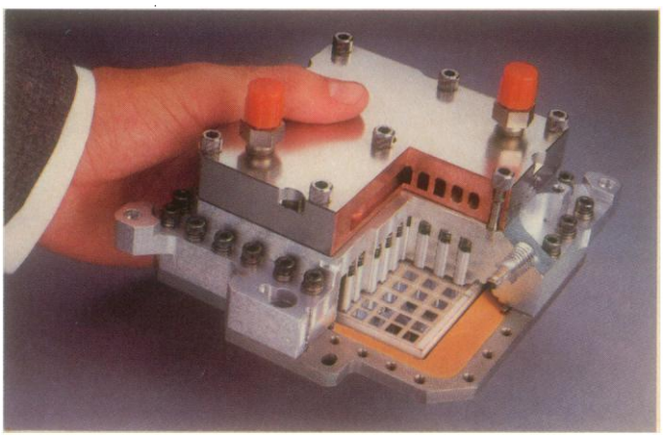
Thermal Conduction Module

To: Jim
From: Bill
Subject: IBM Technology

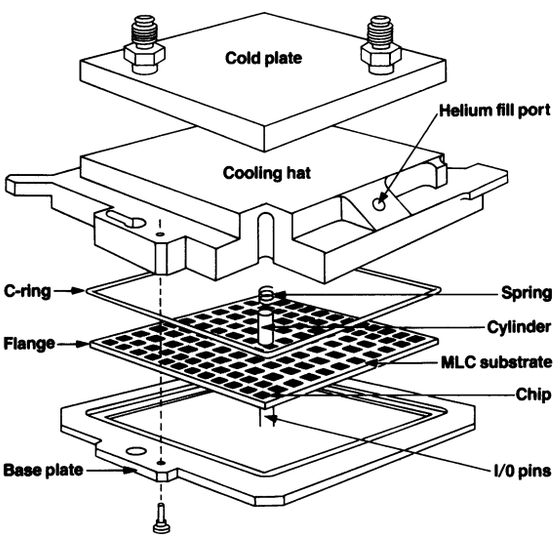
I've been reviewing some of our past and present technological achievements, and it occurred to me that the scientific, engineering and academic communities might like to know more about them. Will you select one from the following list as the first topic? Thanks.

Vacuum tube digital multiplier
IBM 603/604 calculators
Selective Sequence Electronic Calculator (SSEC)
Tape drive vacuum column
Naval Ordnance Research Calculator (NORC)
Input/output channel
IBM 608 transistor calculator
FORTRAN
RAMAC and disks
First automated transistor production
Chain and train printers
Input/Output Control System (IOCS)
STRETCH computer
"Selectric" typewriter
SABRE airline reservation system
Removable disk pack
Virtual machine concept
Hypertape
System/360 compatible family
Operating System/360
Solid Logic Technology
System/360 Model 67/Time-Sharing System
One-transistor memory cell
Cache memory
Relational data base
First all-monolithic main memory
Thin film recording head
Floppy disk
Tape group code recording
Systems Network Architecture
Federal cryptographic standard
Laser/electrophotographic printer
First 64K-bit chip mass production
First E-beam direct-write chip production
Thermal Conduction Module
288K-bit memory chip
Robotic control language

Bill-
Good idea! Our TCM is a state-of-the-art technology. Let's start here.
Jim



Cutaway of TCM (15x15x6 cm) which contains logic and buffer memory equivalent to an IBM System/370 Model 148. Its new packaging, cooling and assembly technology provides IBM's largest computers with the greatest circuit density yet reported.



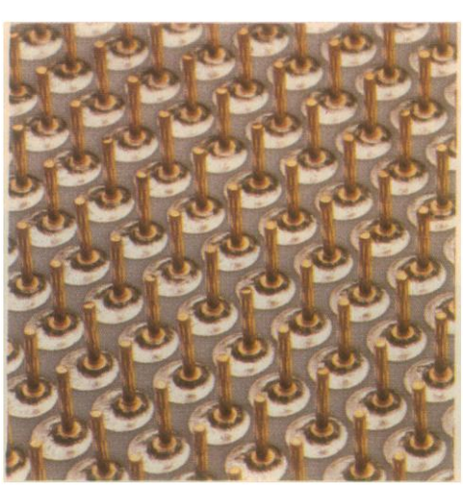
Exploded view of TCM assembly.

The time it takes a signal to travel between circuits is key to a computer's performance. The shorter the distance the signal has to travel, the faster the computer can operate. Shortening the distance requires improving the circuit density of the packaging and interconnections, as well as placing the circuits closer together on the logic and memory chips.

Circuit packaging in IBM's most powerful computers—the 3081, 3083 and 3084—is the densest yet reported in the industry. This has been made possible by our Thermal Conduction Module (TCM) and the way it is combined with a high-performance circuit board.

A TCM holds up to 133 logic and memory array chips on a 90-mm substrate, consisting of 33 layered ceramic sheets. More than 120 meters of wiring within these layers connect up to 45,000 circuits within the TCM. And 1,800 pins are brazed to the substrate bottom to plug the module into a circuit board.

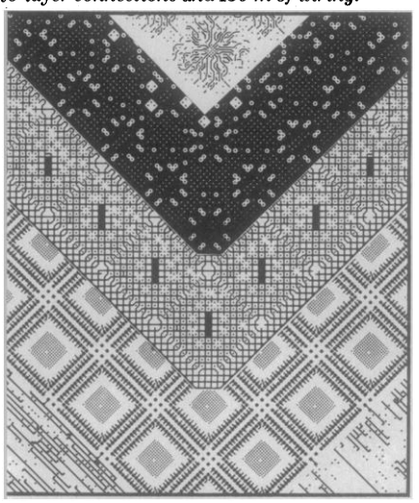
All of this requires computer-aided



Detail of input/output pins brazed to back of multilayer ceramic (MLC) substrate which plug TCM to next level of packaging.

Thermal Conduction Module

Magnified portion of ceramic sheets (0.2 or 0.28 mm thick, unfired), the basic building blocks of the 33-layer MLC. A typical substrate contains 350,000 vias for layer-to-layer connections and 130 m of wiring.



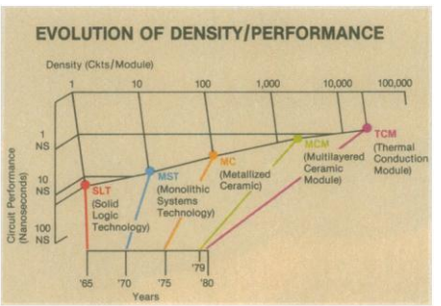
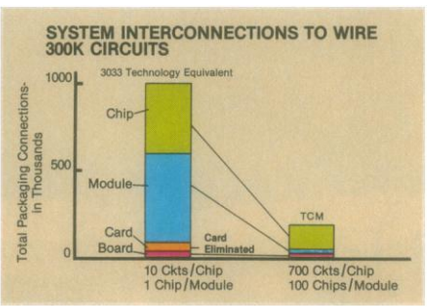


Illustration of TCM's dramatic benefits. Average performance improved more than 20x over 1965 level. Average circuits/module increased from one in SLT to 30,000 in TCM.



Effect of TCM technology on hypothetical 300K circuit system. Circuits/chip and chips/module increased with dramatic reductions of system interconnections and elimination of card-level package. Result is lowered cost, improved performance and reliability.

design techniques and precision manufacturing operations unique to IBM.

Thus "packaged," the chips require a new cooling mechanism to remove the heat created by their unprecedented density. Within the hermetically-sealed TCM, spring-loaded cylinders contact the chips and conduct heat away from them. Helium surrounds the chips and cylinders, providing an inert atmosphere. Its heat-conducting efficiency is approximately six times that of air, and it carries the heat to an aluminum alloy "hat" atop the TCM. The heat is then conducted to a cold plate through which water circulates at 24°C.

The circuit density of the TCM required IBM engineers to develop a high density, high-performance printed-circuit board on which to mount the modules and to provide power and signal paths. This board is the densest yet reported for large-scale manufacturing.

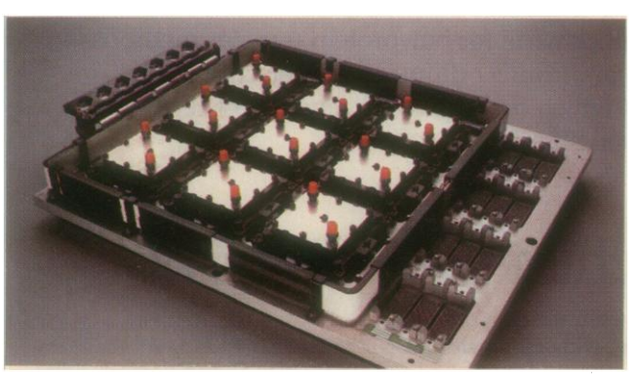
This 600 x 700 mm printed-circuit board contains 20 layers of circuitry, and includes more than one kilometer of wiring. It can accommodate up to six or nine TCMs depending on the board configuration.

Together, the TCM and the circuit board eliminate an entire level of packaging previously required in computers. This combination contains all the functions normally attributed to modules, cards, boards and interconnecting cables in prior technologies.

The circuit density made possible by this new packaging, cooling and assembly technology allows a single TCM to contain as much logic and buffer memory as an IBM System/370 Model 148. Today's large-scale IBM 3081 carries up to 26 TCMs on four circuit boards which contain its complete logic—nearly 800,000 circuits—and displace only four cubic feet.

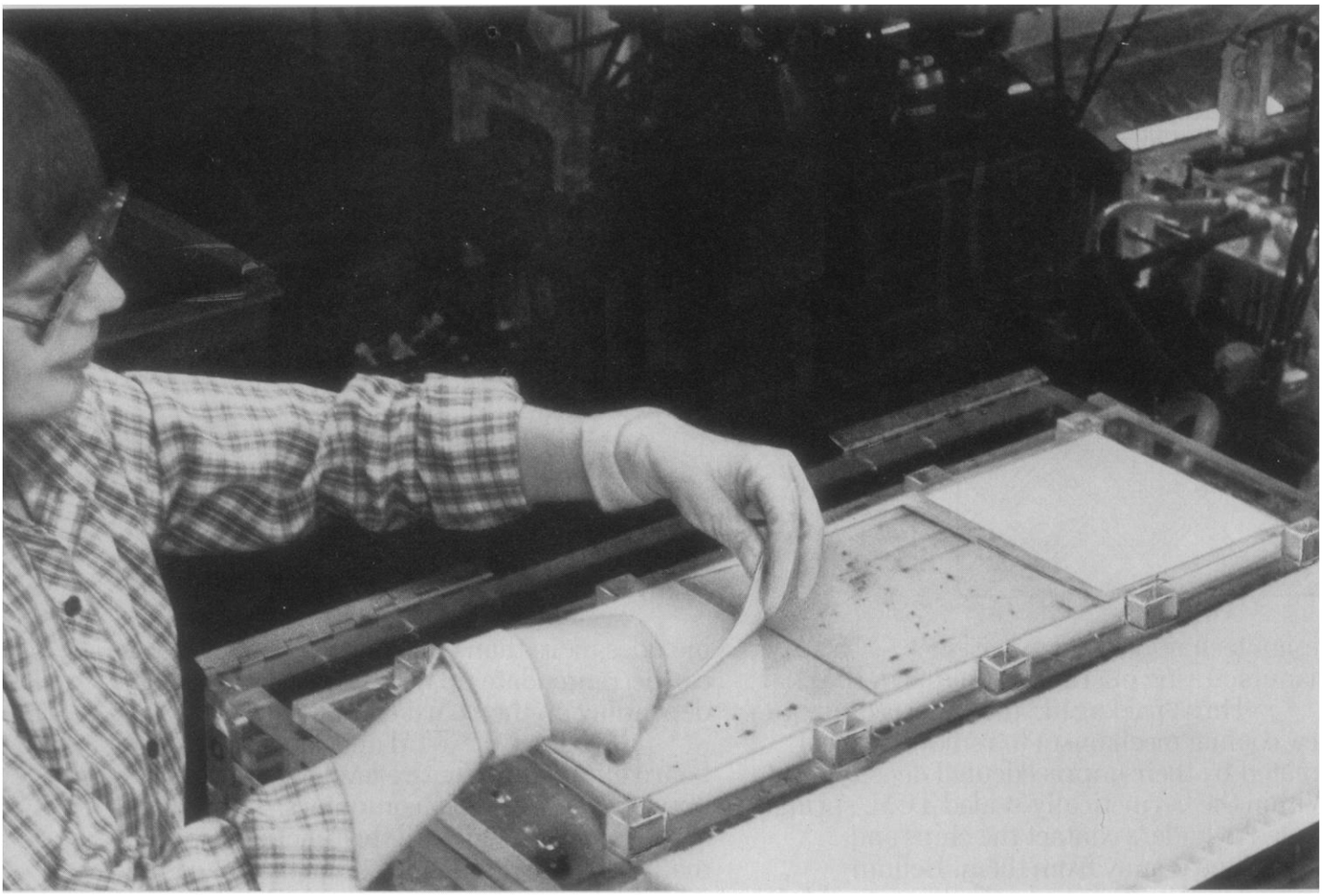
IBM scientists and engineers worldwide have contributed technologies to the TCM. These technologies are all part of our continuing commitment to research and development, funded with more than $8 billion over the past seven years.

IBM®



This 3081 printed-circuit board carries nine TCM's and is, in itself, a major advance in circuit packaging.

A recent issue of the IBM Journal of Research and Development is devoted to the IBM 3081. For a free copy, write: Director of Technical Publications, IBM Corporation, Dept. 500, 44 S. Broadway, White Plains, N.Y. 10601.



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Since it was named as the reference standard in hybridization studies almost 20 years ago, researchers have continually found new uses for S&S BA85 nitrocellulose. Now this versatile medium is used to help investigators transfer and immobilize proteins for identification.

For example, proteins separated using two dimensional electrophoresis can be transferred with BA85 by capillary blotting or by electrophoretic means. Staining reaction with appropriate antibodies and other analytical methods can then be employed for identification.

These exciting new methodologies promise to impact on virtually every area of the life sciences. Researchers are currently analyzing body fluids with the ambitious goal of mapping every protein of human origin. Others are using protein studies in the development of monoclonal antibodies for immunologic work. In basic research, protein analysis helps to identify the translation products of organisms that have undergone genetic manipulation.

In all these areas from pure research through commercial and eventual clinical applications, BA85 makes a vital contribution. And, as with all S&S products, the company's commitment only begins with the product. Full technical support, topical reference literature and a proven willingness to work side by side with scientists to answer special needs are an integral part of the way S&S does business.

Call or write for our protein transfer methods—capillary, contact diffusion and electroblotting—all of which make exciting new use of BA85, the proven standard.

Shown—Preparation for the electrophoretic transfer of multiple Coosmassie blue stained 2-D gel separations of basic human and platelet proteins onto S&S nitrocellulose using DALT electrophoresis system. (Photo courtesy of N.L. Anderson, Molecular Anatomy Program, Division of Biological and Medical Research, Argonne National Laboratory.)

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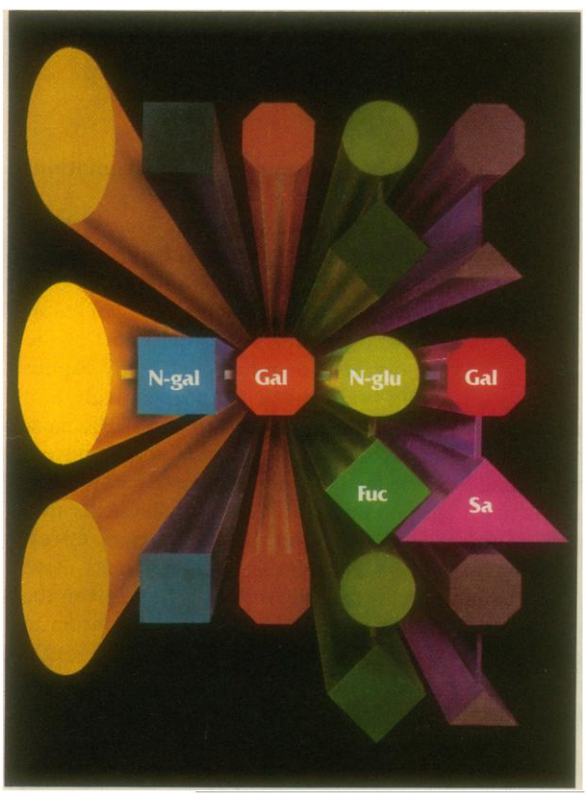

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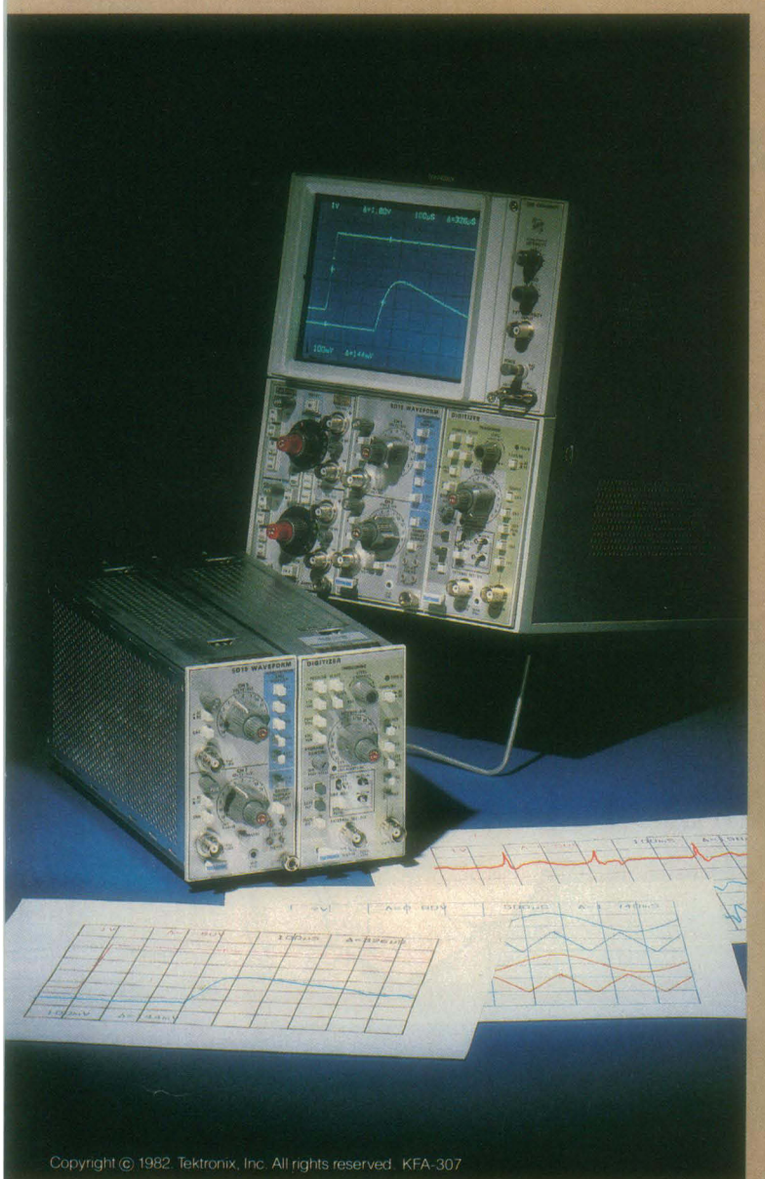

Now you can have the benefits of digital storage by the simple addition of the Tek 5D10 plug-in to any Tek 5000 Series scope. The 5D10 is powerful testimony to the long-term value of Tek's unique plug-in concept: nothing else gives you so much capability at an affordable price.

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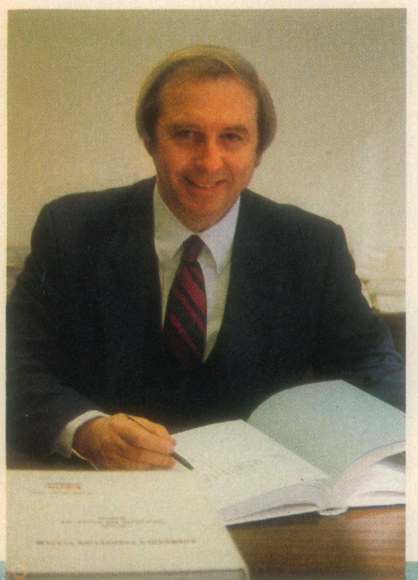
Exxon introduces offshore oil

Joe Burkhardt helped design a production facility that works on the floor of the sea.



Some of the world's untapped petroleum may be trapped in rocks under water too deep for conventional platforms. That's why Joe Burkhardt and teams of Exxon scientists and engineers have pioneered the development of new technology to take production into deeper and deeper waters.

Breaking new ground beneath the sea

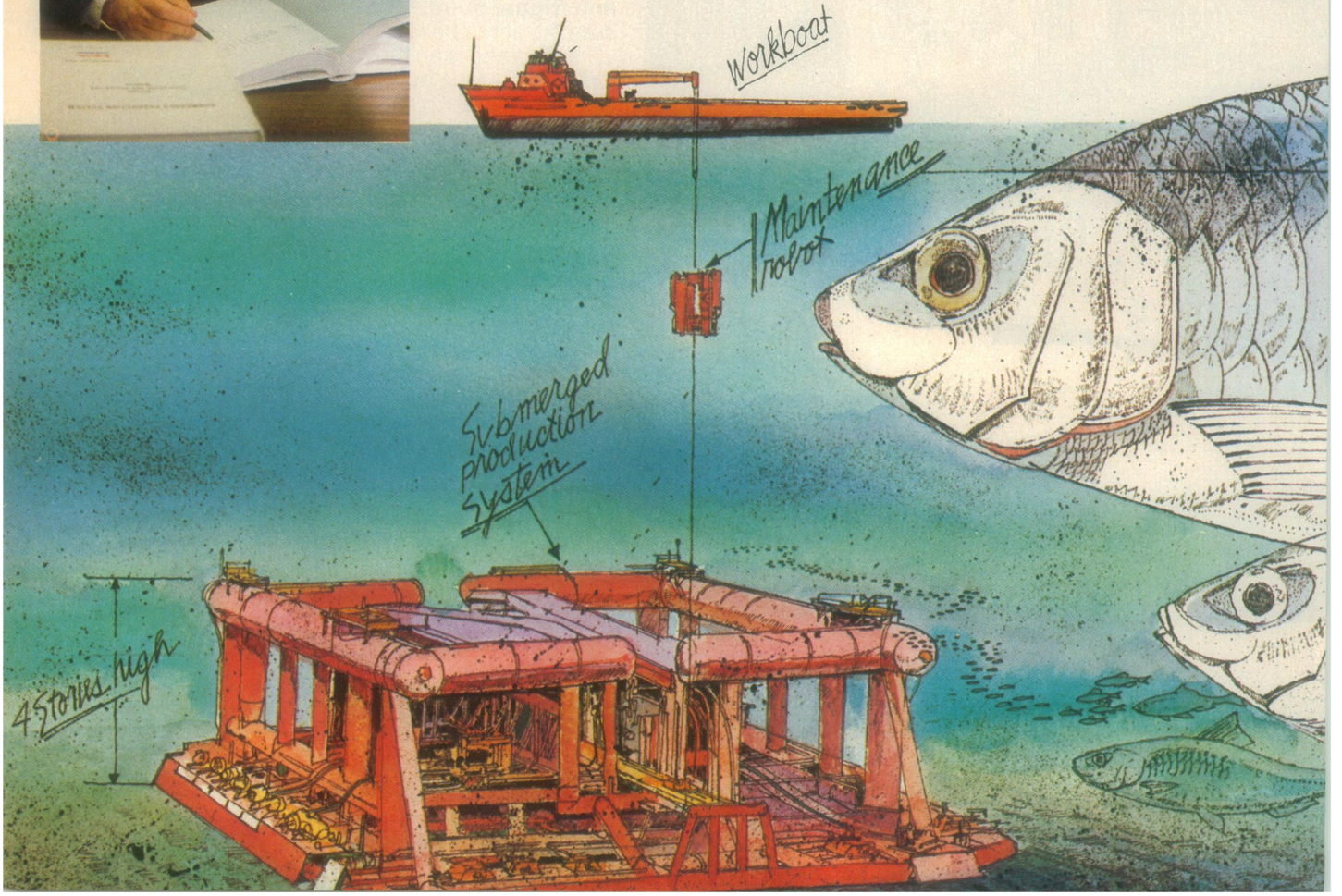
In 1968, Exxon leased tracts off the coast of Southern California, including some under 1800 feet of water. This made it necessary to study ways of producing oil in waters too deep to build platforms. These studies began in a flooded pit near Ventura, California, and culminated in the Gulf of Mexico with the 1974-79 pilot test of Exxon's Submerged Production System—a massive manifold set on the floor of the Gulf.

This prototype SPS controlled three producing wells drilled through openings in its base and delivered the oil to a nearby platform. Although the test was conducted in only 170 feet of water, it proved that the system could produce oil almost anywhere in the sea where a well could be drilled.

Now, three years later, the first commercial application of SPS technology is on the floor of the North Sea, installed by Exxon and another company.

Subsea maintenance by robot

SPS's have the potential to operate in water depths inaccessible to human divers. So Burkhardt and his



a new step in technology.

colleagues developed sophisticated robotics to perform routine maintenance.

The robot Remote Maintenance System (RMS) lowers itself along a buoyed cable from a surface vessel to the SPS. It then travels along a track which gives it access to critical valves and control components. The RMS can replace faulty parts, perform pressure tests and carry out various other maintenance functions. The entire robot operation is observed on closed-circuit television and remotely controlled from the surface vessel.

The SPS and the environment

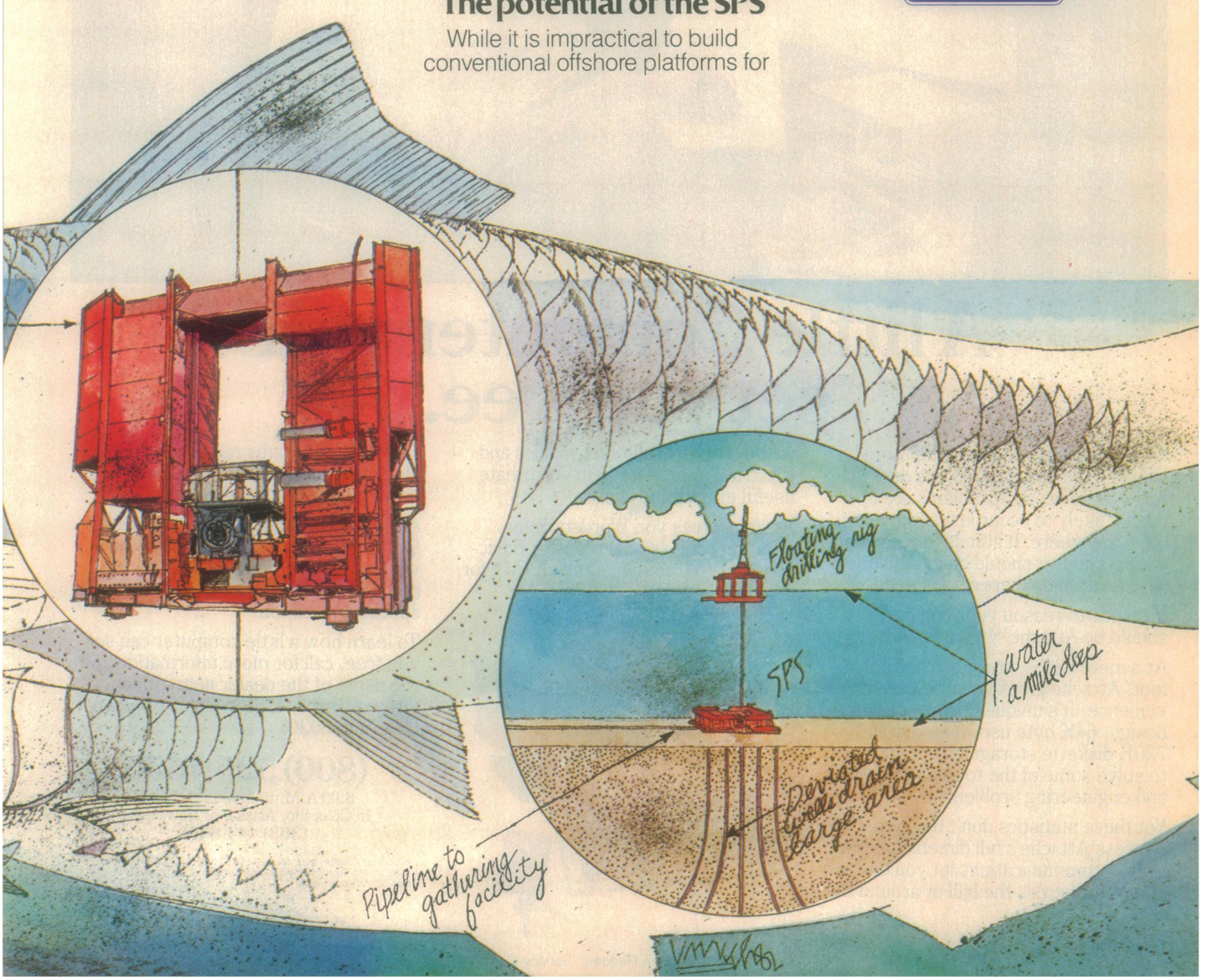
Safeguards incorporated in the SPS reflect Exxon's continuing concern for the environment. A high degree of redundancy is built into many of its subsystems. Fail-safe electrohydraulic control and shut-in systems are used throughout. In the unlikely event that leakage should occur, manifolding on the SPS is covered by inverted "pans" which would collect the leaked oil, trigger an alarm, and stop the leak by closing valves.

The potential of the SPS

While it is impractical to build conventional offshore platforms for water depths much beyond 1,000 feet, SPS technology could be practical to depths of a mile or more. If this full potential is realized, the SPS could be used to open up new areas for oil and gas recovery—areas that cannot be tapped today.

The design and construction of sophisticated deepwater energy systems is just one example of the research and development carried out by Exxon.

EXXON



A little Computer will set you free.

Where is it written that computers should keep you chained to a desk? After all, ideas and problems are dynamic; likely to occur just about any time, anywhere. It stands to reason that your computer should be available whenever and wherever it's needed.

It stands to reason your computer should be Attache™ from Otrona.

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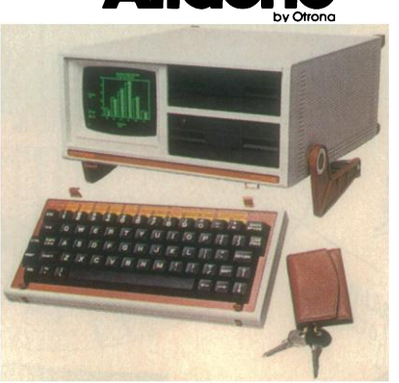

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21 January 1983, Volume 219, Number 4582 **SCIENCE**

High-Technology Jobs

Unemployment was a dominant issue in many states in the last election, and it could remain so for some years. The older industries such as steel and autos may eventually partially recover, but they face great international competition. Governors of states are under pressure to do something that promises to lead to more jobs. Many governors are pinning their hopes on high-technology industries, which have grown while other industries have been stagnant or decaying. The National Governors' Association has sponsored meetings and committee work on the topic. About half of the governors are fostering some kind of activity, such as the formation of an advisory council on high technology, in their own states.

Representing the National Governors' Association, Charles S. Robb of Virginia stated in testimony before a congressional subcommittee* that "the industrialized world stands on the threshold of a technological revolution that will change the American way of life and the composition of the nation's work force as much as the industrial revolution did a century ago. . . . Our ability to lead this technological revolution, as indeed the United States led the industrial revolution a century or so ago, will bear directly on our share of world markets—a share that will continue to erode unless we act promptly and wisely." Governor Robb also touched on the importance of interactions between universities and industries in fostering innovation in high technology.

At a juncture at which governors are under pressure to increase jobs, they find themselves with limited resources. At the same time, outlays for education are large. They are aware of activities around Route 128 in Massachusetts and near Palo Alto in California. They have to ask themselves whether their state universities can do what Stanford and the Massachusetts Institute of Technology have done for their regions. If the recession continues, other universities can expect increasing pressure and questions from governors and legislators.

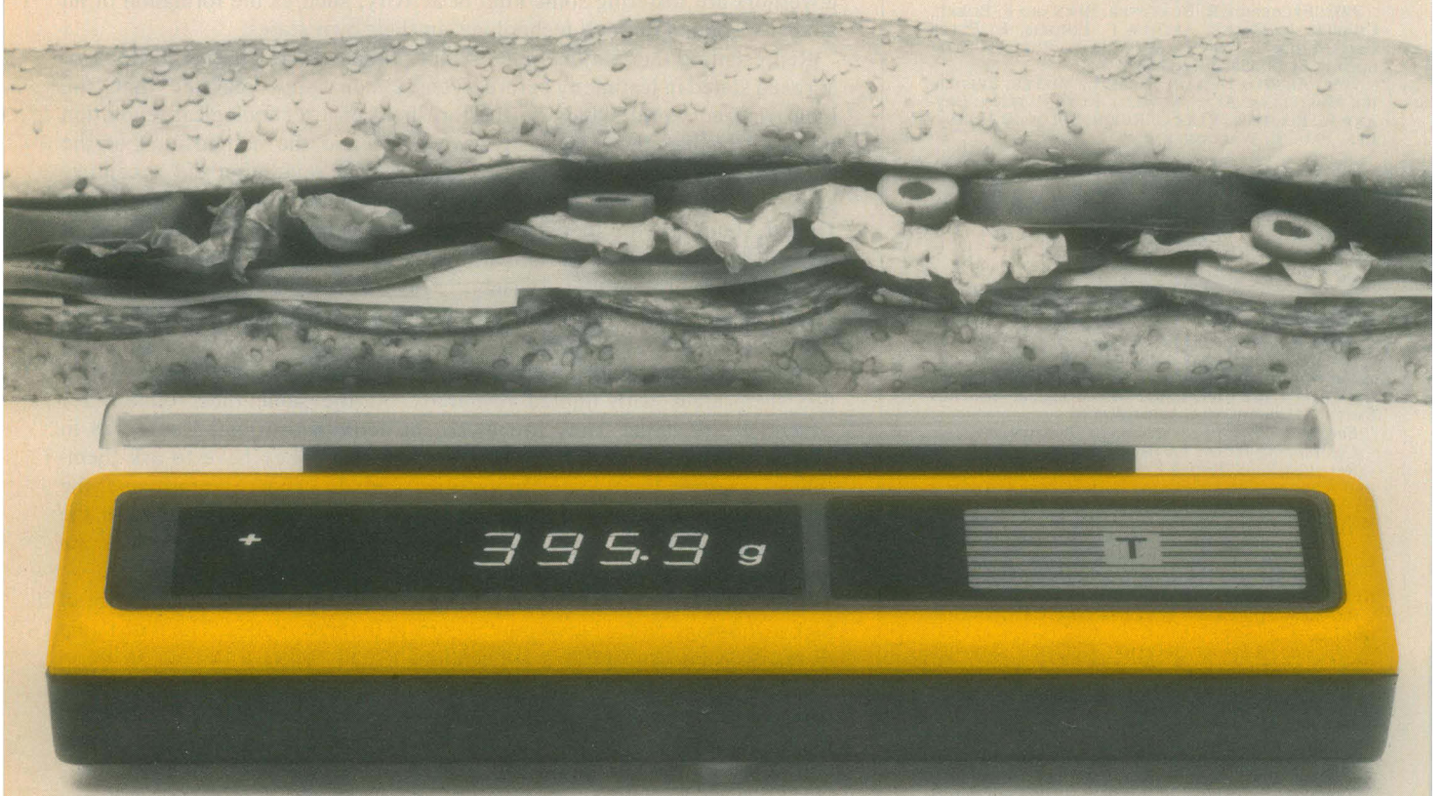
There is a large gap between a belated recognition of the importance of high technology and achieving something in the way of jobs. The translation of research into substantive applications usually takes a decade or more. The transformation of small innovative companies into giants takes time. Governors may be well advised and have great plans, but their tenure is limited. Many were swept out of office in the last election. Their successors will wish to formulate their own programs.

For alert states there may be a partial solution for some economic problems. Many of the high-technology companies currently centered on Route 128 or in Silicon Valley are looking elsewhere for expansion as costs of labor, housing, and land have become excessive. A congressional staff study† describes responses of 671 companies to a questionnaire concerning factors that influence their decisions to locate facilities.

The high-technology companies are science-based. Research and development outputs are more important to them than to other manufacturing industries. Major determinants in their decisions to locate facilities include availability of skilled labor, labor costs, and state and local taxes. Other factors include community attitudes, costs of property and construction, transportation systems, available area for expansion, good schools, and proximity to recreational and cultural resources. The study indicates that high-technology companies plan to expand at highest rates in the Midwest, Southeast, Southwest, and Mountain and Plains states. Where they will actually locate may well depend on local initiatives. Michigan, North Carolina, and Arizona have been especially active in seeking to foster high technology and are meeting with some success. In the majority of states there has been more talk than action.—PHILIP H. ABELSON

*Testimony before the Subcommittee on Science, Research and Technology, Committee on Science and Technology, U.S. House of Representatives, 29 April 1982. †"Location of high technology firms and regional economic development," staff study prepared for the Subcommittee on Monetary and Fiscal Policy, Joint Economic Committee, 1 June 1982.

Introducing the electronic balance with the big appetite and the low profile.



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24-25 MARCH 1983

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announces the

Eighth Annual AAAS Colloquium on R & D Policy

Shoreham Hotel • Washington, D.C.

R & D, High Technology, and Economic Recovery

Trends and Topics

- R & D in the FY 1984 budget
- Congressional reactions
- Industry R & D funding
- International competition
- Human resources
- Research partnership

Current Data

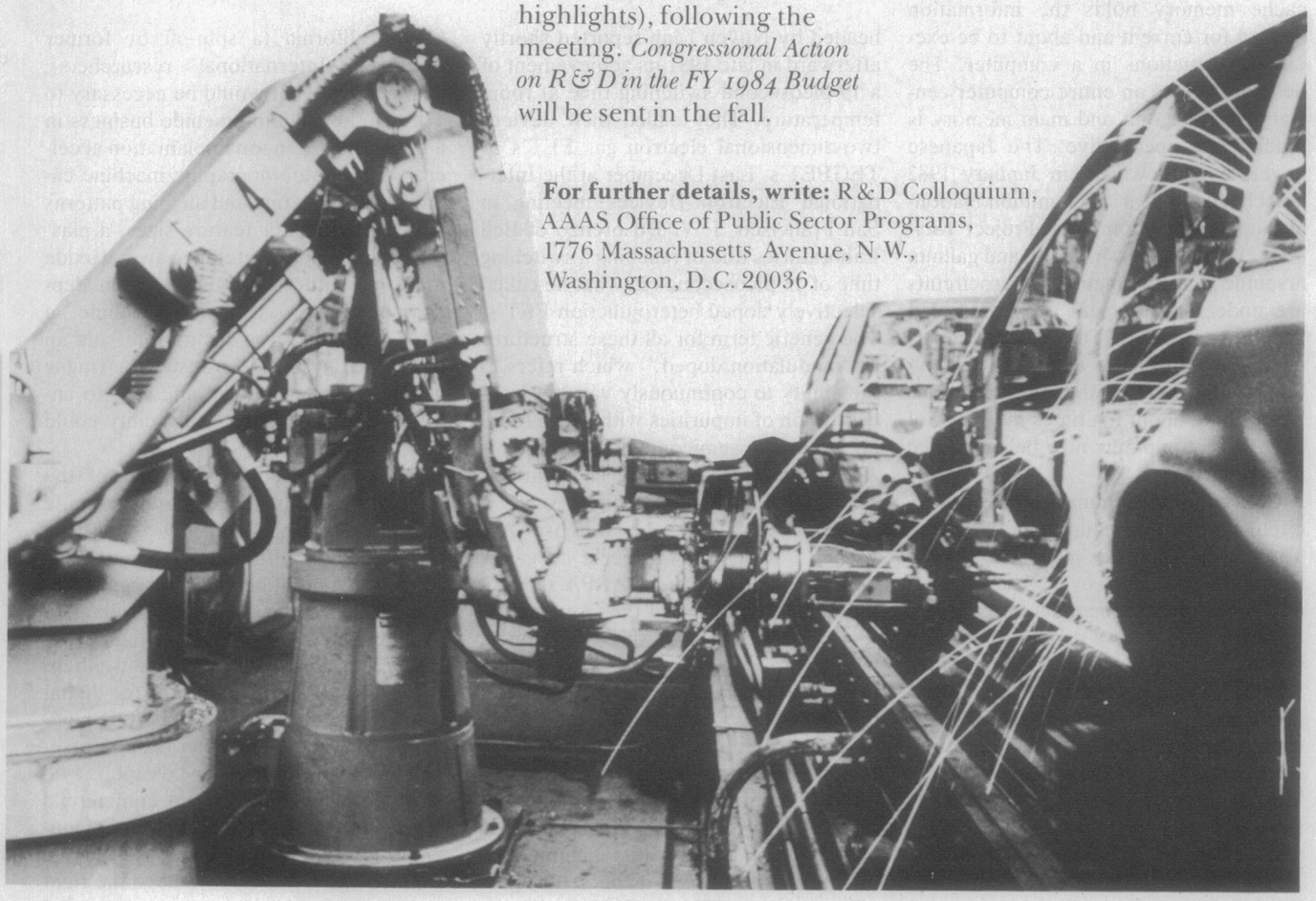
Registrants will receive *R & D in the FY 1984 Budget: A Preliminary Analysis* in advance of the Colloquium and *AAAS Report VIII: Research and Development, FY 1984,* by Willis H. Shapley, Albert H. Teich, and Jill P. Weinberg (including Colloquium highlights), following the meeting. *Congressional Action on R & D in the FY 1984 Budget* will be sent in the fall.

Informed Debate

Leaders from:

- The White House
- Federal R & D agencies
- Congress
- Industry
- Universities

For further details, write: R & D Colloquium, AAAS Office of Public Sector Programs, 1776 Massachusetts Avenue, N.W., Washington, D.C. 20036.



Ford Motor Company

For advance registration, please use the form on the facing page.

8th AAAS R & D Colloquium
Washington, D.C.
24 & 25 March 1983

Advance Registration Form

Thursday & Friday, 24 & 25 March, at The Shoreham Hotel, 2500 Calvert St., N.W., Washington, D.C.

Registrant's Name _____ (last name) (first name and initial)

Affiliation _____

Mailing Address _____ (street and number)

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☐ Please check here if you need special services due to handicap. We will contact you prior to the meeting.

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☐ $ 80 Partial Registration (sessions, three publications)
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Separate Lunch Tickets at $17 each (no refund for meals after 21 March)
☐ Lunch on Thursday, 24th ☐ Lunch on Friday, 25th

Program, badge, meal tickets, and R&D in the FY 84 Budget: A Preliminary Analysis will be mailed 11 March. Registrations received after 11 March will be held at the AAAS Registration Desk at The Shoreham Hotel. AAAS Report VIII: Research & Development FY 1984 will be mailed in June and Congressional Action on R&D in FY 84 Budget will be mailed in the fall. (Highlights of the Colloquium will appear in Report VIII. Inquire for earlier reports and proceedings.)

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