GENERAL ELECTRIC
Monogram
March-April 1982

The 1982 Management Meeting

Our objective— A leaner, more agile, more entrepreneurial GE

"WE INTEND TO MAKE THESE CONCEPTS—reality, excellence and 'ownership'—the basis for a pervasive operational atmosphere in which people will dare to try new things, where their own creativity and drive will determine how far and how fast they move. From revitalized core businesses to the newer growth businesses, the end result will be an organization more high-spirited, more adaptable and more agile than companies a fraction of our size."

The speaker is General Electric Chairman John F. Welch. And the message, first delivered to 500 top GE executives attending the 1982 Management Conference at Boca Raton, Fla., earlier this year and to share owners in the 1981 Annual Report, is one that Welch and Vice Chairmen John F. Burlingame and Edward E. Hood, Jr., are stressing as the Company seeks to accelerate its growth in today's slow-growth economy.

Ways to accelerate growth, Welch points out, are by driving for excellence and by learning to face the realities now shaping the '80s and beyond —unrelenting competition and constant market change.

"In this environment, a company must be a lean, low-cost producer of quality goods and services in order to survive, let alone prosper," he says.

But what is meant by reality, excellence and ownership? What are Welch and his colleagues in the CEO (Corporate Executive Office) aiming for when they talk about these three concepts?

The first and fundamental concept is reality.

"Understanding *reality*—having a sure grasp of the facts of the marketplace and then dealing with these facts in today's much tougher business environment—provides the foundation for *ownership* and leads to *excellence*," explains Welch.

"Ownership," he says, "means that more and more individual GE employees will identify with—that is, *own*—the common goals of our enterprise, and more and more managers will run their businesses as if they own them. Together these will lead to excellence—a climate of personal and collective excellence that not only turns out the highest quality products and services, but also a company that is 'better than the best.'"

But the key is reality.

As the CEO puts it, reality is the opposite of wishful thinking. It is, in Welch's words, "Seeing the world the way it is, not the way you wish it to be. When you look at the reality of a situation, whether it's a customer trend, or a competitor's strength, or a government regulation, you don't wish it were different. You face the facts and take action. You don't stand around waiting for things to change for the better."

It boils down to seeing what is happening right now in the marketplace, understanding what that means for the future. Points out Welch: "It's important to speculate on what could be, but it's absolutely essential to see what is."

Once reality is understood, ownership will follow and the CEO will move more decision-making to operations—to managers who know their mar-

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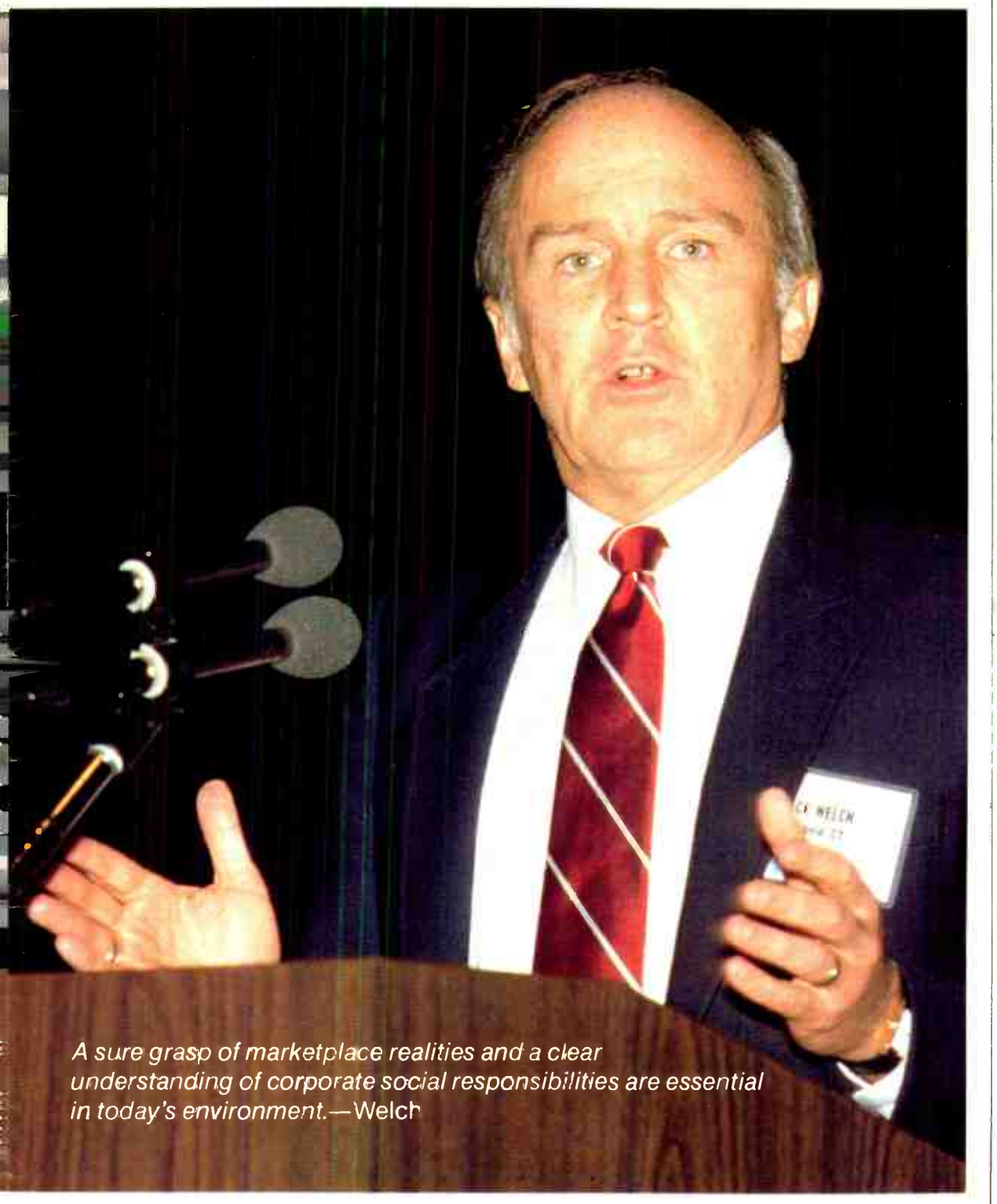

A sure grasp of marketplace realities and a clear understanding of corporate social responsibilities are essential in today's environment.—Welch

kets best. It means, too, that picking the right person for the assignment is "the name of the game."

"Then that person develops the strategy," Welch says. "The strategy won't be developed at headquarters. The planning is going to be done by you. We'll go over your plans and your ambitions every single time. But they're going to be yours. You're going to own them."

The net result will then be excellence. As Welch notes, "If there's one thing I'm convinced we must drive for, it's excellence; calling for the best in all of us—in some cases being even better than we thought possible. Whether you call it 'better than the best' or 'quality,' I want it to surround the concepts of reality and ownership, to surround General Electric itself."

States Welch in conclusion: "Why are we driving for reality and ownership? Why is it so critical? How does it come together? For me, it comes together in one simple thing—we're going to be a leaner, more agile, more entrepreneurial company. We're going to take advantage of our $27 billion enterprise. We're going to act like a network of small businesses that can move rapidly."

At the Boca Raton Management Conference, the concept of reality was further explored by Vice Chairman John Burlingame.

"Reality is a difficult concept for many of us to deal with," he told the attendees. "Maybe it's because one man's fantasies are another man's realities. It's amazing how often fantasy or hope enters the business equation and displaces reality. How difficult it is to keep it out.

"How many times have you heard the comment, *There's nothing wrong with this business that a little volume wouldn't take care of?* And how many times was either the volume not forthcoming or, when it was, it was at a price that made the problem worse—not better? As we move through the current recession, we can take comfort in the hope that an upturn is around the corner and a rising tide will lift all boats. But that doesn't include the boats that are sinking because of leaks. Thus, we must not wait for the wish of improved economic activity to come true. Either we caulk the seams and get up to good performance levels, or we abandon the boat."

Then, as examples of what Burlingame was saying, managers of three GE businesses told how they had faced reality in 1981—Senior Vice Presidents Brian H. Rowe of Aircraft Engine Business Group and Ralph D. Ketchum of Lighting Business Group and Vice President Warren H. Bruggeman of Nuclear Energy Business Operations.

Briefly, here's what they said.

Rowe: In mid-1980, the commercial airline market was bullish. Everything looked rosy. Then came the recession, deregulation and rising fuel costs.

It was a time of introspection at AEBG. We tightened our belts, cut back production, stretched investment for plant and equipment, and, in addition, we terminated and renegotiated programs. We learned to do our job smarter. We went back to basics in both cash management and inventory control.

We have turned over a lot of stones and cut our costs for the next couple of years without jeopardizing our future. Our latest forecast shows that the market is still growing. As a result of all these actions, we were able to improve our 1981 earnings.

Brian H. Rowe

Ralph D. Ketchum

Warren H. Bruggeman

Ketchum: Lighting began facing reality in the early '70s when the first oil crisis forced consumers to turn out their lights. The lamp market dropped 15%. Also, GE's profitable agency distribution system ended in 1974. There was an increase in imported lamps. Photoflash and automotive lamps nose-dived.

To ensure its goal of sustainable earnings growth, LBG reduced costs by paring the workforce and restructuring its organization. It set productivity goals, developed quality circles, launched new marketing programs, and introduced new energy-efficient products.

Even though we're under attack from many quarters, Lighting is a strong, well-positioned business in an enduring and profitable market. The final numbers for 1981 showed respectable sales and income levels. (For a story on Lighting Business Group, see pages 8-13).

Bruggeman: Another familiar beginning. A pioneer leader in nuclear power, GE was accustomed to selling four to five boiling water reactors (BWRs) annually a decade ago.

Then came the oil embargo of 1973. It was misread by the nuclear industry, which had expected nuclear energy to be the panacea. But the cost of electricity shot skyward, and conservation became a byword. The political climate turned hostile. The bottom of the nuclear market fell out.

No strategic plan, no wishful thinking was going to change the nuclear steam supply market. Only our utility customers could tell us when and if there was going to be a revival. We had to level with our people and, even more importantly, level with ourselves.

A plan evolved: develop nuclear's profitable reload fuel, services and international licensing businesses, capitalize on the income potential of system changes, bid on select new steam supply system jobs. Also, thin out the work force and manufacturing facilities that had been geared to an order rate of three reactors a year, consolidate facilities, restructure the nuclear organization, eliminate a division, improve communication, and take advantage of GE's superior BWR product performance.

The result thus far: We went off welfare in 1981 as we converted a budgeted loss into a modest profit. And we intend to increase our profitability in the coming years.

Summing up, Vice Chairman Burlingame said, "These are businesses that are taking decisive action to cope with new realities spawned by competition, by socio-political factors, by technology, and by the energy situation. Their ultimate success is by no means guaranteed, but they are before you today because they are taking their destinies in their own hands and not wishing for the good old days, or hoping for a comatose economy to revive."

Other stories of entrepreneurial spirit emerged from the Management Conference, too. Stories that, in the words of Vice Chairman Hood, "are as diverse as GE itself; stories that share the common thread of smart, committed people with concepts and ideas—figuring out what customers need and how to put together our resources and technology to meet those needs better than anyone else."

Telling stories about the world competitive arena were VP Edward C. Bavaria, general manager—Middle East/Africa Business Development

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GE success stories share a common thread of smart, committed people with concepts and ideas that meet the needs of our customers.
—Hood

Division; John M. Trani, general manager—Audio Electronics Products Department; and D. Rex Blanchard, Chairman of the Board—GE Plastics Europe.

Discussing opportunities in service were Executive VP Norman P. Blake, GE Credit Corporation Financing Operations; VP Robert T. Bruce, general manager—Installation and Service Engineering Business Division; and VP Gregory J. Liemandt, general manager—Information Services Business Division.

(A story on Liemandt's Division appears on pages 20-23.)

Bavaria: As GE develops businesses overseas, the Middle East can be viewed as a "promised land." The tremendous growth in Middle East oil revenues is providing money to drive such markets as power generation, industrial development, health, education, defense, consumer products and transportation.

How do we develop these markets? Previous Mideast dealings have taught us several lessons. The Middle East countries are sophisticated. They want best value. The days of opportunistic selling are over. There must be sufficient resources to back up our pursuit of markets. After-sale service is critical to winning orders. More time must be spent up-front with the customer—selling GE and then marketing our vast capabilities.

And we must be selective. We need to choose those markets in which we can become a dominant force, and then commit, to them, innovation in products, in designs and in customer support.

Trani: Like many GE businesses, Audio felt the "Japanese invasion of America" which began in the late '60s. Almost overnight, the audio business changed. The competition coming from Japan was tough. For GE, it was execute or exit. We decided to execute because we believed we could beat the Japanese at their own game.

In the early '70s, it became apparent that microelectronics was the wave of the future in audio products. A custom AM/FM integrated circuit was developed, and it had a significant impact—eliminating cumbersome parts and saving money. We paid close attention to quality, and radically improved the style, fit, finish, feel and performance of our products. We changed our distribution structure. We began a steady flow of innovative products.

From a break-even position in 1975, Audio last year broke every record in its 35-year history. Sales were up and so was income. There is no successful business that doesn't take risks. People like to be challenged.

Blanchard: For GE Plastics Europe, the Company's affiliate in the Netherlands, the challenge was to offset the economic slowdown in Europe. We did this by creating applications that need our products—applications for which *our* products, rather than others, are particularly well-suited.

For example, we've been working with Ford-Europe for two years on a new vehicle with a lightweight, thermoplastic bumper made from a new family of GE resins developed specifically for this application. The car and bumper are being introduced this year.

Our strategic response today keys on technology reinvestment, integration to reduce structural costs, learning to serve and to be a fully self-

sufficient profitable participant in the European market and environment.

Blake: The competitive edge of GECC is its entrepreneurship. The great challenge we all face is building businesses in response to change, creating new and different products for emerging new markets. At GECC, nearly half of our growth in 1981 earning assets was derived from products or markets that didn't exist three years ago.

This performance characterizes the entrepreneurial spirit of GECC and its response to the two most significant forces of change—inflation and deregulation.

A classic example of how inflation spurred a new market for GECC is in auto leasing. In three years, we developed a nationwide market as an auto lessor by anticipating the trend toward leasing.

Bruce: Installation and Service Engineering is in the business of offering solutions. By developing and matching our technical strengths to the needs of the marketplace, we received an all-time high in orders in 1981.

The latest opportunity is applying product service in support of GE's factory-with-a-future automation. Other opportunities include designing power plants, retrofitting machine tools, and supplying a total service package that includes installation, maintenance and modernization.

Continuing to stress the "ownership" approach, Vice Chairman Hood told the conference attendees that the CEO wants increasingly to put the accountability for decision-making on the people who are much closer to the real action.

To show that the CEO means what it says about "ownership," Hood also announced several major policy changes that simplify procedures, eliminate many mandatory reviews, and give Sector executives a higher capital investment approval level and more freedom to re-delegate to whatever level they see fit.

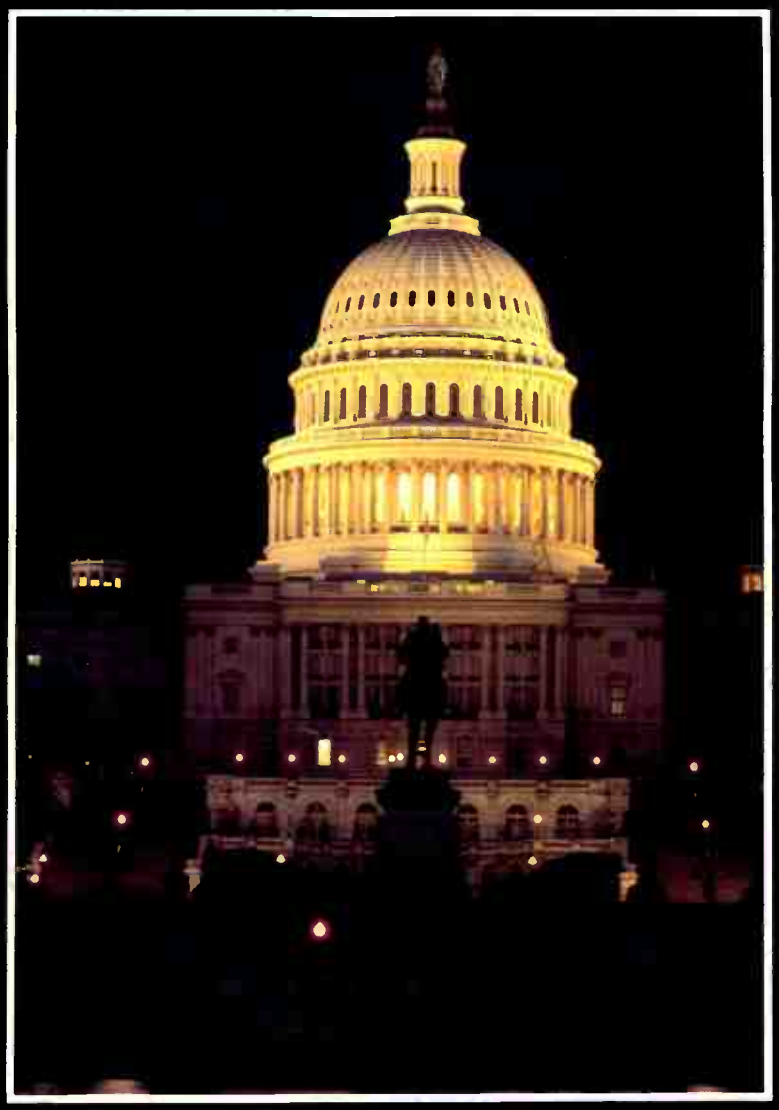
"These are initial, but significant, steps which underscore our conviction that general managers should run their businesses, that they should be able to make critical decisions that affect those businesses," Hood went on.

"Longer term, we want to go much further—to give the flexibility to be more agile, more entrepreneurial, and to be free to do your own thing. How far and how fast depends on you."

Leaner, more agile, more entrepreneurial—these can add up to a healthy corporate balance sheet. In Welch's view, corporate social responsibility in the '80s begins with good company health. A healthy business leads to jobs and job security, and allows GE to meet social, educational and cultural responsibilities.

Welch concluded: "If we just challenge ourselves to be better than the best, to 'own' our businesses and to take on the marketplace, I'm convinced the CEO will give its support to all those who demonstrate the courage and determination needed to be a winner. To this entrepreneurship, we in the CEO can add the considerable central strengths of GE: our financial, technical and human resources, all bonded together by the unifying power of the GE initials—our trademark and our most enduring asset. We can be better than the best. Let's do it."

Ed Hood (l) calls on John Trani, Ed Bavaria and Rex Blanchard to discuss international competition.



General Electric lamps bathe nation's Capitol in light.

A little night light

THE STATUE OF LIBERTY'S freedom light. The glittering spotlights of a three-ring circus. The lights that lead to home. These are the lights of General Electric. Since 1879, the Company's oldest business has been lighting the buildings and bridges, theaters and trolleys, streets and stadiums, monuments and movies of America. Using fixtures and lamps off the shelf or tailored for the purpose, GE has illuminated a panoply of Americana that includes San Francisco's Golden Gate Bridge and trolley cars, Philadelphia's Independence Hall, New Orleans' French Quarter, Mann's Chinese Theatre, St. Patrick's Cathedral and the Alamo. Special lighting projects have included the National Christmas Tree, numerous World's Fairs, and the movie sets of *Hello, Dolly!* *The Seven-Year Itch*, and *The Wiz*.

For more on GE lighting, turn to page 10.

Stars of Broadway's Evita *shine under GE spotlights.*

Houston's Astrodome is filled with GE lights.

GE high-efficiency indoor lighting goes to the circus

GE lamps play on Buckingham Fountain, part of Chicago's Loop.

Senior VP Ralph D. Ketchum

Leading the way into

the second century of light

ONE HUNDRED AND THREE YEARS AFTER the first practical incandescent light, General Electric's lighting business is meeting challenges seldom paralleled since those early growth days when power companies gave away lamps to encourage the use of electricity.

Consider:

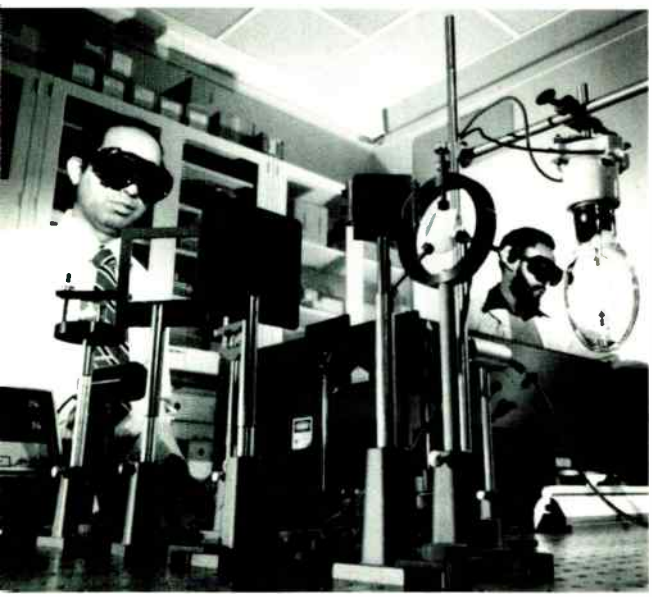
- There's been an increase in imported lamps selling at well below traditional U.S. prices.

- The increasing sale of low-priced lamps through discount stores is eroding the market share of food stores—one of the Lighting Business Group's (LBG's) key distribution channels.

- The photoflash market is declining rapidly as consumers switch from chemical flash to cameras with built-in electronic flash.

- In the automotive lamp business, the drop in sales of new cars, which typically have 38 lamps each, is having a negative impact on the Group.

- Lastly, LBG's high fixed costs can be a handicap in the low-growth early '80s.



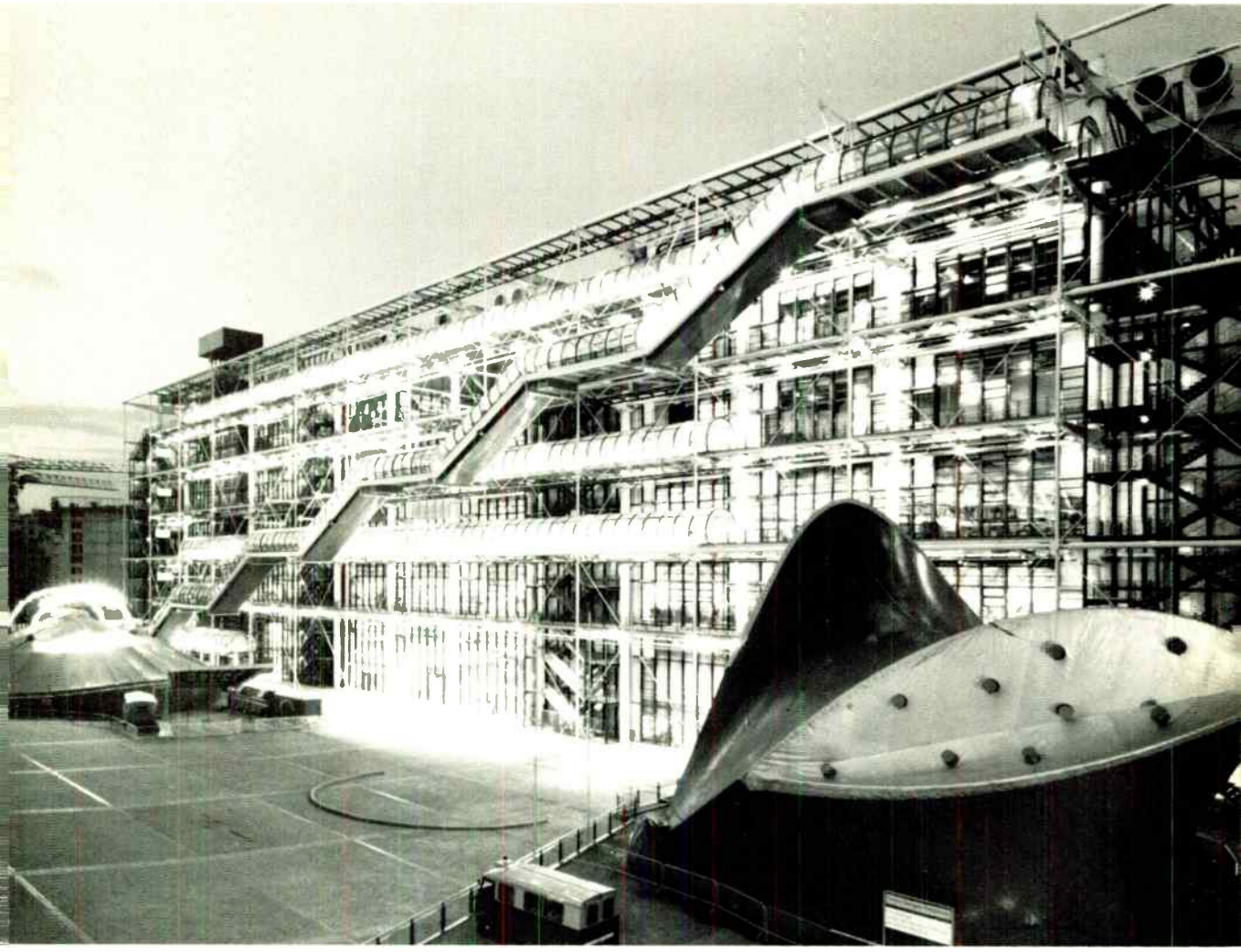
Ashok Bhattacharya and Alex Farmer use laser for high-efficiency lamp research at Nela Park.

In light of these hostile business conditions, how does the Lighting Business Group plan to continue to grow and prosper?

"First, we are taking steps to protect and strengthen our core businesses," says Senior VP Ralph D. Ketchum, LBG's group executive. "Second, we are capitalizing on the income opportunities offered by our growth businesses, and diversifying wherever possible. And, finally, we are stressing quality and increased productivity through solid cost-improvement programs.

"We plan to lead the way into the second century of light."

One of the steps the Group has taken to bring this about was the formation in January 1981 of a new Manufacturing Technology Programs Department, headed by Joseph F. Vercellotti. The department's main objective is to assure that LBG's technological advantage is maintained and strengthened in the years ahead.



Art shines under General Electric lamps at the futuristic Pompidou Center in Paris.

"We concentrated first on organizing and redeploying the Group's technical talents," notes Vercellotti. "That done, we're working on computer-aided design and manufacturing, lasers for cutting and welding, automated assembly and optical inspection systems. Our new computer process controls, which we've installed in two plants, have already yielded a 5% -8% increase in productivity and improved quality."

To buttress and expand current product offerings, development programs are under way in the core incandescent and fluorescent lines, as well as in the newer, high-efficiency sodium vapor and metal halide areas. The newest fluorescent product, the Optimiser System, is a ballast and lamp combination aimed at commercial users. It has yielded an average 33% energy savings in its first three installations.

Of equally great potential, according to Henry J. Singer, VP and general manager—Lamp Products Division, is the increasing indoor use of Lucalox® high-pressure sodium lamps.

"Lucalox 400-watt lamps are currently being used to light the streets of New York and other cities," observes Singer. "Moreover, these lamps are now available down to 35 watts, and their use is being expanded to many commercial installations." One of the first such installations, at Ohio Medical Indemnity in Columbus, saved the customer $9,700 in energy costs in one year.

The biggest bet the division is making, though, is on the Electronic Halarc™ lamp, which is expected to be introduced in 1983. "What we've essentially done here," explains Singer,

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"is to take the components used in GE's large commercial/industrial Multi-Vapor® lamps, reduce them in size and wattage, and incorporate new sophisticated electronic circuitry. The result is a lamp that will use one-third the energy of comparable incandescent bulbs and last five times as long. While the Halarc will be relatively expensive (about $10), it will save the consumer about $25 in electricity during its life."

The Lighting Business Group also is employing its engineering and manufacturing capabilities in areas other than lighting.

"The Lamp Components Division is one of the world's leading manufacturers of quartz tubing," says Paul L. Dawson, Division VP and general manager. "In addition to supplying LBG, we sell quartz to semiconductor firms—including Intersil, fiber optics companies, and manufacturers of quartz heaters and copier equipment."

The Division's external sales of components constitute one of the fastest-growing parts of the business. Sales have tripled over the past four years and are expected to continue to rise.

Two years ago, the Division entered a joint venture with Utah International to develop a tungsten mine which will begin producing in the first quarter of 1982. The mine is expected to provide about 40% of the Company's tungsten needs. In addition, LBG is already meeting about 10% of its natural gas needs through 71 Group-developed natural gas wells.

To improve quality and productivity in the core lamp business, Dawson is implementing many elements of "the factory of the future." Unique to his division, however, is a "conform" machine that converts metal powder into rods, which are then drawn into lead wire for incandescent lamps. A second such machine is being readied to convert scrap to aluminum for use by the Major Appliance Business Group.

At LBG's Lighting Systems Department in Hendersonville, N.C., General Manager Thomas L. Williams is enthusiastic: "Our business is tied directly to energy cost. As lighting costs go up, our energy-saving systems become more attractive all the time."

Serving four major markets—street lighting, area lighting (parking lots, stadiums, etc.), industrial, and hazardous area (mines, oil wells, graineries)—the Department has seen real sales growth of 8%-10% a year over the past five years.

Offering high-intensity discharge lighting systems that can save as much as 40%-50% in energy costs, Lighting Systems is a market leader in the outdoor and industrial lighting markets. Selling its systems primarily through the Apparatus Distribution Sales Division and Electric Utility Sales Division, Lighting Systems has weathered the construction slump by aggressively pursuing replacement orders.

One of the first components to use quality circles to improve quality and productivity, the Department also is new-product-oriented. Its most recent offering is a remote energy management system that can control lighting in 256 separate areas via computerized radio frequency control.

To enhance its international opportunities, Lighting Systems entered a joint-venture agreement with Japan's Eyelis Company three years ago and last year purchased France's Eclatec, one of the largest lighting systems firms in Europe. It also has licensees in Mexico, Spain, Italy and England. Combined, Lighting Systems and its affiliates provide sales coverage throughout 95% of the free world.

Recent important contracts included the lighting of GE's Erie, Pa., locomotive plant, and the Ambassador Bridge, which links Detroit, Michigan, to Ontario, Canada, and the relighting of New Orleans' French Quarter.

And what's ahead for Lighting Business Group?

"There doesn't seem to be any technological limit to how far we can go in making lamps more efficient," says Dr. Pieter J. von Herrmann, manager—Lighting Research and Technical Services Operation. "Using electronics, halogen chemistry, discharge physics and new materials, we're developing more energy-efficient products all the time. But we're also keeping the customer in mind—we're devoting a lot of attention to cost, color rendition and product life."

Adds Ralph Ketchum: "We're beginning a major new advertising campaign in 1982. We're telling customers how to save on lighting costs, how to choose the right lamps for particular needs, how to 'decorate' with light, and why they should buy General Electric. The trend toward more energy-efficient products plays right to our inherent strengths, ensuring that lighting will continue to be an enduring and profitable market. I see a whole new era of lighting just getting under way."

Lighting Business Group is moving into the future with advanced testing procedures (above), the making of quartz tubes for semiconductors (below, left), and computer-aided design and manufacturing.

GE Foundation makes $1 million grant

The General Electric Foundation awarded a $1 million grant to the National Action Council for Minorities in Engineering (NACME) in December.

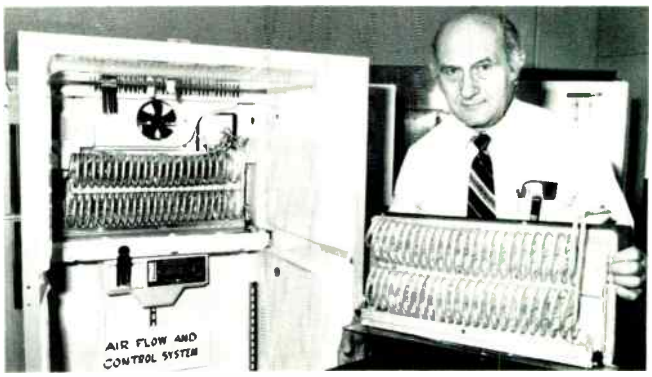
The award, which will support scholarships and other NACME programs in 1983-86, follows successive $300,000 grants from GE to NACME for the 1981 and '82 academic years.

In commenting on the grant, GE Chairman John F. Welch noted the key role American industry plays through NACME in increasing the number of minority engineers. "We are particularly impressed with NACME's new emphasis on retaining minority engineering students," he said. "This is a necessary complement to NACME efforts to attract, motivate and prepare minority youth for engineering studies."

NACME president Lloyd M. Cooke said the grant "once again demonstrates the Foundation's leadership."

Since 1973, the GE Foundation has contributed more than $10 million to colleges and associations, including NACME, that help minority students become engineers.

GE Chairman Welch congratulates NACME's Cooke.



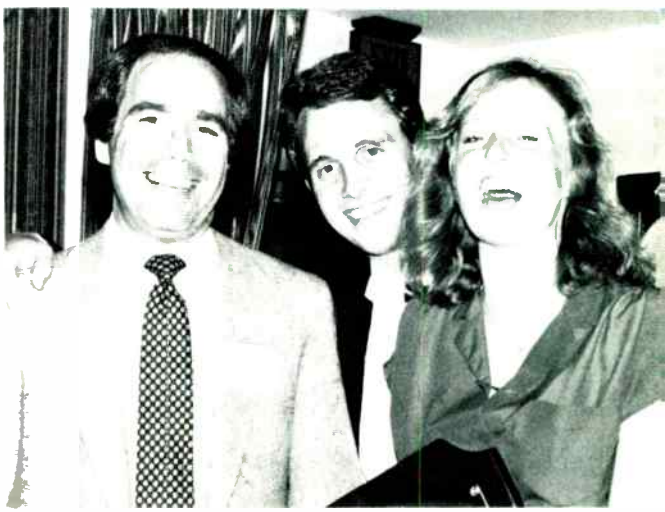
Ben Horvay: refrigeration expert.

Ben and Gabe: the Fulbright brothers

Two brothers, one a GE employee and the other a GE pensioner, went abroad last year as Fulbright Scholars.

J. Benjamin Horvay, a senior technologist at Louisville's Refrigeration Products Engineering Department, taught an eight-week course in refrigeration at the University of the Republic of Uruguay.

His brother, Dr. Gabriel Horvay, went to the Technical



Southern Cal students and advisor (left) celebrate victory.

Mickey Rooney as "Bill."

University of Leningrad to lecture on vibration and stress analysis. Dr. Horvay was an applied mathematician at Schenectady's Research and Development Center before retiring in 1969.

Bravos for Mickey, GE Theater

"Congratulations to GE for sponsoring 'Bill', one of the most moving and inspiring television movies we've seen in years."

"You really brought good things to life with this week's presentation of GE Theater. 'Bill' was without question one of the highlights of this Christmas season."

"Your 'Bill' probably did more to make people aware of the contribution potential of retarded adults than any other single event in the past 25 years."

"Never in my 43 years have I been so moved by a show."

Those comments come from the hundreds of "thank you's" GE has received since the Dec. 22 airing of "Bill" with Mickey Rooney in the title role, portraying a mentally handicapped adult who had been institutionalized for 44 years.

The show garnered more than "thank you's." It tied for a Golden Globe Award for being the Best Film Made for TV, while Rooney also received a Golden Globe Award for Best Actor.

In addition, "Bill" and "A Long Way Home," another GE Theater presentation starring Timothy Hutton, received Christopher Awards for affirming the highest values of the human spirit, exhibiting artistic and technical proficiency, and attaining a significant degree of public acceptance.

"A Long Way Home," which also aired in December, was named the Golden Halo winner by the Southern California Motion Picture Council.

College tournament sponsored by GE

It's not as famous — yet — as the Rose Bowl or the National Invitation Tournament, but the first McIntire Commerce Invitational did bring together five of the best college teams in the country. Undergraduate business school teams, that is.

The McIntire Invitational, funded by a $15,000 grant from the General Electric Foundation, was held in November at the University of Virginia, which designed and conducted the case-study contest. The teams had to analyze the case of a lighting fixture company on the verge of bankruptcy, and present a written and oral report.

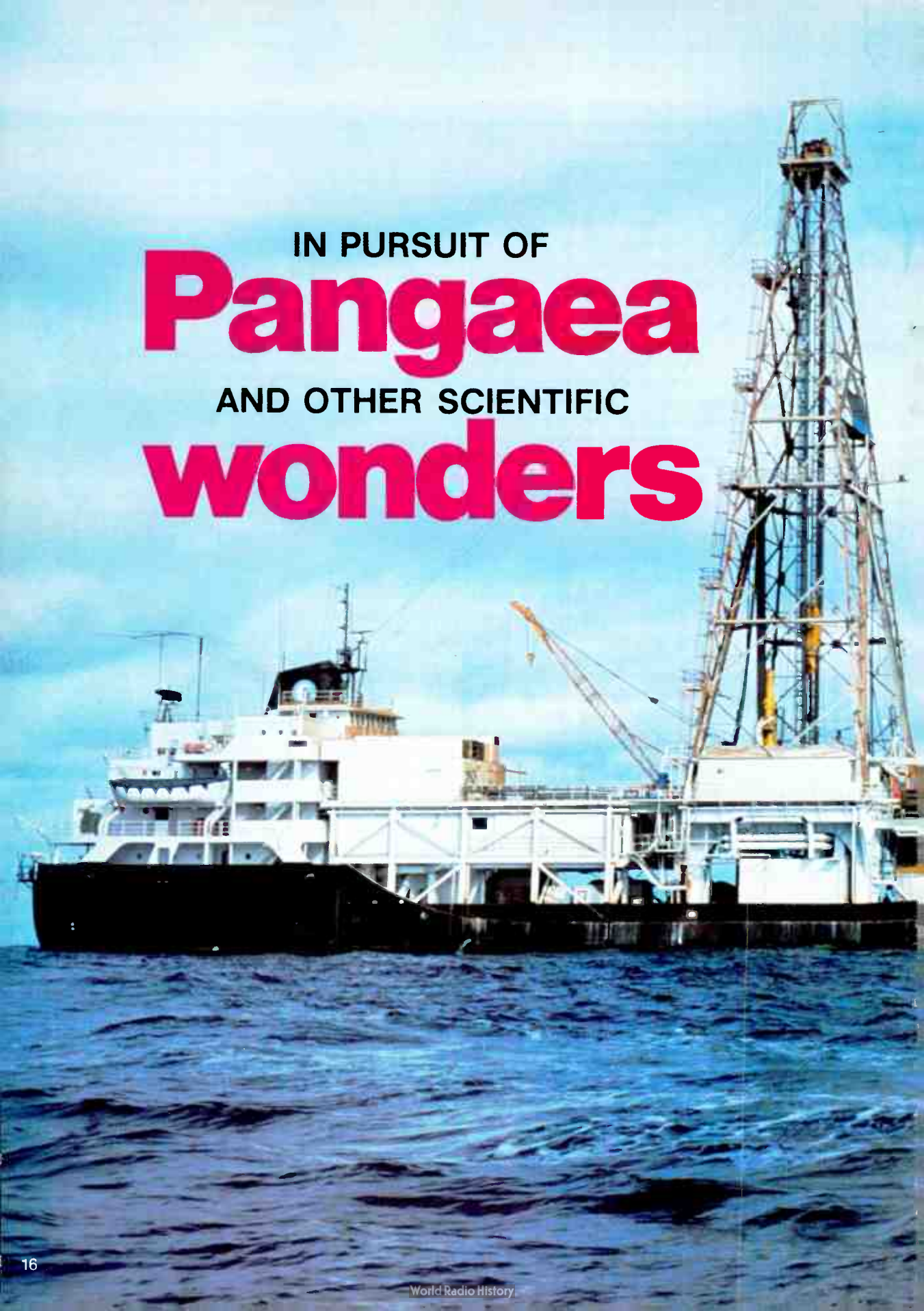
The University of Southern California won the contest. Other teams came from Ohio State University, Indiana University, the University of Michigan and New York University.

Company receives two awards

GE recently received awards for mine safety and an ad program.

The Mine Safety and Health Administration and the American Mining Congress presented a "Sentinels of Safety" award to Utah International's San Juan Mine. The New Mexico facility was one of 12 surface coal mines (out of 2,510) to go through 1980 without a lost-time injury.

And the CEBA Award for Communications Excellence to Black Audiences went to the Company's Educational Communications Programs for an advertising campaign created for *Ebony* magazine. It was the second time in four years GE received a CEBA award.



IN PURSUIT OF Pangaea AND OTHER SCIENTIFIC wonders

THIS SHIP, the *Glomar Challenger*, is on a remarkable journey to find Pangaea — a continent once so huge it spawned lesser continents like Asia and Africa and the two Americas.

Sailing on every sea, the *Challenger* has relentlessly probed the ocean floor — drilling, analyzing, recording. And, although it will never find Pangaea, because eons ago this land mass broke into pieces which then drifted apart to form the earth's continents as we know them today, the *Challenger* has made it possible for scientists to prove the theories of continental drift and plate tectonics.

The pursuit of Pangaea is only one of many research projects aboard the *Challenger* — projects that are unlocking the mysteries of the earth's rich and dramatic geological history.

The *Challenger*, now in its 14th year, is the world's foremost scientific vessel. Built and owned by Global Marine Drilling Company of Houston, it is leased to the National Science Foundation and the University of California's Scripps Institution of Oceanography.

This uncommon ship is replete with General Electric equipment — from thruster and propulsion motors to dc generators and shipboard controls. It is this equipment that enables the *Challenger* to perform its special sea-going feats, like sinking 20,000 feet of drilling pipe (that's about four miles) through dark briny waters and then piercing an unknown, inhospitable ocean floor for another 3,000 feet. Thus far the *Challenger* has lifted more than 200,000 feet of the earth's crust from the sea for scientific scrutiny.

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Photo by Kevin Reid

Photos by Kevin Reid

Near the Azores, Challenger crewmen fasten together 90-foot sections of drilling pipe before sinking them into the Atlantic. Above: Capt. Joseph Clarke, ship's master for 14 years; the GE shipboard control panel. Below: Scientist at work.

Photo by Kenneth Garrett

Perhaps no one knows, or loves, the *Challenger* as much as Joseph Clarke and Loyd Dill. They have been masters ever since the ship was christened in 1968.

"She's a great ship," says Clarke, his wavy white hair a subtle reminder of his nearly 40 years on the high seas. "She's one of the most traveled ships in the world. Most ships travel far, but they stick to the same routes and visit only a few ports. The *Challenger* does not run to the same places, but sails everywhere."

Then, for emphasis, Clarke rattles off a litany of exotic names and places: "Yokohama, Singapore, Shanghai, Cape Horn, the Bay of Bengal."

"There isn't a sea or ocean the *Challenger* has not been on," he says.

For Clarke, captaining the *Challenger* is like a dream come true. Growing up in California, he read the adventure novels of Howard Pyle, and his imagination was fired by Pyle's wonderful illustrations of the sea. Clarke spent many a day on the San Pedro docks, the port at Los Angeles, watching ships depart for faraway places. In 1943, he enlisted in the Navy.

"It's not just a love for the sea," Clarke tells us, "but a love for those faraway places calling from over the horizon."

The *Challenger* allows him to find those places and, at the same time, help man understand his own planet.

The *Glomar Challenger*, like most ships—freighters, tankers, transports—is a durable working vessel. It is 400 feet long, has a 65-foot beam and displaces 11,200 tons. It draws 21 feet of water. It has a crew of 74, including some of the world's top scientists. But unlike other ships, the *Challenger* is distinguished by a drilling rig.

"She's a deep-sea oceanographic drilling ship," Clarke reminds us.

The drilling rig towers 198 feet above the water line. On deck, stacked like a neat pile of telephone poles, are nearly five miles of drill pipe. The pipe comes in 30-foot joints made up in 90-foot stands.

Equipment from GE includes:

- Four main thruster motors (two forward and two aft) that keep the *Challenger* in position while drilling is being done;
- Six propulsion motors that are also needed during drilling to battle wind and waves that could move the ship;
- All the ship's service ac generators as well as dc generators used for drilling;
- Drive motors; and
- Shipboard controls that allow Clarke to run the *Challenger* from the bridge, hooking him up to the engine room. With the shipboard controls, Clarke can operate the ship's propellers and thruster motors.

"In the 14 years I've been captain," he says, "the GE equipment has been extremely reliable. It rarely malfunctions, and the downtime has been just about negligible."

Echoing Clarke's sentiments is John Duke, *Glomar Challenger* project manager. "The performance of the GE equipment is excellent," he says, "and—when it's needed—so is the service."

Today Bill Segui, senior field engineer for Installation and Service Engineering Business Division in San Diego, is the GE employee who knows the *Challenger* best. He has made trips all over the world and has met a multitude of multinational roustabouts and scientists—Frenchmen, Russians, Englishmen, Japanese, and Germans.

The pursuit of Pangaea sounds romantic. And indeed it is.

In 1912, German explorer, meteorologist and geologist Alfred Wegener noticed how the continents looked like pieces in the same jigsaw puzzle. After observing the splitting apart of ocean ice floes during an expedition to the polar ice cap, he hypothesized that there was once a "mother" continent, which he named Pangaea, and that continental drift destroyed her.

More than 50 years later, scientists aboard the *Challenger* proved Wegener's theory of continental drift. But that was just one of the ship's many contributions to science. Others include:

- Proving the theory of plate tectonics, which sprang from the concept of continental drift. The earth's crust, or lithosphere, is made up of plates that slide slowly over the globe. It is plate tectonics that cause continental drift.
- Discovering that below the lithosphere the earth's interior is composed of concentric shells that differ in size, substance and density.
- That beneath the basin of the Gulf of Mexico, huge oil deposits should be found.
- How oceans are born and mountains formed.

Beams Captain Clarke: "To me, there's not a ship like the *Glomar Challenger*, anywhere!" ▬

Target markets of

PETRO-LEWIS DEALS IN OIL and gas properties. G.D. Searle manufactures pharmaceuticals. Levi Strauss sells clothing. Leif Hoegh is a shipping concern. Holland America owns dozens of European companies. Coopers & Lybrand handles corporate and individual finances. And the Bank of New South Wales is the largest banking complex in the southwest Pacific.

All seven are customers of General Electric Information Services Company. But, more than that, they represent seven distinct markets being targeted by the GE computer services subsidiary, which surpassed $500 million in sales last year.

"We've changed our basic marketing philosophy," notes Gregory J. Liemandt, President of GE Information Services. "Until a year ago, our strategy in this huge and growing market was to sell almost anything to almost anyone. That approach was successful for a time, but we had to learn to say NO to ourselves. We had to stop fragmenting our human, financial, technical and software resources across 20 or 30 different market segments."

So GE Information Services, which pioneered computer timesharing in 1965 as a solution to the high cost of computer power and then expanded into software programs to drive and direct that computer power, began analyzing its markets. Was there a strategic fit between GE Information Services' strengths and what each market needed? How well was the GE subsidiary positioned in that market with people, products and programs? And how good was each market in terms of business health, growth prospects and competition?

"We have deemphasized many of the less promising markets, and are now concentrating our resources on a few target markets of opportunity," adds Liemandt.

Among the target markets of opportunity, or TMOs, are:

- the energy industry;
- manufacturing;
- order service;
- transportation;
- general business;
- financial service firms;
- banking and finance.

GE Information Services sets sights on several

Software programs from GE Information Services have enabled Levi Strauss sales representatives (above) to confirm orders immediately, G.D. Searle managers

opportunity

business information segments.

to control their pharmaceutical manufacturing operations (below, right) and Leif Hoegh officials to keep track of their container fleet (below, left).

"We've developed a strategy for each TMO, and have reorganized our departments to focus on the TMOs," says Arthur J. Marks, Senior VP—Programs Management Operations.

"We're in the business of making information work for people," adds Michael J. Emmi, Senior VP—Sales and Services Operations, "and it's people, our people, more than 5,000 of them, who make information work. Our customers need our people power... people who are trained to understand the customer's business and problems, and who can design, implement or support software solutions."

To see how GE Information Services has helped customers, let's return to those seven companies.

Petro-Lewis Corp., of Denver, Colo., uses a software program called the RAMS™ System to calculate the value of its oil and gas reserves.

"We sell limited partnerships in our properties," explains Janice Tanabe, manager of property economics for Petro-Lewis, "and we have to determine the surrender value of those properties. We also use the RAMS System for our public reporting requirements and to determine the collateral value of our properties."

The RAMS System was developed by Energy Enterprises of Denver, Inc., one of four software companies acquired by GE Information Services last year. (The other acquisitions were Banking Systems Inc., Software International Corporation, and LTI Consulting Services Corp.)

When G.D. Searle needed a manufacturing data processing system, it licensed the MIMS® System from GE Information Services. Flexibility was a key reason.

"With all the records, specification numbers and changes a firm in the pharmaceutical business must cope with, a highly flexible system is a necessity," states Jack Michelson, Searle's vice president of technical operations.

The MIMS System not only helps Searle's management improve productivity by keeping a close watch on inventories, scheduling and purchasing. It also allows the company to add new products and new business centers to the control system within a relatively short time frame.

(continued next page)

While the MIMS System can be customized to suit almost any manufacturing operation, GE Information Services recently introduced a packaged software program—MIMS® MFG.—that already includes modules designed to control inventory, parts, production, purchasing, billing, scheduling, and material requirements and planning.

Levi Strauss & Co. worked with General Electric Information Services' custom applications group to develop a special computerized order entry system for its WomensWear Division.

Before the system went into operation, Levi Strauss sales representatives had to wait up to three weeks to confirm orders. This delay—considered standard for the apparel industry—led to many overbookings, as well as other costly situations.

Now, however, a Levi Strauss salesperson can confirm orders instantly by using a portable computer terminal—even from the customer's office—to access the GE Information Services network. Once the order is placed, the system processes the data, matches it against available inventory, and either confirms the order or suggests available substitutions.

The order entry system has been so successful that Levi Strauss has expanded the program to four other divisions.

Leif Hoegh & Company uses an equipment control system through the GE network, the world's largest commercially available teleprocessing network, to keep track of its worldwide container fleet.

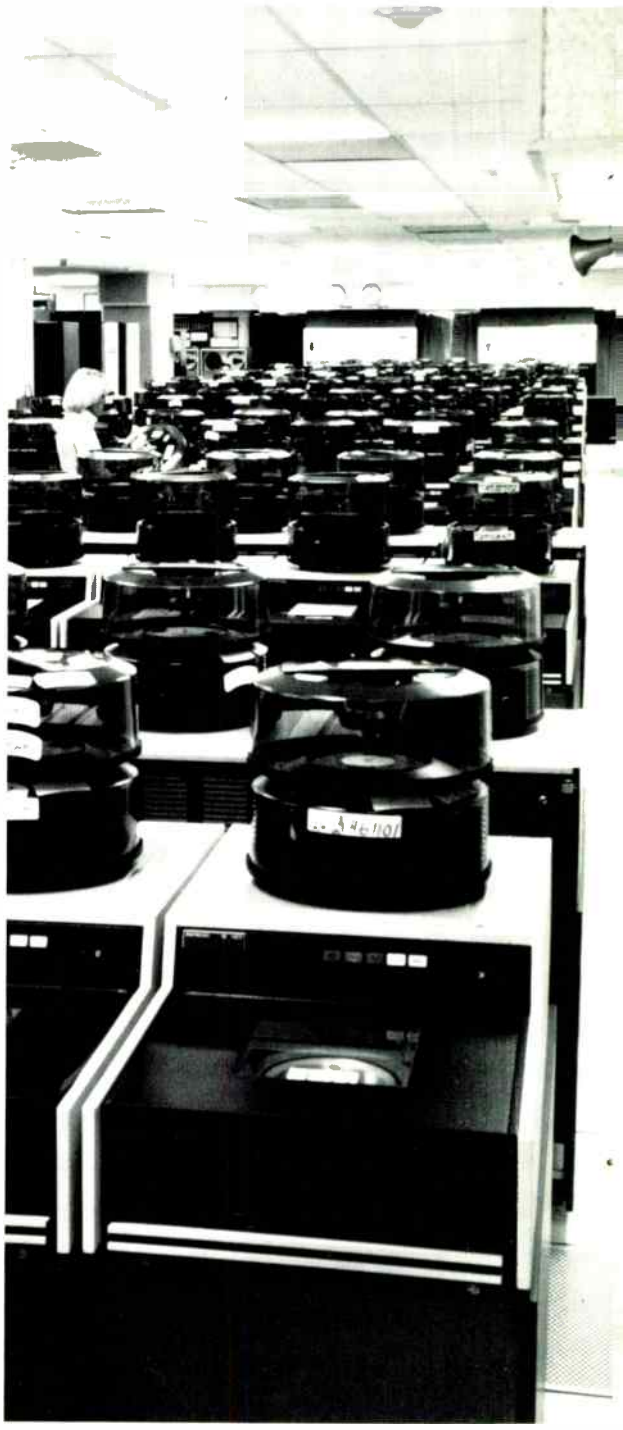
Headquartered in Norway, Leif Hoegh operates 12 vessels carrying containers, in addition to many other cargo and passenger vessels. The equipment control system is designed to let company agents know the whereabouts of thousands of shipping containers: what types are available in certain ports, which ones are in repair, and which ones are on which vessel.

Leif Hoegh also uses the system to keep a history of usage on each container, and to maintain information on the terms and costs of leased equipment.

Holland America Line had a different business information problem.

A multinational with 80 separate reporting components around the world, it was preparing

GE computing services have expanded greatly



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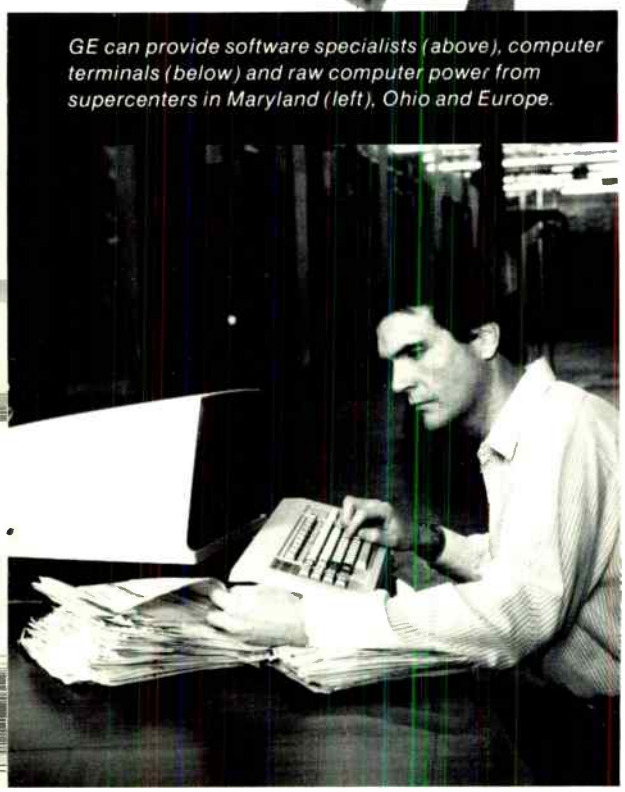


GE can provide software specialists (above), computer terminals (below) and raw computer power from supercenters in Maryland (left), Ohio and Europe.

consolidated financial reports manually. Sometimes the figures were "in the mail" when the reports were needed. Often, the figures had to be translated from different currencies.

Holland America, however, didn't want to develop a corporate data processing department. So it turned to GE Information Services and the INTERNATIONAL COMMAND® System.

One of a dozen major programs for the general business market, the INTERNATIONAL COMMAND System is scheduled to provide Holland America with timely, accurate and standardized financial reports. It will automatically make currency conversions and budget comparisons, and can generate forecasts and profit plans.

Coopers & Lybrand is using GE Information Services to market its personal financial plan, FINPLAN.

Developed by the accounting firm and made available worldwide on the Company's teleprocessing network, FINPLAN does for individuals what financial planning does for corporations. The system helps assess a person's financial position, evaluate alternatives, and calculate family income, estate and tax protection plans.

The Bank of New South Wales, with assets of 12 billion Australian dollars, deals in the international money market through major financial centers in Sydney, London, New York, San Francisco, Hong Kong and Singapore. It deals with about 1,000 other banks in 90 different countries.

To avoid overexposure of funds in any particular market, the bank sets dollar limits on the types of transactions that can be made — such as country, currency, company, type of deal.

Adhering to those limits was a problem. Dealers around the world had no way of knowing the bank's current position concerning the limits. And, if more than one financial center dealt in a limit area at the same time, the limits could be exceeded.

The solution: A dealer-supported computing system was custom-designed for the Bank of New South Wales. This special information system keeps an up-to-the-minute record of the exposure limits, allowing the bank to take full advantage of all transactions within its self-imposed guidelines.

Sums up Marks: "We have positioned our TMO marketing strategy to serve the needs of these companies, as well as 6,000 other customers."

DR. ROBERT C. DeVRIES

Diamonds are not forever

LEANING BACK IN HIS CHAIR, Bob DeVries playfully tugs at his beard.

"I'm almost 60 years old," he says with a mischievous wink. "I've got to get cracking and find out what else I can do for this company."

Get cracking! In his 23 years with General Electric, Dr. Robert C. DeVries has cracked open many mysteries about superhard materials. His work has led to understanding, and controlling, the processes for making industrial diamonds and another superhard substance, cubic boron nitride. He holds 21 patents, has authored 63 publications, and has lectured extensively.

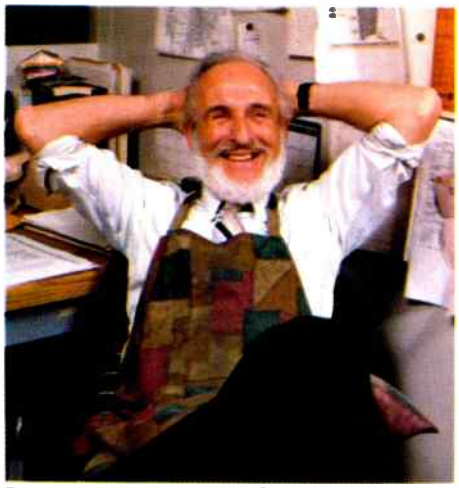
In recognition of those contributions, Corporate Research and Development awarded a Coolidge Fellowship to DeVries in 1981. (Charles W. Eichelberger, an electronics engineer, received last year's other Coolidge Fellowship — named after the late William D. Coolidge, the GE Vice President and director of research who invented the Coolidge x-ray tube and ductile tungsten filament.)

"It's the highlight of my career," says DeVries. "For a scientist at GE, this is the ultimate — recognition by your peers."

As he's talking, DeVries squirms in his chair to give himself a pat on the back. There's nothing egotistical about the back-slapping. It's just a fun-loving, enthusiastic gesture. Typical Bob DeVries.

An inorganic chemist at Schenectady's Research and Development Center, DeVries is a man of many interests. He jogs. He skis. He hikes. He sings in a choral group. He collects top-spinning toys. He cracks nuts.

"There's a right way and a wrong way to crack nuts," explains DeVries in all seriousness. He digs into a bag under his desk and comes up with a handful of hickory nuts, black walnuts and butternuts. "If you cleave this butternut here, you'll get the meat out in big chunks. That's the object. Many underdeveloped countries could improve their nut yield by learning how to crack nuts more efficiently."



Bob DeVries relaxes in his Schenectady office.

DeVries is a beekeeper, too. He has two hives in his backyard. Each produces up to 120 pounds of honey a year, which he gives away to the neighbors. "You can learn a lot from watching bees," he adds. "They have a marvelous society that works. But you can even see differences from one hive to another. One will begin working at 6 a.m.; the other at 9 a.m. One bee will work harder than another, too."

The man who interested DeVries in bees is the same one who sparked his scientific career: a geology professor at DePauw University named E. 'Rock' Smith. "I wanted to be a language major, but he got me interested in geology, chemistry and physics," notes DeVries.

Graduating from DePauw in 1948, DeVries went on to Penn State University. There he studied mineralogy and worked with others on optimizing the composition of blast furnace slags for the steel-making industry.

He joined GE — for the first time — in 1954, and was involved in ceramics research. Then, as he puts it, he got the seven-year itch. He left GE in 1961 for a teaching position at Rensselaer Polytechnic Institute. Three years later he was back at GE.

"I feel many of us can be bigger scientists here than on our own because there are always experts down the hall to draw on," says DeVries. "We have scientists working on everything from glass to turbine buckets to advanced plastics. If you can't find something in that realm, then you've got a problem."

DeVries found diamonds.

(continued on page 26)

Working in "The Diamond Mine," DeVries removes a cell containing materials used in making diamonds from the high-temperature press.

"All the gravy had been done already," quips DeVries, referring to the pioneering work by other GE scientists that resulted in Man-Made™ industrial diamonds and Borazon® cubic nitride. "But there was a lot about these materials that we didn't know. How does a diamond crystal grow? Why will it start here and not there? What can we do to improve yield, yet maintain quality?"

Working in what's called "The Diamond Mine" at Schenectady, DeVries put his scientific curiosity to work on diamond nucleation and growth. He found new ways to make diamonds of uniform size. He suggested new methods of seeding to change the growth rate of crystals. He developed techniques for improving quality of both small and gem-sized crystals. He tracked crystal growth with new polishing and dusting techniques.

"Bob has brought his scientific talent to operating problems and helped us improve diamond quality and production," adds Dr. P. Douglas St. Pierre, manager—Engineering Section at the Company's Specialty Materials Department in Worthington, Ohio.

For his work with diamonds and cubic boron nitride, DeVries received (along with five other GE scientists) the coveted American Society for Metal's Engineering Materials Achievement award in 1973. A year later, the Japanese government invited him to be a guest lecturer at the Tokyo Institute of Technology. Last year he was in India, speaking about high-pressure synthesis and characterization of superhard materials.

Lately, DeVries, Roy Tuft and Bob Reihl developed a method for fingerprinting diamonds. An invisible pattern is written into the diamond surface by ion implantation — with no harm to the diamond, DeVries explains — and made visible by electrostatic charging. "It's a way to show that this is my diamond," he says. The Company introduced the process to jewelers and diamond merchants earlier this year.

As a Coolidge Fellow, DeVries was granted a one-year leave of absence to pursue individual projects.

"A year off doesn't mean a year of goofing off on the Mediterranean," he says, again with that elfish wink. "There are three things I'd like to do."

The first, which he's already started, is to work on the production line at Worthington to see, first-hand, what problems remain in making diamonds.

A second project involves writing a book about diamonds, both man-made and natural. "We still don't know how nature made diamonds," says DeVries, wishing he were 150 kilometers inside the earth to inspect the process personally. "Where did the carbon come from? How long did it take to grow natural diamonds? How come nature didn't make any diamonds bigger than my two fists? If we could find out what nature did, we might be able to improve our own techniques."

As a third project, he plans to go prospecting. "I'll be talking with geologists from Utah International to see how I can relate my background with their work in the field," he says. "I don't know how much longer I can contribute in diamonds. I'd like to find out what else I can do for GE."

Organization Changes

Consumer Products Sector

Roger W. Schipke, Senior VP and Group Executive—Major Appliance Business Group

William R. Webber elected a Vice President

Industrial Products Sector

David M. Engelman elected a Vice President

William R. Fenoglio, VP and General Manager—Component Motor Division

Charles B. Hellmann, General Manager—Distribution Equipment Division Marketing Department

Roger D. Morey, Jr., General Manager—Components Sales Department

Gary L. Rogers, General Manager—General Purpose Control Department

Duane H. Shull, General Manager—PAR-800 Programs Department, Locomotive Products Division

International Sector

Thomas W. Tucker, National Executive—Saudi Arabia

Power Systems Sector

James R. Geurts, President—General Electric Environmental Services, Inc.

Services and Materials Sector

Jack R. Mulford, VP and Manager—General Electric Information Services Employee Relations Operation

Technical Systems Sector

Richard G. Sim, General Manager—Medical Systems Special Health Programs Department

Utah International Inc.

T. Rognald Dankmeyer, General Counsel—Utah International Inc.

Aircraft Engine Business Group

Robert J. Smuland elected a Vice President

The house that Alice built

About her house, Alice Wing proclaims: "Nothing fancy. But it's mine. I bought the land, and on it I created something totally new!

WHEN ALICE WING rebuilt her life a few years back, she used a hammer and nails, a saw and a level to do it. Today, on a quarter-acre parcel in a suburb of Syracuse, N.Y., stands the result of her work — a one-story, seven-room house.

"Nothing fancy," she claims. "But it's mine, every bit of it. I bought the land, and on it I created with my own hands something totally new!"

A customer-returns authorization coordinator for General Electric's Semiconductor Products Department, Alice Wing is proud of the house that she built. It's not every day a person builds a house — especially from scratch, and especially doing it alone. So why do it? Why try to tackle such a tough, backbreaking job that is better left to specialists — contractors, carpenters, electricians and plumbers? Why do it alone?

"When you're out on the street with two children and no husband to support you and no place to go," she says, "you've got to do something. I can tell you, it was tough going with the kids. Building the house was something I had to do!"

Faced with this situation, the average person probably would give up. Not Alice Wing.

"I believe in myself," she tells you. "You can't look at something and say I give up. I knew I could do it. I never had any doubt. Even here where I work at GE, I'm determined to do the best job I can."

Alice Wing did have an edge, however. Her father was a carpenter.

"My father let me come along with him on some of his jobs," she explains. "I watched him work, and he showed me how to drive a nail straight. He was as stubborn and determined as I am, and when he taught me something, I had better darn well learn it the first time."

Using her own, handmade blueprints, she started on her house in an empty lot across the street from where her parents lived. She dug her trench, poured the footings and then lugged in the cinder blocks and put them in place.

"You get awful tired at the end of the day," she recalls. "But I love that kind of work."

The house went up. It was small at first — 400 square feet containing two bedrooms, living room, kitchen and a small closet with a chemical toilet. But no hot water. She dug her own well.

As the years went by, she added to it — another bedroom, a dining room, a hall and a bathroom.

"There's still so much I want to do," Alice Wing says. "I've thought about knocking out a wall and making my living room bigger. But I have eight grandchildren and I need the bedroom when they visit. I enjoy my grandchildren more than the space."

Wielding a hammer, she says: "As long as I can hold a hammer, I'll always be young!"

Flying high with the Hornet

Both fighter and attack plane, the F/A-18 Hornet being built for the U.S. Navy and Marine Corps includes avionics equipment from the Company's Aircraft Equipment Division and two GE F404 engines like the one below being prepared at Lynn, Mass.

"Wrap it up, and send it to me today. With that airplane, I'll never lose another fight."

That pilot, quoted late last year in *The New York Times*, had just test-flown the F/A-18 Hornet.

Powered by two General Electric engines and with significant avionics equipment supplied by the Company's Aircraft Equipment Division, the Hornet is the Navy's largest aircraft program — in both dollars and planes. Current plans call for 1,377 Hornets to be delivered to the U.S. Navy and Marine Corps through the 1990s.

In addition, Canada has ordered 137 Hornets. And Australia, in its largest defense purchase ever, has agreed to buy 75 F/A-18s.

What makes this plane so special? Unlike most modern military aircraft, it's a dual-mission plane. In less than an hour, it can be changed from fighter to attack plane. Built by McDonnell Douglas Corp., with Northrop Corp. as major subcontractor, the F/A-18 is designed to replace both the F-4 Phantom fighter and the A-7 Corsair light-attack aircraft.

The Hornet embodies the latest in supersonic technology, too.

The GE F404 engines, for example, are in the same 16,000-pound thrust class as the Company's J79 engines. The F404s, however, are half the weight of their predecessors and have one-third fewer parts.

"We've used advanced technology to simplify the engine without sacrificing performance," says the Aircraft Engine Business Group's Burton A. Riemer, general manager — F404 Project Department. "We are achieving our goal to develop a reliable, easily maintained and highly operable engine."

The twin F404 engines give the Hornet 32,000 pounds of thrust — enough thrust so a pilot can even accelerate while climbing straight up. Top speed is 1.8 times the speed of sound.

"The greatest part of the F-18 is the F404 engine . . . the F404 reliability and maintainability is its strong suit, better than what we had designed," notes Admiral Thomas Hayward, Chief of Navy Operations.

The Aircraft Equipment Division supplies the Hornet's flight control electronics, electrical generating system, 20-millimeter Vulcan gun and ammunition handling system, cockpit displays, engine thermocouples, and a fuel flow system.

The flight control system, produced in Binghamton, N.Y., includes four computers for an extremely high level of reliability. Flaps, rudders and ailerons are all controlled electronically, without mechanical linkages.

"The system eases the control tasks for the pilot of the highly maneuverable F-18," explains Charles E. Barron, general manager — Aerospace Control Systems Department. "It also monitors its own operation through a built-in, self-test function."

The Hornet is the first fighter to be equipped with this digital flight control system.

Understanding QUA

One man's view

WHEN IT COMES to the subject of quality, Philip Crosby is a "contrarian."

He'll be the first to tell you that American-style managers don't know quality. They don't know how to define it. And, worse, they don't know how to inject it into their products. In fact, claims Crosby, the only problem with quality is lodged in the mind of management. "It doesn't understand what quality really is," he says.

An expert on quality, Crosby is chief executive of his own company—PCA Incorporated. He was a corporate vice president for ITT, where, in his own words, "I had 500 quality managers reporting to me from all over the world." He formed his own firm in 1979 to help companies improve the quality of their products and services.

Recently, Crosby addressed a conference of GE executives, outlining to them his "strategy of quality improvement." It contains four absolutes —conformance, prevention, performance, and measurement.

The most important of these, asserts Crosby, is conformance. "Quality," he says, "is one thing—conformance to the requirements."

When you determine the specifications of a product or service, he continues, then you have set the requirements, too. "Say you want a hole one inch in diameter—plus or minus 10/1,000s. That's the requirement. Very specific. Not two inches. Not half an inch. But one inch. And once you have that requirement, you must stick to it."

As an example of stick-to-itiveness, Crosby cites the Japanese.

"People today are trying to figure out why the Japanese do so well. What is it they have? Is it their 5,000-year-old civilization? No. That civilization was making junk before World War II—same people, same traditions, same everything. What's the difference? They take the requirements very seriously. If they write one inch—plus or minus 10/1,000s—everybody spends their whole life trying to make it one inch—plus or minus 10/1,000s."

But, adds Crosby, in the United States, "you've got a whole cadre of people who do nothing but sign quality waivers. This one's good, that one's bad. Oh, it isn't that bad. What the hell, don't be a fanatic about this thing. Let's get a waiver. *That's not conformance to the requirements.*"

The second of Crosby's absolutes is a system for prevention.

America has always been a land of "eternal growth." You never worry about preventing errors, because you can always make an extra product to cover your mistake—or get a waiver so your mistake can slip by.

"It's all written down," he claims. "Drill, inspect, get a waiver. Make 10 to get seven."

Crosby then asks you to imagine yourself in a foreign country. "You get to the airport where you're supposed to call the GE representative. You walk into the phone booth to make the call, but you've got only one coin. Well, you're going to read the instructions in that phone booth, you're going to get out the number you're to call, you're going to rehearse, you're going to know exactly what you're doing before you put that coin in the slot because you may not get another chance. That's what the Japanese had. One dime. They had to have a system of prevention because they

LITY

Quality expert Philip Crosby, talking to a General Electric audience, outlines his strategy for excellence.

couldn't afford the luxury of making 10 products to get seven. People will not prevent errors unless they take your requirements seriously—unless *you* take your requirements seriously."

The next absolute in Crosby's strategy is performance standards.

"I'm not talking about acceptable quality levels when I say performance standards, I'm talking about zero defects," he explains. "Having a quality level insures you're going to have bad products. If, in the widget business, for example, you had an outgoing quality level of 3% defective, and you made a million widgets, 30,000 are going to turn out bad. And then that's the basis on which to determine the number of servicemen you need."

Crosby's belief is that you can't have quality levels substituting for performance standards.

"If you have a quality level of 3%, everybody takes it," he says. "Engineering takes it, manufacturing takes it, purchasing takes it, finance takes it, quality takes it."

What does he mean then about performance standards? "Zero defects—that's what we're talking about," he reiterates. "Zero defects, or defect-free, means *do it right the first time, do it right every time*—not 97% of the time, not 96%, not 99.8%, but every time. That's all it means."

Measurement is the last of Crosby's absolutes—measuring the cost of non-conformance to the requirements against a system for prevention.

"Each year," he explains, "non-conformance, which pays for the scrap, rework, service and all that kind of jazz, costs a company so much money—let's say 16% of sales for sake of argument. To bring that cost down, you must spend money on prevention—for inspection and testing necessary to measure your program, for training, and for teaching your people what quality really is."

He continues: "So, we say non-conformance costs 16% of sales and, through your system of prevention, you set a five-year goal of getting that cost down to 12%. That's a 25% reduction—that's a lot of money. And that you can measure!"

Crosby sums up his view: "You've got to get quality around something you can put a glove on—something you can manage. A fundamental of good quality is conformance to the requirements. That has to come first. And if you say that, and make that a policy, everybody will understand what you mean."

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