MEASURE

The inside story
on HP's newest personal computer

MEASURE

"Man is the measure of all things."
—*Protagoras (circa 481-411 B.C.)*

Hewlett-Packard Company designs and manufactures computers, electronic test equipment, handheld calculators, electronic components, medical electronic equipment and instrumentation for chemical analysis. Manufacturing facilities are located in 23 U.S. cities in eight states and in 10 cities in nine countries in the rest of the world. HP sales and service offices can be found in more than 80 U.S. cities and (including distributorships) in approximately 200 cities in 70 countries around the world.

ON THE COVER

Meet the HP 150 ... the company's newest entry in a busy personal computer market. The machine's most dramatic feature is its touch-sensitive screen which lets you point your way through a computer program. Measure looks inside HP's Computer Groups at the changes the machine has caused in the organization. Cover photo by Tom Upton.

UPFRONT

HP graphics play a heavy role in box-office smash.

Computer security is making headlines around the world. (See story on page 16 by staffer Betty Gerard about HP's own efforts in the field.) But HP also helped dramatize the problem through a supporting role in the movie "WarGames."

In the spectacular closing scenes of the movie, tension builds in the make-believe U.S. defense command post. Wall screens and computer terminals around the room flash with the changing pattern of approaching enemy nuclear missiles.

It's all a skillful illusion created by computer graphics consultant Colin Cantwell, using four HP 9845C desktop computers along with other HP equipment.

Colin and his firm, Crystal Chip, spent 10 months on the project, which was a critical part of the film's dramatic action. He designed and programmed half a million frames of computer graphics, which were then reproduced on film and projected onto screens behind the actors on the war-room set.

What appeared to be 12 large animated wall maps were actually images beamed from a battery of synchronized movie projectors located off-camera. The many small terminal screens showed similar images that had been transferred to videotape.

The multiple images had to mesh with the dramatic action, so Colin first used the computer to draw 100 pages of storyboard in order that the director could view the overall effect of the proposed graphics display at any given point in the script.

The final images were all created on a single design station using a desktop computer connected with an HP 9874A digitizer on which the drawings were done. The large size (up to 18 feet) of the war-room screens meant the computer graphics had to be photographed from a very high-resolution vector display (the HP 1345A) driving an HP 1336A display tube. The huge mass of drawings was stored on an HP flexible disc drive, then played back—one frame at a time—by three other desktop computers, each connected to a motion picture camera by a 16-bit interface.

These computer-controlled camera stations usually filmed three to four frames a minute, 24 hours a day, seven days a week—slowly exposing the 17,000 frames of computer graphics required for each minute of action on the sound stage.

"Under the gun of such time pressure, it was important to use a computer system that was trouble-free and could evolve the perfect version of a picture as rapidly as possible," Colin says. Colin, who designed the original models for "Star Wars" among his other screen credits, has long been an admirer of the 9845C. As a consultant to HP, he did the graphics for the original demonstration package for the desktop when it was introduced in 1980. **M**

Hewlett-Packard computer graphics were used in a splashy way in "WarGames" war room.

HP's newest personal office computer, featuring a touch-sensitive screen, puts the company in a fiercely competitive market where there have already been casualties. But HP people around the world are betting that the new machine and the changes in the HP organization will provide just
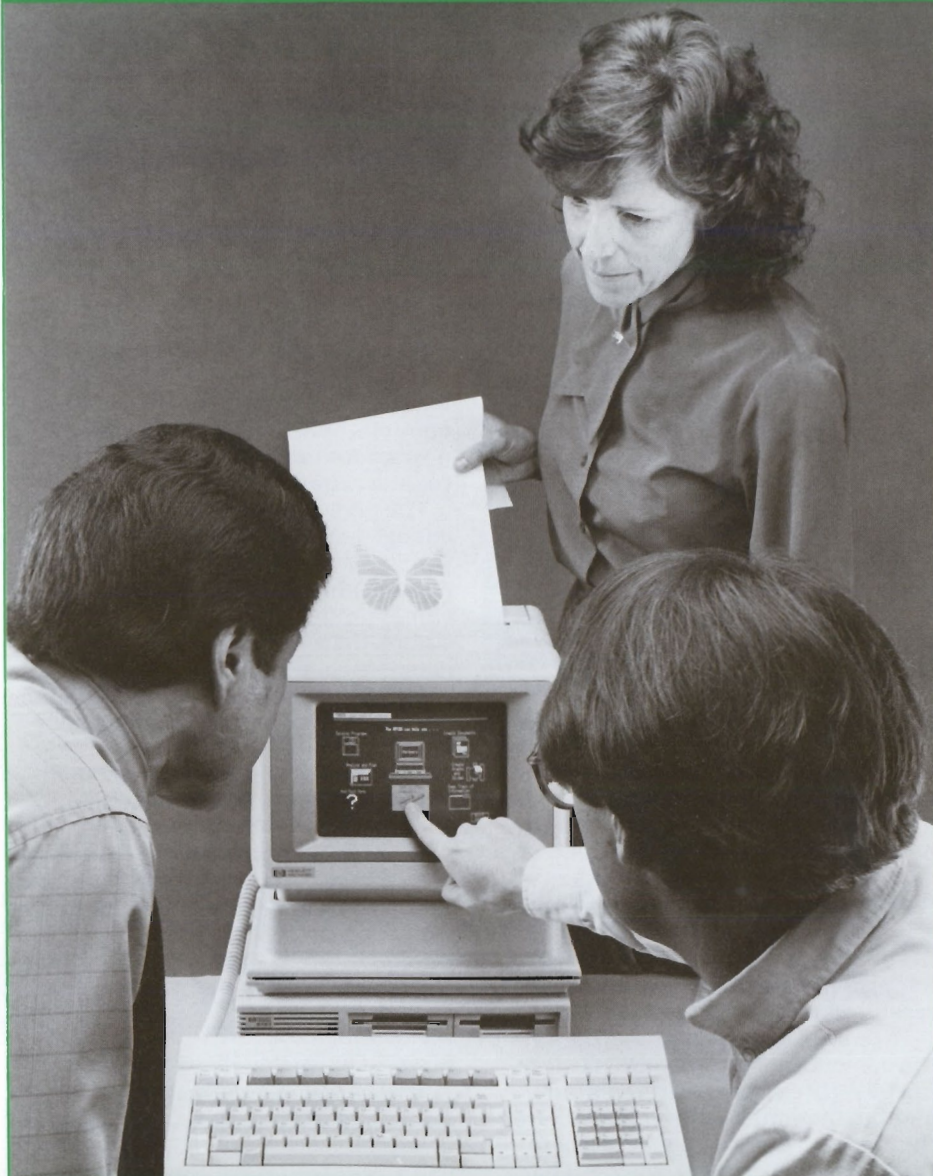
THE RIGHT TOUCH

When HP unveiled the HP 150 personal computer in September, the company found itself in a market filled with uncertainty, competition and pitfalls the likes of which it had never seen before.

HP tackled the challenges as if the company's future depends on it. In many ways it does.

"Success in personal computers is absolutely essential to continuing in the business we are already in," says John Young, HP president.

It's much like a set of falling dominoes. If HP isn't successful in the personal computer market, it won't be successful in the entire computer market. And if HP

TOUCH

Textures and colors of graphs are changed by touching the HP 150's screen.

doesn't succeed in computers (now more than half the company's revenue), it would hamper the company's overall performance.

Paul Ely, executive vice president of the Computer Groups, puts it another way. "At some point toward the end of the decade, personal computers will be our primary business if we are a successful computer company."

To be sure, HP has had offerings in the personal computer market before. In 1977, HP established its commitment to the young industry by creating the Personal Computer Operation in the Corvallis (Oregon) Division. That group's Series 80 computers, introduced in 1980, have become one of the most popular in the technical and engineering markets and serve as workhorse controllers for many instrumentation systems.

But confusion has overshadowed such successes. In addition to Corvallis' Series 80, the Data Terminals Division in Sunnyvale, California, was cranking out the 100 series of personal office computers, while people in Fort Collins, Colorado, were responsible for the 200 series of desktop computers for the technical market.

"We had several organizations in the company that were somehow addressing the market," says Cyril Yansouni, now general manager of the Personal Computer Group (PCG), "but none of them had it as their major focus."

In some ways, it was as if HP's strengths were working against the company. HP had become successful by selling from engineer to engineer. Customers had been willing to pay top dol-

lar for the HP label, knowing that it stands for quality and superior technology. Market research had been informal, based largely on HP engineers' opinions of whether customers' engineers would accept a product under consideration.

The personal computer market has changed that. With 1983 sales of about 7 million machines, the personal computer is much more of a mass consumer product. But to the casual consumer, there's a fuzzy line dividing personal computers for the home (the Ataris, Colecos, Sinclairs and Commodores) from personal computers for business (the IBM PCs, Apples and DECs). Part of the reason: More than 200 American companies now manufacture personal computers, double the number of only two years ago. Dozens of European and Asian companies have also jumped into the market.

More than 200 American companies now manufacture personal computers, double the number of only two years ago.

HP is aiming the HP 150 for the business market. "Companies will put a computer on every desk long before there'll be a computer in every home," says Srini Nageshwar, manager of PCG's retail marketing program.

Despite the fuzziness in both the company and the marketplace, Hewlett-Packard has had a good track record. "We had more than $500 million in sales in the personal computer market in 1982," Cyril points out.

But to focus its efforts, HP set about in early 1983 to revamp its product thinking, modify the Computer Groups' organization, improve its dealer program and begin consumer advertising (see boxes about dealers and advertising on pages 5 and 7).

PCG decided to build the HP 150 to microcomputer industry standards: the MS-DOS operating system and the Intel 8088 microprocessor, both popularized by IBM's PC. That decision made it relatively easy for outside software writers to rewrite their packages

for HP's new machine.

"Our objective in designing the HP 150 was not to build another IBM personal computer look-alike," explains Tom Anderson, general manager of the Personal Software Division in Santa Clara, California.

One important difference was HP's choice to use twin 3½-inch floppy disc drives as the HP 150's standard instead of an IBM compatible 5¼-inch drive. The reason was simple. The 3½-inch drives, made by Sony and introduced by HP more than a year ago, are less expensive than their larger cousins, use less space, and have had a failure rate one-fourth that of the 5¼-inch drives. Yet both discs hold the same amount of information.

But the feature which most clearly sets the HP 150 apart from the IBM PC is its touchscreen.

Jim Sutton, an R&D section manager at the Personal Software Division explains that the touchscreen was originally designed as an option. "Over the course of the development of the product, we convinced ourselves first of the value of the touchscreen and second of our ability to manufacture it for a cost low enough to make it a standard feature of the product."

Invisible beams of infrared light crisscross the HP 150's screen. When your fingertip breaks both a vertical and a horizontal beam, it sends a signal to the computer, just as if you'd touched a key on the keyboard.

One industry observer feels HP's touchscreen goes beyond other pointing devices such as the mice and light pens. "It's almost as if the touchscreen turns your finger into a conduit between your mind and the computer."

To take advantage of the touchscreen, most of the software packages for the new computer were written with fingertip control in mind.

For example, the first screen you're likely to see when you turn on the HP 150 belongs to PAM (for Personal Applications Manager). This software shields you from memorizing the dozens of nitty-gritty commands needed to run the computer's operating system. With the touch of the finger, you can choose programs to run, can copy files and discs and can load software.

A Personal Card File program puts

the familiar desktop rolling card file inside the HP 150 computer. As you touch the on-screen "knobs," the card file spins to the proper spot in the alphabet. Touch an index tab and bring up a full-screen version of that card, complete with the familiar tab at the top and two little cut-outs at the bottom.

Other best-selling software packages, like WordStar® and VisiCalc® let you point your way through the program.

When the HP 150 entered the market this wealth of software was ready. This up-front emphasis on software was "a first for an HP personal computer division," says one industry observer. "Never before have so many software packages rolled out of HP's doors back-to-back with the hardware."

IBM started the move toward relying upon outside software houses when it introduced the best-selling IBM PC in 1981. Before that, most personal computer manufacturers wrote their own operating systems and software. The rationale was that once consumers had purchased the hardware, they'd have to come back to the same company for all their software.

But IBM turned the industry upside down by providing all hardware and software technical specifications to third-party manufacturers so they could develop their own add-on products. Many of the software packages now available for the new HP 150 gained their popularity when they were introduced for the IBM PC. Because the two machines use the same operating system, it was easy for third-party software vendors to modify them for the HP 150, adding enhancements that take advantage of the touchscreen feature.

The new directions in hardware and software strategy weren't the only major changes within HP. In a company known far and wide for its emphasis on decentralized operations, top management decided to recentralize the personal computer efforts.

The resulting Personal Computer Group came together in January 1983 under Cyril Yansouni. The group's charter is to develop and to manufacture personal and portable computers,

A monarch butterfly poses on a fingertip during the filming of the TV commercials.

TURNING HP INTO A BRAND NAME

The personal computer industry spent more than $500 million on advertising in 1983, and HP joined the crowd early last November with its own "setting you free" campaign.

HP is hoping to make its name a household word in an industry which is only seven years old. The company's ad budget for personal computer products quadrupled to approximately $35 million, and HP's first product television commercials took to the air in November. (A series of five television spots in 1981 was aimed more at enhancing the company's overall image.)

In the new television spots and print advertisements in major national publications like *Business Week*, the *Wall Street Journal* and *Time*, HP's slow-moving caterpiller becomes a butterfly. Some people have even compared the metamorphosis to the company's attempt to change its image from specialty-market computer supplier to mainstream personal office computer manufacturer.

"Working at a sure and steady pace almost always produces results. The problem is, it doesn't get you much attention," says the announcer as a black-and-gold caterpiller crawls across the keyboard of an HP 150. "So even though Hewlett-Packard technology has produced a number of firsts, some of you still don't know who we are. Maybe now you will."

Personal computer manufacturers, including HP, are beginning to realize what the soap and cornflakes people recognized long ago: Brand preference among consumers shapes the marketplace. Marketing and distribution have become more important than research and development. That's why Apple spent upward of $40 million and the personal computer division of IBM spent $45

million advertising their products this past year.

It's television and print advertising that will increase consumer awareness of HP's personal computer products. Those ads will help draw people into retail outlets to see and perhaps buy those products. But unlike the soap and cornflakes fields, computer consumers are still learning about this young industry and its product offerings.

"There's a real evolution of consumer perception in the marketplace," explains Jim Eaton, advertising manager for the Personal Computer Group.

"There's tons of research about who buys personal computers and why. But the marketplace is changing so fast that data from 1980 and 1981 are meaningless today."

Before HP's television ads were ever seen on the air, they were tested by a group of consumers. A foot-deep stack of media research helps Jim decide in which markets, at what times and during which shows HP's TV spots will be most effective. HP is beefing up its efforts to gather meaningful information.

"The research function is critically important," says Jim, "for it shows us where this very young market is going." One of the five functional areas in the Personal Computer Group organization is now the marketing information systems department of Bill Bondurant. Bill's group also does work for the combined Computer Groups' Marketing Information Center.

In addition to the nationwide advertising campaign, the company is backing its dealers with a cooperative ad program that provides them with funds and material for their own local advertising.

TOUCH

The HP 150's disc drive and display take up less desk space than an open book.

HEWLETT-PACKARD

terminals, and workstations. There are now six divisions and four operations in the group:
- Personal Office Computer Division
- Personal Software Division
- Grenoble Personal Computer Division
- Portable Computer Division
- Vancouver Division
- Roseville Terminals Division
- Personal Computer Distribution Operation
- Puerto Rico Operation
- Singapore Operation
- Brazil Operation

The hot manufacturing spot in the group today is the Personal Office Computer Division in Sunnyvale, California, which builds the HP 150 using some of the newest manufacturing techniques available in the corporation. Just-in-time scheduling of parts keeps inventories (and, therefore, costs) low. Delivery trucks rumble regularly to the plant's loading dock to drop off supplies from vendors. Many of the computer's components, including the plastic cabinetry, are manufactured by outside firms.

In another HP building in nearby Santa Clara, employees ready software for the HP 150 at the Personal Software Division. One of its busiest places is the new HP COACH customer center. It derives its name from its toll-free telephone number: 1-800-HPCOACH.

Experts from all parts of HP—accountants, personnel experts, master schedulers, test technicians, computer programmers, hardware support experts, secretaries—joined HPCOACH to answer customers' telephone ques-

tions about personal computer products. Each of the center's 33 employees has been trained as an expert in one or two software applications.

To prepare these experts for days filled with telephone questions and complaints, the center held three special training sessions in September.

Trainers from Pacific Southwest Airlines, who normally teach passenger agents how to handle irate travelers, showed HP people how to deal with tough individuals on the phone.

The following week, a former police chief taught center employees how to break questions into small, easily handled components and how to probe tactfully for underlying complaints.

The third session featured HP field managers who discussed the types of inquiries dealers most frequently receive from customers.

Today the center fields as many as 250 telephone calls a day. As more HP 150s are sold, that number will grow.

In dozens of key markets across the U.S., HP has opened personal computer centers. In these company showrooms, set up in HP sales offices, prospective customers can see demonstrations of personal computers, peripherals and software.

Customers are often sent to the centers by local HP computer dealers to see

OFFICE PERSONAL COMPUTER MARKET-SHARE LEADERS (U.S.) 1983

IBM	26.0%
Apple Computer	21.0
Radio Shack	13.4
Hewlett-Packard	6.5
Digital Equipment	3.2
TeleVideo Systems	2.4
Zenith	2.3
Osborne Computer	2.3
Commodore	2.2
Texas Instruments	2.1
Victor Technology	2.1
Altos Computer	2.1
Other	14.7

Source: Future Computing of Richardson, Texas

the full HP product line. It's often prohibitively expensive for a dealer to keep the complete product offering on the floor of the store.

These PC centers don't act as sales offices, but are points of information, support and training. Customers still place orders through local dealers.

Starting early this year the HP 150 will be introduced to markets outside the U.S. "With the HP 150, we can enter the international marketplace and be a force because we understand how to localize a product," says Alan Nonnenberg, manager of major accounts for PCG.

"With HP's application centers, we have local development capability in major countries outside the U.S. to customize personal computers and software to local market needs."

The application centers in European markets have been working with the U.S.-based Personal Office Computer and Personal Software divisions to tailor hardware, firmware and software to local customs. For example, the French version of the HP 150 features French keyboards, displays French error messages and runs French application software.

Can HP be successful in the U.S. and the rest of the world with the HP 150? A recent study by *Datamation* magazine ranked HP as the world's fifth largest personal computer manufacturer. Industry experts at Future Computing put HP in fourth place in the office personal computer race. With HP's sound financial position and its reputation for high-quality products, the chances for success are good.

Orders, shipments, and dealer sign-ups all have exceeded targets so far. In fact, manufacturing space for HP 150 production is being increased beyond its original target.

As *Forbes* magazine reporter Kathleen Wiegner told her readers, "Of the handful of companies that has even a chance to give IBM a run for its money in microcomputers, Hewlett-Packard is a strong contender." **M**

LET'S MAKE A DEAL

It's a fact: Most personal computers for business are sold through retail stores. With the introduction of the HP 150 came a heightened interest in establishing a second-to-none dealer program for Hewlett-Packard.

"In the past, the dealer channel was not essential to us," says Cyril Yansouni, general manager of the Personal Computer Group (PCG). "When we had to make a trade-off, it was always in the direction of our direct sales force."

HP had 420 outlets in its dealer network at the end of 1982. "But many of them were not the optimal, mainstream dealers," says Alan Nonnenberg, former manager of the retail program and now major accounts manager for the Personal Computer Group. "Of course, at the time, we didn't have a mainstream product either."

The HP 150 helped change that. Today the machine can be found on the shelves of more than 600 retail outlets in the U.S. The dealers range in size from small specialty computer shops to international chains like ComputerLand.

The presence of the HP 150 on dealers' shelves has solved a problem many HP salespeople were facing when they called on customers. "Our direct sales people would call on the people who make the decisions on which personal computers to buy for their company," explains Alan. "And those decision-makers would say, 'I was in a computer store over the weekend and I didn't see HP represented. How do you compare with...

"We had ignored the fact that those people were also normal consumers on Saturdays and that they visited computer stores. On Mondays they carry those ideas back to work with them."

To earn shelf space alongside the Apples, IBMs and Digitals of the world, HP revamped its arrangements with dealers. Among the improvements:

Retail computer stores, like this one in Los Gatos, California, play an important role in HP's personal computer marketing plan.

- **Dealer training.** HP now offers product and service training to the dealer's sales and technical staffs.
- **Distribution.** HP established a new central distribution center in Sunnyvale, California. The new distribution center's goal is to have smaller orders on the dealer's doorstep one week after the order arrives.
- **Cooperative selling.** HP will concentrate its direct personal computer sales efforts on about 150 large, national accounts. In those organizations, HP will offer employee purchase programs run by local dealers. In all other companies, HP sales reps will work with dealers. An incentive program encourages cooperation over competition.
- **Dealer hotline.** Technical questions from dealers about personal computers, peripherals, software and operating systems come to a new toll-free hotline at PCG headquarters in Cupertino, California. A second toll-free hotline (1-800-FOR-HPPC) handles general inquiries about advertising and pre-sales data

for all of HP's personal computer products.
- **Stocking the HP 150.** A new flooring plan lets dealers work on a pay-as-you-sell basis with a third-party credit company. The new plan also lets dealers stock systems free for 60 days, then pay interest on them for up to 180 days. Demo systems are available on consignment.

There's also a new mechanism in place to improve the improvements. Once each quarter, a group of 10 to 12 dealers will meet with company representatives to provide feedback on products, promotions, HP's advertising and other topics. This new organization is called the HP Dealer Advisory Council.

"We recognize that the dealer sales channel is a major driving force in the personal-computer market today and in the future," says John Young, HP's president. "With this new dealer program, Hewlett-Packard is striving to establish a widespread, full-service dealer presence."
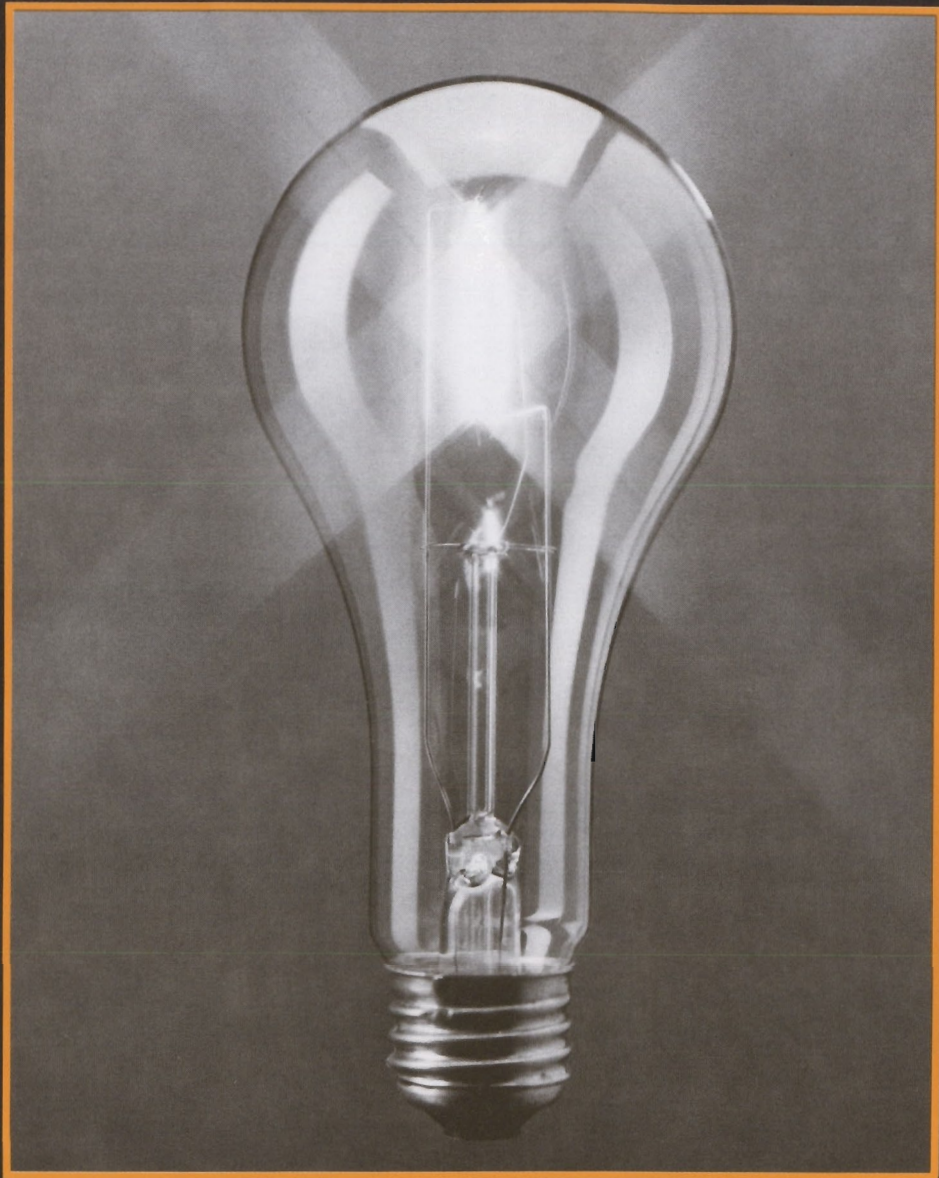
TOM UPTON

SHINING ON

In the fast-changing world
of high technology,
this 45-year-old product
hasn't lost its brilliance.

Few companies well into their fifth decade can boast that the first product they ever made still sells. Fewer still can point with pride that the original product featured technology that isn't obsolete in this high-tech age.

Hewlett-Packard can say both.

The 200A audio oscillator, named by Bill Hewlett and Dave Packard so it sounded as if their young company offered a slew of products, has been modified slightly through the years and is now called the 200CD. But the basic technology and the original concept invented by Bill while an engineering student at Stanford University remain.

"Bill and Dave were on track with the way they built the 200A," says Max Ramble, signal source product marketing engineer at the Lake Stevens Instrument Division, where the 200CD now is made. "The technology has stood the test of time."

The 200A was retired in 1953, the year after the 200CD took over. Both featured the now-famous light-bulb technique introduced by Bill and Dave to help stabilize the amplitude output of the audio oscillator. A key difference is that the 200CD has an expanded frequency range that requires a second light bulb.

Differences aside, the 200A and the 200CD symbolize excellence in the audio-testing field. Max says that it was a sign of commitment to quality for a shop to use an HP audio oscillator. And, up until the 1960s, electronic textbooks discussed the technique used in producing both products.

"HP audio oscillators were in engineering classrooms across the country," Max says. "There was a whole generation of engineers who grew up with the 200A and the 200CD."

And that familiarity with the product on campus later creates customers for the 200CD. Max and the LSID sales and support group estimate that more than 100 tons of 200CDs have been sold since the product was introduced. Among the names on the long customer roster is Walt Disney Studios, HP's first big customer in 1939. Disney bought a 200A for soundwork on the classic movie "Fantasia." Through the years, the 200A and the 200CD have been used to design, produce and maintain telephones, stereos, radios and other audio equipment.

But perhaps the most famous HP audio oscillator is a miniature gold-plated 200A, built in the mid-1950s. Bill and Dave received the shining instrument to commemorate the 10,000th audio oscillator to roll off the production line.

In all, the 200A, the 200CD and the rest of HP's broad line of signal source products have reaped great rewards for the company, Max says. Since 1939, HP has seen a 20 percent compounded annual growth rate from these products.

And, as Max points out, it only proves that, with the light bulb, Bill Hewlett had a better idea. **M**

HP ARCHIVES
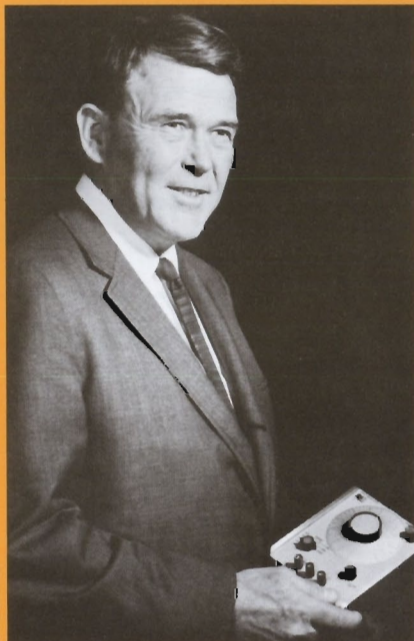
Bill Hewlett holds this 1968 version of the audio oscillator that launched HP.

BILL'S BRIGHT IDEA

When Bill Hewlett was a Stanford University master's candidate, he turned a light bulb into a bright idea. It was so bright that from it the young Hewlett-Packard Company was born.

Bill was working with a Wien Bridge oscillator, which was used to generate an output signal and to test audio equipment, such as radios and telephones. The problem with the Wien Bridge was that the output amplitude became unstable when varying levels of electrical current were transmitted through the instrument during testing.

The solution? Insert a light bulb. The light bulb's resistance fluctuated with the changing levels of electrical current in the oscillator and compensated for those changes. The result was a stabilized output amplitude and the beginning of one of the most successful stories in corporate history.

HP ARCHIVES

Hewlett-Packard Company's first product was the 200A audio oscillator.

YOUR TURN

ANOTHER BIGGIE

In the March-April 1983 issue of *Measure* I noted the "Small List of Some of HP's Biggests."

This photo from my own memorabilia captures at least a better contender for HP's "biggest" product than those in the article.

The sale was made at a trade show where I met with officials of the U.S. government's Office of Telecommunications Policy (OTP). The following Monday HP had an order for a complete mobile spectrum monitoring system: a van complete with antennas, portable power and an HP 8580A automatic spectrum analyzer in a multibay rack. This was then produced by the former Microwave Division.

The system was used largely to collect data on government communication channel use. This allowed OTP to make best use of the available spectrum.

So for those people who ask if HP makes or made the Packard automobile, you can now answer, "No. But we did sell a rather special Hewlett-Packard motorhome."

REED OGDEN
Santa Rosa

FLYING WITH HP

The article on "HP's No-Fuss Airline" in the November-December issue was very interesting.

Approximately one year ago, I was to attend an interview at Roseville, California. I was scheduled to fly on one of the HP planes from San Jose to Roseville and then return later that day. But, because I was the only passenger, the flight was cancelled the day before my interview.

There wasn't enough time to arrange another commercial flight, so I drove a company car—a three-hour drive each way. Although my trip was pleasant, I wonder if the six hours on the road would be offset by the "approximately 45 minutes" flying time?

Having been a civilian test navigator before coming to HP, I was looking forward to my flight. Perhaps another day.

DONALD DROZDENKO
San Jose

HP's aviation department takes a number of factors into consideration before deciding to cancel a flight: the number of people scheduled to fly in each direction, the weather, the destination and the aircraft being flown. Aviation's Debbie Buffo explains, "It's been a long time since we've had to cancel a Roseville flight because we didn't have enough people. More often than not, it's the weather that disrupts our schedule."

Your HP airline article told us not to be surprised if we saw an airplane with "HP" on the tail at our local airport. That reminded me of this photo I've been saving of a plane used to demonstrate HP products.

The modified DC-6B flew in January 1969 to Hawaii, New Zealand, Australia, Asia, Africa and Latin America with more than 100 instruments, computers and calculators on board.

EBO CAVALLINI
Santa Rosa

WHAT WE HAVE IN COMMON

Over the years as I have moved from position to position within HP, I have been exposed to a variety of exceptional Hewlett-Packard people. These people have exhibited many varied talents, skills and attitudes. To help me keep the "HP way" alive and well in the '80s (a job we all share, by the way), I have used three concepts to describe their common attributes.

1. They are professionals, aware of their roles in the organization and their contributions to HP. They address problems with honesty and objectivity and maintain high standards of performance for themselves and those around them.

2. They have a strong sense of ownership about their organization and their responsibilities. Quality is taken as a personal commitment, profitability is a part of every decision and a sense of urgency is brought to every task.

3. They view their positions with a service orientation, seeking to create a supportive, team environment in which an awareness of the strengths and weaknesses of people around them can lead to a strong feeling of contribution by all members of the organization.

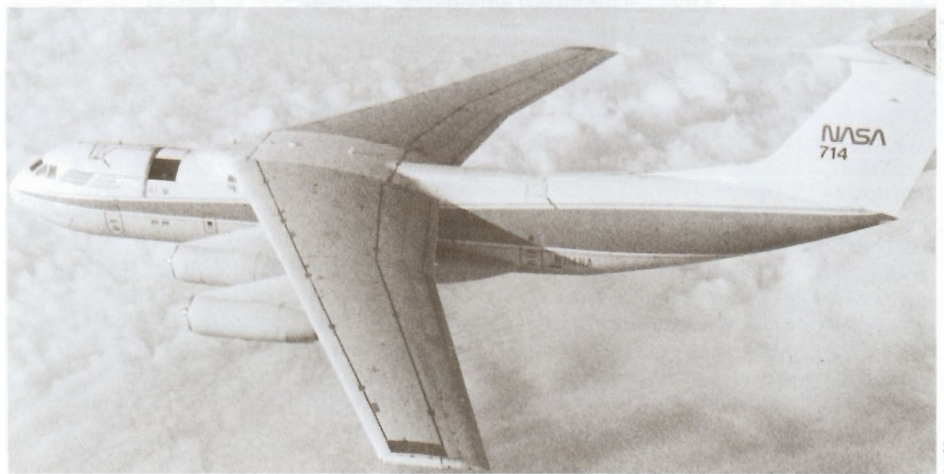I hope other HP people find these concepts useful in approaching their jobs.

JOHN JONES
Santa Clara
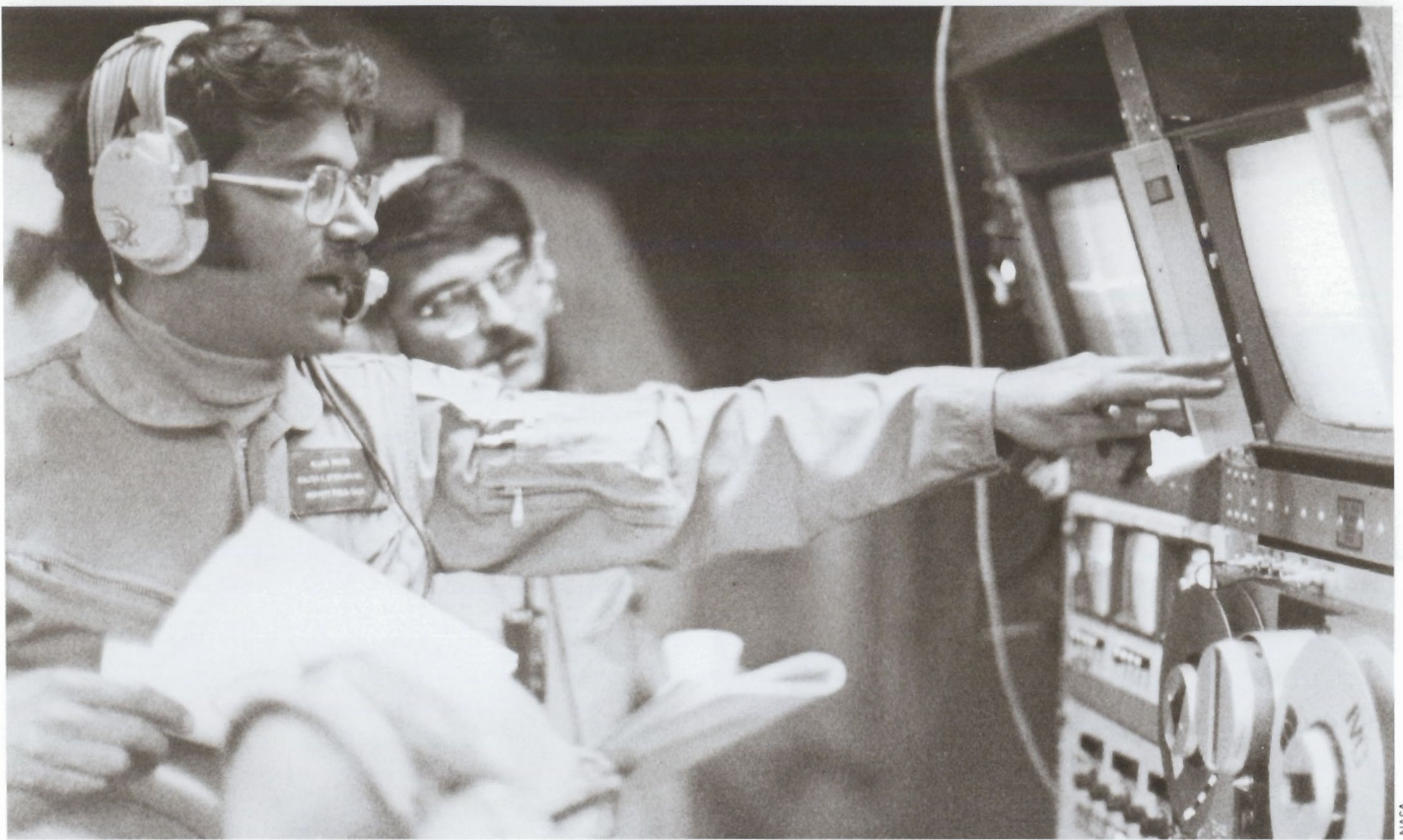
Star tracker operator Allan Meyer checks the monitor for the on-board telescope during an observatory flight.

HP computers help NASA program take off

A 10-year-old converted cargo plane flies astronomical missions as part of the National Aeronautical and Space Administration (NASA) Airborne Science Program.

A meteorologist's brainstorm put HP on a pleasant collision course with NASA's Airborne Science Program more than 15 years ago—an association that has ballooned both in scope and in the amount of HP hardware and software flying scientific missions around the world.

Today, HP computer gear aboard two NASA planes studies far-away galaxies and down-to-earth weather systems. It all began when a scientist from the Goddard Weather Satellite Instrument Group brought an HP 2100 with him on board a Convair 990 airplane used by NASA for collecting weather data.

The computer worked so well—even while airborne—that NASA people decided they'd like to have a data processing system as part of their standard equipment.

"A lot of us wanted to buy computer equipment," recalls NASA's Carl Gillespie, who has been part of the program since the 1970s. "Because we're a governmental agency, we had to go out for bids. Though HP's bid was not the lowest, the winning bid came from a small job shop that used HP equipment."

While a lot of the HP equipment is
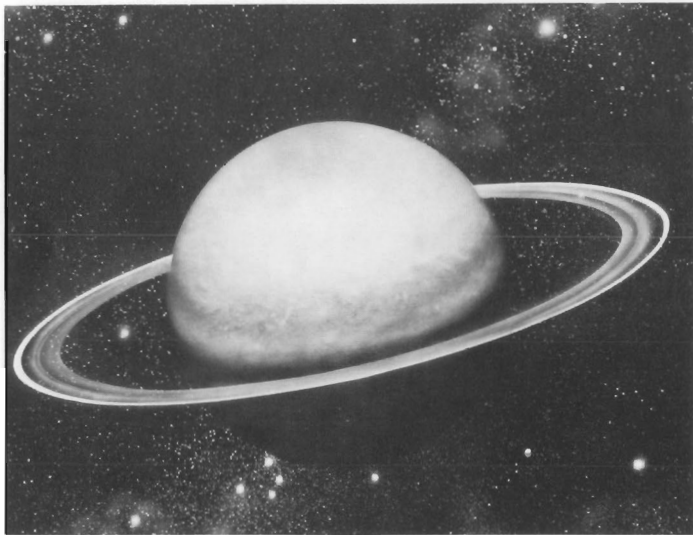
This artist's conception of the planet Uranus shows the rings which were detected during a flight of the Kuiper Airborne Observatory.

Before every Kuiper Airborne Observatory mission, the crew works up a flight plan (this one covers the western U.S.) on an HP computer.

airborne, more can be found on the ground at NASA's Ames Research Center in Mountain View, California—home base for the flights.

Two HP 2113 computers on each plane are the program's real workhorses. They do "housekeeping" chores like storing and generating flight paths, logging the aircraft's action and keeping the plane on course. On the converted Lockheed C-141 cargo plane used for astronomical missions, one of the computers stores the coordinates and magnitudes of more than 250,000 stars from the *Smithsonian Astrophysical Observatory Star Catalog*. Then, on command, the computer produces maps of star fields.

But the HP computers' most important tasks are controlling the on-board scientific equipment and collecting the data gathered by the teams of flying astronomers, geologists and meteorologists.

Other HP equipment, both on the ground and in the air, supports the primary computers. An HP 2108 computer controls a video tracker. Two HP 7906 disc drives store programs and data. Four HP 7970 digital tape drives (mounted sideways in the C-141) log data. And an HP 6942A multiprogrammer provides signals for the flying scientists.
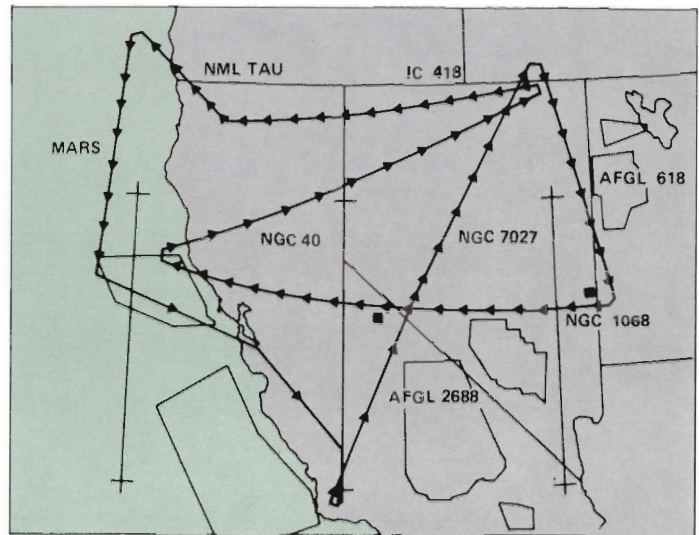
Over the years, scientific teams on both planes have made many significant contributions to the fields of astronomy and meteorology.

The C-141, known as the Kuiper Airborne Observatory (KAO), is the flagship of the program. A large hole in the side of the hull holds a 36-inch-diameter reflecting telescope. Its advantage over earth-bound telescopes is the clearer infrared image of the galaxies it can produce by flying at altitudes from 41,000 to 45,000 feet.

"Water vapor weakens the infrared signal, so by flying above 99 percent of the moisture, the telescope is able to observe the infrared radiation emitted by stars, planets, nebulae and galaxies," says Carl.

The observatory's most famous discovery came in March 1977 when astronomers found that the planet Uranus had several rings. This finding came as a surprise to all on board. They had trained the telescope on the planet that night to observe the eclipse of a distant star.

Cornell University's James Elliott was the principal experimenter on that mission: "Thirty-five minutes before the star was expected to be covered by Uranus, the star's light unexpectedly dimmed for a few seconds ... a few minutes later,

another abrupt dip occurred, then another, and another and another."

Only later did he realize that the sudden dips were caused by shadows of the rings of Uranus as they passed over the telescope.

More recently, a special camera attached to the telescope took computer-generated, false-color photos of the space shuttle Columbia as it flew past KAO for landing. The photos showed the temperature of the special tiles on the plane's wing, body flap and fuselage.

Meanwhile, the missions flown by the Galileo II (a Convair 990) depend heavily on the weather. The plane looks for all kinds of storms—hurricanes, thunderstorms, monsoons—and meets them head-on. "Scientists call these natural phenomena 'targets of opportunity,'" says Sarah Young of Informatics General, the company that provides the data processing support staff for the airborne programs. "Sometimes we decide to alter our flight plan midway and scout out such a target."

On a weather fact-finding trip, an airborne laser system on board the Galileo II fires a beam through the air surrounding a thunderstorm. The laser scatters the dust, pollen and small particles in the air. By measuring the shift of the particles,

the wind velocity can be determined. The on-board computer system prints the results 40 seconds after the laser scans the sky.

"These studies provide meteorologists with a more complete picture of what happens during a storm," explains Sarah.

In 1979, the Galileo II was in Asia for an international study of monsoons called MONEX (monsoon experiment). For two months the plane took a variety of atmospheric readings: temperature, density, pressure, humidity, ultraviolet sky radiance, etc. The data was used to improve short-range predictions of monsoon rainfall.

When the El Chicon volcano erupted in southern Mexico in 1982, it formed a sulfuric acid cloud that now covers one-third of the globe. Scientists aboard the Galileo II used HP equipment to collect data about the cloud layer.

"A lot of the instrumentation that we test later ends up on a space-shuttle mission or on a weather satellite," says Sarah.

"We're on the brink of being able to understand some of the larger interactions of the Earth and its atmosphere."

Lately a cousin of the Galileo II and the Kuiper Airborne Observatory has been grabbing a lot of headlines. IRAS, the Infrared Astronomical Satellite (a joint development of the United States, the Netherlands and the United Kingdom launched in January 1983) has mapped the sky.

Explains Carl Gillespie, "Because IRAS is in space where there is no water vapor, it has been able to look at things never seen before." But IRAS exhausted its supply of liquid helium and now is a piece of junk.

"The KAO will be able to follow up on some of IRAS' interesting findings," explains Carl. And that may produce some more sales for HP.

From their exposure to HP products on the airborne observatory, astronomers from around the world have purchased HP gear for their own observatories.

Now that's high-flying praise. **M**

Jim Pantaleo and Sarah Young manage the data-processing portion of NASA's Airborne Science Program on both the Galileo II (used for weather exploration) and the Kuiper Airborne Observatory (used to study stars and planets).

THE SKY'S THE LIMIT

Years ago, a programmer hustled a hodgepodge of HP equipment out of a NASA jet aircraft and into a tiny Samoan hotel room. After he set it up, he plugged it all into a wall outlet.

Whammo! Every light in the hotel blacked out.

Jim Pantaleo, who helped shepherd NASA's Airborne Science Program through its infancy more than 15 years ago, says such a scene was not unusual in the early days. Jim is now a staff specialist for Informatics General, a firm that contracts with NASA and other organizations to provide technical, computer and management services. Most of his work centers around Kuiper Airborne Observatory (KAO) missions. Jim's counterpart on the Galileo II is Sarah Young, who's been with the NASA project for seven years.

Eventually, the hotel lights came back on and the computer did its job. "We've had good use out of our HP systems—and rarely under the best of circumstances," says Jim.

The humid Samoan atmosphere caused some unusual challenges for the computer equipment. "Theoretically a computer is supposed to sit in an air-conditioned room," says Jim. "I don't think any of this equipment has ever *seen* an air-conditioned room." The HP computer is part of a cache of gear used on scientific missions around the world. The data-processing functions on the missions are managed by Informatics.

Informatics has a staff of 12— hardware technicians, programmers, etc.—on the airborne pro-gram. Most spend at least part of their time flying day-, week- or month-long missions with scientists whose experiments have been accepted by NASA.

Jim remembers his first flight on the KAO. "We were able to help the astronomers by entering their data on our computer.

"Before that, there wasn't a lot of dependence on our system. It was used for star plots, but that was about all. As the need for data collection became more critical, the dependence on our computer equipment telescoped."

A typical flight carries one or two Informatics employees. They solve hardware or software problems in the air, plot flight plans and adjust those plans if weather forces the plane to alter its course.

"The computer flies the Kuiper Airborne Observatory," says Jim. "It must follow a precise flight plan to keep the telescope pointing accurately."

Sarah points out that the Informatics people don't analyze the scientific data. "We help the experimenters take their data. Sometimes we are asked to write analysis programs, and we rely on our trusty HP 1000s to do the analyses."

Sarah's job means she must be ready to fly anywhere on the globe with just a moment's notice. After seven years on the project, she's used to her vagabond existence. "At least," she says, "one day is never like any other."

CLOSEUP

PEDALING COMPUTERS

HP-Netherland's Enno Graal tackles the obstacle course during the 1983 Computastars final competition in Birmingham, England. The yearly international sports event pits teams from many computer companies' factories, sales offices, software houses and data processing departments against one another.

HP's Dutch team, in its first year of Computastars competition, finished eighth of 11 in the women's category and fourth of 29 in the men's battle. And cyclist Enno Graal finished second in the men's all-round and took the silver medal back to Amstelveen.

FOCUSING ON SAN DIEGO

When ABC-TV's "Good Morning, America" cameras came to San Diego, California, they were looking for cooperative efforts between industry and education. One stop was at Poway High School.

Hewlett-Packard's San Diego Division adopted the school a little more than a year ago as part of a company program to improve computer literacy in 14 California high schools. Each school received 10 HP 86 personal computer systems (complete with monitors, printers, disc drives, software and with plotters made at the nearby San Diego Division). An HP representative visits the school to give math teachers technical and training assistance.

Joe Costa, the division's employee relations manager, demonstrates one of the computers for two high school students and the ABC film crew.


ON THEIR WAY UP

Three years ago materials engineering manager Al Jones brought 10 people together (a handful of Colorado Springs Division employees and a like number of salespeople who call on HP) at the foot of Pikes Peak. Their mutual objective: climb the 14,000-foot mountain and have a fun time doing it.

Al's idea grew into an annual event that promotes improved relations between HP and its vendors.

This year 87 people made the trek to the top, including (left) sales rep Gary Massey from Front Range Marketing Company and HP materials engineer Alan Engle. The entire group met afterwards at the HP recreation area in Colorado Springs for a barbeque.
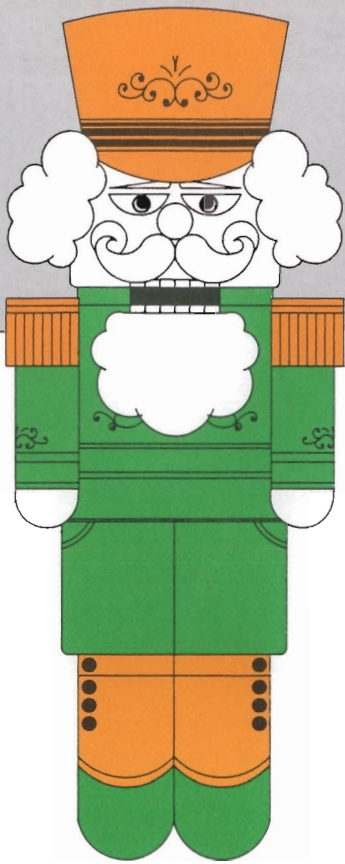
COLORADO BALLET KEEPS TOM KRANTZ ON HIS TOES

If you've seen "The Nut-cracker" ballet, you remember the enchanted moment when the toy nutcracker grows to person size.

Something like that recently happened to Tom Krantz of the Engineering Productivity Division in Fort Collins, with the help of a Series 200 desktop computer and other HP products.

Experimenting with software normally used for engineering graphics, Tom re-created a cunning little nutcracker from artwork originally designed by Connie Asher and used by the Colorado Ballet to promote its recent Denver performance of the classic. Tom's wife Sharon, who is on the ballet staff, showed the HP-plotted nutcracker at work —and Tom was asked if he could enlarge it.

Tom obliged by producing some images of a four-foot nutcracker, using the largest paper available on the HP 7585 plotter.


FRED GODEL

HIT ME WITH YOUR BEST SHOT

At the picnic for HP employees in Frankfurt, Germany, one of this year's most popular booths featured the photographic images of the sales headquarters' management staff.

The object of the game: knock down a manager's photo for a prize. (Just don't try it at the office on Monday morning.) From left, top row: Gerhard Beitz, Fritz Schuller, Wolfgang Rucker, Dieter Hoffman, Jürgen Hengstmann. Bottom row: Günter Ziepa, Klaus Stamer, Dieter Egermann, Dieter Schlosser and Uli Weltzien.
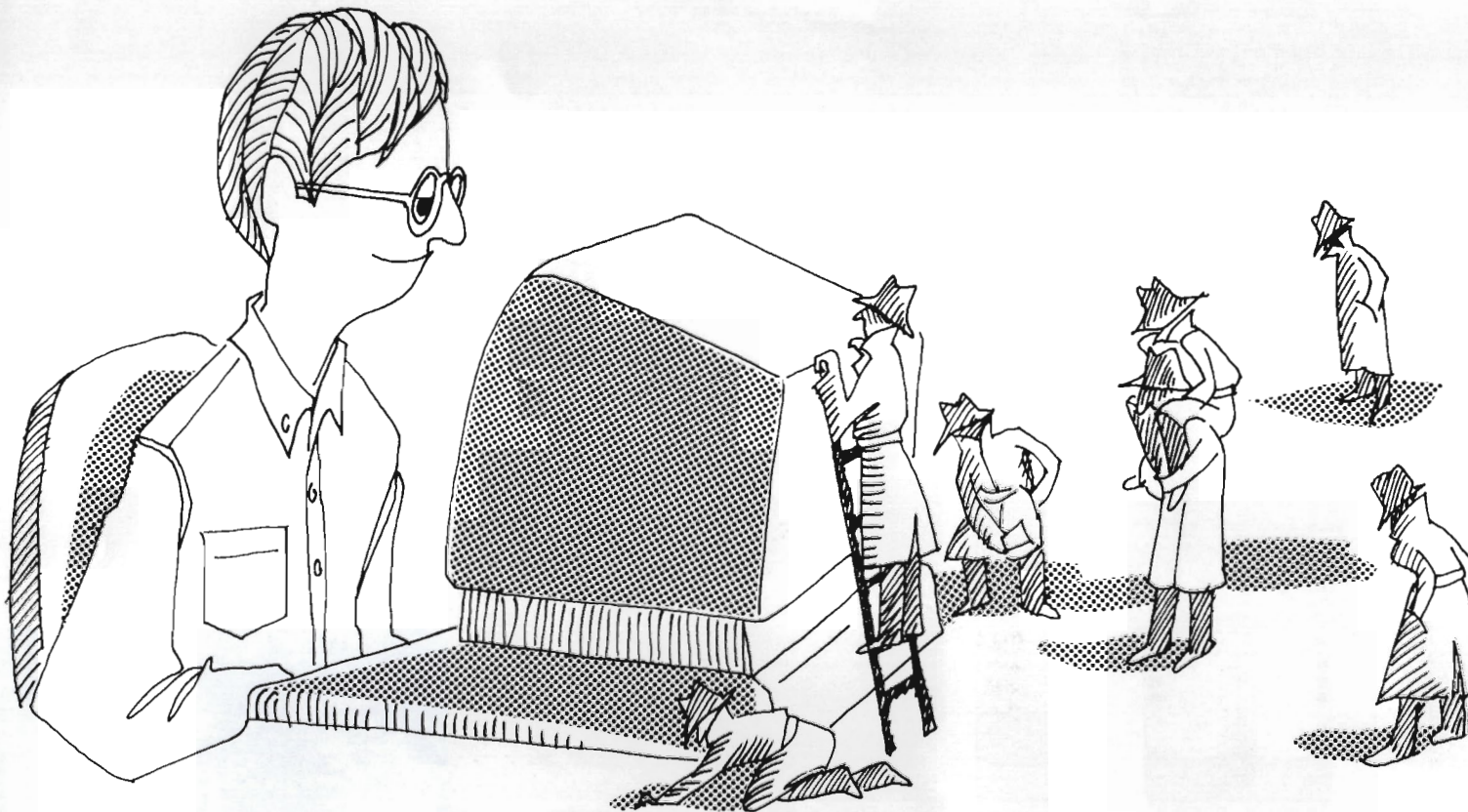
Computer security:

Could "War-Games" happen at HP?

Talk to folks around Hewlett-Packard about the trendy subject of computer security and sooner or later the movie "WarGames" is mentioned.

The celluloid adventure of a teen-age computer buff who accidentally plugs into the Defense Department's NORAD system was make-believe, of course, but questions linger. How vulnerable are the computers throughout HP to physical damage or assault on data? Since the company is both a user and a manufacturer of computers, what are the broader implications of computer security for HP? And what can we do to protect ourselves?

The difficulty with attempting a straightforward answer is the implied challenge to computer mischief-makers who are likely to be less beguiling than the young hero of "WarGames." Chances are that if we publicly declare our internal computer systems are safe from invasion, we become an attractive target. And if we admit there are gaps in our defense… we still become an attractive target.

What is clear, however, is that security measures which are doing a creditable job for Hewlett-Packard today will need tightening in the future. Access to computerized information is becoming more widely dispersed through the spread of personal computers and computer networks. The days are ending when a mainframe computer and its stored data could be secured by means of enclosure in a locked room. Today

data bases have moved out to smaller computers in offices, factory floors and homes—and ensuring their protection is a whole new game.

Indeed, the first companywide rules on computer security—issued in 1977—emphasized the physical protection of mainframe computers and measures for disaster recovery. Concern about guarding information is newer, and a section on control techniques for data has just been added to the company's information systems manual. Putting those techniques into practice is up to local management, with Corporate internal auditors coming around periodically to take a look.

The Information Systems Steering Committee (ISSC), which coordinates HP's data processing activities, recently formed a permanent subcommittee on computer security.

Says ISSC chairman Carl Cottrell, "We hope to come up with specific minimum standards for computer security that top management will buy into and that Internal Audit will use as a model."

While tight local-level computer security is important, it is not going to be enough to do the job, Carl adds. "We're moving in the direction of public packet-switch networks, which are not secure, and opening ourselves to more vulnerability.

"If you know you're part of a
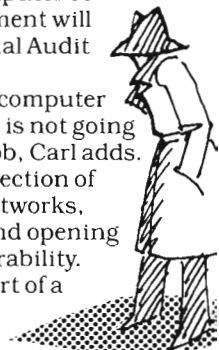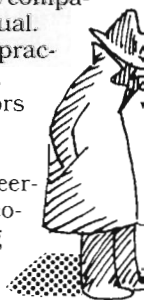
public network, you'd better be vigilant."

Bill Ashton, who manages all Corporate administrative systems, heads ISSC's security subcommittee. He sees a balancing act, "working at increasing the security of computers without losing people's ability to communicate and to do their jobs."

"We're trying hard as a company to make it easy, simple and friendly to use computers," he says, "but at the same time we have to recognize that everyone doesn't need access to all types of information."

GUARDING ACCESS

In the professional area of finance, strict controls have always been the norm for handling ledgers and money transactions—manually or by computer. Similarly, personnel departments are used to treating employee records with strict privacy.

But in the atmosphere of the R&D labs, the notion of placing restrictions on using the computer as a software research tool runs counter to the tradition of free exchange of promising ideas. Furthermore, HP engineers are now encouraged to continue their work away from the lab through a computer home-loan program.

As one observer said, "Lab notebooks were considered pretty sacred and engineers didn't carry them home. Now the lab notebook is likely to be in someone's home computer."

At a best guess, HP is relying five to 10 times as much today on computerized information as it did a decade ago. Perhaps 70 percent of the company's business activity is dependent on computers. The positions of FISM (data processing manager in factories) and RISM/BISM (the counterpart job in sales regions and branch offices) have been created in recent years to provide day-to-day management of computing activity.

Individual systems are assigned to "systems managers" who determine which department is the "owner" of the information and what capabilities each individual user should have. Different degrees of control are established depending on the nature of the data.

The Computer Support Division includes a section on computer security in systems-manager training that it gives all HP 3000 customers, both inside and outside the company.

The HP 3000 computer itself has the ability to insist on the entry of a two-level password before permitting someone to log onto a terminal. Regularly changing that coded password and keeping it well-hidden from view are part of the human aspects of good computer security.

In one scene in "WarGames," the current password to the high-school computer is readily available from a scribbled note on a desk. It is used by the teen-ager in the movie to break in to change grades. Such direct access by outsiders via telephone lines can be prevented if the computer is equipped with "dial-back" software. It works by disconnecting the call and calling back to a previously approved telephone number to double-check the identity of the would-be user before allowing the connection.

Some new considerations come into play when the computing equipment is movable. A Corporate task force is completing guidelines for workstations, concentrating on the powerful new HP 150. Says chairman Luis Hurtado-Sanchez, "It's obvious that the transportability of the workstation and its peripherals creates some physical security considerations. Do you require property passes? Record serial numbers? Engrave identification numbers? Anchor the equipment to a desk?"

"As to data security, users will need to remember to back up files regularly and not assume that the long-lived floppy discs will last forever," he says. "Floppies with sensitive data should be taken out of the machine and stored under lock at night because they can be carried away in a pocket."

Since R&D computing has boomed in the past two years, Corporate Engineering has also started to look at the exposure of HP information in computer files, focusing on R&D. Bert

Raphael, manager of R&D information resources, expects to come up with a proposed set of audit guidelines for R&D computing that will be meshed with the ISSC subcommittee's effort.

"Worrying about securing our information is a new idea for many HP people, as for industry generally," Bert says. A new Scientific Computing Facility which is currently being installed at HP Labs in Palo Alto will have strict administrative security.

"There's a real danger of outside threats to security of research data," explains Tony Fanning, who is now concentrating on aspects of R&D security in Bert's group. "We want to keep out the browsers who are just curious, the hobbyists who find it a challenge to try to break in, the poachers who want to profit from information they gain and the destroyers who compulsively steal or contaminate material."

EVERYONE'S BUSINESS

Paul Haefner of Corporate manufacturing systems, who oversaw the new section in the information systems manual dealing with data security, sees computer security as the business of everyone at HP.

"In the past, controls were the province of accountants and auditors," he says. "But when you're dealing with information rather than numbers and physical controls, you're talking about all aspects of our business and a more pervasive issue."

One of the company's models for preventive security is the Corporate Computing Center in Palo Alto (formerly known as Bay Area EDP). Doug DeVries, who became responsible for its security in 1978, is mentioned almost as frequently as "WarGames" in HP conversations about computer security. He often serves informally as a consultant to other company locations.

The center is the hub for processing the company's critical systems for payroll, worldwide communications, order processing, invoicing and accounts receivable, among others.

Data access to mainframes in the
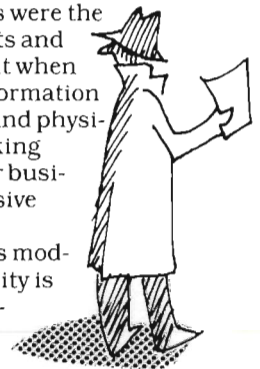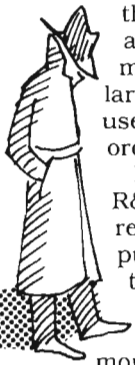
center is now guarded by a sophisticated software security package (ACF2) which lets a user write the rules for who can access information. Actual entry to the huge central computer room is also strictly controlled.

It took an investment of seven personyears of work to bring the Palo Alto computing center to its present level of security. (Doug observes that a rule of thumb in the industry is that about one percent of a facility's annual data processing budget should be spent on protecting its computer assets.)

DISASTER PLANNING

As part of that planning, the Loveland Instrument Division's large EDP center in Northern Colorado is kept ready to serve as a stand-in in case of emergency. The Loveland and Palo Alto centers have been testing their respective disaster procedures at each other's locations since 1980.

"A dozen Corporate people will roll in here over a weekend with all their tapes and equipment to construct a system that is a look-alike to their own," says FISM Jim Hallock. The division's own processing is pulled off the computers to accommodate a run-through to see that all procedures are right to bring up critical Corporate systems in the substitute location.

"Lots of people are doing isolated things very well," says HP internal auditor Ed Miller, who pays particular attention to EDP. (See box.) "We'd like to see these ideas made available to other entities as well."

Corporate Internal Audit, according to manager George Abbott, is "not an enforcer but an awakener" when it comes to both the physical security of computers and their data. "We see if people at a location are concerned," he says. "We don't look in their desks, but we get uncomfortable if we see sensitive printouts lying around." Each location is expected to have a computer security plan and its own controls in place to ensure the continuity of processing and the integrity of data.

(Interest in computer security is shared by HP's outside auditors. Price Waterhouse's European auditors recently invited systems specialist John Conry of HP-Winnersh to lecture on various practical aspects of protecting computers and their data.)

A number of other Corporate departments also have a stake in various aspects of computer security. Lawyers worry about protecting franchised software from unauthorized copying. Government Affairs keeps an eye on impending laws and regulations in the area of computer data. Jim Hacker, manager of Corporate Industrial Security, is responsible for investigating any episodes of computer crime.

Whether it is good luck or good defenses, HP has escaped headline-making breaches of its computer security. There have been some minor breaks, such as the service engineer who left the telephone number and password of the office computer visible on his desk at home—and they wound up on a "pirate bulletin board" shared by computer buffs.

But while the probability of computer tampering is low, the potential impact on the company is high.

Admittedly, providing security for networks of computers will add another dimension. HP is now committed to developing a worldwide interactive network based on x.25 packet technology, portions of which will use public data networks. One consideration: the public portion will be shared with outside users.

Hank Taylor, Corporate communications and office systems manager, believes HP "can narrow down the risk" in several ways.

"We can limit the number of user addresses from which calls are accepted," he says. "To discourage invaders, the network will flag patterns of repeated short calls in addition to the HP 3000's password protection. We could also reject collect calls."

Wim Roelandts, network R&D manager for the Information Products Group, is looking at encryption—the scrambling of transmitted data—to protect against intruders who might tap into lines between computers or between a computer and terminals. "You can do encryption fairly simply with computers," he says, "but it is also possible for computers to crack the mathematical algorithms that are used unless they are quite sophisticated."

At HP Labs, the Measurement and Communication Lab is doing advanced cryptography research and data security system design. The information and signal processing department under Kai Yiu has produced an encryption apparatus which can talk in real time to HP 3000s and desktops. It can also be used for high-speed file encryption. One division is already cooperating in the project.

"Through encryption, we can make sure that both users and messages can be authenticated," Kai says, "and an intruder won't be able to understand the scrambled message." He believes that a data security system should be able to detect any change in data such as substitution, addition, deletion, or modification.
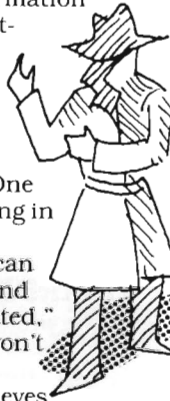
PROTECTING CUSTOMERS

As both a user and a seller of its own computers, Hewlett-Packard is doubly involved with computer security.

Provided as optional equipment with the HP 3000 is MONITOR—an intermediate-level system that sits between the machine's MPE operating system and the applications being run. Each terminal has its own friendly name and can be pre-set to start and stop at given times with a particular application.

Explains R&D engineer Steve Rhodes of the Manufacturing Productivity Division, "MONITOR also keeps users from wandering into sensitive transactions—it controls passage from one program to another."

Another module, CUSTOMIZER, maintains the "dictionary" which drives all applications and sets the rules for data access.

To control installation of its MPN software products, the division has developed the Option Install Program. It uses an encryption technique to prevent users who don't know the proper keys from installing options they haven't purchased. (It also allows HP application designers to add options to their products in a modular way.)

Ed McCracken, general manager of the Business Development Group, be-

lieves that from now on the company will increasingly perform security audits on the computer products that it brings to market.

"As systems become more operational—performing functions beyond handling financial data—our customers will be even more concerned about security of their computers.

"There's a dichotomy between the need for our systems to be more secure and more accessible at the same time. It is a challenge that we must address very seriously in our hardware and software products."

Can Hewlett-Packard itself avoid a "WarGames" type of invasion in a world filled with pirate bulletin boards listing computer access information?

Bruce Woolpert of the Personal Software Division, who oversees the HP DESK electronic mail network in the U.S., suggests a simple defense. "The state of the art in computer security right now is managing information carefully and not being careless," he declares.

"It's all very well, and necessary, to lock the computer room at night and to limit access to account structures. But leaving passwords visible or terminals logged on while you're at lunch is like leaving your credit cards lying around."

In the real-life world, Hewlett-Packard's traditional openness has to be tempered when it comes to the business of protecting computer assets. **M**

LOCKING IT UP

A number of HP entities already have local security measures:

● The Microwave Semiconductor Division uses SECURITY 3000, from an outside vendor, which controls log-on by asking one of a set of personal questions chosen in advance by the individual—such as the make of one's first car. "Every once in a while I see someone smiling as they log on," says FISM Ron Reimert. The system also prevents people from logging on over the weekend or at unusual hours.

● To make it easier to change passwords instantly on hundreds of jobs on the HP 3000, the Fort Collins Systems Division and 20 other sites use a program called STREAMER. It inserts passwords where needed.

● The Lake Stevens Instrument Division has installed PLM (Program Library Maintenance) to keep tight control on any changes to programs. It sees that the object code matches the source code so that changes and maintenance are easy.

● The Disc Memory Division takes a different approach with its Audit Control System, which each night reports on program changes made during that day.

● Yokogawa-Hewlett-Packard has put together localized software to control powerful system-manager log-on.

● The European EDP center in Geneva has written a program called DDSACCESS to control remote access to computers linked by DS software. Users must meet certain special characteristics which have been loaded into the computer.

● Security has been stressed in the Executive Computer Showcase, an EDP center set up at the Corporate offices for use by top management. Software engineer Jeff Orum, who oversees that activity, included a callback systems he developed for the HP 3000 while at the Information Networks Division. Originally intended as a way to reverse phone charges for engineers working at home on terminals, the system has now been enhanced to validate the user at a specified number.

● Customer engineers in the field now carry an HP 75 equipped with FIREMAN to exchange repair information with their office HP 3000. Security was an important consideration in designing the interface software. The project team of CEs in Fullerton, California, developed a special-purpose program which limits the type of messages that can be transmitted.

● Corporate marketing administrative systems has installed the Employee Security System (ESS) in all field EDP centers worldwide. It asks the person logging on to give his or her employee number, a unique password and the name of the application. ESS also buffers the user from direct access to computer commands. The system is cross-checked twice a month with the region's employee data base.

● As part of the computer security at HP-Netherlands, physical access controls are in place to control printed outputs as well as to limit who can enter the computer room.
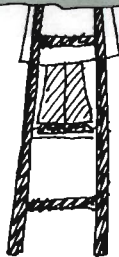
At the
HEART
of the Medical Group

ou have grown weary painting still lifes and Paris street scenes. You decide to enlist in the French Foreign Legion. The year is 1816.

Standing in line with other hungry artists, you go through various physical examinations to prove whether you are healthy enough for the rigors of the Legion. Out of the corner of your eye you notice a distinguished-looking gentleman approaching you. He has a perforated wooden cylinder stuck in his ear. "Strange…very strange," you think to yourself.

Suddenly, the man thrusts the wooden cylinder against your bare chest—the other end still planted firmly in his ear.

"O mon Dieu, sacré bleu! What are you doing, monsieur?" you ask.

"Pipe down and breathe, you idiot!" the man shouts. "You surely must know who I am—René Théophile Hyacinthe Laënnec—the father of chest medicine."

"S'il-vous plait, René, what is that thing sticking out of your ear?"

"This, monsieur, is my latest invention," René replies. "I call it a monaural stethoscope."

The chances of having a modern-day physician approach you with a wooden cylinder in the ear are slim. Today doctors use the familiar binaural stethoscope—two flexible rubber tubes attaching the chest piece to spring-connected metal tubes with ear pieces.

On close examination, you might notice that the stethoscope is manufactured by Hewlett-Packard.

The HP 280 Rappaport-Sprague stethoscope is the company's lone entry in the binaural stethoscope field. According to HP marketing staff engineer Colleen Janick, the HP 280 is the "Cadillac" of the stethoscope marketplace.

Andover Division has R&D responsibility for the HP 280 while Chelmsford (an operation of the Medical Products Group) markets the product.

Laënnec's wooden cylinder and the HP 280 have the same basic function: listening to sounds produced within the body, chiefly in the heart and lungs.

The ancestry of the HP 280 goes back

Willie Mitchell puts a shine on the metal parts of HP stethoscopes at the Waltham Division.

nearly 50 years when a Sanborn Company engineer, Maurice Rappaport, combined efforts with cardiologist Howard Sprague to develop the first of what has become known as the Rappaport-Sprague stethoscope. Hewlett-Packard acquired the Sanborn Company and its stethoscope in 1961.

Unlike fast-changing computer technology, the stethoscope has remained basically the same for years, according to Bob King, manufacturing engineer at the Andover Division. "The design and mechanical workings of the HP 280 really haven't changed for many years," Bob says. "There has been no need to improve its acoustic quality."

Instead, HP is looking for ways to improve the HP 280's durability and comfort. "We still receive some letters from doctors who would like the ear tips to fit more comfortably," Bob says.

While the technology and instrument itself have changed little in recent years, the marketing of the HP 280 has seen sweeping changes.

Colleen says that before 1980 HP had the top end of the stethoscope market all to itself. "Specialists and top professionals came to us to buy the HP 280," she notes. Meanwhile many nurses and medical students for the most part chose to buy low-cost, limited-application stethoscopes.

"About three years ago, other companies realized HP was reaping the benefits of this upper-echelon group without having to face any substantial competition," Colleen adds. That is no longer true. "Other companies are now putting out high-precision stethoscopes with top marketing efforts."

The HP 280 is now sold almost exclusively by more than 90 distributors throughout the U.S. Many are medical school bookstores or medical-surgical supply houses.

One aspect of HP's instrument that has helped keep it at the head of the class is the finish the metal portions receive at the Waltham Division.

"We thought it (a fine-jewelry finish) couldn't be done," said Gene Fournier, fabrication section manager. "But we managed to accomplish the task through the fine efforts of metal finisher Willie Mitchell."

The basic steps include polishing the metal, buffing it and coloring it again after it is plated. Willie knows the steps by heart. He's been doing them 20 years. "I've been doing it for so long I think I could do it with my eyes shut," he says. "They asked for a jewelry finish and they got it." **M**

JOHN YOUNG

HP's president describes the company's year-end results and the HP Board's Far East trip.

John Young poses with employees on the front steps of Samsung Electronics—HP's independent sales operation in Seoul, Korea.

We've now closed the books on fiscal year 1983, and we can look back at last year's results with some satisfaction, particularly in light of how many of our competitors fared. Our fourth quarter was a record-breaking one, with both orders and shipments at all-time highs for HP. This strong last quarter contributed to total orders of $4.9 billion for the year, up 18 percent from 1982. Shipments grew by 12 percent, and earnings tracked those well with an increase of 13 percent.

The improvement of the U.S. economy is reflected in the 27 percent growth in domestic orders. Internationally, the recovery has been slower. Economic uncertainty, coupled with a continued strong dollar and the resultant increase of HP prices outside the U.S., contributed to a more modest 7 percent growth in HP's international orders. This disparity of order growth poses some challenges for us, as we consider our international character a key strength.

We believe there are some actions we can take to better balance our sales and value-added activities in other countries. The establishment of more facilities in markets where we participate will enable us to create more value locally, particularly in the form of software, and generate exports in some instances.

Fiscal year 1983 saw good progress in increasing our international presence. It included the establishment of new manufacturing facilities in England and Canada, the expansion of operations in Singapore and France, our increased equity position in Yokogawa-Hewlett-Packard, the inauguration of a new plant and Latin American software center in Guadalajara, Mexico, and the decision to locate a branch of HP Labs in Bristol, England.

All of HP's product groups reported increased sales during 1983. Computer sales growth of 14 percent just barely outpaced instrument growth of 11 percent, although our instrument people will be quick to point out that they led the fourth quarter with a very strong 31 percent growth. Medical and analytical products experienced growth rates of 10 and 5 percent respectively.

This past year also included some efforts on cost and expense controls. Our costs of goods sold increased 12 percent, exactly tracking our sales growth. Growth in administrative costs was just 7 percent, reflecting a restraint in hiring and the payoff for the many systems we installed to improve productivity in this area.

On the other hand, we made strong commitments to our R&D programs and our marketing activities. The latter costs grew by 22 percent and included increased hiring in our field sales force, as well as stepped-up advertising. We made these investments with a view to the long term, and I think we are already beginning to see some positive results. Our sparing use of assets in a low-growth year enabled us to add to our cash balance, and we ended the year with more than $700 million net cash on hand.

There are two strategic directions I would like to note. The first is HP's response to the evolving way our customers use information personally to improve productivity within their organizations. The HP 150 touch-screen personal computer signaled a new thrust into the mainstream market for business-oriented personal computers. The product is off to a strong start. Our dealer program is developing ahead of schedule, and major software suppliers have signed up to adapt their programs to use the enhancements of HP Touch.

A second strategic direction has been our emphasis on quality as a competitive element and the increased productivity and cost competitiveness we have derived from this focus. As a result, we've seen examples everywhere of dramatically lowered field-failure rates, shortened cycle times, reduced inventories and lowered manufacturing costs. We've used our own distributed information systems effectively to manage our assets and accounts receivable. Our productivity—defined as dollars of sales per employee companywide—has shown steady improvement. This trend will contribute to our ability to compete in world markets.

As a worldwide company competing in worldwide markets, HP has many strengths to call upon. I have touched on only some of them in this message, but there is one asset that is so fundamental that we often forget it. That strength is a worldwide base of employees who are committed to excellence in all of their pursuits. With this foundation, we can continue to build on our strong product lines and customer base. I believe we can look forward to 1984 with some optimism.

HP BOARD TOURS FAR EAST

Last September, HP's Board of Directors held its annual overseas meeting in the People's Republic of China, and I thought you might be interested in why we chose that locale.

The 1983 international meeting, like the one in Europe the previous year, demonstrates the fact that HP is a worldwide company. We have operations, customers and competitors throughout the world. One purpose of our Far East tour was to review our operations and opportunities in this

rapidly growing part of the world.

One of the most striking things about the Far East is the consistency with which electronics has been designated as a strategic industry in each country, with its success deemed vital to overall economic growth. Countries are pursuing a variety of measures to promote the success of their own electronics industry, and one goal of our tour was to understand the strength of the competition we will be facing.

A second motive for our visit to the Far East was to celebrate the 20th anniversary of our Japanese joint venture, Yokogawa-Hewlett-Packard. As you may remember, we recently increased our equity position in YHP, and this will allow us to expand its role in our Asian operations. On a personal note, I was pleased to be able to congratulate YHP's employees for receiving the coveted Deming Prize for quality late in 1982. It was also instructive for our directors to see Japanese quality procedures firsthand.

Our stay in the People's Republic of China allowed us to view the opportunities presented by this vast and rapidly changing nation. There we have the unique situation of having a 65-person distributorship devoted solely to sales and support of HP products but entirely within the Ministry of Electronics. We had fruitful discussions with members of the government, including a one-hour private audience with Premier Zhao, who will be visiting the U.S. in January as President Reagan's guest. The hospitality extended to us was most gracious and gave us every opportunity to understand the complexity of an underdeveloped country with a planned economy.

Certainly our Far East tour and directors' meeting in China served to reinforce in our minds the global nature of HP's business. And that is a perspective I would like us all to have as we enter the year ahead.

John

NET SALES ($ MILLIONS) **FIVE-YEAR GROWTH IN NET SALES**
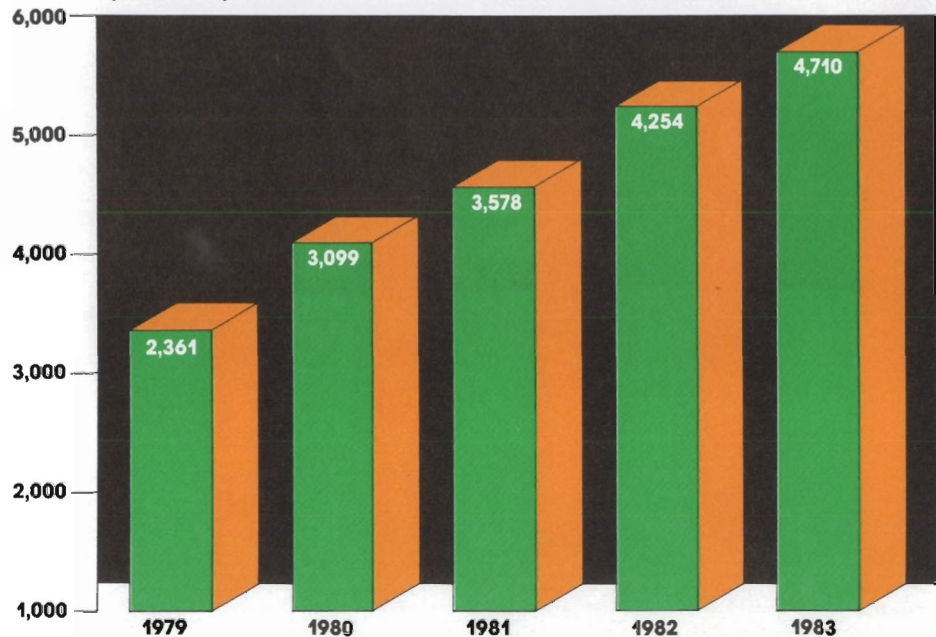
SALES GROW TO $4.7 BILLION IN FY1983

Hewlett-Packard Company reported a 32 percent increase in net earnings and an 18 percent increase in net sales for the fourth quarter of its 1983 fiscal year, which ended October 31. Sales totaled $1.330 billion—the highest level for any quarter in the company's history. Orders for the period totaled $1.285 billion, also setting a record.

Net earnings for the fourth quarter amounted to $147 million, equal to 57 cents per share on approximately 255 million shares of common stock outstanding. This compares with net earnings of $111 million, or 44 cents per share on approximately 251 million shares, during last year's fourth quarter, (restated to reflect the company's 2-for-1 stock split in August 1983).

Fourth-quarter orders of $1.285 billion were up 26 percent over orders of $1.023 billion during the fourth quarter of 1982. Domestic orders amounted to $789 million, up 33 percent from the year-ago quarter, while international orders gained 16 percent to $496 million.

For the fiscal year, sales totaled $4.710 billion, compared with $4.189 billion for fiscal 1982, a 12 percent increase. Net earnings were $432 million, or $1.69 per share on approximately 255 million shares of common stock outstanding, up 13 percent from $383 million, or $1.53 per share on approximately 251 million shares in 1982. The per share amount for 1982 has been restated to reflect a two-for-one stock split in August 1983.

Orders for the year totaled $4.922 billion, an increase of 18 percent over orders of $4.180 billion during fiscal 1982. Domestic orders totaled $2.901 billion, up 27 percent over last year. International orders gained 7 percent, to $2.021 billion.

All four business segments contributed to the record fourth-quarter orders. Compared with fourth quarter 1982, the computer products segment was up 26 percent, electronic test and measurement was up 31 percent, medical electronic equipment was up 6 percent and analytical instrumentation was up 16 percent.

NEWSCLIPS

Recaps the newsworthy events, changes and achievements within HP.

FOURTH QUARTER

Hewlett-Packard ended FY83 in fine style, with a 32 percent increase in net earnings and an 18 percent increase in net sales for the fourth quarter. Sales totaled $1.330 billion—the highest level for any quarter in the company's history. For full details and a report on year-end results, see page 23 of this issue.

CHART CHANGES

Two operations of the former Optoelectronics Division have been elevated to division status, replacing the original OED. The former Visible Products Operation now takes the OED name, with Mike Cowley as general manager. Rick Kniss is GM of the Optical Communication Division (formerly the Interface Products Operation)....In the Business Development Group, the former Business Development Center has been integrated into the Application Marketing Division (AMD) and Systems Marketing Center (SMC). Joe Schoendorf becomes GM of the latter, with Ed Hayes moving to GM of AMD. Newly added to the Business Development Group is the Engineering Productivity Division, formerly part of the Computer Products Group. (See "Leasing" on this page for other BDG news.)....Bob Wayman has been named Corporate Controller succeeding Jerry Carlson, who has taken a leave of absence....Effective November 1, HP South Africa shifted from Intercontinental to Europe's South East Region.

HP LABS ABROAD

HP is establishing in Stoke Gifford, England, the first branch of HP Labs to be located outside Palo Alto. Director of the new center will be Don Hammond, who relocates this January to start up the activity in temporary quarters shared with the Computer Peripherals Bristol Operation. Chuck Tyler will succeed Hammond as director of the Physical Research Center.... Two new labs have been created within HPL's Computer Research Center. Ira Goldstein heads the Application Technology Laboratory, while Erich Neuhold directs the Information Management Laboratory.

LEASING CHANGES

Increasing customer interest in leasing HP equipment has led to formation of two new entities. The Financing and Remarketing Division within BDG consolidates marketing and admin for all leasing and for resale of HP computers. GM is Don Schmickrath. Also new is the Hewlett-Packard Finance Company, a wholly owned subsidiary which serves as the intermediary borrowing funds to finance customer leasing of HP products. It will manage its own portfolio. Manager is Joe Barr.

NEW HATS

Bob Rogers became region manager for the Midwest Sales Region on January 1....Ernesto Kolster is GM of HP Venezuela....Max Fallet has transferred from Böblingen to Palo Alto as manager of Corporate distribution. Roger Grossel has joined HP as export administration manager in Washington, D.C....Bill Murphy is now Personal Computer Group marketing manager, with Srini Nageshwar as retail marketing manager and Alan Nonnenberg as national account marketing manager in that organization. ...Other new marketing manager roles: Derek Smorthit to the Computer Peripherals Bristol Operation, Mike Matson to the Microwave Semiconductor Division, Casey Cornett to the Manufacturing Test Division, Wolfgang Flender to the Böblingen Engineering Operation.

NEW PRODUCTS

The new Control/1000 industrial automation system from the Data Systems Division adds the high-performance HP 1000 Model A600 computer and a new software package to the HP 2250 measurement and control process from the Loveland Instrument Division....The HP 41CX calculator from the Portable Computer Division is billed as the most powerful advanced calculator on the market, with clock and calendar functions, text-file editing and extended memory. Suggested U.S. list price is $325....From the Lake Stevens Instrument Division: the HP 3577A network analyzer which offers high accuracy and resolution over the 5 Hz to 200-MHz frequency range, and the versatile, fast HP 3561A dynamic-signal analyzer....Vancouver Division has announced four new printers in the HP 2930 family. They have improved print quality at a decrease in price of as much as 50 percent....A trio of new industrial terminals (HP 3092A and 3093A and HP 3981A) from the Grenoble Networks Operation are in sealed, rugged packages for use in harsh industrial environments....A low-priced, compact Speech Output Module from the Roseville Networks Division can be used with an HP 1000 or HP 3000. It has a library of more than 1,700 words and sounds....The Personal Software Division has developed a VisiCalc® program which runs on all HP 3000s.
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MOVED LATELY? CHANGE OF ADDRESS SHOULD BE REPORTED TO YOUR PERSONNEL DEPARTMENT.