MEASURE

For the people of Hewlett–Packard

May–June 1981

E-BEAM BRIGHTENS THE FUTURE

UP FRONT

Comments on
the changing HP scene —
and the people behind it.

The story of Carson Kan's recovery from cancer ("Second chance to live," pages 3-6), and his subsequent efforts to counsel and comfort others afflicted with the disease contains a note with an increasingly familiar ring — finding himself attended by medical equipment produced by his own company. The story is told by Shirley Gilbert, editor-communicator for Data Terminals Division in Sunnyvale, California.

After six hours on the operating table for his second operation, Carson awoke to discover so many instruments attached to his body that "I played count-the-tubes." He noticed that much of the equipment was HP-made.

Carson's experience is a reminder of the report carried by Upfront in the July-August issue last year: the rallying of HP people and equipment when two young members of two HP families almost simultaneously suffered serious head injuries in separate traffic accidents. Kay Canale of HP Labs reports that her son, Chuck, is now "up and around, and in about two years should be able to live a pretty full life." Karen Eby, the 16-year-old daughter of Norm Eby, medical systems specialist at the Richmond, Virginia office, also continues her struggle for recovery.

Both received critically important support from the use of an HP capnometer which had just then been introduced by Waltham Division and made available under a chain of circumstances that a Hollywood scriptwriter would probably discount as unlikely.

In its first issue of 1981, HP-Italy's employee publication, "Grandangolo" (which translates as "great angle") lived up to its name. It told the story of "il terremoto" — the earthquake — that shook regions of southern Italy late last year, killing 4,000 people and devastating scores of towns. The November 23 quake drove people from their homes at dinner time, and forced the closing of most businesses the following day. HP's 10-person sales office in Naples was shut down for the day.

The quake, of course, was a very personal experience for HP people on the scene — both terrifying and exhilarating. Luciana Lista, Naples branch office administrator, recalls that "I was almost resigned to fate, waiting for a quick finish. Everything was falling. I clutched my children. Then we fled downstairs into the midst of people hugging one another, happy to have escaped. In the general chaos there were some car collisions, but owners only smiled and said, 'Don't worry. Think nothing of it!' On other occasions there would have been a fight. Then we spent a long night in the open."

The next day — Monday morning — everyone got in touch with one another. No injuries among the HP people. A few came to the office. Customers were called. Arrangements were made with the widow of a professor in Lioni to repurchase an HP-85 personal computer — the only thing intact when he and his work were crushed by a collapsing building.

Luciana called Roberto Albanesi, country manager, and Alfredo Scarfone, personnel manager, in Milan and was assured that they would do anything to help — even come to Naples, if needed. "That was very reassuring, because we still lived with the fear of another quake."

It was the interior countryside and villages that were hit hardest. Hearing of the need of one such town, Calabritto, HP-Italy donated a fully functioning, prefabricated portable office to the reconstruction program. It's there still, serving a variety of agencies as the tasks of restoration and repair pick up pace after a cold and snowy winter. **M**

**Workers continue
to dig through rubble
10 days after the Italian earthquake.**

SECOND CHANCE TO LIVE

Only one thing came between Carson Kan and his pursuit of the good-old American dream: cancer. Today, the 12-year HP veteran counsels others facing the same ravaging disease. Shirley Gilbert, editor at Data Terminals Division in Sunnyvale, describes his remarkable story of recovery.

The boyish Chinese chap with the moustache stands at attention in the local Chinese restaurant with several menus in his hand. He courteously shows me to a table and I turn to look for Carson Kan, the HP employee I'm supposed to meet for lunch. Suddenly the man with the menus slides into the booth across from me.

"Hi, I'm Carson Kan," he says with an impossible grin that shows he's pleased with his prank.

Carson, a project manager at the Computer Systems Division in Cupertino, California, and with HP for 12 years, is known for just this kind of quick wit, his rapid-fire one-liners and an irrespressible sense of fun.

Today we've met to discuss a more serious subject: cancer.

Five years ago, at age 29, Carson discovered he had testicular cancer.

"Where was I at the time? I was into the American dream," says Carson, "the good-ole, middle-class American dream. You know the one. Get a wife. Get a house. Get kids. The dream didn't say anything about getting cancer."

When doctors discovered the cancer and removed a testicle, Carson still wasn't too worried. "I figured they would give me a pill. I had already had an operation, so I thought I just needed a little more treatment, and I would be cured."

That was in March 1976. Later, doctors found a "questionable" lymph node and decided on radiation therapy first, then an operation to remove the lymph nodes, followed by more radiation therapy. The radiation treatment exhausted and nauseated Carson, but he dragged himself to work for about four hours every day. Then

Carson Kan is surrounded by friends and co-workers at a party celebrating the fourth anniversary of his comeback from cancer.

came the six-hour operation.

After that it looked like Carson was going to be just fine. His cancer, doctors said, was in remission and Carson assumed he could go on with his life.

A year later, after Carson completed his monthly series of tests, his doctor asked him to come into his office. "'How much vacation time do you have, Carson?' the doctor asked. I told him and he said, 'Take it all, Carson. The cancer has spread to your liver. You don't have much time.' "

The news hit Carson like a ton of bricks. It was his first encounter with the word 'terminal.' "I cried and cried," said Carson of that bitter moment, "and in my mind I kept thinking 'You're going to die, Carson, you're really going to die.' " In a kind of trance, he stumbled to the hospital's human support office and talked with counselor Dan Dugan. "I remember I rambled and rambled and he listened. He really listened. He didn't give me advice or tell me how to

feel. He felt all this pain with me."

Next Carson began chemotherapy, a series of potent drugs designed to knock out the cancerous cells. He went from bad to worse after the treatments: pain, fever, sweating and weight loss. Carson's doctor decided to try a then-experimental therapy involving three strong medications. The treatment is especially painful and Carson seemed to suffer every side effect in the book. His white blood cell count went way down. He lost more weight (he weighs 140 pounds when he's well, but he dropped to 79 after the treatment). He had a perpetual sore throat and couldn't eat a thing. He even got pneumonia.

"I could see how I looked," says Carson, "by looking at others. People would look at me in a weird way and when I looked in the mirror I started crying."

The treatment had almost taken too much out of him. The hospital sent him home to recuperate and slowly Carson

The moment of greatest hope for recovery came when Carson returned to HP. "I was ecstatic. I never thought I'd ever be back there again. I knew from then on I'd make it."
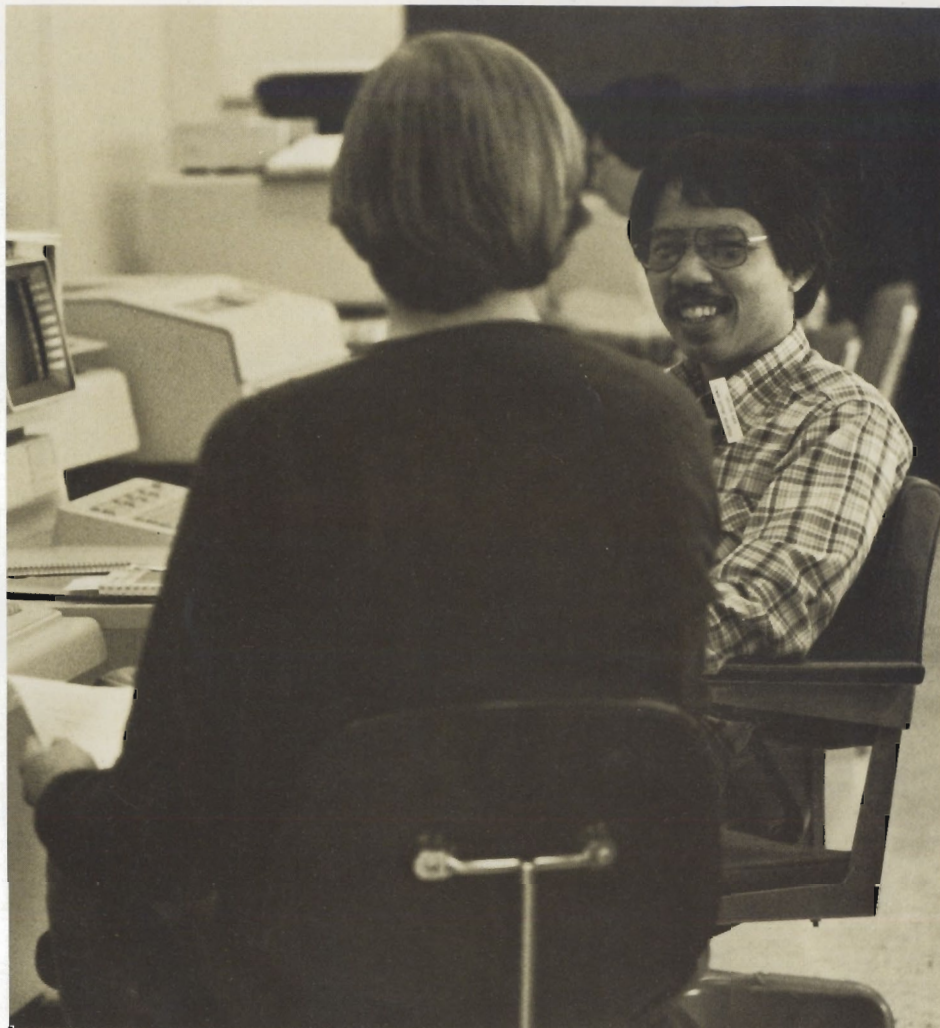
saw himself improving. He couldn't believe it at first. "My gauge was my weight. I gained a little weight and when I saw that, I forced myself to eat even though it was painful."

Carson also tried to help the healing process along by using positive mental images. He got the idea from a book called *Getting Well Again*. Carson had to mentally picture some powerful force healing him. "At first I thought of the Hoover Dam. That seemed very powerful to me. And I pictured myself on this table —sort of like a Boris Karloff movie setting — and then a giant switch was thrown and the electricity went through my body and I was cured."

But that was too Hollywoodish for Carson. He decided he would visualize a cure more effectively if he could imagine his white blood cells multiplying and the cancerous cells being destroyed. To do that, he went to El Camino Hospital, where all the tests had been taken, and asked to see his cells. "They were hesitant," recounts Carson, "but I insisted and finally they let me see them. Once I saw them, I pictured the white cells getting stronger and the cancer cells dying. I did this two or three times a day."

But the moment of greatest hope for recovery came when Carson returned to his office in HP's Cupertino complex. His father tried to help Carson up the steps, but that was something he wanted to do on his own. "I walked, well, I *barely* walked to my desk and sat there for two or three hours. I was ecstatic. I never thought I'd ever be back there again. People dropped by to visit. It was a great, positive environment for me. I knew from then on that I was on a roll, that I would make it."

From there Carson went from looking very sick, to looking almost well, and then gaining enough weight to be called well again. "I went back to my doctor," says Carson, "and he assured me I wasn't dying. He told me I didn't need any more treatments. I was amazed."

What was it that cured Carson?

"Western medicine," says Carson, "let me get to the point where I could take care of myself. The chemotherapy gave me time." But Carson also believes that it was the huge, loving army of friends, co-workers and relatives praying and hoping for him that helped with the cure. The network of concern — both inside and outside HP — was incredible to him.

Some Filipino friends offered him a round-trip ticket to the Philippines to undergo psychosurgery there. He chose not to accept their offer. Whole congregations prayed for Carson's recovery. Meditation groups offered their energy in his behalf. "I figured at one point there were at least 1,000 people wishing me well," says Carson. "HP friends would ask, 'Do you mind if we pray for you?' 'Hell no! Go ahead,' I said. 'Can we offer candles in your be-

SECOND CHANCE TO LIVE

"I try to live my life so that if I die tomorrow I'll minimize the regrets. If there's a problem that's not resolved, I want to resolve it."

half?' 'Great,' I'd say, 'Go to it.' There was so much positive energy around."

Carson admits the cancer has changed him a great deal.

"Before," he says, "I always had the world exactly where it was supposed to be. I knew where I was going. I never cried." Now he sheds tears whenever he feels like it.

Carson also listens and talks to others with cancer. He has become a counselor and lecturer to others who suffer from the illness. "After I was okay for awhile, a friend asked me to talk to his buddy who had cancer. Then other people started calling — friends of relatives and relatives of friends — and we shared and compared notes."

Al Steiner, general manager of the newly renamed Colorado Telecommunications Division on the move to Colorado Springs (formerly Mountain View's Delcon Division), is one HP employee who feels he has been greatly helped by Carson's counseling.

Al discovered a year ago that he had the same type of illness that Carson had. He went through the same arduous chemotherapy sessions and almost died from them. At home, recuperating, Al met with Carson.

"He came and talked to me and my wife, Barb, and it was just great. Carson told me what was normal and, yes, I admitted I was having the same feelings. It was a great relief to me. Here was someone who had the same thing I had and he was fat and sassy, sitting in front of me making terrible jokes, very much alive and well."

At times the counseling is depressing, admits Carson. "I'd want to cry, give up. "Losing anyone still gets me down." But now he sees more and more survivors.

Carson lectures at Stanford Hospital in Palo Alto, El Camino Hospital in Mountain View, the University of Santa Clara and Kaiser Hospital in Santa Clara. He helps others by relating his experiences as patient and survivor.

Having cancer, according to Carson, teaches you how to live. "I try to live my life," he concludes, "so that if I die tomorrow I'll minimize the regrets. If there's a problem that's not resolved, I want to resolve it. I won't let you or me get away with bad feelings hanging in the air between us."

At lunch in the restaurant Carson energetically spears a prawn with a fork on the large dish in front of him.

A fork with his Chinese background?

Carson grins. "Chinese people never use chopsticks if they're eating off American plates," he says mischievously. Then he digs into the food with great gusto. **M**

LIVE FROM PALO ALTO

HP and television have been linked successfully since the mid-1960s when the company began developing a video production facility and a network for distributing videotapes. On April 2, that connection took a leap ahead with the first live satellite broadcast from the HP television studio in Palo Alto to more than 1,200 HP employees in 38 cities throughout the United States.

HP's first video teleconference was a four-hour product training session for members of the Instrument and Computers sales forces. They learned about Loveland Instrument Division's new 3054C data acquisition control system, Roseville's HP 2250 measurement and control processor and Data System's HP 1000 microsystem model 5. The audiences, meeting in specially equipped Holiday Inn conference rooms, had several opportunities throughout the show to ask questions via telephone to an on-camera panel of experts.

Soaring air fares and hotel rates have made video conferencing a logical alternative to in-person gatherings. "When compared to the traditional method of taking the trainers on the road to the sales force, our costs for the teleconference were about half," said Marika Ruumet, of HP-TV and producer of the program.

The logistics for a video conference are complex. Meeting rooms must be booked for groups ranging from as small as six to as large as 100. Meals must be ordered and telephones installed. Microwave and satellite links must be scheduled and tested to carry the audio and video signals 22,000 miles into space and back to earth. Prerecorded segments of the program must be edited and timed. Dress rehearsals for the show must be staged.

HP's first video conference was labeled a great success, despite some transmission problems with a repeater station feeding the video signal to the satellite part of the program. "Based on feedback from the attendees and the local coordinators, the overall rating of the program came out higher than a regular new product training tour," said Bob Lindsay, coordinator of the program from the Computer Marketing Group.

A great potential is seen for video conferencing at HP. Although there are no definite plans yet, there probably will be a day when teleconferences will be used to introduce new products at nationwide press conferences, offer customer training seminars and send training classes to HP employees. And some day in the future all HP sites around the world may be linked via satellite to send televised information back and forth. M

Dish antennae receive the HP new product training program at 38 sites across the United States. On the screen is the telephone number for audience questions.
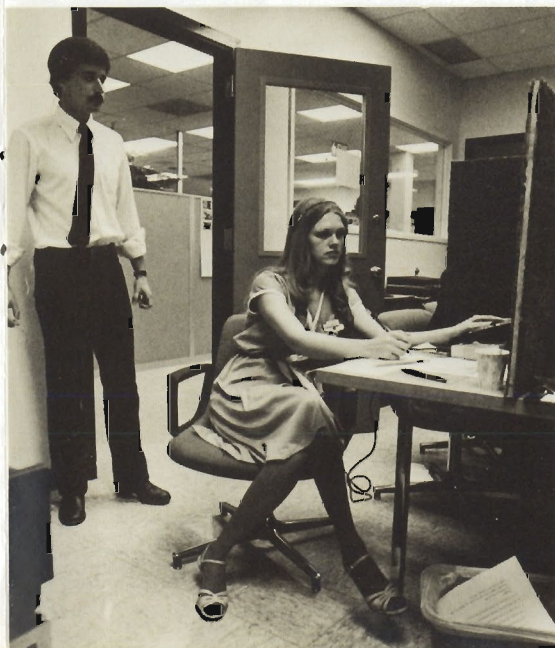
LIVE FROM PALO ALTO

In hotel meeting rooms equipped with television monitors, members of the sales force watch the teleconference.
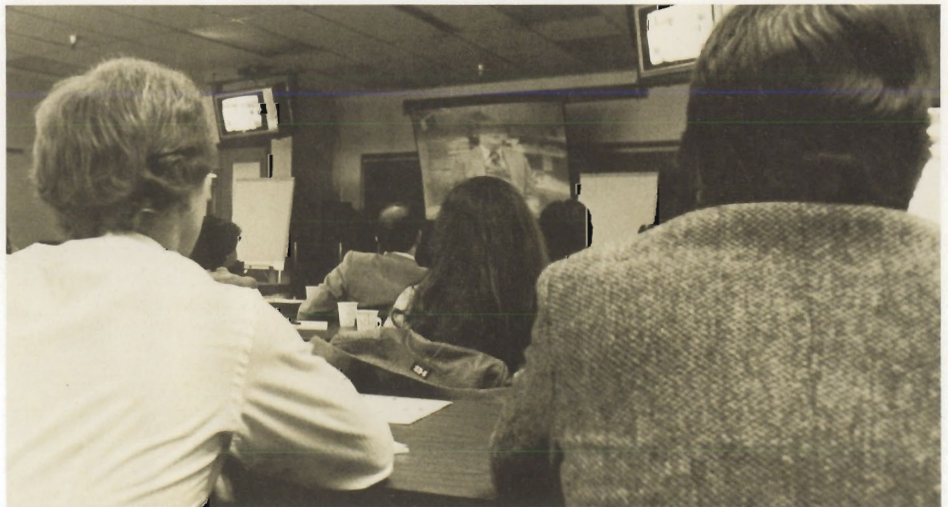
A studio audience of Instrument and Computers sales people listen attentively to a description of HP's new 3054C data acquisition system.

When questions come into the switchboard in Palo Alto, telephone operators, like Pat Flanagan, relay incoming questions to Mark Tolliver, program coordinator for Instruments. Mark, listening to the broadcast through an earphone, then relays to the studio information about which caller is on which line with which question.

Video and audio signals are beamed 22,000 miles into space and then returned to earth stations across the United States. In the future, a series of satellites could link HP sites around the world.

22,000 MILES
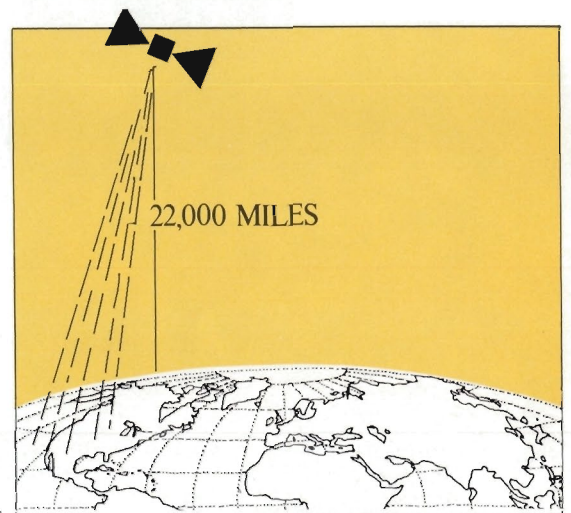
There are good things brewing
at HP every day,
because break time is . . . **MORE THAN**

One winter's day almost 40 years ago an HP employee named Al Spear walked from his workplace at the rear of the Tinker Bell building to the front office where he carefully placed a magazine article on Dave Packard's desk. The article described the benefits of a coffee break during work shifts, noting its ability "to stimulate production and eliminate fatigue."

The article simply confirmed the experience of Al Spear and others who — after an early start in the morning on little or no breakfast — often found themselves low on gas by mid-morning. Hungry! Tired!

Some weeks later, Al and his coffee-loving cohorts reinforced their message by giving management a large coffee pot as a Christmas present, one obviously intended to serve more than a few people.

"And that," recalls Al who is now retired, "is how the coffee break got started at HP."

It was, in fact, the start of a tradition — an institution built around coffee and doughnuts in the morning and coffee in the afternoon. Free for the taking. Today it's the basis of a benefit received by just about everyone around the HP world,

JUST A CUP OF COFFEE

though with a number of local favorites and options instead of the original goodies.

The new era of calorie counting, for example, has had a highly visible impact on the consumption of doughnuts and other pastries, with quite a few divisions substituting fruit on certain days. Coffee, too, is not as universally accepted today as in earlier years, giving rise to alternatives ranging from tea to instant hot-spiced cider mix.

Not everyone is entirely pleased with these innovations. One reformed doughnut eater has been heard lamenting the changes; to him they mean fewer opportunities for exercising his new-found willpower by resisting the offerings of the baker.

No need to feel sorry for him. After all, the essential ingredient of the coffee break — in the minds of most people — is the break itself. Above all, it offers opportunities for "catching up" with fellow employees, for communications, or for just plain time out.

Indeed, the coffee break has become one of the best means for fostering the development of the "HP Way." Once a week at many plants and offices you can find departments or groups holding "extended" coffee breaks to discuss plans and performance. Sometimes they'll ask someone from another department or even a corporate visitor to offer a new perspective on local or company activities.

On the company's books, of course, "free" coffee is anything but. One division recently tallied the cost of providing tea, coffee, cocoa, cups, sugar, milk, doughnuts, cookies and fruit. It came to about $100 per person per year. Not included in that calculation were such overhead costs as rent and the salaries of those involved in the purchase and preparation of these items. Beyond these, the company accounts for the time off for coffee breaks as a benefit, figuring its cost as equal to 4.05 percent of U.S. base salaries. In 1980 that cost totaled $27.3 million.

Large as such a figure looms, no one at HP has ever seriously questioned the value of the coffee break. Forty years after its invention it is still "stimulating production and eliminating fatigue," to name just two of its benefits. **M**


Over the years, coffee break at HP has taken on a variety of roles — birthday celebrations (as in this 1956 photo), farewells, communications meetings and the like.

As they still do today, corporate managers in 1969 gathered around the morning coffee pot to catch up on company news and views. Someone once called it "corporate communion."

HP
UNVEILS
E-BEAM

Engineering drawing shows inner work-
ings of E-beam column that can "write"
circuitry directly into silicon wafers at
ultra-high speed and accuracy. Top
down perspective is shown on cover.
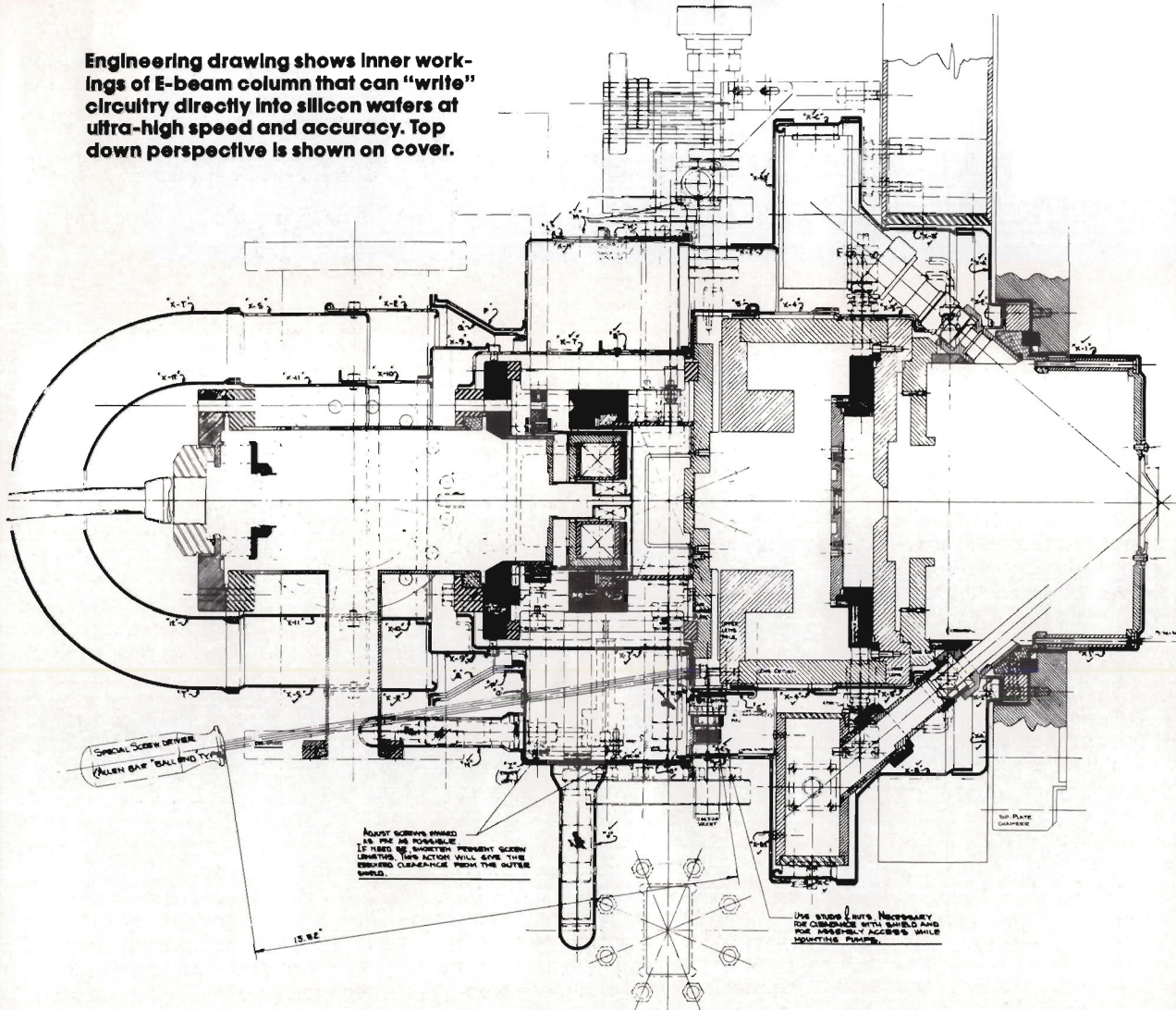
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-beam is a powerful new technology in the making of integrated circuits. It promises much higher speed and accuracy in the design and production of microcircuits at dimensions far beyond our present limits of smallness. After seven years of painstaking effort, HP's most ambitious R&D project is just about ready to go to work. Ross Snyder, Corporate Public Relations, provides the story.

We have all read that famous statement that, if the automobile industry had been able to match the record of the electronics industry this past 30 years, a Rolls-Royce would cost three or four dollars and deliver thousands of miles to the gallon. It's really true, for example, that the price and performance of computers have been improving steadily at about 30 percent a year, so that $40,000 today will buy a computer twice as powerful, far easier to use, much smaller and more economical to run, than a million dollar 1970 model. At that rate, in three or four years, the world will probably see a machine of that same ability in a typewriter-size package costing only $3,000, and using no more power than a television set. What a contrast with a world in which most goods and services are doubling in price every five or six years!

The main reason for electronics' remarkable record is microelectronics: the art of making those silicon chips containing large numbers of transistors and other circuit elements. Microelectronics has made

the Santa Clara Valley of California famous and the U.S. the world leader in electronics wizardry.

It is not immediately obvious why world leadership in electronics rests so heavily on this headlong effort to cram more and more tiny devices onto smaller and smaller areas of silicon. Miniaturization clearly, by itself, makes possible some highly desirable accomplishments, such as pocket-size scientific calculators, portable television sets and airborne radar command centers. But making things smaller is only one of the benefits we realize from microelectronics. It may seem surprising, but it is nevertheless true that, by compacting more and more electronics into smaller space on fewer chips, we can make things that are far more reliable and consume less power, even though at the same time they are far more complex.

But small size, great reliability and low power requirements are only three of the benefits realized from squeezing more and more electronics into ever smaller spaces. Speed is another. One ultimate determiner of the speed with which

electronic devices can function is the distance between them. The smaller the distance the faster the devices. The demand for speed rises with the complexity of the tasks to be accomplished. Computers that perform millions of instructions a second, communications networks that switch millions of transmissions in similarly short times, and airborne radar systems that can differentiate their targets from all other objects, at supersonic speeds, clearly can exist only if their electronics are very, very fast as well as small, complex, reliable and low in power consumption. Low cost is the fifth benefit of micro-miniaturization. The area of a circuit, not its complexity, mainly determines its cost.

All of these benefits are gained, all at once, as electronics designers make microelectronic integrated circuits with more and more elements in less and less space. And that is why miniaturizing electronics is possibly the most important technology of all, in determining how human civilization will develop in the future.

Any endeavor that promises a

THE E-BEAM TEAM

Due to simultaneous development and manufacturing activities, materials management was anything but a routine task. Participants include (from left) Lynne Zorn, Richard Yee, Tina McIninch, Linda Zukosky, Al Marks, Jim Wolf, Joe Davis, Dee Davis, Bill Grimm and Everet Penn.
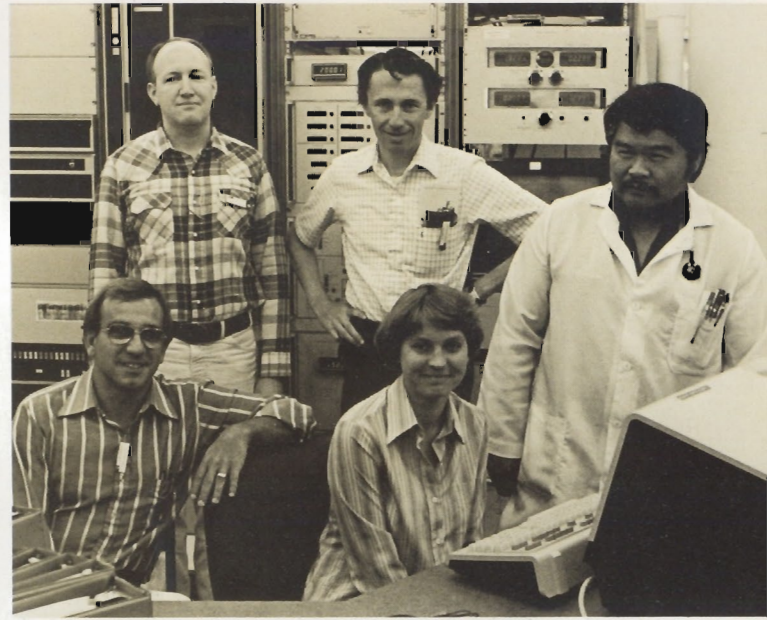

Extensive software is used to link the many complex components of the E-beam lithography machine. From left, software developers include Lee Casuto and Sherry Ramsey (front row); Rick Powell, John Eidson and Richard Meriales.
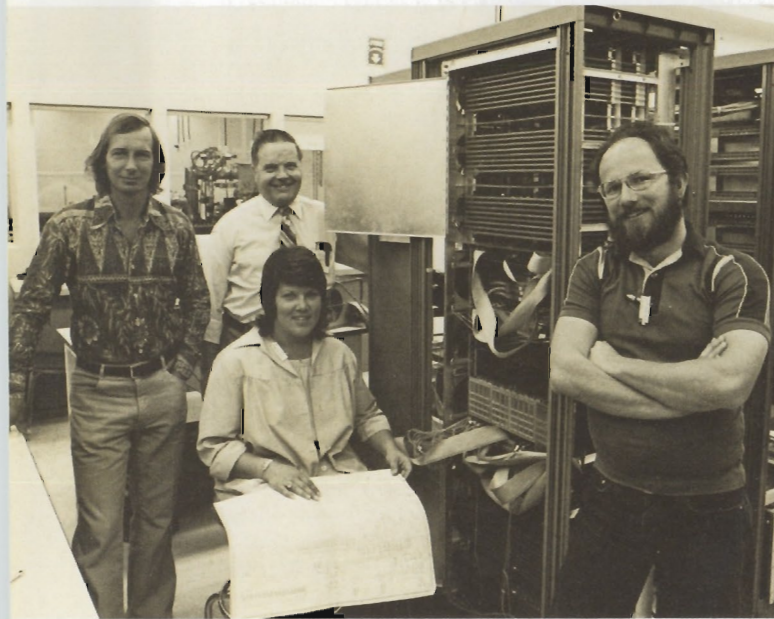
E-beam memory system requires 10,000 RAM ICs able to store 151 million "bits" (technical details of the entire project appear in the May 1981 Hewlett-Packard Journal). Among the system's designer-builders (from left): Ron Scudder, Bob Moody, Peggy MacDonald and John Wallace.
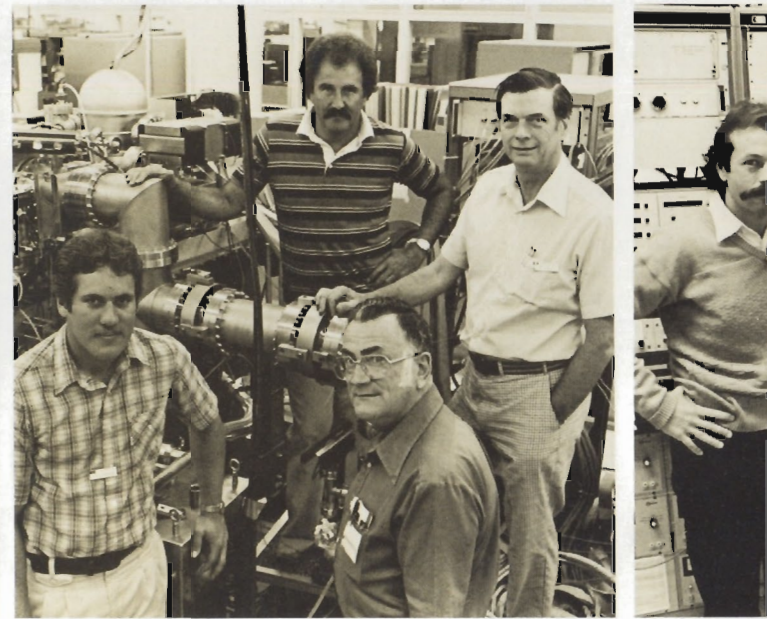
Target for E-beam machine will be IC wafers or masks positioned with extreme accuracy and speed by very complex loading and staging system. Among its developers (from left) are Eric Johnson and Emmett Gerrity in front; then Ron Lackey and Pete Dawson.
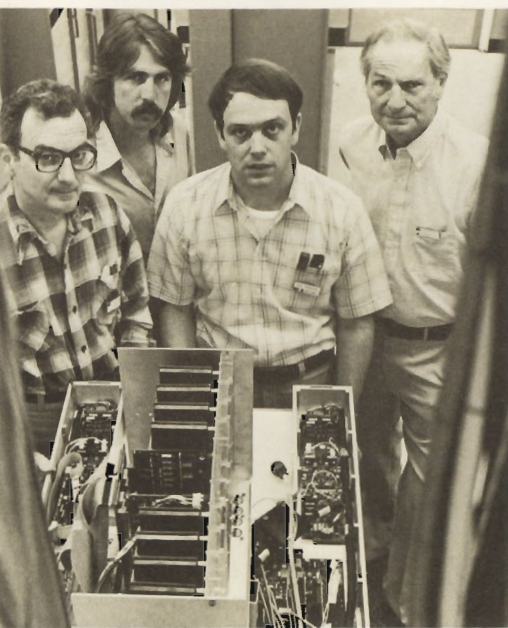
State-of-the-art electronics for HP's most ambitious R&D project is represented here by (from left) Dave Baker, Mike Connell, Bob Crawford and Alan Keen.
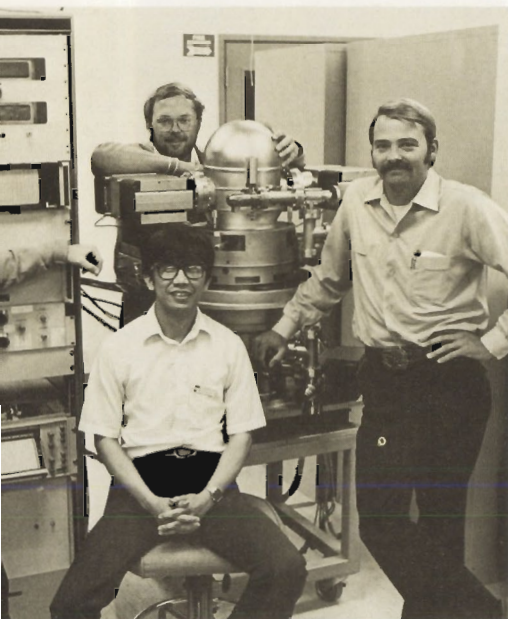
Delivery end of E-beam system is the ultra-sophisticated lithography column these people helped design and build (from left): Steve Palermo, Dave Riehl (rear), Huei Pei Kuo and Ken Winkleblack.

large improvement in the microelectronics art thus is a contribution toward the progress of all human civilization, as well as a bid for technical leadership by the organization that does it, and for the community of nations of which it is part. That is the effort the E-beam people at HP Labs took on when they began the project Hewlett-Packard reveals this month. They have not been alone. Electron beam lithography holds such great promise that some of the ablest organizations in the world have been pouring their best efforts into the race. That includes Bell Laboratories, IBM and Texas Instruments in the United States, and at least two first-rate Japanese concerns.

Integrated circuits are conventionally built up on wafers of silicon by coating them with photographic materials, exposing those to patterns of light through masks, then etching, implanting, or otherwise processing the resulting tiny tracings. This produces interconnections, layers of transistors and other semiconductors, and areas of electrical isolation, as successive mask-and-exposure operations are performed. Several things limit the smallness of the circuit elements that can be produced in this way. One of these is the wavelength of light. Another is the quality of the lenses it is possible to make, to focus the light so finely.

Today's best efforts by these conventional techniques have produced such results as the 450,000-element "Super Chip" revealed in March by scientists of HP's Desktop Computer Division in Fort Collins. Here, the center-to-center spacing between adjacent conductors on the chip is 2.5 microns. (A micron is a millionth of a meter. A human hair is about 100 microns thick.) Basic physics appears to limit the results attainable by these optical means at about 0.8 micron. It now seems reasonable, with electron beam technology, ultimately to achieve 0.1 micron geometries. Compared with today's 1.5-micron conventional technique, E-beam circuits of 0.1 micron spacing would give us not the 15-times improvement that is the difference between those numbers, but a 225-times increase (15 times 15) in the number of circuit elements that may fit in the same square area of silicon!

The basic principle of electron-beam integrated-circuit lithography is no different from the process that produces a television image — a stream of electrons in a vacuum is focused and directed, by electrical

means, so as to trace a pattern. In a TV set, that pattern is written on the phosphorescent surface of the tube. In the E-beam IC processor, it is on the electron sensitive coating applied to the silicon chip.

Electron beams can be focused much more finely than can light beams. Their exact position on the wafer can be determined with much higher precision. Even more important, tiny changes in beam position can be made electrically from chip to chip on a wafer, or from one successive operation to the next, in accordance with computer-controlled instructions that make constant corrections. This is obviously impossible when exposing a whole wafer all at once with light through a mask.

So, beyond the ability to multiply the number of circuit elements we can get on a chip, E-beam technology offers other possibilities that can give its users important competitive advantages. One of these is the ability to design new chips faster, and thus to get whole new electronic products proved and on the market faster and at lower cost.

The basic principle of E-beam is no different from the TV-imaging process—a stream of electrons focused to trace a pattern.

A typical new conventional IC requires about nine masks. Getting each chip design right usually requires doing it over about three times. Changes are tedious and time-consuming. A successful new chip design ordinarily takes many designers and years of time. The design of a new computer will require from 10 to as many as 50 chips, a new calculator five to 10. A million dollars is not an extraordinary cost for final development of a successful chip. For a new product, multiply that by the number of chips needed. Now, because the electron beam can be computer-controlled, it is quite possible to make each chip, or each row of chips, on a wafer containing a hundred or more, different from all the others, all without going through the mask-making process. Many different designs can be made at once, for comparison. Subsequent changes can be made, not

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E

by making new masks, but by changing the instructions to the controlling computer. The E-beam technique thus quite possibly will give HP the ability to design new products not only faster, but better.

E-beam machines can make ICs of greater density and complexity than those previously possible by writing directly on the silicon chip and its electron-sensitive coatings. Direct-writing E-beam machines probably will be used, then, mainly for new and far more complicated designs than any HP has had before. But the E-beam technique is also useful to make masks for circuits of conventional geometries. These masks can then be used in the usual means, so E-beam techniques can also speed present-day, "workhorse" designs. Although the cost of an E-beam lithographing machine may be as high as $4 million, it could justify its price in a short time by this procedure alone, even ignoring the ultimate possibility of circuits never before achievable.

Calculations indicate that an even more-mundane application might quickly justify the cost of an E-beam machine.

Gate-array chips are "common" circuits, with many unconnected circuit elements ready for connection into whatever the designer may wish. These chips can greatly speed the design, and are often used in final products. They are rarely optimal designs, since connections may be longer than is desirable, and interconnected elements may be further apart. Again, it is usual to make the interconnections through a series of masks, each a tedious process, and with each mask costing from $1,000 to $3,000. The E-beam

machine can quickly and directly make the connections and just as quickly make changes. The result, again, is improved speed in design at lower cost.

How does HP's E-beam machine differ from those coming from other laboratories? Very little is being made known about those developments, but experts have reason to think HP's E-beam system may have notable advantages in speed and beam definition. The HP machine can operate at 300 megahertz, that is, its beam can be turned on and off 300 million times a second. That is seven to 10 times faster than other E-beam systems we know about. And it's very important. Because the E-beam machine must "write" circuit elements one at a time, one after another, complex circuits might otherwise take a very long time to produce, much longer than it takes to expose all the chips on a wafer at once, through a mask. The HP machine's speed thus may well make the difference between a machine for masks or experimental use only, and a machine capable of commercial production of ICs not manufacturable any other way.

The sheer size of the project that led to the new HP E-beam system is

impressive. It began in 1974, and it has taken several person-centuries to accomplish. In the process, it was necessary to design a whole new high-speed computer, as controller, running at a 40-Mhz clock rate. Also required was a 20-megabyte main semiconductor memory (10,000 individual RAM ICs), to store the IC pattern.

New physical theory had to be derived when it was observed that electron scatter from the high-intensity beam did not follow the pattern the textbooks forecast. That led to complete redesign of the main writing element of the machine. Years and years of hard work went into writing the computer programs giving it the ability to correct its own errors in focus, chip location, registration of successive writings, astigmatism and other matters — all on the fly. It can even measure and correct for lack of flatness in the silicon substrate material. Also, a precision x-y stage was designed which, with software, can position the wafer to an accuracy of plus-or-minus 200 angstrom units (roughly the size of 40 atoms).

The question naturally arises, will the company offer these remarkable machines for sale? The original plan was to use them solely to give HP designers those advantages that have been described: to produce new ICs with capabilities competitors could not match, and to put those ICs into new instruments and computers with similar advances. Yet consideration may be given to the possibility of offering the system as an HP product. It's all a matter of carefully considered return on investment. The jury is still out on that question. **M**

VANPOOLING A BENEFIT?

In a classic illustration of the HP Way, corporate decision-makers, who, by and large, do not participate in ride-sharing programs, have chosen to discontinue the HP vanpool program in the Bay Area. In arriving at this decision, these individuals did not deign to consult with even one of the people most directly involved: the vanpool riders themselves. Will this high-handed manner become standard procedure for decisions involving reduction of employee benefits in the future?

FRED HARDER
HP Design Aids
Cupertino

In retrospect, we certainly could have done a much better job in communicating the plans to change our vanpool program with the people involved. The emotional attachment of our people to the HP program was not fully appreciated and consequently represented more of an adjustment than we had originally thought. I have personally spent a number of hours discussing this subject with many of the individuals involved, and we have tried to be helpful and responsive to their suggestions to minimize this transition.

First, let me reiterate that HP continues to strongly support vanpooling, carpooling and other commuting alternatives. Some background information about the HP vanpool program might be appropriate in putting this subject in perspective, as well as to explain the company's feelings about ride-sharing programs in general.

HP began its vanpool program in 1976 to serve as one of several examples of the company's commitment to energy conservation. It was formed as an in-house program because, at the time, there was no qualified outside agency available. Had there been one, HP would have used its services.

In the past four years, the HP program grew to include 34 company-owned vans and between 350 and 400 participants in the Bay Area. Having proved the concept worked, we felt it was an appropriate time to evaluate the results and consider the future direction. We conducted a thorough study of costs, administrative procedures, insurance and legal liabilities, program efficiency with regard to gasoline savings, and other factors. The Executive Committee agreed with a recommendation from those involved with the analysis that HP should continue to support the concept of ride-sharing — including vanpooling — but that the company

should not operate an in-house ride-sharing program when an alternative program existed in the community.

In the San Francisco Bay Area we are fortunate to have an organization called RIDES for Bay Area Commuters, Inc.— a non-profit agency that has more than 250 vans on the road serving more than 3,000 passengers in 10 Bay Area counties. We initiated talks with RIDES, but this was not our first dealing with the agency. We had been impressed with RIDES as it began to grow a few years ago; in fact, HP donated a computer to the organization in 1978 to help it develop a more efficient carpool and vanpool passenger-matching system. We felt it appropriate to support this community effort and decided to work out a transition of our program to RIDES.

During the three months since we announced this decision, we have been working with the local HP vanpool groups who are transferring to RIDES or to other commuting alternatives that will be cost effective and compatible with individuals' needs. Many have already completed or are in the process of transferring to RIDES vans, some have purchased their HP vans, and others have formed carpools. A few groups have yet to make a decision, but are expected to do so by July 1. We are continuing to work with them to find alternatives.

As part of the analysis and decision-making process, we created an HP ride-sharing and vanpooling guideline that has been shared with all U.S. divisions. Basically, the policy says that an HP entity wishing to become involved in vanpooling should seek a competent third party with which it can work to promote ridesharing for HP people. In the absence of such an organization, an HP entity may start its own program, but it should do so without financial subsidy, and it should continue to search for a competent outside agency with which to effect a transition at the earliest possible time.

In sum, HP's role in ride-sharing shall continue to be to provide support, program coordination and information to HP people about commuting alternatives, and further, to promote those alternatives to employees as one of many ways by which they can make a valuable contribution to energy conservation efforts. It is not HP's intent to develop and administer in-house ridesharing programs unless there are no community agencies available to provide these services for our people.

BOB BONIFACE
Executive Vice President
Palo Alto

YOUR TURN

Invites you to question or comment on matters of importance to the readers of Measure.

HP IN SCI-FI SAGA

I read with interest the excerpt from Alvin Toffler's *The Third Wave* in which he describes the "new-style work environment" of HP's Colorado Springs facility. It brought to mind another reference to HP which I ran across in a science fiction short story called "Time Shards" by Gregory Benford.

The excerpt deals with two scientists who are trying to learn about early cultures by attaching a computer-controlled turntable device to the fine grooves of ancient earthenware pots.

The computer board hooted a readiness call. Hart walked over to it, thumbed in instructions and turned to watch the stylus whir in a millimeter closer to the spinning jug. "Damn," Hart said, glancing at the board. "Correlator's giving hash again. If you'd given me enough money, I could've had a Hewlett-Packard. Wouldn't have to fool with this piece of ..." Hart's voice trailed off.

I think the implied quality of HP computer systems is evident and speaks highly of the company.

MOLLY NOLAND
Service engineer
Colorado Springs

RETIREE CLUBS: GROWING STRONGER

"The trouble with retirement is that you never get time off."

Variations of that statement have been echoed jokingly by many of HP's retirees who have found there is, indeed, plenty of life after leaving HP. And, for more and more retirees, that life still involves a close association with the company where they worked for so long.

"There's nowhere else that we have more fun" than getting together with other HP retirees is the way Elsie Yearian describes her involvement as treasurer of the Hewlett-Packard Retired Employees Club (HPREC) in the San Francisco Bay Area.

And fun is what they have: luncheons, bus trips to nearby divisions like Santa Rosa and tourist spots like Hearst's Castle and Fisherman's Wharf. Each year they hold a picnic that is a true miniature of the ones held each summer at all HP locations.

There are three active retirees groups now organized in the United States — at Waltham and San Diego Divisions, in addition to the one in Palo Alto. All have their light and social sides, but they also provide some very real services to the divisions from which they sprang.

At San Diego, for example, Joe Costa, employee relations manager, credits the small (37), high-energy group of division retirees with "really making a contribution.

"We used to get so many requests for tours from outside groups like Junior Achievement and college electronics classes that we just couldn't accommodate all of them," he relates. "Now retirees give these tours as well as the ones for new employees. It's absolutely fantastic. You can't imagine the reaction we've had from a new person who thinks, 'Wow! This must be a good company to work for if their retired employees come back to give tours.'"

That sentiment is echoed by the people who work with the retiree

Discussing their activities during retirement are Curt Chaner, Ray Rooney and John Walling. The three got together at last month's retirees' picnic near Palo Alto.

HP retiree Hilda Madison is one of several San Diego Division retirees who lead orientation tours for new employees.
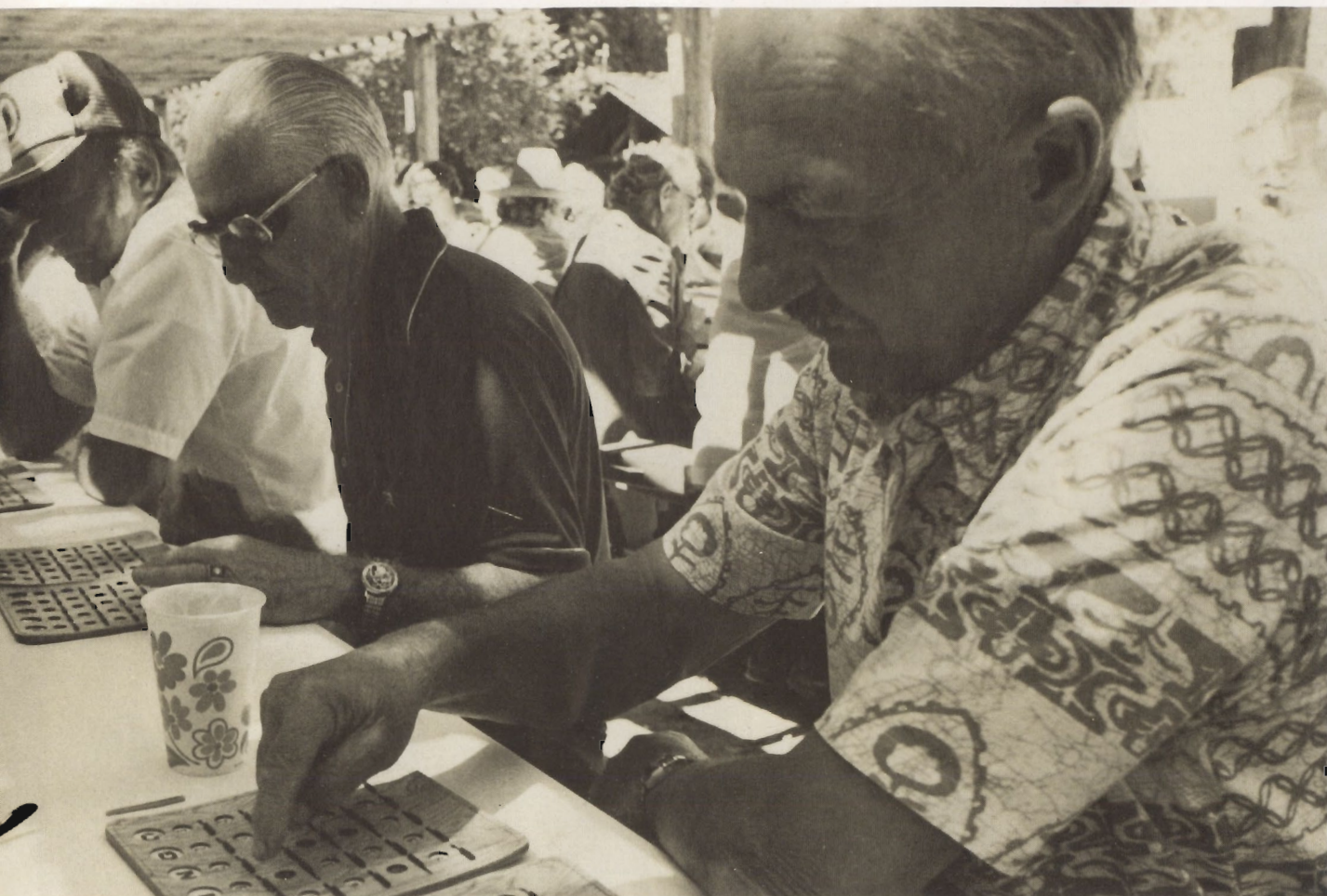
groups in Waltham and Palo Alto as well. "We hope to involve our retired employees more in the future when we start giving pre-retirement seminars," says Janet Dale, who coordinates the Waltham-Andover Quarter Century Club (open to both retired and active employees with at least 25 years of service).

Each year the group staffs the vintage product display at Waltham's annual open house because "they usually can explain what the equipment was and how it worked", according to Janet.

Most of Waltham's people started with Sanborn Company, acquired by HP in 1961. But they also spent many years as HP employees so they receive the division publication, Monitor, as well as an annual invitation to the Waltham picnic. The Quarter Century Club has two socials a year: an installation of officers in December and a spring picnic at the division's recreational area, Club Sandwich on Cape Cod.

This year the Waltham outing and HPREC's picnic were both held on Saturday, May 16. Not surprisingly, there was the traditional U.S. picnic fare of steak, corn-on-the-cob, baked beans, salad and garlic bread, as well as bingo, dancing

and a chance to catch up on conversation.

While announcing the winners of the nine-hole golf tournament held the day of the HPREC picnic, Ray Rooney, who helped get the group started in mid-1979, explained that the club's name derived from "HP and REC — because all of us are old wrecks!"

That's definitely not an accurate description of the 170 people who belong to the group. Besides their many social get-togethers (they're already busy arranging a boat trip on the Sacramento River), HPREC members also help out with new-hire orientations and other tours at Peninsula divisions.

And while San Diego is just now revving up the social side of the retirees group, it was about a year ago that Joe Costa invited three or four retirees to a pre-retirement seminar "to tell our people what it's really like after they leave HP." Recalls Joe, "The people who agreed to participate were so great — they gave everyone the word right from the horse's mouth, so to speak. They said things like 'Hey, you guys, quit smoking now — or it'll be too late.' They were really convincing."

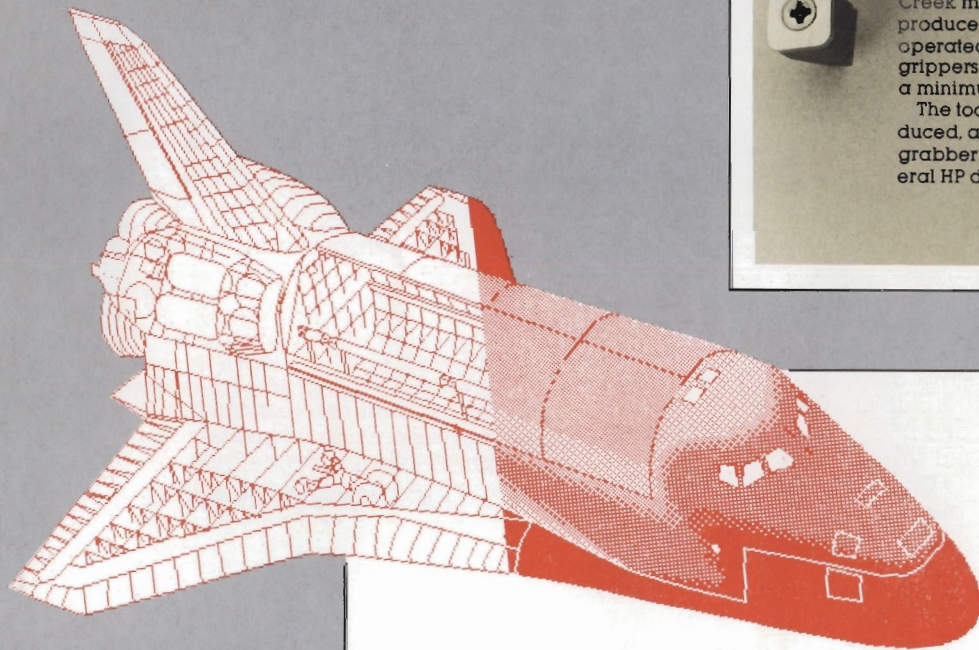Joe has nothing but praise for re-

Bingo is always one of the most popular activities at HP picnics. So when the Hewlett-Packard Retired Employees Club (HPREC) held its second annual picnic last May, nearly everyone got into the game. In the foreground, Ray Hefner, who has been with the company 33 years (and is now at Microwave Semiconductor Division in San Jose), whiled away the afternoon two bingo cards at a time.

tiree Hilda Madison, who has been riding herd on the retiree activities at SDD. "When she retired in 1972, she said she didn't really know what she was going to do, maybe a little painting, a little gardening and ceramics. Well, lately she hasn't had much time for any of these because she keeps coming back to help us out.

"God love her — I don't know what we'd do without our retirees." **M**
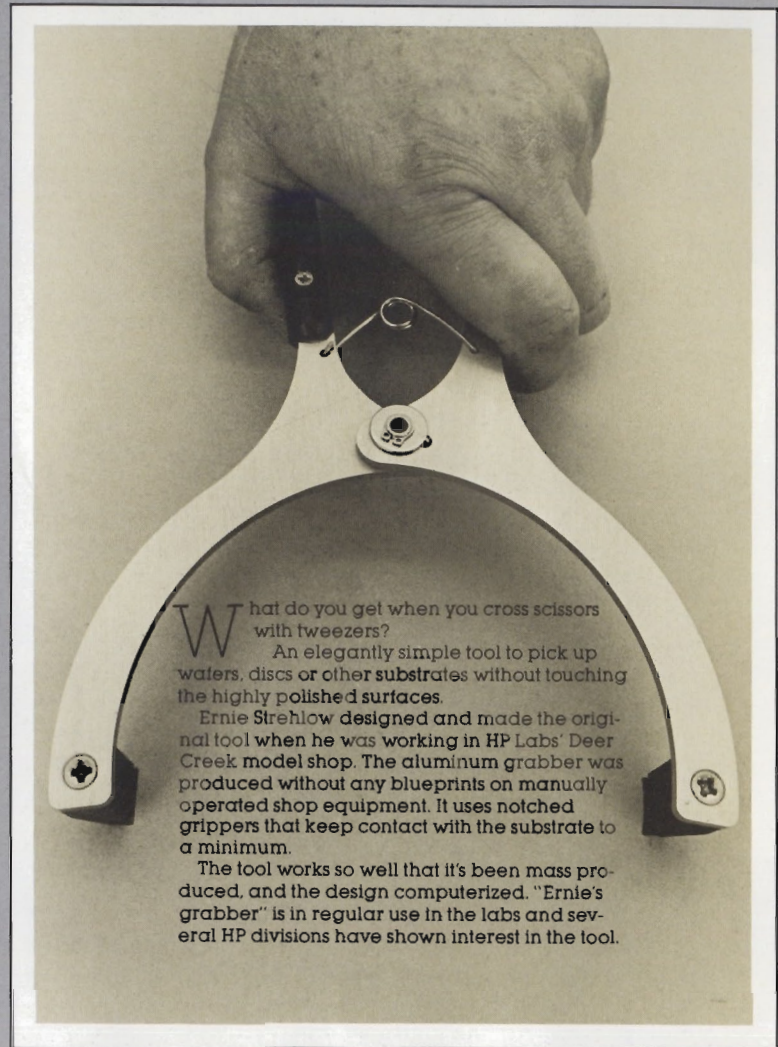
CLOSE UP

Zooms in on the
ever-changing world
of HP people,
products and places.

What do you get when you cross scissors with tweezers?

An elegantly simple tool to pick up wafers, discs or other substrates without touching the highly polished surfaces.

Ernie Strehlow designed and made the original tool when he was working in HP Labs' Deer Creek model shop. The aluminum grabber was produced without any blueprints on manually operated shop equipment. It uses notched grippers that keep contact with the substrate to a minimum.

The tool works so well that it's been mass produced, and the design computerized. "Ernie's grabber" is in regular use in the labs and several HP divisions have shown interest in the tool.

Hanging in weightless suspension, astronaut Robert Crippen tidies up the mid-deck storage area with a special vacuum cleaner during the flight of the space shuttle "Columbia." Just visible in the center of the photo are the protective cases holding the two HP-41C calculators used to run two special programs: the "flight-critical" center-of-gravity program aligned the shuttle's trajectory with respect to the Earth's zenith for correct re-entry, while the acquisition-of-signal program computed time intervals between tracking stations on the ground. During launch and re-entry Crippen kept the 41Cs right at his side.

Photo by Commander John Young, courtesy of NASA

In these days of skyrocketing fuel prices, anything that offers 10 percent fuel savings has to be just short of miraculous. Enter the HP-41C, which is now custom programmed for Beech Aircraft Corporation's top-of-the-line, high-performance prop jet. Beech engineers and HP worked together to develop a permanently programmed module that not only figures out the most economical and quickest routes, but also solves other vital flight problems that save a pilot time and work. No special math skills are needed to run the program since it communicates in ordinary English. How successful is it? On one recent flight, the calculator program achieved a 26 percent fuel saving. Beech estimates that if the pilots of all 650 Beech Super Kings carried out the simple instructions from the HP-41C, it would save about four million gallons of fuel a year.

You've heard about putting yourself in the other person's shoes?

For three supervisors at the Microwave Semiconductor Division, that meant spending three hours at work in the role of a person with a physical disability as part of the division's Handicapped Awareness Day, on April 29.

Production supervisor Ruth Chavez wore blinders and colored glasses that blocked out all vision, and she carried a white cane which she found made it surprisingly easy to get around familiar territory.

Also taking part in the experiment were Doug Pung, manager of manufacturing specs, who wore earplugs to learn how it felt to have a hearing impairment, and security manager Frank Lopes, who used a wheelchair. Frank, who was in a wheelchair himself for three months in 1951, found he'd forgotten how to go down the cafeteria line or to open doors while in a seated position.

PJM

Christine Lim, purchasing supervisor at HP Malaysia, is now a Pingat Jasa Masyarakta, or PJM. She received the title last year from the governor of Penang for her numerous community service activities. Among them: organizing a party for youngsters of all races as part of the International Year of the Child; setting up a fund-raising dinner and auction for Mt. Minam Cancer Hospital and a home for the elderly; and organizing many special events for area orphanages. "It's a wonderful honor," says Christine, who also chaired HP Malaysia's community activities committee. "I love working with children because they give back to me more than I can ever give them."

NEWS CLIPS

Hospital Accounting System 3000

HP 9826 computer

SECOND QUARTER FY81

Orders for the second quarter of FY81 were just under $1 billion, exceeding the previous all-time record set in the first quarter.

The company reported a 15 percent increase in sales and a 14 percent increase in net earnings for the second quarter of its fiscal year ended April 30. Similarly, sales for the first six months increased 16 percent over the first half of 1980 while net earnings increased 15 percent.

Here are FY81 results with results for the corresponding FY80 period in parentheses:

Second quarter sales, $867 million ($754 million); net earnings, $74 million equal to $1.21 per share on 61 million shares of common stock outstanding ($65 million, equal to $1.09 per share on 60 million shares outstanding).

For the first six months, sales were $1.64 billion ($1.42 billion); net earnings, $137 million, equal to $2.26 per share ($119 million, equal to $2.00 per share).

Incoming orders for the second quarter amounted to $989 million, a gain of 23 percent ($803 million). Domestic orders totaled $522 million, up 41 percent from the year-ago quarter. For the six-month period, orders totaled $1.92 billion, up 20 percent from a year ago ($1.6 billion).

Profit-sharing percentage for the first half was 7.46 percent.

STOCK SPLIT

HP's Board of Directors on May 15 declared a two-for-one split of the company's common stock, effective on shares outstanding June 17. Shares closed on the New York Stock Exchange the preceding day at $100.25. The current total of approximately 60 million shares outstanding will increase to approximately 120 million. At the same time, the regular quarterly cash dividend changed from 10 cents per share on the old number of shares to six cents per share on double the number of shares, a 20 percent increase. Previous HP stock splits were in 1979, 1970 and 1960.
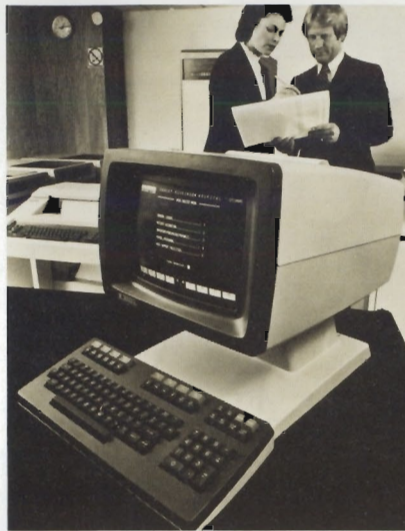
RESTRUCTURING

HP has elevated its handheld calculator and personal computer activities to product group status. General manager of the new Personal Computing Products Group is Dick Moore, who will also continue to serve as general manager of the Corvallis Division. Fred Hanson will manage the division's new Hand-held Calculator Operation. Manufacturing operations in Brazil and Singapore now report at the group level.... The Colorado Springs Division has formed an Oscilloscope Operation and a Graphics Displays Operation under Dar Howard and Dave Dayton respectively. Both organizations, along with a Logic Systems Operation formed in 1979, report to general manager John Riggen.... HP-New Zealand will become a full-fledged subsidiary on November 1 under Wayne Squires as country manager. It has been operating as a district of Intercontinental's Australasian Area.

IN THE PUBLIC EYE

Ground was broken April 16 for an interim manufacturing facility in Marysville, Washington, to house the future Lake Stevens Instrument Division. LSID is scheduled to transfer from Loveland, Colorado, this sum-mer.... HP has moved up to 120 in the annual Fortune magazine ranking of the 500 largest U.S. industrials, based on 1980 sales of $3.1 billion. The company was 150 last year.... Group marketing manager assignments for Bob Rogers in the new Personal Computing Products Group and Bill Murphy in the Peripherals Group. (Murphy also continues as Boise Division marketing manager.) In division marketing manager roles: Steve Haslett to Microwave Semiconductor Division, Alan Nonnenberg to General Systems Division, Walt Fischer to Colorado Telecommunications Division, Jim Mosakowski to the future Lake Stevens Instrument Division, Jerry Boortz and Fred Bode to Colorado Springs Division's new Oscilloscope Operation and Graphics Displays Operation respectively.... On May 27 HP Labs scientists announced a powerful new electron-beam system for higher speed and accuracy in designing microcircuits for the company's own products (see story beginning on page 12 of this issue).
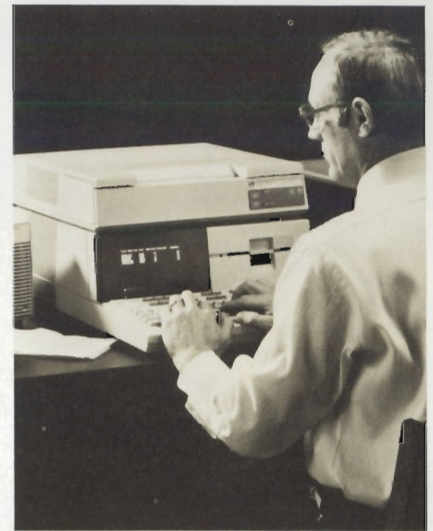
NEW PRODUCTS

The Desktop Computer Division's new HP 9826 computer for laboratory automation and computer-aided test offers from two to five times the speed of the popular HP 9825 at the same price. It features CRT graphics for displaying computational results.... Waltham Division on May 4 introduced the Hospital Accounting System 3000, which includes four specially designed software packages designed to run on an HP 3000. It will be sold by a new medical computer sales force being formed to handle a forthcoming series of administrative systems for health care applications.

Division review at South Queensferry, Scotland, brought together (from left) John Doyle, vice president-R&D, John Young, HP President, and Tom Crawford, South Queensferry R&D.

A MESSAGE FROM JOHN YOUNG

The first half of 1981 is complete and this is a good time to give you a report on how things are going. I visited many of our European operations in April, and Japan and Southeast Asia in May, so I have the views of the managers in those areas to report along with the financial figures.

The order performance pretty well tells the story. U.S. orders in the first half were up 30 percent over a year ago, and somewhat ahead of our expectations. The economy had an unusually strong recovery during that period, and that, coupled with some very well received new products, combined to produce this very satisfactory result.

International orders, on the other hand, were up only 11 percent, with most of the gain coming from Canada, Japan and other Intercon countries. Europe—which represents about one-third of our total business—had relatively little growth from a year ago, indicating a continuation of the economic slowdown in European markets that began last year. Further, the currency situation has added to the challenge of generating orders. Major European currencies have devalued as much as 30 percent against the U.S. dollar over just the last six months, thus effectively increasing prices to our customers by that amount.

Southeast Asia, while small in absolute level, has significantly increased its business levels over those a year ago. The developing countries in this area are moving rapidly to industrialize, and it's easy to see from a few days' personal experi-ence why this part of the world is expected to lead in real economic growth in the decade ahead. Our new area headquarters in Hong Kong is a help to the country sales teams there, and with this excellent base in place HP is well positioned to continue to participate in the growth phase of these economies.

Total company orders for the first half were up 20 percent, but shipments increased only 16 percent. As a result, we added about $280 million to the backlog. Costs and expenses grew a little faster than shipments so pre-tax profits, the base for calculating profit sharing, only increased by 12 percent. A lower tax rate in 1981 helped offset this expense growth, so net earnings were up by 15 percent. The compression in our pre-tax operating margin concerns us a good deal, and we must focus attention on turning this situation around.

We have been cautious in approaching this business year, and appropriately so. The adverse effects of the business recession on some companies in our industry have been well publicized, highlighting the importance of the conservative stance we have been taking. By properly anticipating slowing orders, I believe we are in a good position now to achieve performance improvements in the second half.

What's the outlook? The U.S. economy has already started to drop back from the growth spurt earlier this year, and we anticipate that our domestic order growth rate in the second half will slow somewhat. European economies are not ex-pected to turn up before late in the year. This moderating growth outlook dictates that we must continue to watch hiring and keep pressure on expenses across the board.

The backlog is not evenly distributed. Some divisions must move aggressively to increase shipments to meet customer commitments. Others will hold the line. The best opportunity to improve our order picture is with new products. We should make every effort to accelerate close-in R&D programs where possible.

Let me conclude with a word about profit sharing. The payout was 7.46 percent, down from 8.52 percent in the first half of 1980. This decrease was due primarily to three factors.

First was the lower growth rate in pre-tax profits mentioned earlier. Expenses and product costs need attention if we are to turn this around in the second half.

A second factor directly relates to a change in employment growth rates. Participation in cash profit sharing begins after a six-month waiting period. When the hiring rate slows, the number of employees eligible for profit sharing increases faster than total employment. This happened in the first half as total employment was up only eight percent from a year ago, but eligible employees increased 11 percent. Fortunately, the reverse of this effect will occur in the period when a more normal rate of hiring resumes.

The third factor is simply the rapid rise in payroll costs that have pushed up total payroll as a proportion of the sales dollar—all the more reason to concentrate on productivity, as it affects our competitive position as well as your profit-sharing check.

As I indicated earlier, we have a good chance of improving our performance in the second half. By moving up shipments and tightening expense controls, we can have a very satisfactory year, and improved profit-sharing results for everyone.

John

MEASURE

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

INSIDE

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Palo Alto, California 94304

Moved lately? Change of address should be reported to your personnel department.