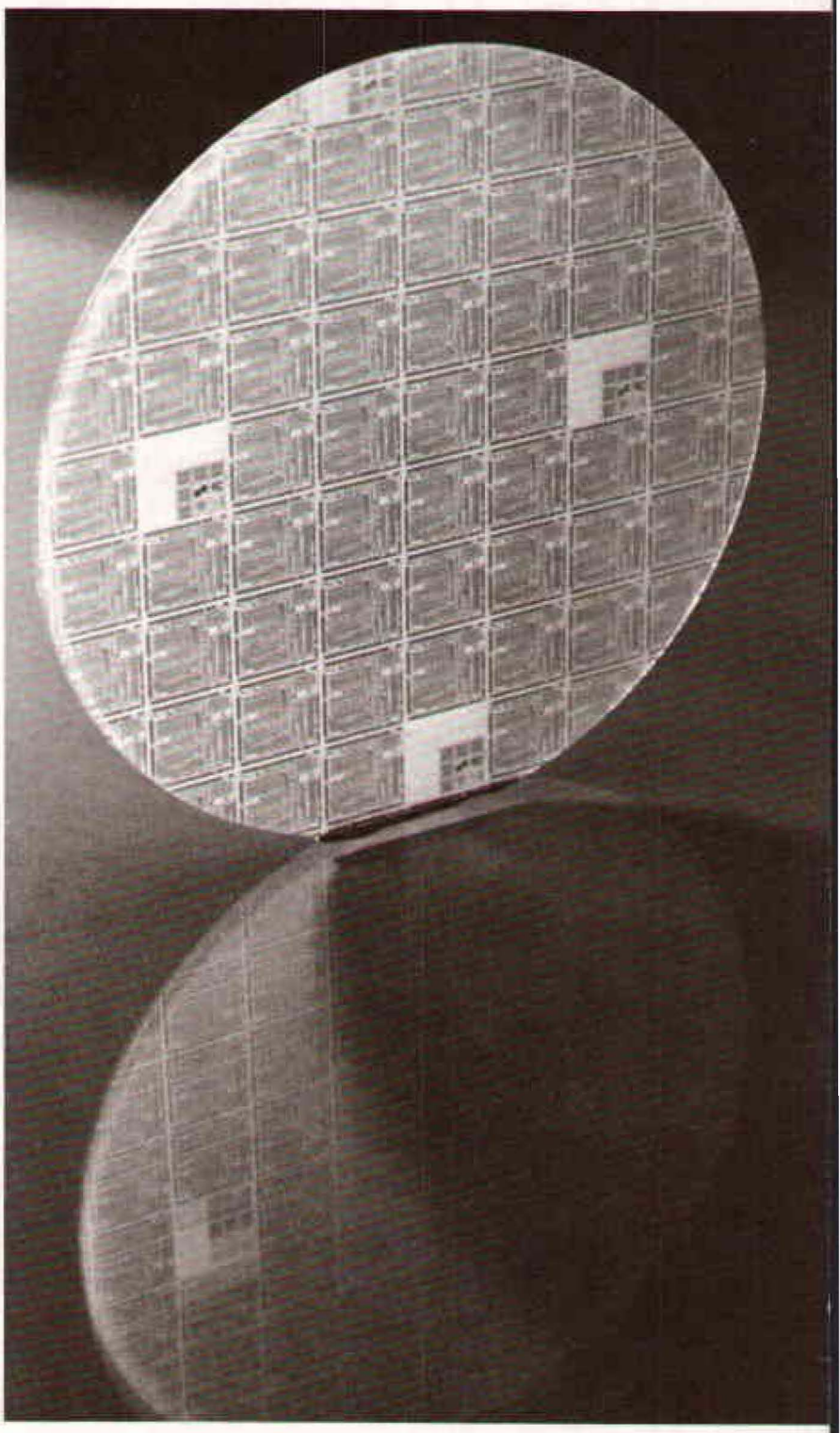
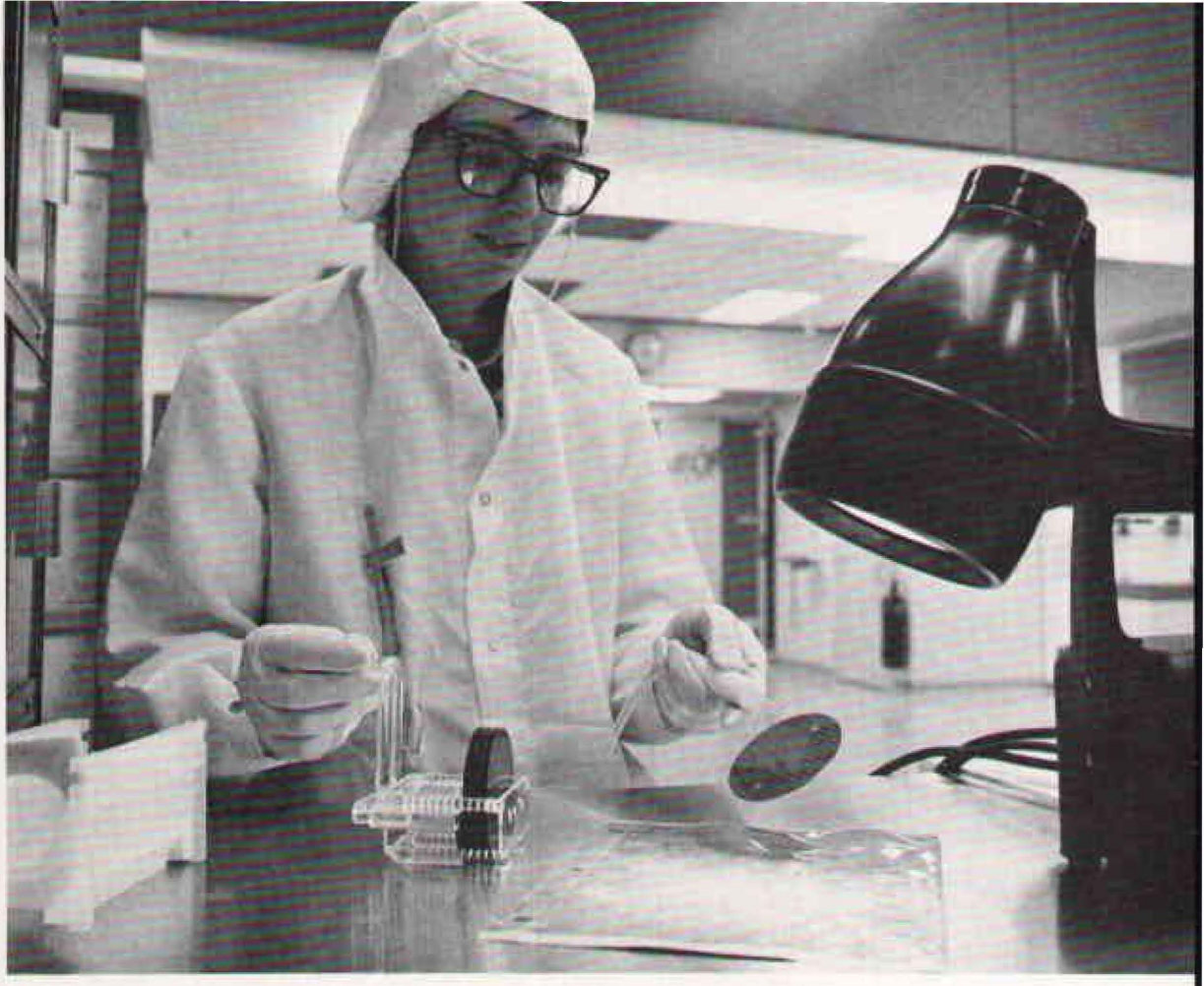
Measure

For the men and women of Hewlett-Packard / MAY 1977





The miracle in a small package–

HP's big stake in the IC revolution

☐ The introduction of HP's 9100A desktop calculator in 1968 was hailed as a technological milestone. The 9100A could solve problems in science and engineering that had been beyond the reach of earlier electronic calculators, even outperforming some computers of its day. It could be programmed with magnetic cards so that complex problems could be solved with a few keystrokes. And it was no bigger than an office typewriter, which was quite an accomplishment at the time.

Today that same capability — and a little more — is packed in a pocket-sized, battery-powered version, the HP-67. It weighs only 11 ounces — 58 times less than the 9100A.

The reason for this tremendous reducing act in less than a decade? Integrated circuits. Tiny devices that combine thousands of circuit elements on a single silicon chip. The IC, third-generation descendant of the vacuum tube and the transistor, has made it possible to put the equivalent of more than 70,000 transistors into that pocket calculator.

In a speech to Stanford graduate students and alumni last November, HP Executive Vice President John Young commented on the dramatic progress of IC technology. "In 1960," he said, "simple minicomputers would typically need 10,000 separate, discrete transistors, each made on a single chip of silicon. Then came the integrated circuit revolution. By 1965 there were commercially available ICs that combined about ten transistors, with all their interconnections, in a single chip. Semiconductor technology has, ever since, been giving us ICs of larger and

Under the strictest of clean-room conditions, Jane Plankinton of HP Labs inspects a silicon wafer that may contain up to 150 identical integrated circuit chips. Each chip can routinely accommodate 10,000 or more circuit elements with present technology, and the number is growing rapidly.

larger scale, concentrating more and more transistors and other circuit elements into less and less space.

"When these devices become more and more complex, and smaller and smaller, much more is accomplished than miniaturization. We can also cut costs, increase speed, reduce power requirements, and at the same time improve reliability.

"By 1968, 100-transistor ICs of reasonable price became common, costs came down, speeds went up, and reliability improved. Minicomputers began to grow up, doing many of the jobs that once required big mainframe computers . . . At the same time, the new and more complex ICs were making it possible for large mainframe computers to expand their performance ten times and more, without comparable increases in price or reduction in reliability. This process has continued right up to today, when manufacturing a 10,000-circuit-element chip is about as easy as putting one transistor there in 1960. If one extends this growth rate, the number of elements per chip will reach 100,000 in 1980, and perhaps 1,000,000 in 1985."

An integrated circuit is made by focusing light on photosensitized silicon surfaces through a succession of complex masks. Each layer is formed by "developing" that surface much as you would a photograph, leaving a pattern of exposed substrate. The appropriate semiconductor material is then diffused into the silicon and this sequence is repeated, with variations, for the next process step.

The 10,000 or more elements that go into it are first laid out and drawn in large scale — often with the help of computer-aided drafting equipment — and then reduced photographically to form the masks. As more and more elements are concentrated on a chip that's only about a quarter of an inch square, the photomask method will become obsolete — the fine lines required will be impossible to achieve through optics.

Sandi Carr of Data Systems Division "digitizes" a sketch of a new integrated circuit design and enters it into the computer. Much of the software used in IC design and production was developed within the company.

When that happens, the next technological step, according to John Young, will probably be the use of an electron beam to etch the chips directly. "Refining the same methods used in electron microscopes — actually the same way the electron beam in your TV set is focused — we can produce powerful beams 1000 times narrower than the tightest light beams. We can direct the beam entirely by electronic means under computer control, so we can create new designs rapidly, duplicate them reliably, and eliminate many problems that surround the use of fragile optical masks. E-beam circuits will be so small they will be unrecognizable under the most powerful optical microscope."

Making ICs the HP way

Realizing that integrated circuit technology was vital to the company's future, managers at the corporate level began in 1975 to formulate a long-term strategy for the development and production of ICs. In October of that year, an eleven-page document was distributed, outlining the corporate strategy and setting guidelines for the divisions and product groups.

At that time HP already had nine IC facilities. A crucial question was whether to centralize for greater production economy or continue to locate new facilities close to the R&D labs they served.

It requires enormous investments of capital to establish and operate IC facilities, and they can be obsolete in three to five years if they're not continuously upgraded. Divisions were told to anticipate annual expenses approximating the total replacement cost. "This is just a rule of thumb," explained Merrill Brooksby of Corporate Engineering, "but if it costs a million dollars to start an IC facility, then it'll take at least that much each year to sustain it. To keep up with changing technology, about one fourth of the facility should be replaced each year."

Still, it was felt that de-centralization was more in keeping with the HP style of product innovation. As it was pointed out in the written strategy statement, HP is generally most successful when its products are novel and unique at a reasonable price rather than undistinguished and cheap. When low price is an objective, the

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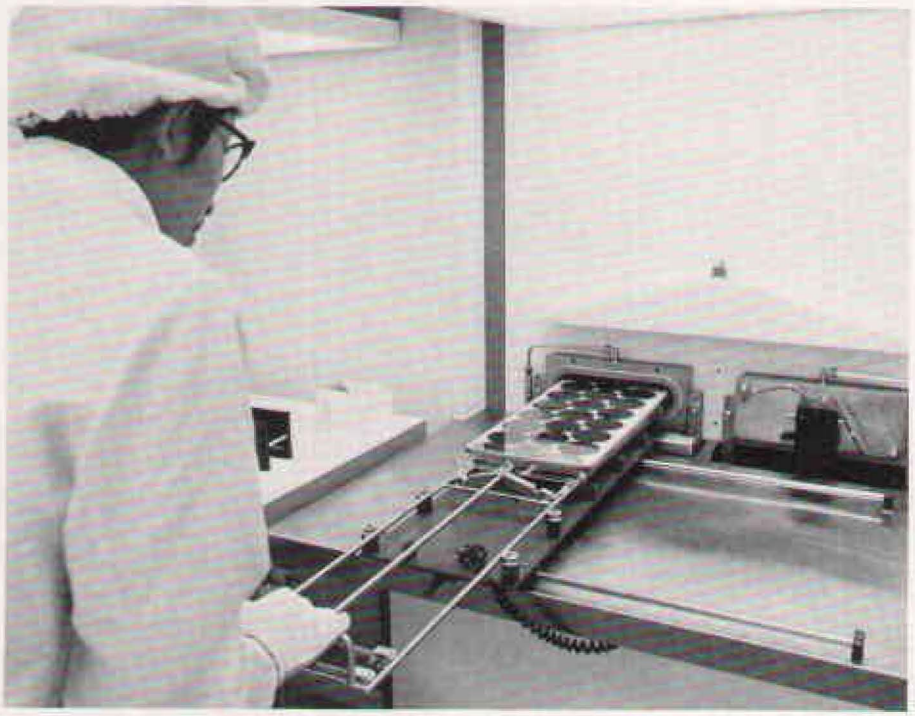
IC revolution

HP approach is to use new technologies in new ways to achieve it.

"If we had a central IC facility it would be difficult to bend enough to accommodate the R&D people," Merrill went on. "It's hard to do research at arm's length. And HP just doesn't need the high-volume production some other companies do, so production efficiency is not our main goal. As Dave Packard put it, our objective is to produce the right product at the right time — not to keep the diffusion furnaces full."

With that general direction established, the questions that remained concerned division economics, and for the most part they had to be answered by the divisions themselves. Whether to start an IC facil-



Henry Chiang of HP Labs puts a batch of IC wafers through one of many process steps — in this case to add a dielectric material. This laboratory on Deer Creek Road in Palo Alto is the newest and most automated IC facility in the company.

Design engineer Lou Scheffer of Loveland (Colorado) Instrument Division checks an IC drawing made on the large horizontal plotter in the background. Most HP divisions use similar computer-aided artwork (CAA) systems to simplify the job of drafting complex circuitry.

Computer-generated drawings of IC designs are made for the sole purpose of checking and editing. To make changes, new data must be entered on the CRT terminal, as Kay Lantner of Santa Clara Division is doing here. The final IC design will be in the form of a computer tape.

ity, share one, buy from a vendor or even from another HP division — these decisions had to be based on each division's requirements.

It was decided that no division should have to be responsible for the success or failure of another. So a division wanting to make use of someone else's IC facility for R&D would have to provide its own people and any special equipment as well as funds. Production commitments would be made only after careful consideration of the costs and schedules.

Facilities are to be used for all phases of the development and production process. To have separate lab and production facilities would not only be too costly, it would also lengthen the time required to transfer an IC design from R&D to production. At some time in the future when facilities are highly automated and controlled, the transfer of IC designs from an R&D facility to a separate production facility might be practical. But today it's not, and in order to make timely product contributions HP must be able to move circuit designs easily from the drawing board into production.

Even the ultra-modern IC facility in HP Labs is used for production as well as research, according to Merrill. "Some of the CMOS circuits for calculators are being produced in HP Labs while a new IC facility is being built in Corvallis. This is consistent with the corporate IC strategy for the start-up phase — to go somewhere else and buy the IC capability first. But Corvallis Division isn't making HP Labs responsible for its success. They have their own people there and HP Labs is only providing the facility. An important part of the strategy is that divisions should establish a learning relationship and not just a vendor relationhip with the facility."

In California, HP has IC facilities in Palo Alto (both HP Labs and Components Group), Cupertino, Santa Clara and Santa Rosa. In Colorado, Loveland Instrument Division, Calculator Products Division and Colorado Springs Division have separate integrated circuit labs. Corvallis (Oregon) Division will soon begin work in its brand-new facility.

Even with these facilities, representing an investment of many millions of dollars, HP still fills about 60 percent of its integrated circuit requirements by buying from outside the company. The reason, quite simply, is that solid-state memory

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A glossary of IC terminology

Did you think you'd mastered the jargon of the electronics age when you learned that "byte" wasn't a misspelling? Well now it is the integrated circuit that has HP engineers speaking in tongues. Just when we think we're catching on about RAMs and ROMs, they throw in some new acronym like PROM. And there we are, waxing nostalgic about our big high school dance while technology passes us by. Here's an attempt to bring you up to date on the alphabet soup of ICs:

BPC — Binary processor chip, a type of "computer-on-a-chip."
CAM — Content addressable memory, in which the location of a desired data pattern can be retrieved on command.
CCD — Charge coupled device, a semiconductor that stores localized packets of charge that can represent digital information.
CMOS — (See also MOS). Complementary metal oxide semiconductor. "Complementary" refers to the presence of both N-channel (negative) and P-channel (positive) devices on the same chip.
DIP — Dual inline package, a popular type of IC packaging.
EAROM, EEROM & EPROM — (See also ROM). Electrically alterable, electrically eraseable and electrically programmable ROMs.
ECL — Emitter-coupled logic, a logic family using the emitters of transistors as the gating elements. Subsets of this same logic family are often referred to as E^2L (emitter-emitter logic) and EFL (emitter function logic).
HiNIL — High noise immunity logic, which can be interfaced with an MOS microprocessor system to protect against noise transients.
I^2L — Integrated injection logic, a new type of bipolar LSI logic which uses upside-down transistors.
LSI — Large-scale integration, in which a lot of circuitry is packed onto a tiny chip. Contrast with MSI and SSI, for medium and small scale integration.
NMOS — N-channel MOS
PMOS — P-channel MOS
MOS — Metal oxide semiconductor, a basic IC technology using metal oxide silicon field-effect transistors.
μP — Microprocessor, a semiconductor central processing unit (CPU), principal component of a microcomputer.
MSI — Medium scale integration, the accumulation of several circuits (usually less than 100) on a semiconductor chip.
PROM — (See ROM). Programmable read-only memory. Refers generically to all ROMs that can be programmed by the user.
RAM — Random access memory, a collection of semiconductor cells that can be in either a "one" or "zero" logic state. This stored piece of information is one "bit" of memory.
ROM — Read-only memory, in which information is stored and used, but not altered in operation. A program stored permanently in a read-only state is called "firmware."
SOS — Silicon on sapphire, a new IC technology. The circuitry, instead of being formed on a wafer of bulk silicon, begins with a thin layer of silicon on a sapphire substrate. Devices are separated by dielectrics — oxide and sapphire — so they can be packed tightly for large-scale integration.
SSI — Small-scale integration.
ST^2L — (See TTL). Schottky transistor-transistor logic, a low power TTL family using Schottky diodes to achieve low power.
TTL (or T^2L) — Transistor-transistor logic, a bipolar circuit logic named for the way its transistor components are interconnected.
VLSI — Very large scale integration, the next step in miniaturization.

and other standard chips can now be supplied very inexpensively by semiconductor companies that mass-produce them. Although their use can be copied by competitors, off-the-shelf ICs are fine for many applications.

To get started making custom ICs, a small division might develop a circuit, have it reduced to photomasks, and have an HP integrated circuit facility include it as part of a normal production run of a standard process. The "customer" division usually sends its circuit design engineer to the facility to learn, to develop the custom IC, and follow it through production. This method has been used successfully by HP organizations in Europe and Japan, which haven't yet established their own IC capabilities.

By making more and more of its own ICs, HP has been able to offer end products that are truly unique contributions — a fundamental corporate objective as well as a central part of the company's IC strategy. The emphasis is on value in the end products more than the devices themselves, and this approach often leads in quite different directions from those taken by competitors.

HP recently made news, for instance, by announcing the first products to emerge from its silicon-on-sapphire research. SOS is an IC process that had been all but abandoned by most of the industry. But HP found that SOS has definite performance advantages for some specialized large-scale ICs, and Computer Systems Group has used the technology in its new "MC²" (micro-CPU chip), which is essentially a tiny computer.

At Santa Clara Division, Susette Urmeneta loads a photomask "camera" or pattern generator that photographically draws a miniaturized version of an IC design, under the direction of a computer. This equipment has replaced the large copy cameras that once made photo reductions for ICs that were far simpler than today's.

Tackling 'hidden' technologies

Until now, most IC research has been concentrated on developing the processes. The circuits themselves have been designed in much the same way engineers have been laying out printed-circuit boards for years. But now, as the processes are becoming capable of putting tens of thousands of circuit elements onto a chip, the job of designing circuitry is more complex. Finding ways to help the designer lay out such circuits is what Merrill calls a "hidden technology" — one that's just beginning to come out of hiding. The solutions will emerge from IC technology itself, as it becomes possible to provide every designer with individual computing power and graphics capability to help reduce the complexity of the job.

The next "hidden technology" Merrill sees on the horizon is concerned with *testing* these large-scale microcircuits. When you have 20,000 elements on one chip, how do you determine if all 20,000 are working right? "Well, again, the answer is by computer. Up to now we've done it pretty much manually. We have to first design a test, de-bug the test, and then de-bug the chip. Then we develop a production test to check each one we make. For years we've been using computers for testing, but now we're moving toward using computers to *design* the tests as well."

There's no time spent trouble-shooting, according to Merrill. If a chip is bad it's discarded, which means that the semiconductor industry throws away about 70 percent of its product. "A 30 percent yield is considered good. Sometimes 10 percent is good, but 30 percent is our optimum, so when it gets higher than that it means we should put more on the chip."

And so the integrated circuit revolution continues. Microprocessors and other ICs are being used in more and more ways in electronic instruments, making them smaller, more reliable, faster and easier to use. The cost of computing hardware is dropping by a phenomenal 30 percent a year, putting it within reach of more and more customers. Before long HP will be able to put the total computing power of an HP 2100 computer on a single quarter-inch chip, and we are only beginning to perceive what other miracles are possible with large-scale integration. □

HEWLETT-PACKARD
STATEMENT OF CORPORATE OBJECTIVES

The Hewlett-Packard Corporate Objectives have changed very little over the years. Periodically there are modifications in wording and emphasis, but essentially they have retained their basic substance.

The most recent up-dating of the Objectives, following discussion at the general managers' meeting last January, resulted in some clarification and re-emphasis in the Introduction, Fields of Interest, People and Citizenship sections.

Individually, these changes do not affect the intent of the Objectives; collectively, they reflect the dynamic nature of the company and the worldwide environment in which it operates.

The achievements of an organization are the result of the combined efforts of each individual in the organization working toward common objectives. These objectives should be realistic, should be clearly understood by everyone in the organization, and should reflect the organization's basic character and personality.

If the organization is to fulfill its objectives, it should strive to meet certain other fundamental requirements:

FIRST, there should be highly capable, innovative people at all levels throughout the organization. Moreover, these people should have the opportunity — through continuing programs of training and education — to upgrade their skills and capabilities. This is especially important in a technical business where the rate of progress is rapid. Techniques that are good today will be outdated in the future, and people should always be looking for new and better ways to do their work.

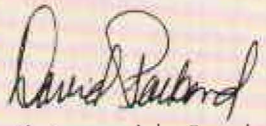
SECOND, the organization should have objectives and leadership which generate enthusiasm at all levels. People in important management positions should not only be enthusiastic themselves, they should be selected for their ability to engender enthusiasm among their associates. There can be no place, especially among the people charged with management responsibility, for half-hearted interest or half-hearted effort.

THIRD, the organization should conduct its affairs with uncompromising honesty and integrity. People at every level should be expected to adhere to the highest standards of business ethics, and to understand that anything less is totally unacceptable. As a practical matter, ethical conduct cannot be assured by written policies or codes; it must be an integral part of the organization, a deeply ingrained tradition that is passed from one generation of employees to another.

FOURTH, even though an organization is made up of people fully meeting the first three requirements, all levels should work in unison toward common objectives, recognizing that it is only through effective, cooperative effort that the ultimate in efficiency and achievement can be obtained.

It has been our policy at Hewlett-Packard not to have a tight military-type organization, but rather, to have overall objectives which are clearly stated and agreed upon, and to give people the freedom to work toward those goals in ways they determine best for their own areas of responsibility.

Our Hewlett-Packard objectives were initially published in 1957. Since then they have been modified from time to time, reflecting the changing nature of our business and social environment. This booklet represents the latest updating of our objectives. We hope you find them informative and useful.



Chairman of the Board

President and Chief Executive Officer

1. PROFIT

OBJECTIVE: *To achieve sufficient profit to finance our company growth and to provide the resources we need to achieve our other corporate objectives.*

In our economic system, the profit we generate from our operations is the ultimate source of the funds we need to prosper and grow. It is the one absolutely essential measure of our corporate performance over the long term. Only if we continue to meet our profit objective can we achieve our other corporate objectives.

Our long-standing policy has been to reinvest most of our profits and to depend on this reinvestment, plus funds from employee stock purchases and other cash flow items, to finance our growth. This can be achieved if our return on net worth is roughly equal to our sales growth rate. We must strive to reach this goal every year without limiting our efforts to attain our other objectives.

Profits vary from year to year, reflecting changing economic conditions and varying demands for our products. Our needs for capital also vary, and we depend on short-term bank loans to meet those needs when profits or other cash sources are inadequate. However, loans are costly and must be repaid; thus, our objective is to rely on reinvested profits as our main source of capital.

Meeting our profit objective requires that we design and develop each and every product so that it is considered a good value by our customers, yet is priced to include an adequate profit. Maintaining this competitiveness in the marketplace also requires that we perform our manufacturing, marketing and administrative functions as economically as possible.

Profit is not something that can be put off until tomorrow; it must be achieved today. It means that myriad jobs be done correctly and efficiently. The day-to-day performance of each individual adds to — or subtracts from — our profit. Profit is the responsibility of all.

2. CUSTOMERS

OBJECTIVE: *To provide products and services of the greatest possible value to our customers, thereby gaining and holding their respect and loyalty.*

The success and prosperity of our company will be assured only if we offer our customers superior products that fill real needs and provide lasting value, and that are supported by a wide variety of useful services, both before and after sale.

Our responsibility to the customer begins with product development. Products must be designed to provide superior performance and long, trouble-free service. Once in production, these products must be manufactured at a reasonable cost and with superior workmanship.

A prime objective of our marketing departments is to see that the finished product is backed by prompt, efficient service. Moreover, good communication should be maintained with the customer and among various HP sales teams.

Because of our broad and growing line of products, very often several sales teams will be working with a single customer. Each of these teams has a high degree of technical knowledge and sales skill. There must be considerable cooperation among teams to assure that the products recommended best fulfill the customer's overall, long-term needs.

HP customers must feel that they are dealing with one company with common policies and services, and that our company is genuinely interested in arriving at proper, effective solutions to their problems. Confusion and competition among sales teams must be avoided by a clear assignment of sales responsibilities, plus sound judgment by HP sales people in understanding customer needs and HP objectives.

3. FIELDS OF INTEREST

OBJECTIVE: *To enter new fields only when the ideas we have, together with our technical, manufacturing and marketing skills, assure that we can make a needed and profitable contribution to the field.*

The original Hewlett-Packard products were electronic measuring instruments. Over the years, our product line has expanded to include computers and computer systems, solid-state components, electronic calculators, medical electronic equipment, and instruments for chemical analysis. Thus our growth has led to a continuing expansion of our fields of interest. To a large extent, diversification has come from

applying our resources and skills to fields technically related to our traditional ones.

The key to HP's prospective involvement in new fields is *contribution*. This means providing customers with something new and needed, not just another brand of something they can already buy. To meet this objective, we must continually generate new ideas for better kinds of products. It is essential that before final decision is made to enter a new field, full consideration be given to the associated problems of manufacturing and marketing these products.

4. GROWTH

OBJECTIVE: *To let our growth be limited only by our profits and our ability to develop and produce technical products that satisfy real customer needs.*

How large should a company become? Some people feel that when it has reached a certain size there is no point in letting it grow further. Others feel that bigness is an objective in itself. We do not believe that large size is important for its own sake; however, for at least two basic reasons, continuous growth is essential for us to achieve our other objectives.

In the first place, we serve a rapidly growing and expanding segment of our technological society. To remain static would be to lose ground. We cannot maintain a position of strength and leadership in our fields without growth.

In the second place, growth is important in order to attract and hold high caliber people. These individuals will align their future only with a company that offers them considerable opportunity for personal progress. Opportunities are greater and more challenging in a growing company.

5. OUR PEOPLE

OBJECTIVE: *To help HP people share in the company's success, which they make possible; to provide job security based on their performance; to recognize their individual achievements; and to help them gain a sense of satisfaction and accomplishment from their work.*

We are proud of the people we have in our organization, their performance, and their attitude toward their jobs and toward the company. The company has been built around the individual, the personal dignity of each, and the recognition of personal achievements.

Relationships within the company depend upon a spirit of cooperation among individuals and groups, and an attitude of trust and understanding on the part of managers toward their people. These relationships will be good only if employees have faith in the motives and integrity of their peers, supervisors and the company itself.

On occasion, situations will arise where people have personal problems which temporarily affect their performance or attitude, and it is important that people in such circumstances be treated with sympathy and understanding while the problems are being resolved.

Job security is an important HP objective. Over the years, the company has achieved a steady growth in employment by consistently developing good new products, and by avoiding the type of contract business that requires hiring many people, then terminating them when the contract expires. The company wants HP people to have stable, long-term careers — dependent, of course, upon satisfactory job performance.

At Hewlett-Packard there are many opportunities for advancement based upon individual initiative, ability and accomplishment. Managers at all levels should be concerned with the proper development of their people and be committed to providing advancement opportunities to everyone, regardless of race, color, creed, sex, age or national origin. Since we try to promote from within whenever possible, people should be given the opportunity — through continuing programs of training and education — to broaden their capabilities and prepare themselves for more responsible jobs.

We want people to enjoy their work at HP and to be proud of their accomplishments. This means we must make sure that each person receives the recognition he or she needs and deserves. In the final analysis, people at all levels determine the character and strength of our company.

6. MANAGEMENT

OBJECTIVE: *To foster initiative and creativity by allowing the individual great freedom of action in attaining well-defined objectives.*

In discussing HP operating policies, we often refer to the concept of "management by objective." By this we mean that, insofar as possible, each individual at each level in the organization should make his or her own plans to achieve company objectives and goals. After receiving supervisory approval, each individual should be given a wide degree of freedom to work within the limitations imposed by these plans, and by our general corporate policies. Finally, each person's performance should be judged on the basis of how well these individually established goals have been achieved.

The successful practice of "management by objective" is a two-way street. Management must be sure that each individual understands the immediate objectives, as well as corporate goals and policies. Thus a primary HP management responsibility is communication and mutual understanding. Conversely, employees must take sufficient interest in their work to want to plan it, to propose new solutions to old problems, to stick their necks out when they have something to contribute. "Management by objective," as opposed to management by directive, offers opportunity for individual freedom and contribution; it also imposes an obligation for everyone to exercise initiative and enthusiasm.

In this atmosphere it is particularly important that the strength of the whole company is kept in mind and that cooperation between individuals and between operating units is vital to our profitable growth.

It is important for everyone to realize there are some policies which must be established and strictly maintained on a corporate-wide basis. We welcome recommendations on these corporate-wide policies from all levels, but we expect adherence to them at all times.

7. CITIZENSHIP

OBJECTIVE: *To honor our obligations to society by being an economic, intellectual and social asset to each nation and each community in which we operate.*

All of us should strive to improve the environment in which we live. As a corporation operating in many different communities throughout the world, we must make sure that each of these communities is better for our presence. This means identifying our interests with those of the community; it means applying the highest standards of honesty and integrity to all our relationships with individuals and groups; it means enhancing and protecting the physical environment, building attractive plants and offices of which the community can be proud; it means contributing talent, time and financial support to worthwhile community projects.

Each community has its particular set of social problems. Our company must help to solve these problems. As a major step in this direction, we must strive to provide worthwhile employment opportunities for people of widely different backgrounds. Among other things, this requires positive action to seek out and employ members of disadvantaged groups, and to encourage and guide their progress toward full participation at all position levels.

As citizens of their community, there is much that HP people can and should do to improve it — either working as individuals or through such groups as churches, schools, civic or charitable organizations. In a broader sense, HP's "community" also includes a number of business and professional organizations, such as engineering and scientific societies, whose interests are closely identified with those of the company and its individual employees. These, too, are deserving of our support and participation. In all cases, supervisors should encourage HP people to fulfill their personal goals and aspirations in the community as well as attain their individual objectives within HP.

At a national level, it is essential that the company be a good corporate citizen of each country in which it operates. Moreover, our employees, as individuals, should be encouraged to help in finding solutions to national problems by contributing their knowledge and talents.

The betterment of our society is not a job to be left to a few; it is a responsibility to be shared by all.

Enterprise: the vital catalyst

by Dave Packard, chairman

☐ Basic to the development of the HP organization has been a belief in the fundamental importance of individual enterprise within the context of corporate objectives. It takes many forms, all of which come down to making a team contribution through individual initiative and creativity.

Of course, it comes straight from the founders who now are recognized not only as industrialists but also as spokesmen for and exemplars of enterprise as the vital catalyst in economic undertakings. As such, Dave Packard was asked to present the opening address to the Scottish Council's Seventh International Forum at Aviemore, Scotland late last year. His topic was "The place of enterprise in a mixed economy," from which the following general remarks were excerpted:

"An individual with a large measure of enterprise often has a strong influence over a group of people. Enterprise is an essential ingredient of leadership. People in a group can have a team spirit — a religious fervor — patriotism — a group attitude that reinforces the enterprise of the individual.

"But enterprise is a most important and dynamic human characteristic when it is present in an organization of people at all levels — not just at the top. The most

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effective organization of people, whether a club, a business, a state, or a nation is a group of people with intelligence, ability, and enterprise committed to a common goal.

"Over the course of history, much of the progress of civilization can be attributed to this human trait. The Norsemen who ventured over the seas to land here in Scotland and later push on to the North American continent had enterprise. The men and women who crossed the Atlantic to the hostile coast of America had enterprise. Inventors over the centuries, including such renowned Scotsmen as James Watt, Lord Kelvin, and James Clark Maxwell had enterprise.

"I do not believe any endeavor of men and women which has been a distinctive contribution to the progress of this world has been accomplished without that precious human characteristic we call enterprise. Great Britain and Scotland were powerful and wealthy countries in past centuries, indeed until World War II, mainly because your people had great enterprise — at all levels of your society — not just at the top. Japan has become a wealthy and powerful nation in these last three decades not because she has great natural resources, not because her people are more intelligent, but rather because an unusually high level of enterprise has developed among her people during this period — and again at all levels — not just at the top.

"We talk much about the need to transfer wealth to the developing nations. This cannot be done with capital, or education, or charity of any kind. Real and lasting wealth cannot exist there without enterprise. Since in my view this appears to be the case, we should then give some consideration to the factors that bring out this quality of enterprise in an individual, and nurture it in a society.

"One of these is individual freedom — individual liberty. Enterprise is encouraged when a person is free to develop and use his talents and his energy in the way he thinks best. Regulations and regimentation are the enemies of enterprise, and we can find examples of this in all kinds of organizations.

"A soldier can have a certain amount of enterprise, but if it extends to innovation, he is likely to find himself in the brig.

"The 'not invented here' syndrome is a common experience in the research and development laboratory. A scientist or engineer will always work with more enterprise on his own project than on one he is directed to do — especially if for any reason he does not think much of the other fellow's idea.

"On a larger scale, the importance of individual freedom in engendering enterprise is demonstrated over and over again by the comparison between the low efficiency of collective farming relative to the productivity of individual farmers.

Freedom and opportunity

"Freedom, and the opportunity for personal reward, then, are the key motivating factors that encourage enterprise in an individual. A company structured to maximize individual freedom, and the opportunity for reward identified with personal performance, will develop a high degree of enterprise among its people. And the same principles apply to all other organizations of people, including states and nations.

"We have many examples of the dynamic force of individual enterprise throughout recorded history — a force that has spurred men and women to rise above the call of duty time and time again across the entire face of the world. Without doubt, the success of individual achievement characterized by this thing we call enterprise is largely responsible for all of the progress man has made over the centuries.

"Even so, free enterprise somehow has not lived up to the expectations of a large portion of the people, even in those areas where it has been the dominant character of the economy. Indeed, a large proportion of people are living under communistic or socialistic governments where individual enterprise is either prohibited or suppressed.

"Socialism, with its concept that a group of people could get together and work efficiently for the common good has had a great appeal over the years. But because it lacks the mechanisms to encourage individual enterprise, it can never have the potential of an individual enterprise system. Religion has made people rise above their personal interests. War, or the threat to home and family, has made people rise above their individual interests. We have yet, however, to find a way to make people put the interest of their fellowman ahead of the interest of themselves in a whole society for any sustained period. And I do not believe that we can ever do so. The opportunity for the individual — for every individual, must be established and jealously guarded, the opportunity for the individual to benefit personally in proportion to his or her good work.

"There may be some way to manage and direct individual enterprise to maximize the welfare of the entire society. We should strive to do this on the assumption that it can be done. But short of that kind

of an ideal solution, I am firmly convinced that the welfare of your country, and of ours, as well as every other country in the free world, will be served best by supporting individual enterprise in the private sector — and encouraging the support of enterprise in the public sector to the extent this can be done.

"If you concur with me that enterprise is an important human quality that has made, over past centuries, a vast contribution to human progress — then I hope you will also agree that the discouragement and the possible destruction of enterprise would be a disaster of unimaginable consequence. We cannot afford to let that happen, and this brings us to the point of our conference here at Aviemore. What can you do in Scotland to revitalize private enterprise in your economy? And related to this all-important issue, what can we do in America to prevent the destruction of private enterprise in our economy?

Equality of opportunity

"A basic starting point, I believe, is to reaffirm our belief in equality of opportunity. I would even suggest that an absolutely essential goal of our societies should be to provide everyone with an equal opportunity to develop his or her abilities, intelligence, creativity, in the optimum way. And to make sure there are adequate incentives to encourage the development of enterprise in the individual at all levels in society.

"We have worked very hard at this over the years in my company. One of our most important corporate objectives directly relates to encouraging enterprise among our people. It reads, "To help Hewlett-Packard people share in the company's success, which they make possible; to provide job security based on their performance; to recognize their individual achievements; and to insure the personal satisfaction that comes from a sense of accomplishment in their work.

"Any organization can develop a climate to encourage and nurture enterprise by adopting a policy and a philosophy along these lines. It is, as I have said, easier in a private enterprise than one in the public domain. But I am convinced it can be done in either.

"Our company has a division located in South Queensferry just out of Edinburgh. We have been working hard with this group of people over the last ten years or so to enable them to make a positive contribution to our company and to your country.

"They have now done so, and this year the Hewlett-Packard people in South Queensferry have been at the top of all of our divisions worldwide. Their growth in business and their level of production have been absolutely outstanding. They have developed a number of significant new products in their research and development laboratories which are marketed throughout the world. In fact, 80 percent of all the equipment produced at HP Ltd. is exported, thus contributing substantially to the U.K. balance of payments.

"Additionally, they recognize the importance of running a profitable organization, and of following the HP policy of self-financed growth on a pay-as-you-go basis. And they practice the philosophy I have described.

"Needless to say, I am very proud of this division. It is an excellent illustration of how individual enterprise can be a tremendous motivating force for human endeavor.

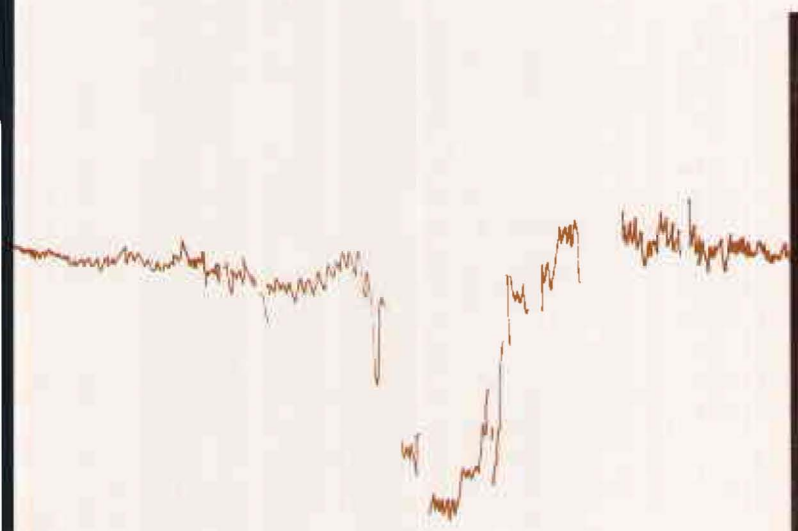
"However, we have had to work very hard under the restrictive prices and incomes policy of the United Kingdom to maintain the high level of incentive and enthusiasm among our people there. It is becoming increasingly more difficult to do so.

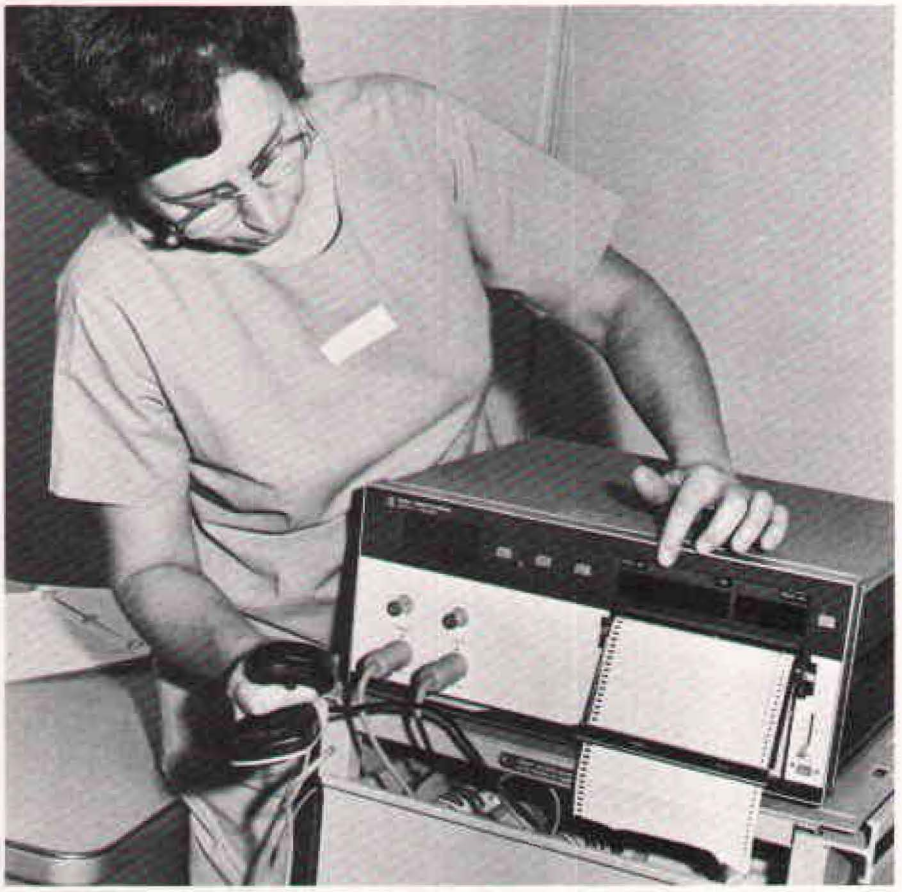
"I am, therefore, very much concerned about the future of our company's operation here in Scotland unless something is done soon to restore the opportunity to reward our people for their outstanding enterprise. I am sure almost every other firm in this country is having similar problems and concerns.

"It seems to me, then, this Seventh International Forum has selected a very important subject for discussion these next two days. The welfare of my company's activity here in Scotland, and indeed the welfare of the entire British Commonwealth will be determined largely by whether the environment and incentives to encourage individual enterprise are once again reinstated.

"There can be no progress in this world without individual enterprise. We must find a way to couple this great source of strength with the aspirations and the needs of all of the people." □

The night luck came to Yates City...





HP 8030, a cardiotocograph that does all available methods of fetal monitoring, is reviewed by Kathryn Schaffer, head nurse at Graham Hospital in Yates City, Illinois. According to reports in the Canton *Daily Ledger* newspaper, the machine has helped doctors save a number of young lives.

☐ In Yates City, Illinois, they introduce young Janet Lynn Moore as "Lucky" — for good reason.

Because only through a fortunate chain of circumstances involving an HP medical field engineer, HP medical equipment and a conscientious obstetrician was Janet brought safely and healthfully into the world some 18 months ago.

At that time, Dan Walton of HP's Midwest Sales Region had arranged with the hospital's Coleman Clinic to demonstrate and train each shift on the HP fetal monitor, a system capable of electronically sorting out and measuring the heartrate of unborn babies and the labor contractions of the mother. The recording and comparison of these two parameters can indicate how well the baby is tolerating the "insults" of the labor contractions.

It turned out that Mrs. Kem Moore was the only expectant mother available for the test. She had been having some pains — but in three days, no baby. So she agreed when Dr. Raoul Reinertsen asked Mrs. Moore if she would be willing to help Dan Walton demonstrate the equipment for the night shift nurses.

The readings, obtained by placing two lightweight transducers on the mother's abdomen, caused some puzzlement. In effect, they signaled fetal distress due to placental insufficiency — a condition not detectable in any other way.

"Frankly," said Dr. Reinertsen, "some of us didn't want to believe the machine. There was some feeling that we could be overreacting. However, Dan Walton demonstrated great in-depth knowledge of what was happening during the fetal monitoring — what the machine was telling us about the condition of the child and the mother. Late that night we decided to do an emergency Caesarian section."

According to reporter Annetta Miller of the Canton *Daily Ledger*, the HP system had detected "a risk factor that arises during labor. The uterine contraction causes a temporary compromise of the mother's blood supply through the placenta, the fetus' only source of oxygen and nutrients. Normally there is a reserve supply of oxygenated blood in the placenta to nurture the child, but in some cases there may be insufficient reserves. The compromise of the baby's supply during labor can result in a "compromised" or depressed child. Depending on the degree of compromise, it may bring about mental retardation, a lifetime spent in institutions, or varying degrees of learning disability. This baby most likely would have been stillborn.

"The Caesarian section was necessary to deliver the baby quickly, before the heart rate dropped dangerously low."

Said Dr. Reinertsen, "I'm convinced the baby would not be alive if it were not for the fetal monitor — and Dan."

A month after the birth of Janet Lynn Moore, HP delivered a new HP 8030, a state-of-the-art fetal monitor capable of doing all available methods of fetal monitoring. According to Kathryn Shaffer, obstetrics ward supervisor at Graham Hospital, it has continued to help save young lives, and to allay a lot of fears. "For years," she said, "we've relied solely on our ears to listen to an unborn baby's heartbeat."

With electronic equipment, everything is much more accurate. "Once you know you've got a problem and you're going to have to do something to get a live baby, you do it."

She added that other members of a mother's family can watch the monitor and feel a better sense of participation in the labor process, and thus be reassured.

Even if the Moores happily disagree, luck should have nothing to do with it. ☐

A man's home is his playground...

"When I was a kid I didn't have any place to go. I used to wish for something — anything —to do." Lloyd Baker, a 76-year-old former maintenance foreman at HP's Palo Alto complex, now has plenty to do — giving neighborhood youngsters the chance to play that he never had.

The idea for doing this began five years ago when Lloyd was recovering from a series of setbacks following the death of his wife. Why not convert his unused backyard in San Jose into a playground? The old but sturdy barn soon became a playroom for pinball and a pool table. The lawn became a picnic area. The outside became a court for basketball, volleyball and badminton. As the photo shows, it's a very busy and happy place — proof that it's never too late to help fill a need that others have.

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