Measure

For the men and women of Hewlett-Packard/FEBRUARY 1973

CRITICAL MASS:

☐ At approximately 11 A.M. on Tuesday, January 16, 1973, the well-known universe in which Hewlett-Packard has done business began to shift perceptibly into a new dimension. By design, the start of the shift coincided with the introduction of the HP-80 businessman's pocket calculator at 15 press conferences around the world, led off by Bill Hewlett's conference (cover photos) in New York's St. Regis Hotel.

Soon thereafter the new dimension began to reveal itself: phones ringing "off the hook" at HP order desks; full-page and multi-page HP ads in daily newspapers and major business magazines; "retail" sales and service outlets in downtown locations; selling via cash and credit cards; reams of publicity in media that had never before heard of HP; plus a growing realization that the company had finally ventured full bore into the wide, exhilarating world of the consumer.

No doubt it had been moving closer and closer to "consumerland" for some time, first with medical products, then analytical instruments, computers, desktop calculators, distance measuring instruments, and the HP-35 shirt-pocket electronic super-sliderule. But the "80" goes the whole way—a deep plunge into a big new market made up of all kinds of people whose only common characteristic is a desire to do sharper and quicker business-problem calculations.

But there's much more to the new dimension than an expansion into new marketing venues. Both the HP-35 and HP-80 represent a commitment of resources on an interdivisional and worldwide basis to a degree unprecedented in the company's history. A recent tally of the HP organizations involved in the pocket-calculator program, for example, turned up seven product divisions, about half-a-dozen corporate departments (starting with the Office of the President), as well as the field marketing teams around the world.

Discussing this phenomena at a managers' meeting last year, President Bill Hewlett spoke of it in terms of "critical mass"—the phrase used by atomic scientists to describe the quantity of fissionable material needed to start a chain reaction.

Only recently, said Hewlett, had HP reached the stage in its development where its many talented people and organizational capabilities could interact on a scale big enough for programs as broad and complex as the pocket-size calculators.

Some of that interaction is described in the following reports. The various photographs by no means represent all of the people involved in calculator programs at their respective organizations. However, it's hoped these do portray to some extent the complex massing and interaction of the many diverse capabilities so critical to the bold new business ventures the company has now launched:

A concatenation of concepts...

Could it be done? That was the first question put to a team of corporate engineers, scientists, mathematicians, designers and other specialists at the time the original concept for the HP-35 was being considered. Could HP squeeze all desired capabilities of a super-sliderule calculator into a neat case that would fit a shirt pocket and sell for about $400? After computer-simulation tests, they said "yes."

Then they were asked: What's the market? How much power? What about EMI (electro-magnetic interference)? How are we going to design the keyboard mechanism? How many keys and what is their function? Ideas came in from all directions. The keyboard question, for example, was even more challenging than design of the miniscule circuits: keyboards traditionally take up lots of room. It was a committee—yes—that finally settled on the thin metal matrix that provides keyboard contact—with great simplicity and elegance. In fact, that speaks for the whole calculator.

In the photo above are representatives of corporate departments that have participated in the "35" and/or "80" R&D programs: The Electronics Research Lab and Solid-State Lab of HP Labs; Corporate Design; Corporate Finance; and the Labs' machine shop. A number of original participants have since transferred, chiefly to Advanced Products Division.

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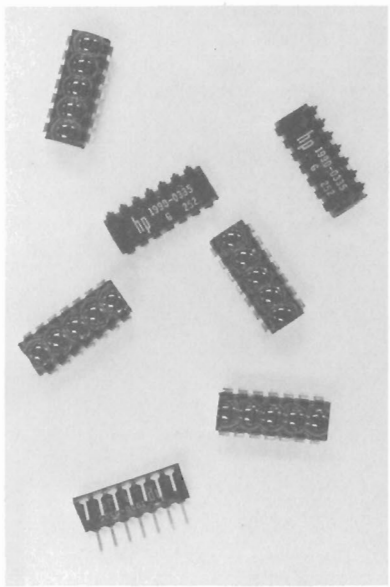

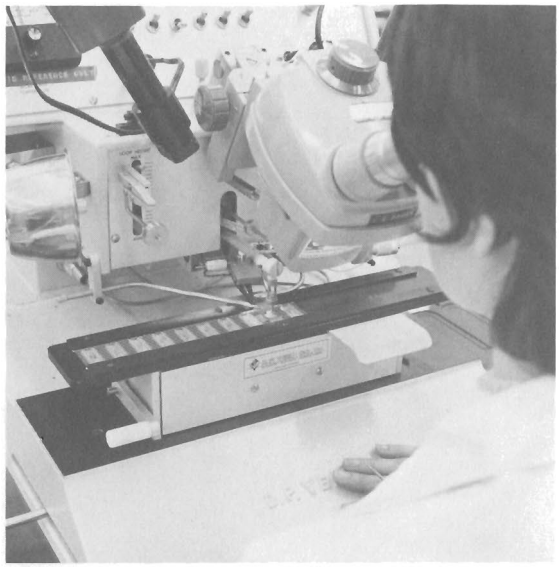

a display of brilliance...

The solid-state content of the pocket calculator line is rightly considered remarkable–state-of-the-art in almost every respect. But even more remarkable is the fact that so much of it is home-grown at HP (the few exceptions include some IC chips–the logic actually designed by HP–and a few standard component products, purchased from outside).

The question of how to display data, for example, was answered beautifully by the Light-emitting Diode (LED) numeric display developed by HPA Division. Now packaged both in Palo Alto and Singapore plants, the HPA display features an ingenious lens design (photo above) that magnifies the apparent size of the digits, thus reducing the cost and power requirements while displaying easy-to-read numbers.

Responsibility for producing much of the integrated circuitry that operates the calculator was given to the Santa Clara Division. And the IC facility there has found itself in a go-go situation ever since it acquired the HP-35 program over a year ago.

But the new "80" has meant not just more of the same –but more of more and more because the circuitry–encapsulated in a half a dozen IC modules, as shown above–now matches the equivalent of some 40,000 transistors! Pictured on the opposite page are representatives of the display products team of HPA Division at top, the IC crew of Santa Clara Division at center, and the components people of HP Singapore at right.

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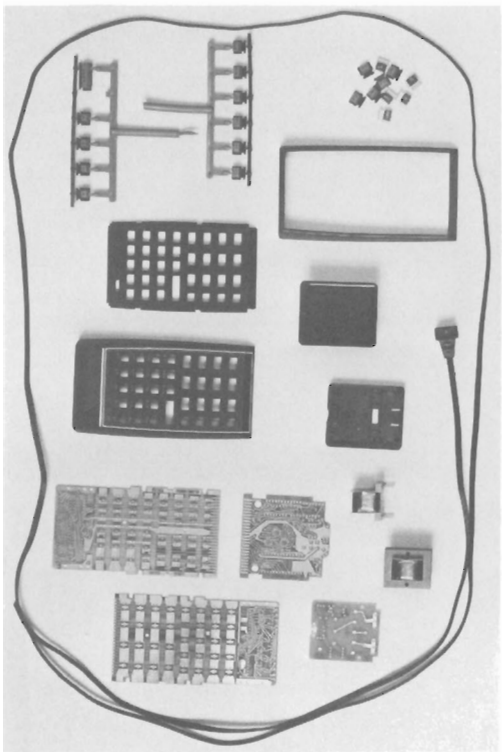

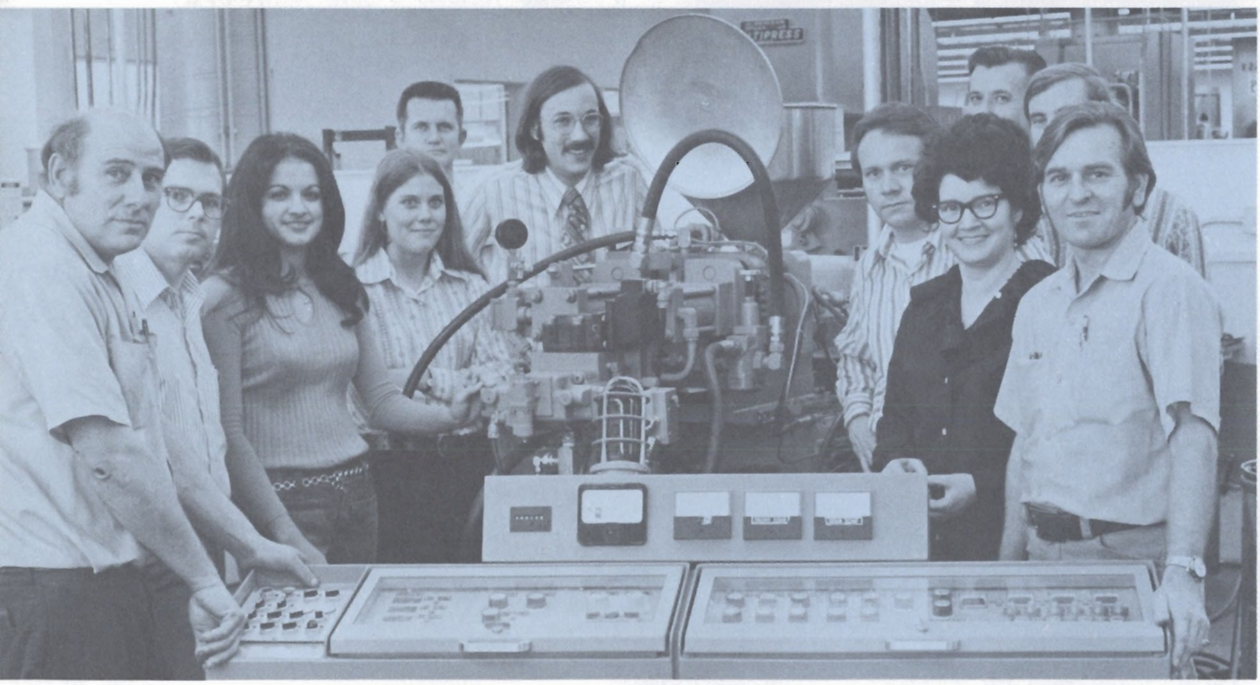

plus 57 varieties of manufactured parts...

For years the people of Manufacturing Division were accustomed to producing, say, 50 items of one product on one day, 100 items for another product the next day. They call it "batch" operations.

It's a measure of the impact—and importance—of the pocket calculator program that several of the division's departments now are in continuous production-line runs for the "35" and "80." That's called "dedicated" production, which is appropriate in more than the intended way because the people involved identify quite strongly with the pocket calculators. "It's become sort of a household word around here," said one supervisor.

The photo at left gives some idea of the Manufacturing Division's involvement in the hand-calculator lines: more than 50 molded plastic parts per machine, printed-circuit boards, switchboards, transformer and cable for the recharger, plus the application of hot stamping and protective coatings.

Along the way they had to develop some very special capabilities: two-color molding, tools and dies to take high-volume use, duplicate tooling, decorative finish molding, automated coating, new printed-circuit techniques, how to work with suppliers and subcontractors as far afield as New York, and—how to keep track of large inventories such as reels of cable that could unroll into a line reaching from San Francisco to San Jose. Said Jim Ferrell, division manager: "A lot of extra demands were put on our people. They have a right to feel very proud of what they've contributed." Key "calculator" departments represented here are: Plastics Molding, at left; Tool Engineering and Tool and Die Shop, above left; Printed Circuits and Transformers, above; and Hot-stamp and Cable areas, at right.

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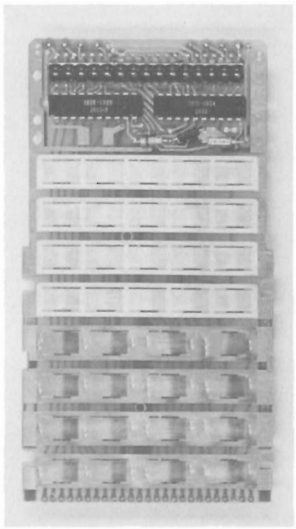
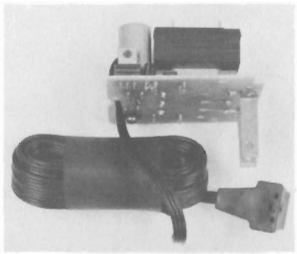
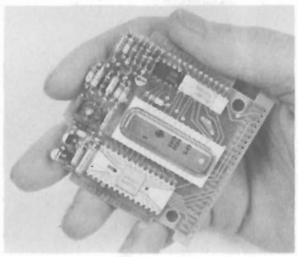






...keep the Flying Tigers flying!

As the name suggests, the charter for Advanced Products Division at Cupertino is an exciting one—and excitement seems to walk in the door each day at HP's newest product division.

It arrives with the morning mail—stacks of ad responses. It rouses the special team of order takers at the sound of a telephone. It permeates the assembly area which has happily taken up the theme of "Flying Tigers" from production manager Bob Schaffer's background as a World War II China-Burma-India P-40 pilot. "It's amazing how they can respond to a production challenge," said Bob. "They're real tigers." And the excitement expresses itself in the plans and designs of the marketing and engineering areas which are working with sales techniques and product concepts that are very unconventional in comparison with the norms of the traditional instrument divisions. Likewise, the APD people who have worked closely with the HP-Singapore plant in setting up comparable calculator production there for markets outside the U.S. report a similar gung-ho spirit. Some of the APD team are pictured at top, the Singapore assembly crew at right.

What is evident about APD and its relation to the calculators is that it represents just the cone of the volcano; by far the largest numbers of calculator-involved people and facilities are in other HP organizations. This makes for an unusual relationship between these organizations—complex and challenging—but one that bears very interesting implications for the future. □

Our French connection

Grenoble.

□ Any thread that might historically tie together Grenoble, France and Santa Clara, California to Cairo, Egypt and Napoleon Bonaparte, as well as to earthquake studies along the infamous San Andreas Fault, must be considered very unusual.

And no question, the man who makes that connection—Baron Jean Baptiste Joseph Fourier—was a most unusual figure.

Let us first set forth his credentials as far as Hewlett-Packard is concerned. These rest primarily on the very important theory of mathematical analysis Fourier first gave to the world in 1807. He developed it as a tool to help solve some differential equations related to the transmission of heat. Dealing with variable data, it showed that these could be represented by a series involving sines and cosines, thus permitting their function to be defined in a form suitable for computation.

The "Fourier Series," as the theory is known, is today the basis for HP's elegant Fourier Analyzer developed and manufactured at Santa Clara Division. The Analyzer, actually a computer-instrument system, is used in uncovering hidden signals contained in complex data such as derived from environmental tests, monitoring machinery to detect impending failure, tuning in and sorting out underwater sounds, and assisting California scientists in studies aimed at predicting how buildings will behave in the event of an earthquake. The HP Analyzer performs these tasks rapidly via a simple keyboard that can be operated by a person without extensive math training.

Jean Baptiste-Joseph's latest connection with Hewlett-Packard arises from the company's year-old operation in Grenoble, France where HP computers and distance-measuring instruments are produced for European markets. Grenoble, it seems, was home—or, at least, heaquarters—to Fourier for a number of years mid-stream in his career. How he got there is itself a tale of considerable interest.

Jean Baptiste's start in life was hardly auspicious. Born on March 21, 1768, the nineteenth child of a tailor, he was orphaned when eight years old, then placed in a military school.

But soon his mathematical talent began to manifest itself. At 16 he became a teacher of mathematics at the school, meanwhile promoting the revolution that was to sweep France in 1789. Although opposed to the terror that followed, Fourier survived to become one of the first teachers at the Ecole Normale Superieure founded at Paris in 1795. There his abilities led to his selection as one of a group of savants gathered to accompany Bonaparte into Egypt in 1798. In the course of this expedition, Fourier was appointed governor of lower Egypt and introduced himself to the study of Egyptology at which he became a master (years later he encouraged Jean François Champollion in the study of Egyptian hieroglyphics, resulting in the translation of the famed Rosetta Stone in 1822).

After Egypt, Fourier returned to France in 1801 as prefect of Isere, with headquarters in Grenoble. Here he focused his remarkable mind on the question of heat conduction. This led to his 1822 masterpiece, *Theorie Analytique de la Chaleur*, which became not only a fundamental example of applied mathematics but also contained the pure mathematical theory of the Fourier Series. Even then very well known as an academic center, Grenoble provided a locale congenial to Fourier's intellections. (This same atmosphere, combined with a very selective program of industrialization, was one of the principal magnets that attracted HP.)

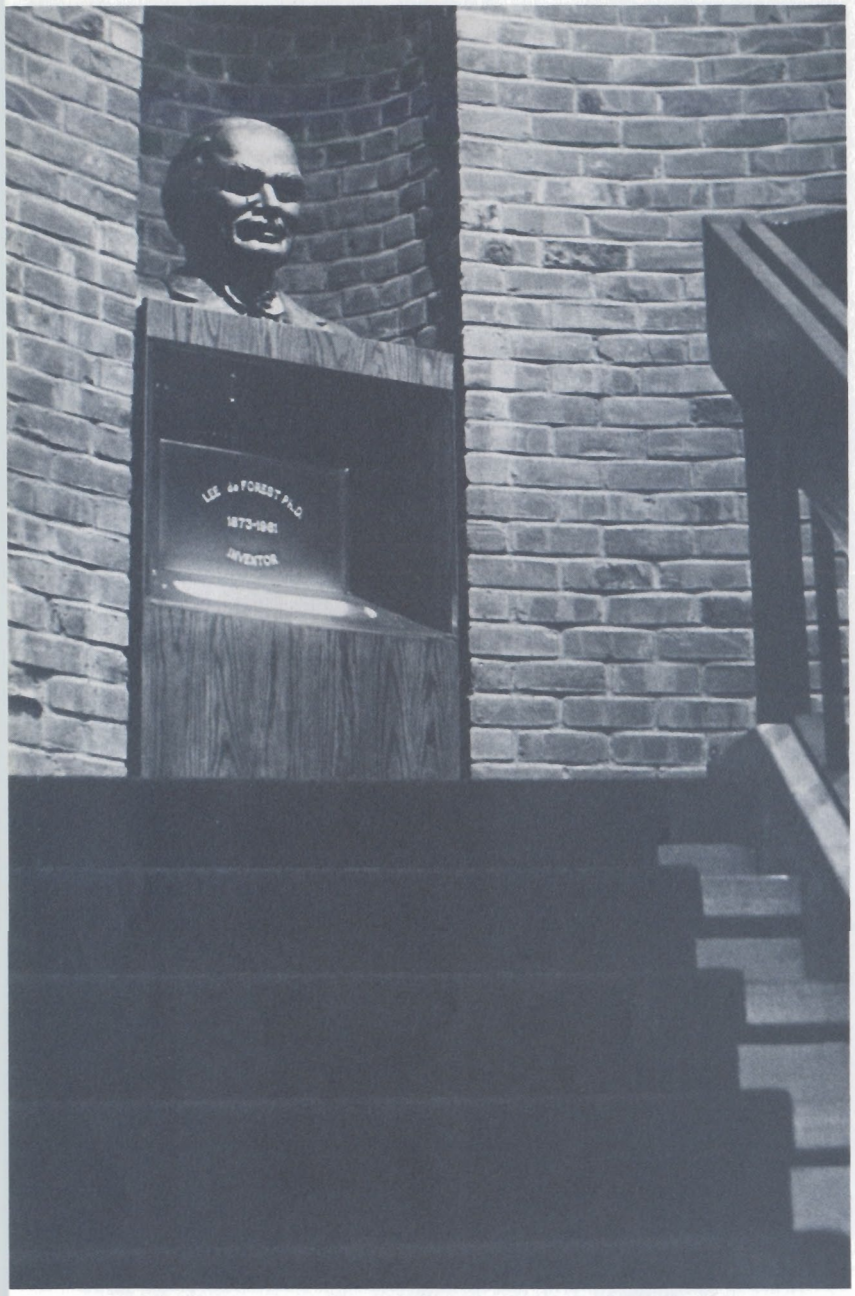
Fourier's Grenoble years, however, came to an end when he rejoined his old leader, Napoleon, during the Hundred Days that were to be concluded in the fields near a small Belgian village named Waterloo, on June 18, 1815.

Fourier returned to Paris and the life of an academician. Curiously, he believed that desert-like heat was beneficial to one's health. Consequently, until his demise in 1830, he spent most of his latter days "swathed like a mummy" in overheated rooms.

Could there be some psychological connection between this desire for excessive temperature, his interest in the sun-worshipping culture of Egypt, and his invention of the theory of heat conduction? Could being nineteenth child in a family soon to be orphaned have inspired his compelling interest in warmth?

Whatever the case, Jean Baptiste-Joseph Fourier, go to the head of the line! HP, for one, salutes your memory and your work—most warmly. □

An HP Fourier Analyzer (left) in association with an HP laser interferometer—both products of Santa Clara Division—analyzes problems of vibration in a precision machine tool.



Live-wire history of electronics

□ It had to happen some day. But, so soon! Just while many of us have been getting used to the idea that we are members of a maturing but still-youngish industry, they put our products and pictures in a museum! However, a look inside this world's first public museum devoted exclusively to the history of electronics, located on the Foothill College campus in the Los Altos Hills above Palo Alto, shows they may not be rushing things after all.

Who of us can remember hearing broadcasts of the world's first regularly scheduled radio station—KQW, in San Jose, in 1909? How many of us have ever seen Lee de Forest's first "audion" tubes? Or the first Poulson arc transmitters from Denmark?

Those are just a few of the highlights of the museum exhibit area. A good many of the exhibits are "hands-on" modules that demonstrate basic principles of electronics which the museum defines as the control of electricity. Included are two HP calculators: the large 9100B which has a program for determining on which day of the week a particular date in history fell, and the Model 35 pocket calculator.

The Foothill Museum is the beneficiary of two important collections of electronics artifacts and memorabilia. First is the Perham Foundation collection, representing the lifelong interest of Douglas McDonald Perham, an electronics pioneer who lived in the San Francisco Peninsula area. His extensive collection of documented electronics hardware was first exhibited in the Perham's private museum in New Almaden. In 1963 it was taken over and reorganized by the Institute of Radio Engineers which later established it as the basis for the Foothill Museum.

The second major collection consists of some 2,500 properties of the late Dr. Lee de Forest (1873–1961). His invention of the three-element vacuum tube, known as the "audion," ushered in the age of radio. Three of his original triode tubes are on display in the museum, and many of his personal papers and documents are on hand in the adjacent library.

The museum still has a big job ahead of it in presenting all of the materials now on its storeroom shelves. However, it is interested in hearing from other collectors and potential donors. Look on it as a contribution to "living history." It beats the alternative. □


TUBES
TUBES

Palo Alto – Bruce Wholey has been elected vice president of the company.

In a newly created position, Wholey will be responsible for planning, developing and coordinating policies to optimize HP's manufacturing capability. He also will be responsible for establishing corporate-wide manufacturing standards and for directing the company's facility planning and construction program.

Previously, Wholey was manager of corporate technical services, a position he assumed in 1969.

Wholey joined HP in 1945. During his 27 years with the company he has held a number of management positions. From 1960 to 1963 he was general manager of Microwave Division, and later served six years as general manager of the Medical Electronics Division.

Born in Canada, Wholey is a naturalized U.S. citizen. He was graduated from the University of Alberta in Canada and received his Master's degree in electrical engineering from Stanford University.

News in Brief

Palo Alto – The HP board of directors has declared a regular semi-annual dividend on the company's common stock. The dividend, 10 cents a share, is payable April 16 to stockholders of record March 26.

Palo Alto – Hewlett-Packard Company has signed an agreement to acquire Field Emission Corporation (Femcor), a manufacturer of high-voltage x-ray tubes and systems in McMinnville, Oregon.

The acquisition, in the final process of implementation, will be accomplished through an exchange of stock, according to Dean Morton, general manager of HP's Medical Electronics Division, Waltham, Massachusetts, and Walter Dyke, Femcor president.

Founded in 1958, Femcor manufactures high-voltage field emission and thermionic x-ray generation systems for medical, industrial and scientific applications. Its product line includes chest x-ray systems, portable detection units, pulse electron accelerators and industrial systems for analyzing components.

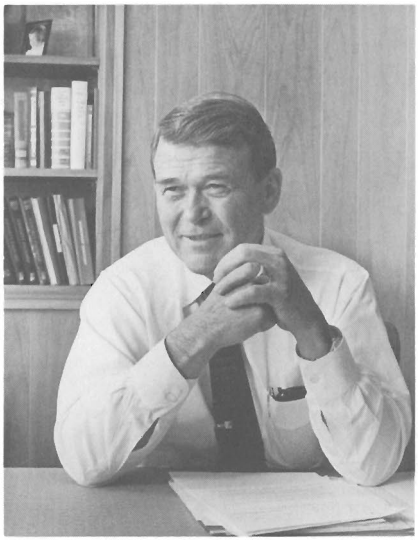
Femcor had approximately $3 million in orders in 1972. It has more than 100 employees and occupies about 53,000 square feet of plant space in McMinnville. Femcor will operate as a separate organization within HP's medical electronics operation.

Waltham, Mass. – Construction will begin here this spring on a 170,000 square-foot addition to Hewlett-Packard Company's Medical Electronics Division headquarters.

The $6 million expansion will more than double the size of the facility to approximately 310,000 square feet. Site preparation is under way and completion of the project is expected early in 1974.

"This major building program is necessary to keep pace with the growing demand for our medical instruments and systems," said Dean Morton, MED general manager. "HP medical sales have reached record levels this year and additional space is needed to accommodate anticipated growth."

The new two-story building will be located adjacent to the existing building at 175 Wyman Street. The division presently employs about 800 people in research, engineering, manufacturing and administrative functions in Waltham.



From the president's desk

I am sure that by now most of you have seen our publicity on the new HP-80 pocket-sized calculator, designed for business and financial use. I thought you might be interested in the background of this calculator.

In March of last year we had a breakfast meeting with about 200 security analysts in New York. This was shortly after the introduction of the HP-35. On each of the breakfast tables we had an HP-35, and it was very interesting to watch the reaction of many of the financial analysts. Although they were familiar with electronics, it was evident that such key designations as sin, cos, log and e^x were more a barrier to an understanding of the calculator's function than a help. The one key that was really useful for compound interest calculations (x^y) was obscure in its use. Right there and then it became evident that what was needed was a pocket-sized calculator designed specifically for the business community, and so designed that it could be readily understood by the user. As we thought more about this problem it became evident that there was a tremendous gap between the language of the user and of our development engineers. The answer was to put together a small team consisting of Bill Crowley, from the Corporate Finance Department, who had a long-standing interest in computers, and France Rode, from HP Labs, who was an expert in programming and who was soon to acquire a very good vocabularly of business terms.

These two visited a large cross section of potential business users, and from their discussions distilled a set of classic problems that they eventually shoe-horned into what is now the HP-80. After a preliminary cut on the format, Barney Oliver came in and with his typical clear thinking rearranged the keyboard to increase the logicalness of its entries and ease of organizing a particular problem. By July the problem had been defined, the circuits determined, and the program laid out for our IC suppliers. By mid-December we were in limited production, and on January 16 we announced this new product to the press.

I assure you it was very well received, and I think we can make a very valuable contribution to the business community. We have given them a device which will allow important financial decisions to be made much more quickly, and much more accurately than has previously been possible. I am sure we will all watch with interest the progress that this calculator will make for the business community.

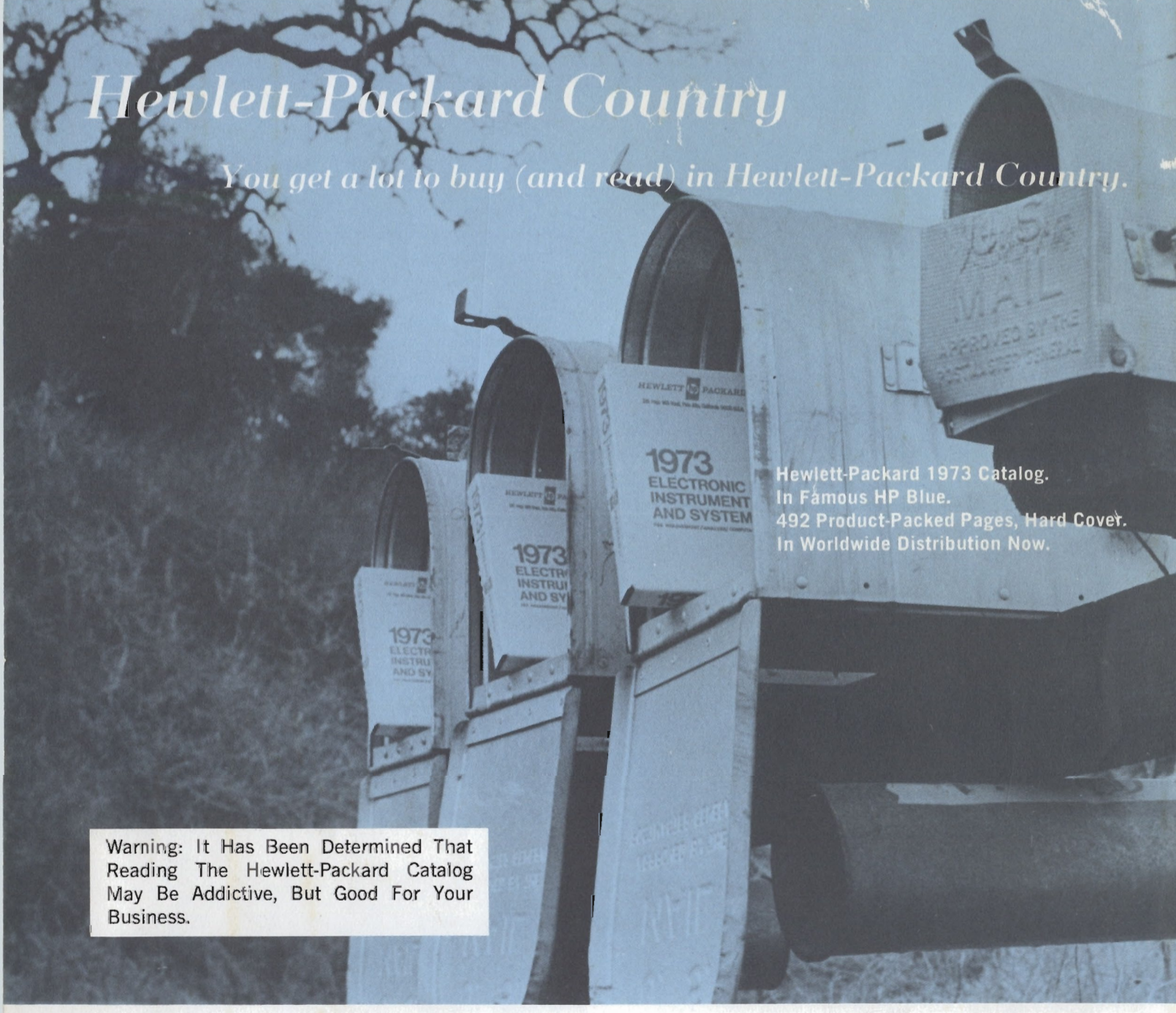
I would like to say one thing more. Although I have mentioned three people by name, the Model 80 would not have been possible without the tremendous effort from a very wide spectrum of HP people. I visited Manufacturing's tool and die shop and was shown a single die that had taken over 700 hours to make. I visited Cupertino and saw the absolutely remarkable job that the Advanced Products Division had done in the planning for the production of this device. I visited with the marketing people and learned of their very carefully laid plans for the introduction and support of the HP-80. Like its predecessor the HP-35, the HP-80 is one of the best examples of what can be done with real teamwork.

One light touch. I recently received a letter that had come from a customer in Minnesota. It said:

> "Gentlemen:
> Please repair my HP-35 Calculator, and bill me for its repairs.
> It dropped out of my parka pocket at 15° below zero and was run through my snowblower. I found it several hours later.
> It still performs all functions properly, but the case is shattered and needs replacing. Please replace the soft leather carrying case also."

Who says we don't make reliable equipment!

Bill Hewlett



Measure

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