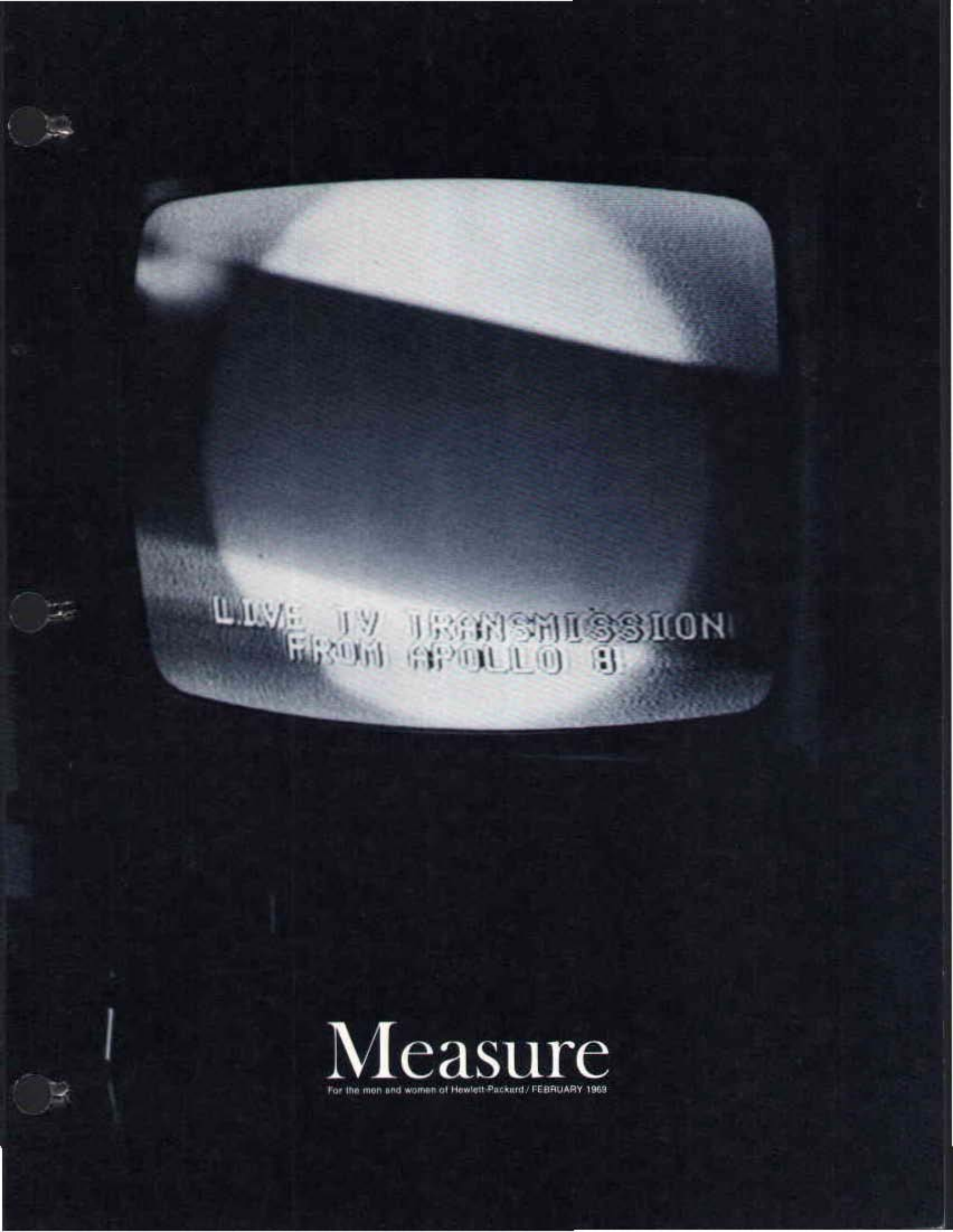
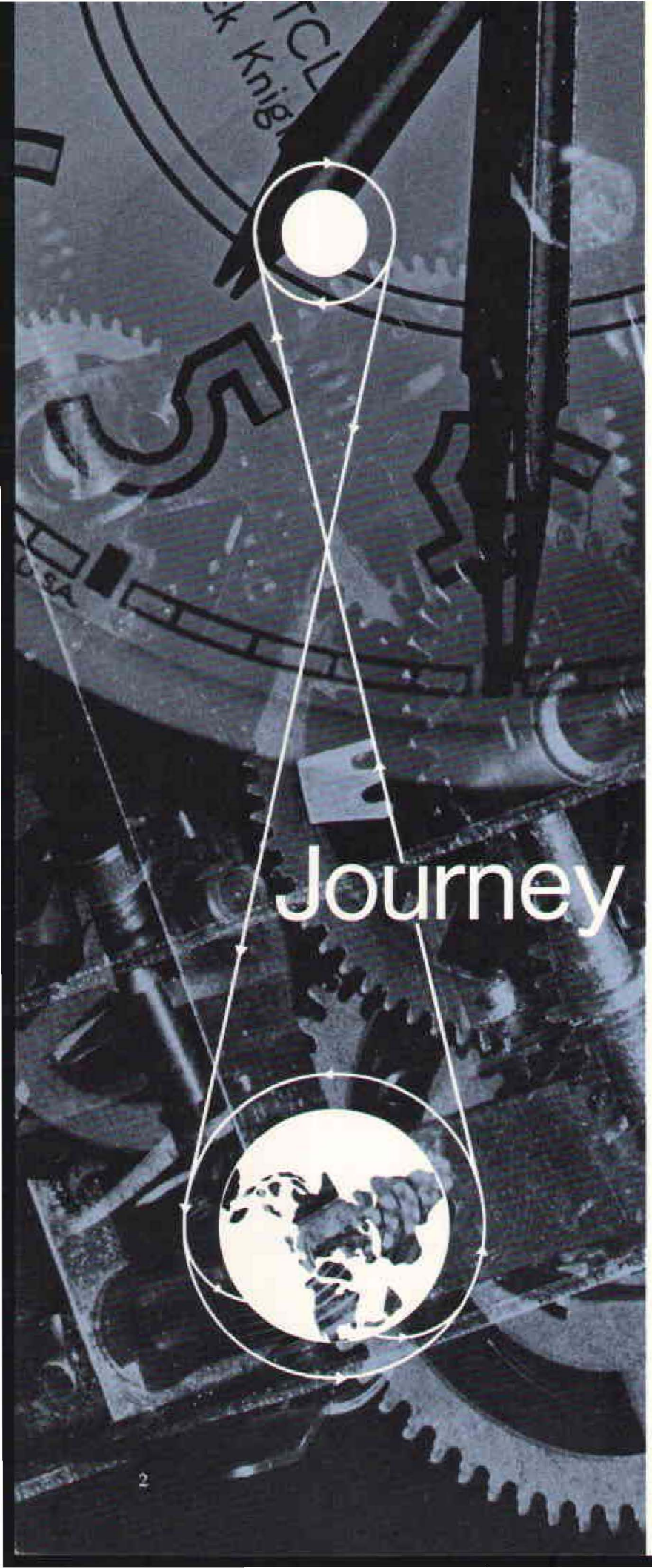


Measure

For the men and women of Hewlett-Packard / FEBRUARY 1969



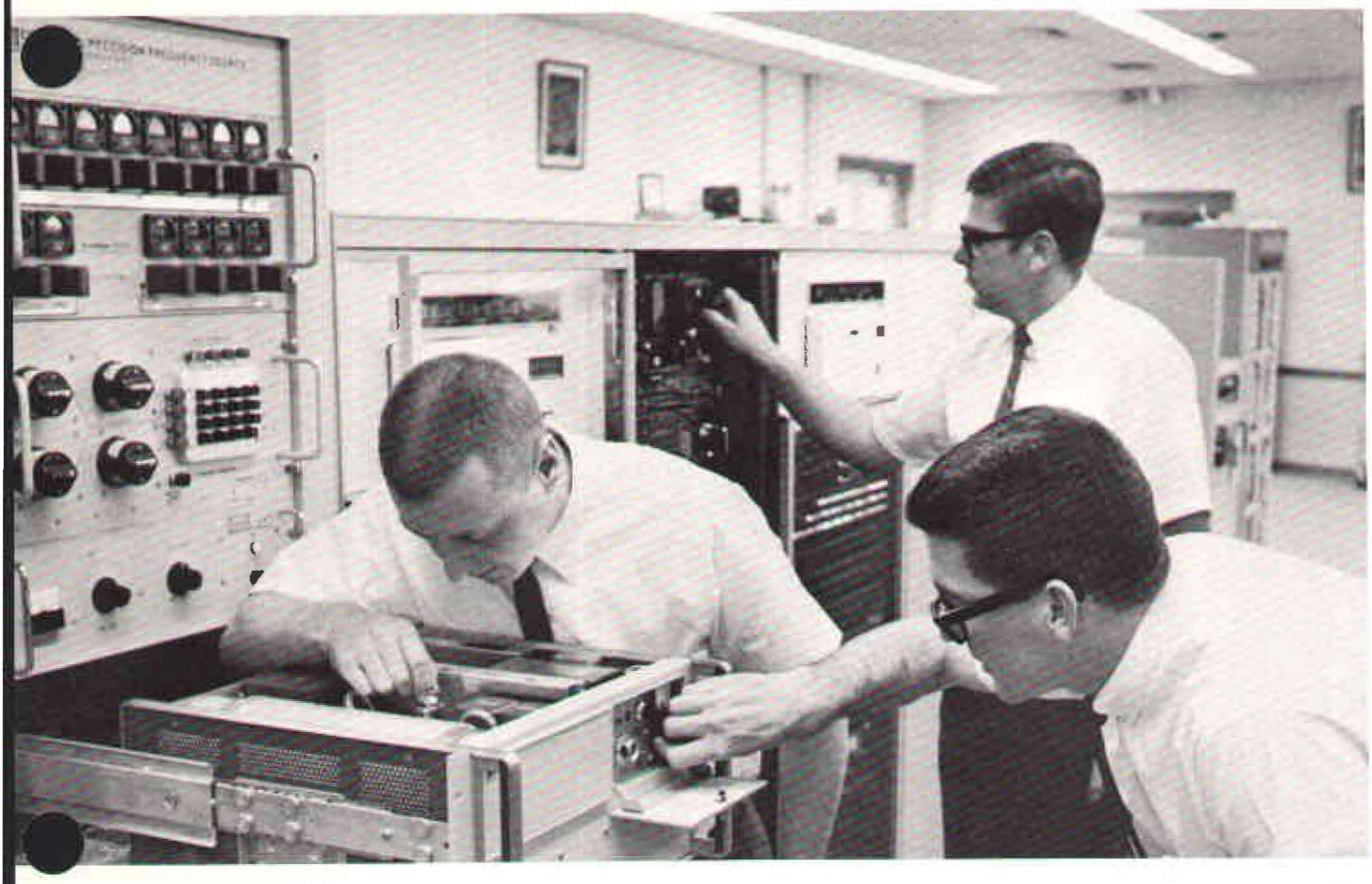
HP's Chuck Little, left, and Ron Hyatt complete installation of precision frequency source at Goldstone by making final adjustments in HP cesium standard. To the rear, Bob Howatt, NASA-Goddard timing systems engineer, checks super-precise binary clock whose timing is keyed to the frequency source. The clock, a section of whose face is shown above, keeps time in milliseconds, and is timekeeper for the various communications and control systems in Apollo network.

Journey into time

☐ Perhaps never before has a planned human adventure drawn such praise for the perfection achieved in fulfilling its goals as that of Apollo 8. To say that the Christmastime mission around the moon went according to plan would be a major understatement. The NASA team's exquisite precision in performance was hailed not only by politicians, poets and the press but also by scientists and engineers, men who could appreciate some of the great technical complexities involved.

Even so, the tendency of many commentators was to simplify the technicalities, probably because they either didn't understand them or because they felt the need to make the achievement more understandable to the public at large. At times they made it seem as though success hinged mostly on ballistics: aim the giant Saturn V rocket correctly, then trust to Newton. Or, at other times the chief impression conveyed was that of a fantastic sightseeing excursion.

Well, it was all of that, but much, much more. Among other things, it was a prime test of the most precise



system of timing ever devised by men. Using Hewlett-Packard products to provide the essential beat, the timing system served as the very heart of NASA's network of telemetry, communications and various other command systems.

The timing system was completely updated just in time for the Apollo 8 flight. The three major new NASA "wing" stations at Goldstone, California, Madrid, Spain, and Canberra, Australia, were each equipped with a new HP-produced Precision Frequency Source (E02-5061A) keyed to an HP cesium clock. The source provides precise frequency outputs used for timing. In addition to the cesium unit, which is the primary source of the outputs, the system uses rubidium-type and quartz-type secondary standards to enhance reliability. These back-up standards are controlled by a "combiner" unit that slaves their output frequencies to that [illegible]e cesium. The combiner automatically will switch them [illegible]service in the event of a cesium standard malfunction. In addition, similar cesium clocks took over the prime tim-

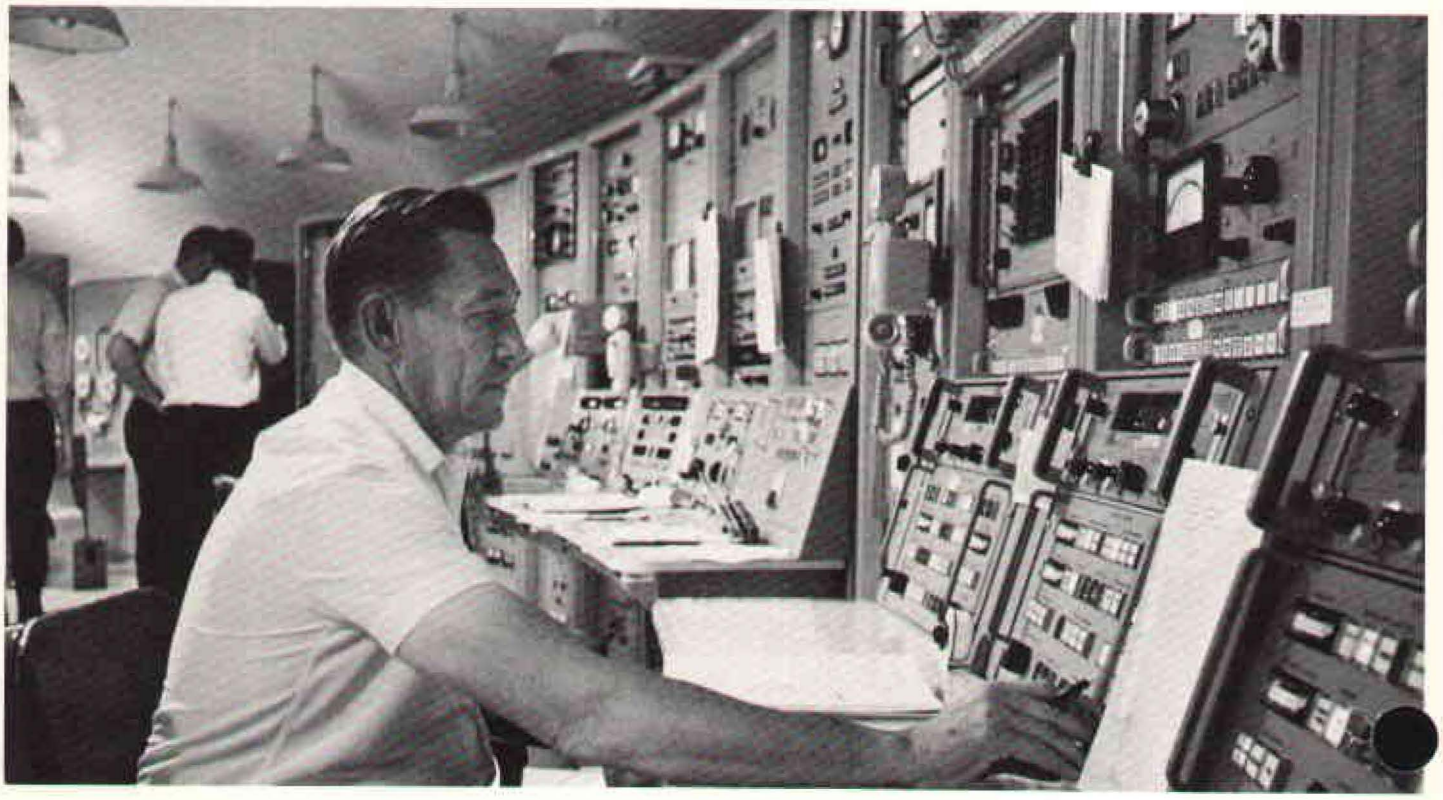
(continued)

Operations room of Apollo-Goldstone tracking station was in direct contact with Apollo 8 during the most critical phases of the journey via the 85-foot antenna above. The station, a key site in NASA's worldwide network of Apollo facilities, houses approximately 160 six-foot racks of electronic gear.

journey into time

Mars Deep Space antenna—world's largest and most sensitive tracking device—will be teamed with the Apollo antenna to keep track of the lunar modules when a moon landing is attempted. Awesome scale of the 210-foot diameter Mars giant is shown in contrast with the two men circled.

With 2½ times greater reach than other tracking antennas, the Mars Station enables Jet Propulsion Lab engineers to track to the very limits of the solar system. Extremely accurate timing system is at the heart of this capability.



role from rubidium standards at 15 land-based NASA nna sites and three Apollo instrumentation ships located around the world. The purpose of the upgrading was to provide a system that was as absolutely stable and synchronous as possible throughout the network — no time gaps or laps, all stations beating within a very narrow few milliseconds of each other for long periods of time.

Was such precision necessary? Was there any real useful value in having thousandths-of-a-second accuracy established for a mission spanning 590,000 miles and 147 hours of flight? Wouldn't a set of good chronometers do the job?

The answers are, respectively, yes, yes, and no.

At lunar distances, particularly, a whole new range of complexity comes into play in earth-to-spacecraft relationships. For one, time-scaling of extreme precision is needed in the continuing process of range tracking. Here, Doppler-shift measurement of a ranging signal (frequency shift of the moving spacecraft as a function of time equals distance) enabled ground controllers to pinpoint Apollo 8's position within a few feet and to determine its exact speed.

Another reason for precision timing can be seen by examining the critical tie between the timing system and the network's data-processing system. With the focal point at the Mission Control Center in Houston, the network's high-speed computers at each of the remote sites and ships "talk" in fraction-of-a-second speeds not only between each other but also in real time directly to the Apollo spacecraft, relaying commands and "up" data to the astronauts. With such a pouring forth at a rate of thousands of "bits" per sec- and with entire data system time-scaled in microseconds, any "drift" or discrepancy in timing between the various sites would have meant quick chaos throughout the network.

More was at stake than just the smooth operation of the computer, however. One critical point was reached whenever the spacecraft emerged from behind the moon, where most of its maneuvers were performed. Because the moon blocked radio transmission during those periods, the data was accumulated, then dumped in a big outburst of "bits" as the earth hove into view. In case anything had gone wrong during those maneuvers it was essential to be able to fix the exact fractional timing of events. Only then could corrective measures be computed properly at Houston and transmitted back to the craft via whichever site had its antenna beamed at Apollo 8.

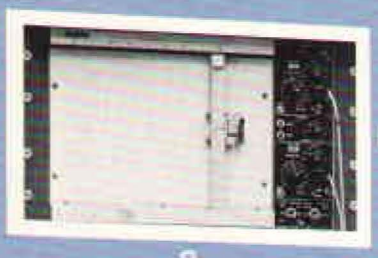
Precision timing will be even more critical when, sometime during the next two years, the two-stage lunar module places men on the moon then returns them for a rendezvous with the orbiting command module. At that historic event, the fantastic facilities of stations such as Goldstone, deep in the desert lands of Southern California, will come into full demand. Both the new 85-foot NASA wing station antenna, and the Mars Deep Space Station antenna operated by Cal Tech's Jet Propulsion Laboratory, have wide enough beam width to cover the lunar surface. However, not even the 210-foot Mars giant, world's largest and most sensitive automatic tracking antenna, could simultaneously provide good position data on the separated modules. So both antennae will come into action. One will lock onto the command module, the other will follow the moon module— right up to the moment when, mission accomplished and jettisoned in space, the vehicle's batteries die.

Scientific missions performed in the course of Apollo 8 also were dependent upon precision timing. Most far-ranging, perhaps, were studies being conducted by JPL concerning the "occulation," or eclipse, of radio signals by a heavenly body. The study is related to highly precise pulsar experiments by the Cal Tech scientists. In addition, scientists interested in mapping and studying the hidden geography of the moon obviously will need precise timing to go with the growing library of lunar photographs.

The utilization of Hewlett-Packard equipment throughout the NASA and JPL space facilities goes far beyond the timing system. Much of it is "on-line" equipment, built into the Apollo S-band network that unifies all of the various tracking, communications and command systems. This list includes frequency synthesizers, many scopes, power supplies, meters, signal generators, oscillators, counters—and even a large number of general-purpose amplifiers that were specially gold plated. HP equipment also is in abundance in testing applications, notably in the JPL-operated standards lab at Goldstone. Equipment from sites around the world is sent there for repair and recalibration. In addition, the lab's head, Bob Fuzie, has available an HP atomic clock. By taking it on one or two quick, around-the-world flights to the various stations, he is able to correct or verify the accuracy of the precision frequency sources throughout the network:

"Gentlemen, synchronize your E02-5061A's." □

Fuzie, head of JPL standards/calibration lab at Gold- c, discusses role of HP atomic clock in synchronizing ing throughout Apollo network. All worldwide facilities must sync within very few milliseconds.



building-block concepts

complex custom combinations

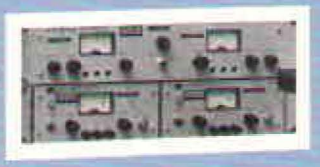
multi-divisional products

cross-linked capabilities

multi-functional markets

Systems Division

markets are "go"



In the free enterprise environment in which we work, [illegible]rsification comes as no surprise. In fact, to people in the business world it seems as natural and inevitable as does cell division to the biologist. But there sometimes occurs what the life scientist describes as a permutation: a complete and complex though quite natural change in the lineal order of development. Systems Division, in a sense, is an HP permutation in that it represents a new experience in growth for the company. The division operates none of the production assembly lines common to other operating divisions. It does not concentrate in any specific range of disciplines. Yet the nine-month-old Systems Division does have a specific mission:

"It seems to me that what we are trying to do is to serve as a focal point for bringing together the various technologies and the various products of the company," said Dick Reynolds, Systems Division manager.

"Our role is to create and market products that are multi-divisional and multi-functional in nature, such as automatic test systems—the kind of product packaging that is not attractive to any one HP manufacturing division simply because it involves too many technologies that they don't have in their own bag of tricks."

As noted by Reynolds, the main market for such activity is in the field of automatic testing equipment. In particular, a great many manufacturers are turned on at the thought of what computer-assisted test systems could do for them. They see such systems as a way out of the di[illegible]ma created by increasingly complex requirements in [illegible] own products and operations, combined with a grow[illegible]ng shortage of trained people.

Think of the concern, for example, that electronic products manufacturers must have for the performance of components, with service costs and warranty obligations moving ever upward. One such firm, Magnavox Corporation of Fort Wayne, Indiana, was Systems' very first customer when it took delivery last October of a computer-controlled custom test system costing some $180,000. Now on line, this system checks out a thick-film receiver circuit every five or six seconds and decides if the unit is "good" or "bad" and diagnoses any problems immediately.

The U.S. market for similar automatic-test equipment systems has been estimated at about $100-million for 1969, but this is just a beginning compared with the potential market in 5 to 10 years. Aware of that potential, the company began preparing for possible entry into the systems market more than two years ago. With the introduction of the HP 2116A computer early in 1967 and the capability of interfacing it with a variety of HP instruments, that possibility became almost a certainty. Official formation of the division took place in May, 1968. Reynolds, formerly managing director of HPSA, returned from Geneva to head the new systems team, which included a nucleus of men in the corporate marketing department who had been working on plans for the division. Today the division has 38 people, most of them with strong technical backgrounds in the various electronics fields and extensive training in computers.

The Systems marketing men often work in ways quite different from the typical manufacturing division engineer. According to Bob Grimm, marketing manager, "Our people have to work with a lot closer coupling to the customer. Our fellows have to spend a great deal of time studying a customer's needs, working up a block diagram fitted to those needs and then developing the specific proposal.

"At the same time, we are anxious to keep the HP field sales people interested and involved. We definitely

(continued)

The HP 9500A automatic test system, demonstrated for visiting customers here by Dawson Mabey, is Systems Division's new and versatile entry into fast-growing [illegible]stems market. The [illegible]0A employs a wide [illegible]ge of standard and optional HP instruments.

Systems Division

don't want to cut them out of anything, because we depend on them for cooperation and contacts. They are very effective in leading us to new prospects and zeroing in on the details of a systems job. We keep field people very much 'in the loop' as evidenced by the many of them we have brought here, along with their customers, for the purpose of demonstrating our capabilities."

The division is beginning to have quite a variety of products and capabilities to demonstrate. One basic system, the 9500A series, employs six standard "building block" products plus software to which a variety of options may be added to create a wide range of highly flexible automatic test systems. The Systems team also hopes to market custom systems patterned after those developed by HP engineers in other areas of the company for their own use.

In addition to own custom projects, Systems Division hopes to market systems patterned after those developed elsewhere in the company—such as IC testing system engineered by HP Labs. Modelling as operator is Labs' Mary Jane Robbins.

Among these are the transistor test system created by Bill Ansley of HP Labs and a component testing system put together by Microwave's Tosh Kondo. In addition, several Systems projects contemplated for initial use within the company will have outside applications.

That ability to work closely with other people and products of the company points up the important basic advantage Systems Division has over its competitors: no other producer of systems has anywhere near the same breadth of instrumentation products combined with computer expertise and experience to draw on. Competition for the most part is made up of firms whose primary business is built around computers or aerospace firms that have developed systems for their own use.

Reynolds and his men are not too interested in competing directly on some of the super-custom systems sought by some industries. These too often—as in avionics and military-type systems—require too large and specialized a commitment.

"But we will try to convince these same customers to go the commercial instrument route in solving their problems," said Reynolds. "We think we can give them greater flexibility and better cost effectiveness in their systems while providing a solution that's more up-to-date—and more easily kept that way—instead of one that was up-to-date five years ago when the system was designed."

The Systems Division of course does not have or claim exclusive rights to the marketing of all HP systems. Quite a few other divisions have systems that clearly are an extension of their own products and technology, and it is certain that there will be more such systems developed in the future as the various divisions grow and expand their capabilities.

"Our job," Reynolds added, "is to maintain a cross linkage between those various capabilities and to utilize them as building blocks in solving customer problems that increasingly involve complex combinations of technology."

Months and even years can go by while customers ponder proposals and alternatives to such systems. Meanwhile there are no nicely rising sales curves to provide day-to-day comfort. The systems business is definitely not for nervous types. □

Although the total systems market is dynamic, any one sale can take many months of work and waiting. Here a major proposal is reviewed at chart by Bob Grimm, marketing, with (clockwise) Jerry Collins, operations, Dick Reynolds, general manager, Dick Landes, contracts, Tom O'Neill, proposals.

Airborne mission: Show HP products around the world

Last month the air-age descendent of the company's famed family of Travelabs, Mobile Labs and Showboats took to the air—to wing its way to 46 cities in two dozen countries over a period of 110 days. The newest exhibit vehicle is a modified DC-6B outfitted with more than 100 products representative of all major segments in the HP line—the most comprehensive traveling product show the company has yet produced.

First leg of the journey that began January 24 was Honolulu, after which the aircraft headed for New Zealand and Australia. The balance of the flight schedule will be filled out in Asia, Africa and Latin America.

As many as 250 customers per day are being invited to board the plane. In one 48-foot-long section they are shown a display of products that can be varied to emphasize electronic, medical or analytical instrumentation. Another 17-foot section presents the HP line of computer and calculator equipment. Engineering specialists in each of the disciplines are also aboard to assist local distributors in demonstrating how HP products or other company services can help solve the problems of customers in all parts of the world.

"If you can't buy one, we'll build it"

Odds are about 1,000 to 1 against your having seen the HP substrate slicer. It's doubtful, also, that you've been properly introduced to the HP whisker bender or the HP paper coater, for that matter.

There really are such products — designed and built by HP people. But they're not for sale. Not outside the company, at least. But if you represent an HP organization in need of machinery that outside suppliers can't deliver — by reason of cost, design specifications, or timetable — then check the special service available in the Palo Alto Group's Manufacturing Division. There, a team of equipment designers and skilled machinists is prepared to tackle just about any machine job, whether it's in the book or not.

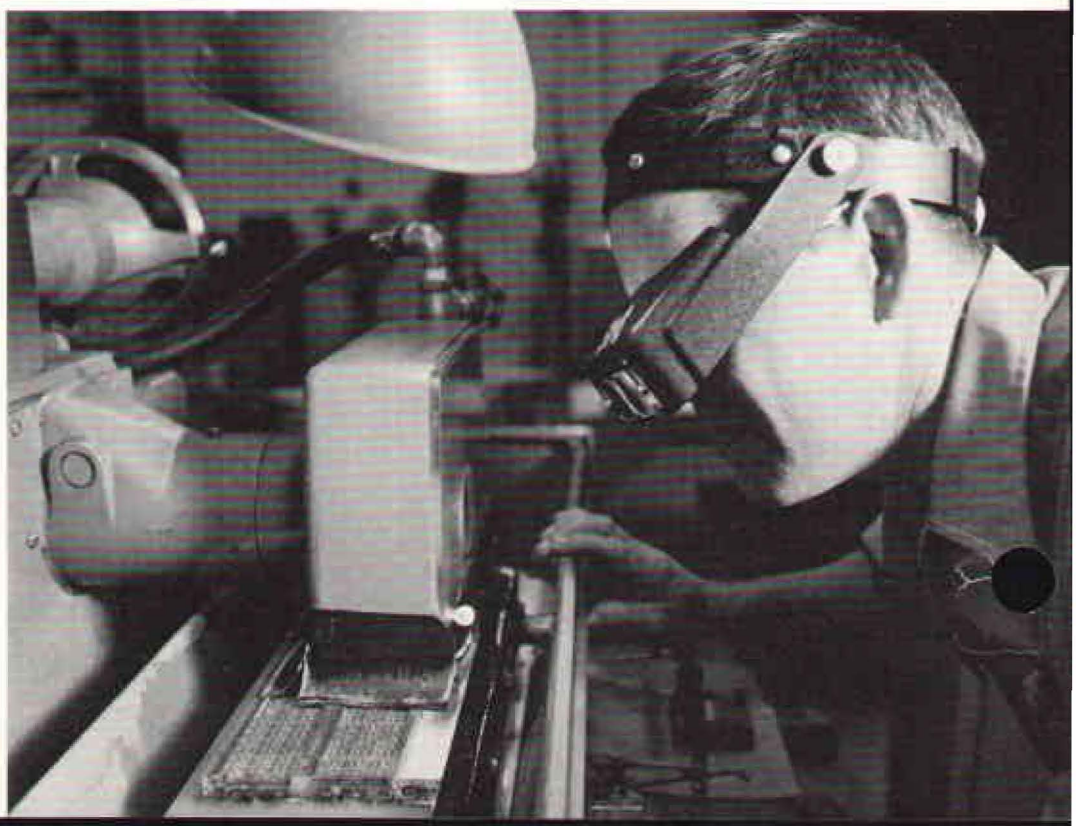
Custom work is their specialty. That includes designing and building machines not otherwise obtainable. It also includes rebuilding and customizing machine tools and other items of manufacturing equipment — making a $2,000 machine tool work with the precision of a $10,000 gem cutter.

"The trick is in hand working," said Rube Leamons, head of the eight-man custom machining section. "We rebuild a machine tool to far closer tolerances than any standard equipment manufacturer could afford to offer."

The equipment design service offered by Cliff Seymour and Bill West, both mechanical engineers with worldwide experience in tool design, is similarly of a handcrafted nature. In most cases, parts are produced right in the division's tool and die shop.

Jack George, product manufacturing engineer, noted that while the team has months of work backlogged, it can still move fast. A mechanism for loading and unloading a Microwave network analyzer demonstration unit was designed, fabricated and installed in a van in a matter of a few days.

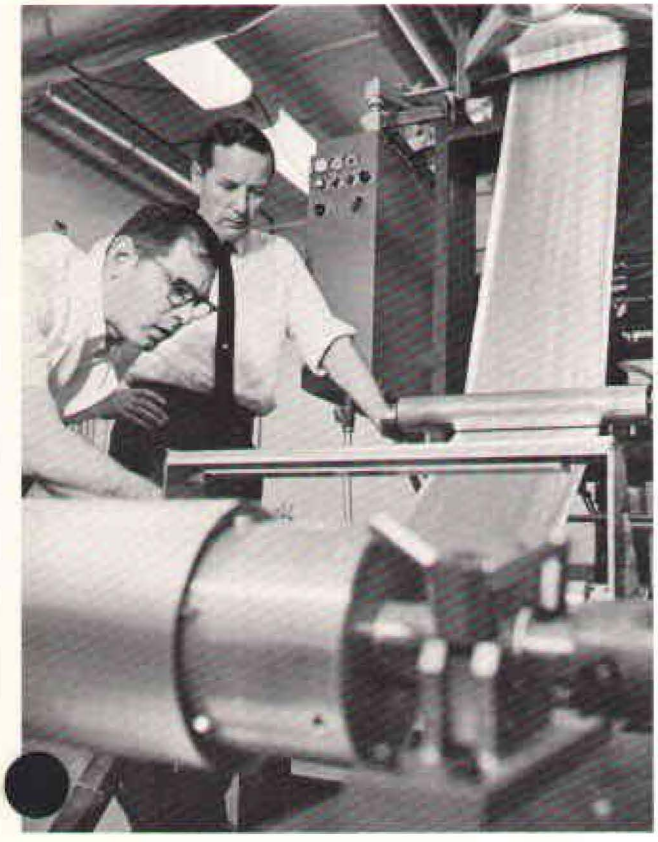
"It had to be right," said George. "We sure didn't want to be the first ones to drop a $100,000 instrument."



Precision cut in sapphire substrate is checked by Bill Sims, Microwave Division modelmaker prior to taking delivery of custom-built slicer. The sophisticated, fully programmable substrate slicer was designed and built by Manufacturing Division's custom machine team.

All parts of machines sent in for rebuilding—including nuts and bolts—are first given thorough buffing to reveal condition of the metal and restore newness. Here, buffer is operated by Ernie Correia, a machine rebuilder at HP for eight years.

The fine art of machine-tool rebuilding is practiced here by Henry Servin in handfitting a grinder for Microwave. Work involves patient hand scraping and rescraping of metal surfaces to create flush fit impossible by machine.



Paper-coating machine designed and built by the custom equipment team now is yielding commercial quantities of special electrosensitive paper for use in HP recorders. The machine is inspected here by Dan Simin, chemical technician at left, and Cliff Seymour, head of special equipment design section.

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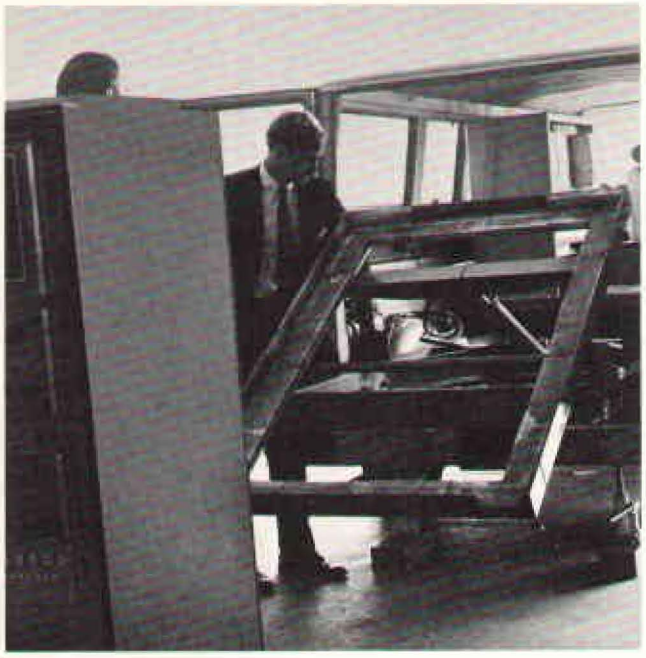
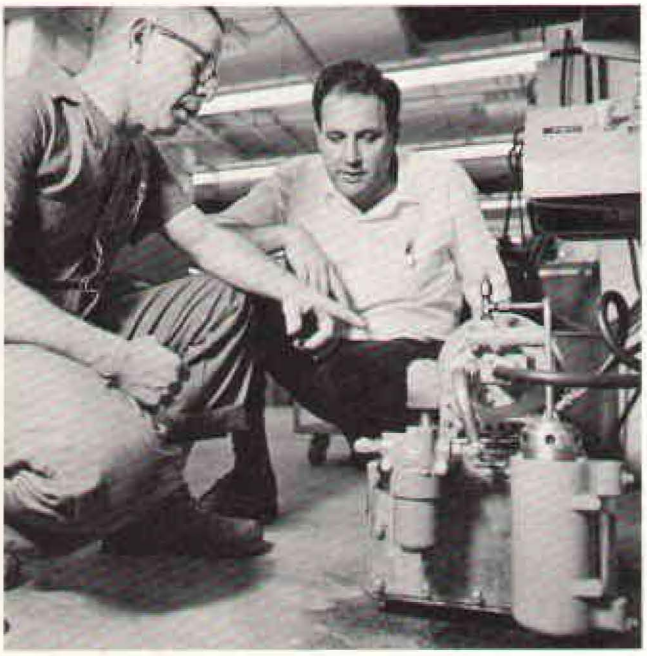


Urgent need for a device that would carefully load and unload demonstration network analyzer system resulted in this efficient rack operated here by Microwave's Jesse Pipkin. The equipment team delivered it eight days after order came in.

A microscope is required to operate "whisker bending" machine designed by Bill West, mechanical engineer. Here Bill uses giant model to demonstrate device for Marly Machado, who was able to handle machine with no prior training.

we'll build it...



Versatile team represents varied machine-making talents, including mechanical, electrical and hydraulic. Here George Balzer, leadman (left), and Rube Leamons, supervisor—both hydraulics experts—discuss pump building project.

Erich Jurak, a machine rebuilder with extensive training in electrical engineering, draws schematic for automating Wiedemann punch press machines. In the foreground are components which machine services will install in the equipment.

ten most WANTED instruments

Escaped from new 1969 HP catalog. Vast rewards $$$$$ for information leading to successful apprehension.

Computter:
Portable digital device. Programmable up to 90 feet. Full line of software including ALLGOLF instructions, FOREtran linguistics, opponent bugging routines and diagnostics operable in yip, yaw, yump, spook and peek configurations. Avoid scorekeeping errors with optional plug-in Di Vicenzo-model compiler.

Sweep osculator:
With almost total dependence on mass communications, politicians are finding themselves cut off from the all-important baby-kissing gambit. They need the sweep osculator, as do all would-be crowd pleasers. UHF/VHF.

Gap-o-meter:
Needed for measuring credibility-, trade-, generation-, missile- and other gaps. Unprecedented growth market. Readings from 0 to 100 on the Pedernales scale.

Gress-gauge:
Standard forward controls for measuring progress and ingress, with reverse for gauging regress and egress. Optional digress monitor available with plug-in silencer.

Status-scope:
Accurate tracing of ancestry and sampling of personal power resources. Pocket- and purse-size kit for all business and social occasions. Great gift for graduation!

Date Acquisition System:
Generates wide range of indiscreet signals. Monitors response simultaneously from up to 200 ambient single sources. Measures resistances, frequency and voltage. Out-of-limits warnings.

Net-worth analyzer:
Fast-growing market among tax consultants, IRS investigators, security analysts, fund raisers, loan appraisers, country club membership committees and heirs apparent.

Dither-meter (di-ther-me-ter):
Device for measuring non-solid state of line supervisors during month-end rush, accountants adding up year-end figures, and engineers awaiting results of prototype testing. Readings from 1 to 10 on the dither scale.

Sophistication Standard:
Multiplies the number of active new elements in an improved product by the number of degrees held by the development team, then divides by the number of competitors who already claim advances even more sophisticated.

Macrowave Scanner:
For the surfing and sailing markets. Automatic monitoring of wave action in sequences of nine. Superior resistance to corrosion and shock. In event of malfunction, device becomes self-activating safety flare visible at nine miles or nine fathoms.

Approach with caution. Notify nearest Bureau of R&D.

News in brief

Palo Alto—Noel Eldred and Ralph Lee have been elected executive vice presidents of the company. Eldred formerly was vice president for marketing and Lee was vice president for western operations. Each has been with the company nearly 25 years.

Palo Alto—Ed Porter has been named vice president of operations and will head an organization of divisions known as the Operations Group. Included are Colorado Springs, Loveland, San Diego, New Jersey, Waltham, Delcon and Avondale divisions.

Palo Alto—Bob Brunner, formerly corporate engineering manager, has been named marketing manager for the newly formed Operations Group (but not including medical and analytical products). A similar appointment was made by the Palo Alto Electronics Group with the naming of Al Oliverio as marketing manager. He formerly was sales manager for the Neely Sales Region.

Perth, Australia—Hewlett-Packard Australia Pty., Ltd., today officially opened an office here to serve the state of Western Australia. The office is located at Suite 13 of the Casablanca Buildings at 196 Adelaide Terrace, Perth. Manager of the branch is Ron Davis, who formerly served as an engineer in the company's Melbourne and Adelaide offices.

Palo Alto—At their meeting on January 17, the board of directors declared a regular semiannual dividend on the company's common stock. The dividend, 10 cents a share, is payable April 15 to stockholders of record April 1.

Palo Alto—Purchase of company stock for the fourth quarter of 1968 under the employee stock purchase plan was made at a price of $84.92. Cost to the participating employees is $63.69, with $21.23 being contributed by the company.

Palo Alto—Mailing of the company's 1968 annual report was made in January to the approximate 17,000 HP shareowners. Extensive distribution also was made to representatives of the financial community and the business press. Along with financial data, the report highlights the company's progress in data processing markets with its growing family of computer and calculator products.

People on the move

Corporate—David Bentley, to internal audit, corporate Finance, from Palo Alto administrative services; Del Fillmore, to finance manager, Customer Service Center, from scope accounting, Colorado Springs.

Palo Alto Electronics Group:

F&T—Dan Feutren, to Santa Clara plant engineering, from Palo Alto plant engineering; Jerry Merkelo, to R&D, from R&D, Microwave; Dan Scheel, to marketing manager, from same position, HP Associates.

Microwave—Ned Barnholt, to marketing, from R&D; Brian Corrie, to components production development, from signal analysis; Norm Cracchiolo, to order processing, from government shipping; Ted Dennison, to systems manufacturing, from R&D; Bob DeVries, to signal analysis, from R&D, Mountain View; Brian Humphries, to marketing, from import marketing, International; Henry Ilg, to manufacturing engineering, from Palo Alto plant engineering; Jim Nivison, to microcircuits bonding assembly and testing, from R&D, F&T; Dick North, to marketing, from advertising and sales promotion manager, Colorado Springs; Bob Olson, to manufacturing engineering, from Palo Alto plant engineering; Russ Perricone, to manufacturing supervisor, signal analysis, from production control; Roger Rauskolb, to analytical instruments, from systems R&D; Bob Rehner, to microcircuit production, from R&D; Larry Stratford, to marketing from printed circuit manager; Glen Suth, to marketing, from marketing, Avondale; Rodger Swan, to systems manufacturing, from computer programming, corporate Management Services; Jerry Woodland, to signal analyzers, R&D, from manufacturing engineering; Bill Wurst, to marketing from R&D.

Paeco—Alan Groves, to printed circuit production engineer, from corporate Process Engineering.

Mountain View—Lyle Loeser, to tool engineering, from same position, F&T.

Eastern Sales—Art Badikian, to sales representative, medical instrumentation, from staff engineer, medical instrumentation, Paramus (New York area); Bark Bush, to area manager and regional medical sales manager, West Conshohocken, from district manager, Cherry Hill; Bob Johnson, to field engineer, Norwalk, from mobile field engineer, Region headquarters; Jerry Richardson, to district manager, Cherry Hill, from field manager, East Hartford; Rick Weaver, to sales manager, Eastern Sales Region, Paramus, from area manager, West Conshohocken.

Midwest Sales—Phil Conway, to regional product manager, Data Products, from Chicago area manager; Willard Harlow, to promotional manager, from staff engineer; Fred Nearing, to regional product manager for Colorado Springs, Loveland, New Jersey and Waltham Electronic Divisions, from district manager—Chicago; Stan Russell, to coordinator, Medical Electronics, from medical staff specialist; Phil Wolf, to district manager, Pittsburgh, from field manager, Detroit.

From the president's desk

It was with mixed emotions of pride and sorrow that I received the news that Dave Packard had been confirmed as Deputy Secretary of Defense. Pride that Dave, who has been so much a part of HP since its founding in 1939, has been nationally recognized for his unusual capabilities as an administrator and a leader. Sorrow that a good friend with whom I've worked for 30 years will be leaving the top executive spot at HP, a position that he has held for the entire period.

More than my personal emotions, however, are involved. There is the basic question for each individual at HP as to what the company will be like without Dave at the helm. Obviously his vision and leadership will be sorely missed. But it's equally apparent that our company has great momentum, a reservoir of talent and a continuity of purpose and philosophy that will help minimize the effect of his departure.

From our close association over the years, Dave and I have developed the same management principles and philosophies, the same hopes and aspirations for HP and all its people. It is these intangibles that in the long run have shaped the character and personality of HP, and I can assure you that they will not change.

With Dave's departure, I have asked Ralph Lee and Noel Eldred to share in top management responsibilities as executive vice presidents. Noel, with his broad experience in marketing and external relations, serves to complement Ralph's strong background in the internal operations of the company.

In addition, Ralph and Noel will be nominated as directors of the company at the annual stockholders meeting this month. In joining the board, they will be replacing Dave and Erskine White, who has recently advised us that he wishes to retire. Erskine's sound council and good judgment have been most helpful to us over the years and will be greatly missed.

The company, as Dave moves to his new assignment in Washington, is in a sound and healthy condition. I know that if all of us continue to work together as we have in the past we can build upon this strength during the months and years ahead.

Bill Hewlett

It's hands, hands down

Take comfort, humans. Machines may do wondrous things, but when it comes to taking care of their own kind—repairing and rebuilding aged or broken machines — they just don't have the right touch. The hands of a skilled man are still the incomparable mechanism for making the various parts of a machine fit perfectly together and work as a unit. In fact, the hands portrayed here can take a brand-new machine tool — the best available commercially — and improve it many times over by custom fitting. That is just one of the roles performed by the custom machine services team profiled on pages 10–12.

Measure

EDITOR
Gordon Brown

ART DIRECTOR
Tom Martin

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