# SCIENCE

7 April 1972

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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE


# Some things are changing for the better.

*Many people know us as an instrument manufacturer: we make more than 2,000 products for measurement, test and analysis. Others know us as a computer company: more than 10,000 own our programmable calculators and computers. We prefer to think that our business is to serve measurement, analysis and computation needs . . . in science, industry, medicine and education. This is the rationale behind every new instrument, computer or system that we tell you about in these ads. This month:*

*When the HP 9600 rolls through your door, your real-time and data acquisition tasks become a lot easier to perform. This new systems family's long suit is the efficient and economic handling of multitudes of analog and digital information, simultaneously.*

## A sensor-based system that makes real sense.

There's a growing demand in industry and research laboratories for sensor-based computer systems that handle great quantities of analog and digital information. Systems built from programmable instruments usually are too expensive; people pay for equipment features that they don't need. Yet the alternative has been a piecemeal approach — break down the customer's problem into several parts and use separate "mini-systems" to solve each part independently.

Now there's a third choice — Hewlett-Packard's new family of compact data acquisition and control systems for cost-effective automation in industry and research. A 9600 Series system monitors, collects, and processes information from sensor-based sources. It then can generate reports, control power supplies, alert operators, drive graphic displays and plotters, and produce control signals for closed loop operations. Although you can't be everywhere at once — supervising and trouble-shooting — our system can.

Two new subsystems within the 9600, one analog and one digital, now do the things a number of programmable instruments used to do. These instrument functions are contained on plug-in cards. Instead of adding individual instruments, you merely slip in an inexpensive printed cirucuit board.

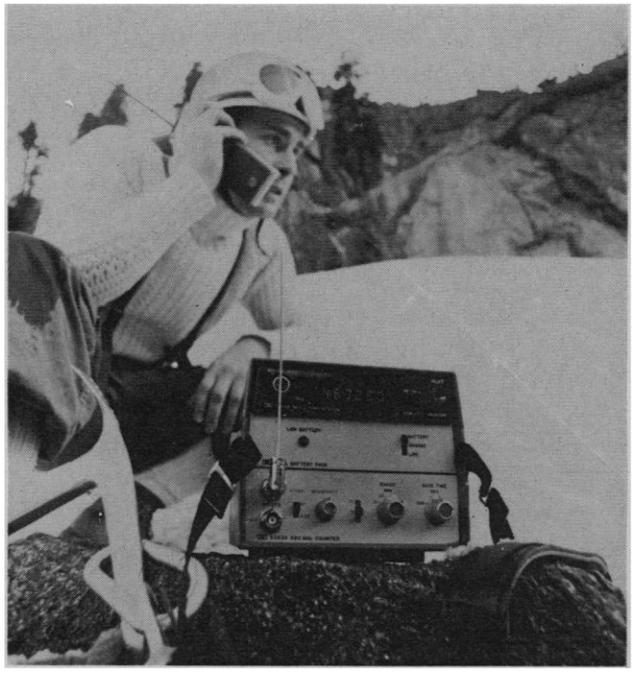
The 9600 data acquisition systems are modular. Start with a minimum low-cost system to control a single test or experiment, and expand with your growing needs.

The full story on the 9600 System family is yours for the asking.

## Nothing can outperform this new digital GC-even at twice the price.

Because the gas chromatograph (GC) is essentially a tool for qualitative and quantitative chemical analysis, its value ultimately depends on how well it does this job. Over the years, many new models have been introduced that perform more accurately than previous

*This would be an unusual case – using a battery-powered counter to check out the frequency of a mountain rescue-team's radio equipment – but it illustrates that HP's portable instruments can go anywhere service is needed.*

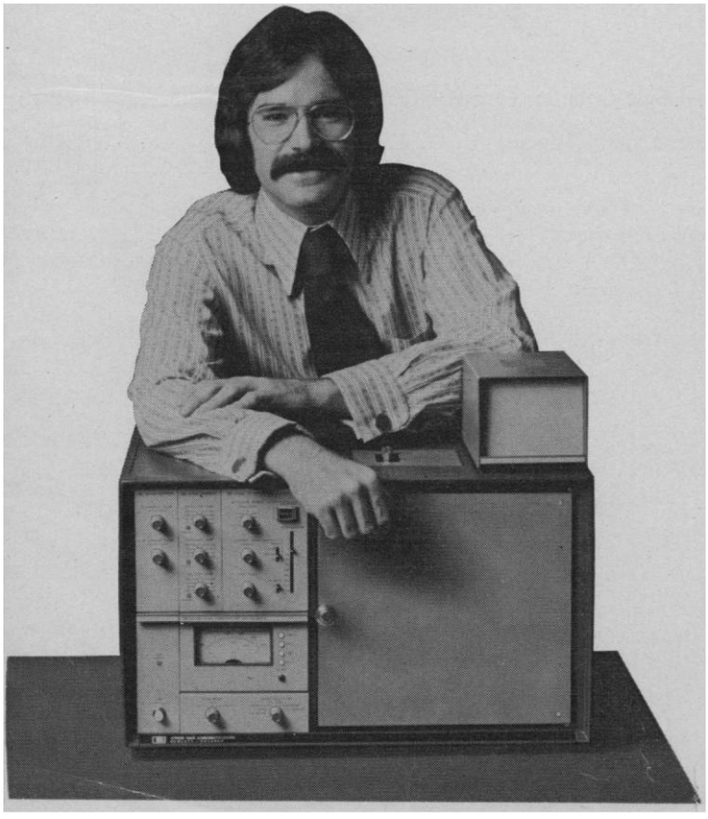


instruments – at a price. The truly amazing thing about the new HP 5700 GC is this: it produces more accurate and precise retention time (qualitative) and peak area (quantitative) data than any GC ever built. Yet it costs about half as much as top-of-the-line GCs of comparable quality.

A new bulletin on the 5700 fully documents this perhaps startling claim. Until you have a chance to study this data consider this: one of the first 5700s off the production line was used "as is" to make two series of replicate analytical runs, one series before and one after an overnight shutdown. The sample used in both series contained seven components, out to $C_{17}$.

The results speak for themselves. In terms of repeat accuracy, the mean retention time of each of the seven components differed less than 0.01 minute after the overnight shutdown; the normalized area % varied only within ±0.001%. In terms of precision, the standard deviations of the replicate retention time measurements fell within 0.0175, both before and after the overnight shutdown; the standard deviations of the area % data were all within 0.0038. No other GC, regardless of price, can do better.

For a fully documented proof of performance as well as a factual description of this new all-digital, computer-compatible automatic GC, write for Bulletin 5700.



## Portable instruments go where the problem is.

Capital equipment such as mobile or remote communications systems and million dollar computers have at least two things in common. They are electronically complex, and they can't be taken into a service center when they need repair. Today's traveling field service engineer must have laboratory quality equipment that will go where he goes.

HP's portable instruments enable service engineers to diagnose and repair this equipment on the spot, reducing expensive downtime. Our portable scopes are small enough to fit under an airliner seat, and, at 24 pounds, are light enough to be carried up antenna masts and into other hard-to-reach places. An HP electronic counter can be held in one hand – it takes only seconds to snap on a function module that provides the specific measuring capability needed. Then there's our multi-function meter – a high performance, instant-reading voltmeter and ohmmeter rolled into one.

And the length of HP's portable measuring capability isn't limited by the distance to the nearest wall socket. Most of our portable instruments feature their own accessory battery pack. Many can run off ordinary car, plane or boat batteries as well as a standard power line. And all of them deliver HP precision in a rugged, portable package.

Ask for the full story on portable instruments that go where the problem is. Write Hewlett-Packard, 1507 Page Mill Road, Palo Alto, California 94304; Europe: 1217 Meyrin-Geneva, Switzerland.

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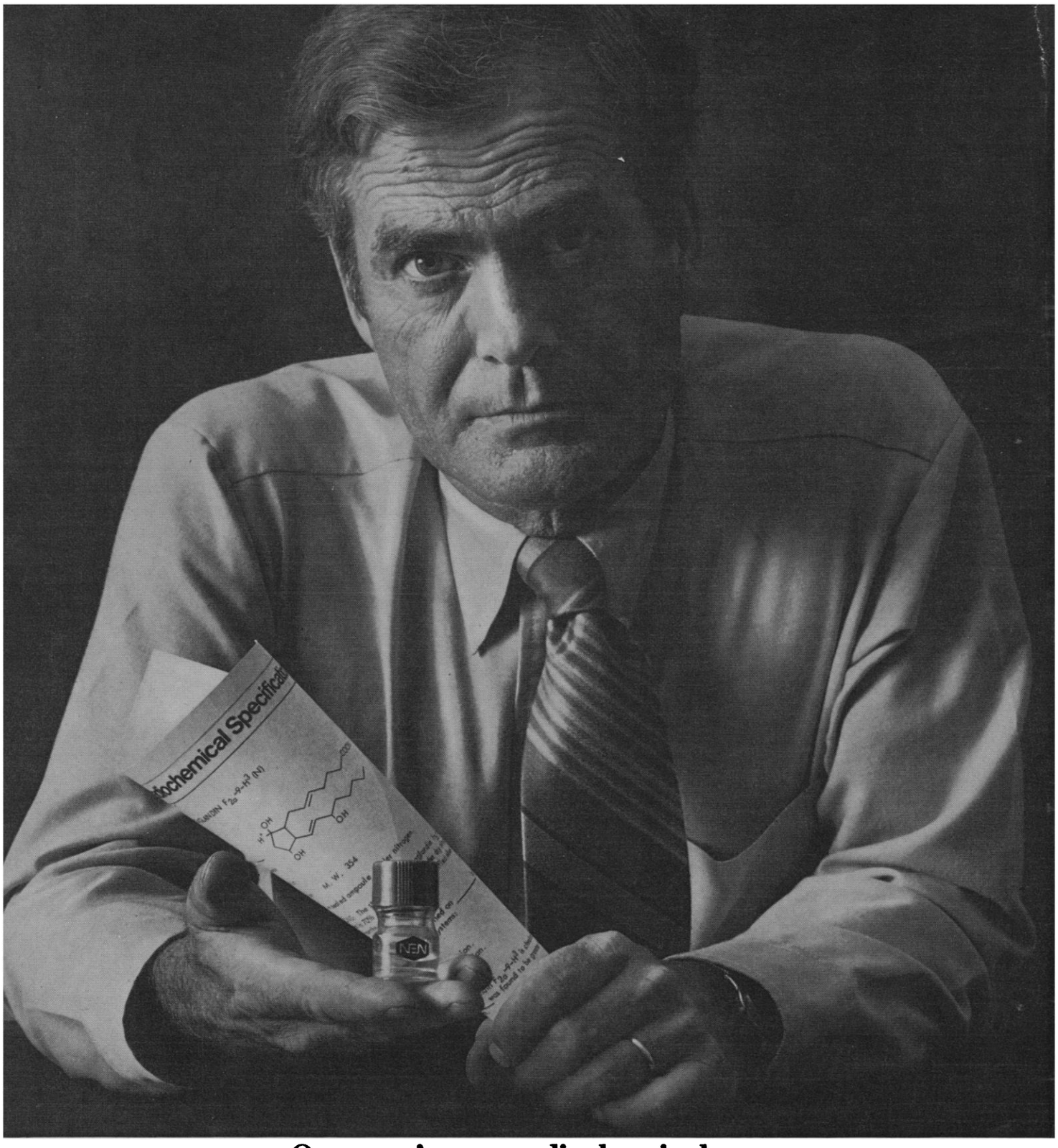
**COVER**

"Pure tone" bat (*Chilonycteris parnellii*) emitting orientation cries. The megaphone-shaped mouth aids in the forward beaming of echolocation pulses, while the funnel-shaped ears are advantageous for the reception of echoes. See page 66. [William Sacco, Biology Dept., Yale University]

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# A Bubble in the Educational Pipeline

Scare stories about unemployed scientists and engineers appear to have created substantial reaction among college-age men and women, as shown in enrollment figures for fall 1971. While graduate school enrollment last fall rose 2 to 5 percent (the latter includes the professional schools), enrollment dropped 2.7 percent in the physical sciences and 7.8 percent in engineering, according to the Carnegie Commission on Higher Education. Total undergraduate enrollment rose 2.4 percent at 4-year colleges and universities, but dropped 1.7 percent in the physical sciences and a whopping 17.1 percent in engineering, following a drop of 1.7 percent a year earlier, and a drop of 2.4 percent in fall 1969.

In the physical sciences, the number of bachelor's degrees in chemistry dropped in 1970 from the previous year and is expected to stay about level through 1972. Unexpectedly large enrollment in first-year and organic chemistry in the fall of 1971 may raise the number of baccalaureate degrees by 1974.

Undergraduate physics enrollment began dropping in the 1969–70 school year, and has continued to drop each year since. Junior-senior enrollment in 1968–69 totaled 14,678. In the fall of 1971, it was 12,755.

Looking ahead a few years, we can expect fewer degrees to be granted, first at the undergraduate and then at the graduate level, in the physical sciences and engineering, although the college-age population will have increased by 3,316,000 between 1971 and 1975. It is not possible to be sure whether this decrease in annual entrants will bring the present surplus of scientists and engineers into balance with the demand or will tip the scale in the other direction. Accurate forecasts are difficult because of the number of variables involved, including particularly changes in the general economy and in the direction of governmental support of scientific efforts. However, the needs for technologically trained experts to meet national and social goals will not have diminished by the time these smaller classes emerge from the educational pipeline. We will still be trying to erase urban blight, produce adequate clean energy, purge the environment, create effective transportation systems, and provide adequate health care, while maintaining our national defense and continuing some level of space exploration. If the state of the economy and a reordering of national priorities has enabled us to convert these needs into demand (meaning jobs), the supply of technologically trained specialists may again be too small in a few years.

Today's students are choosing areas of major study based at least in part on their reaction to today's job market. Their choices will not affect this job market (unless they leave school to seek employment at a lesser skill level), but will affect the supply 4 to 8 years hence.

Without minimizing the seriousness of unemployment among trained specialists, we should be careful not to overemphasize the problem of displaced scientists and engineers lest we diminish our future ability to meet our needs. Unemployment also exists today, and in somewhat greater proportions, among those who majored in the humanities, the social sciences, and education—and the highest unemployment rates of all are found among young men and women with the least education.

—BETTY VETTER, *Executive Director, Scientific Manpower Commission, 2101 Constitution Ave., NW, Washington, D.C. 20418*

# We want to be useful ...and even interesting

Kodak

*Knowledge by eye*

## So does your library

Our biggest-ticket item is the KODAK KOM-90 Microfilmer. It translates from magnetic tape to microfilm at 120,000 characters a second. Fast way to milk a computer and micropublish the output in manageable form. University of Pittsburgh has one.

A project is afoot there to find out what a community of scholars wants of its library. Sure, scholars claim to want to savor of the corpus of all recorded knowledge and thought, in order to remedy its deficiencies. But what do they *really* want nowadays?

Schemes for automating the corpus have not been lacking. The more ambitious, the better. All come up against the patron's urge to crawl out from under the edge of an all-encompassing scheme, proving it is impossible to anticipate how *I* think. Institutions likewise treasure their individuality.

The people at Pittsburgh are examining how an individual institution's processing of the MARC (*Ma*chine-*R*eadable *C*ataloging) tapes from the Library of Congress can best serve its community. The planners of MARC wisely stuck to extant technology. Visitors from Kodak bring to Pittsburgh inside knowledge of where science might build technology if customers want it.

*For contact with the project, write Knowledge Availability Systems Center, University of Pittsburgh, Pittsburgh, Pa. 15213. To bone up on MARC before troubling Pittsburgh, send $2.25 to the Superintendent of Documents, Washington, D.C. 20402 for Document LC 1.2:M 18/5. To buy or rent microfilming equipment, look up Kodak under that heading in the Yellow Pages.*

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## Vision extended by ZIP code

Now that enough ecologists and other biologists are extending their vision into the near infrared by means of 35mm KODAK EKTACHROME Infrared Film in 20-exposure magazines, processing comes easy. A KODAK Prepaid Processing Mailer PK20, sold by almost any photo dealer, now does it. Back come slides from the nearest Kodak Processing Station, ready for the projector, just as though *everybody* expected to see green as blue, red as green, and infrared as red.

## ...but you may get trapped

So, having noted the above, one loads up a 35mm camera, mounts a KODAK WRATTEN Filter No. 12 in front of the lens to keep out blue light, and hires a light plane.

It's a beginning. Whether aloft, in the field, or in the lab, the most you have a right to expect from the first trial of infrared color film is encouragement. You are trying to put one of your private and more subjective sensory channels at the disposal of science. For science's sake, objectivity must be sought. Between the colors perceived and the hard facts conveyed through infrared reflectance, tight linkage is needed. Kodak color products and services that cover the visible spectrum sell well without a claim to fidelity. In the infrared the claim would be meaningless. Reproducibility is what matters.

Unless that first set of slides back from the processing station has answered all questions and exhausted the line of inquiry, more photography is called for. Perhaps quite a bit more before one learns the look that one is looking for. One would like to be able to count on constancy of rendition.

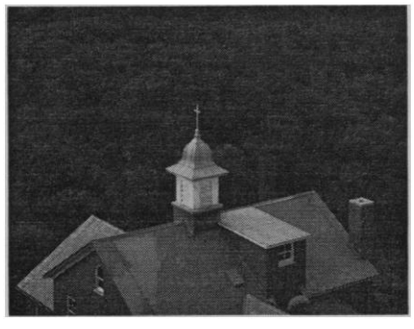
A very small difference in the proportions of three dyes at a given point in the picture can make a very big difference in the look. That it works at all is a miracle. Yet daily in darkrooms the world around, dyes are made to form in something like the right proportions, through manual methods, in small tanks, by people whose principal interest is *not* photographic processing. It stands to reason that automatic equipment in continuous operation under control of specialists might yield more reproducible results. It further stands to reason that for even better reproducibility the specialists should concentrate on that, rather than on providing enjoyment to millions of families the way Kodak processing specialists do. An important inquiry where photography is important may deserve its own specialists.

The trend has been strong in recent years toward high-volume processing. The chemical engineers who design the machines and take pride in their efficiency want high operating temperatures. This influences the design of the films.

*Therefore where color photography—infrared or not—finds important use as a tool of investigation more than just communication, it is well to maintain frequent contact with Kodak, Scientific Photography Markets, Rochester, N.Y. 14650.*

We also feel obligated to point out that direct infrared photography *without color* is less demanding while still intriguing. What would the student conclude from this comparison?

PANCHROMATIC



INFRARED