Oscilloscope Applications

From Late '60's Tektronix Annual Reports

The scope market, a highly dynamic one, is greatly affected by the impact of new and improved products, that do existing jobs better, or let man do something he has never before done—or, not uncommonly, even thought of doing.

Thus the Tektronix oscilloscope is an enabling instrument; many of today's giant economic enterprises were born because of it. Had this instrument *not* been on hand to make the necessary measurements in the first place, those industries might well still be only gleams in someone's eyes.

The oscilloscope is the major and most common instrument of the electronics industry. This year, as each year, other scientific and economic disciplines made it *their* tool also.

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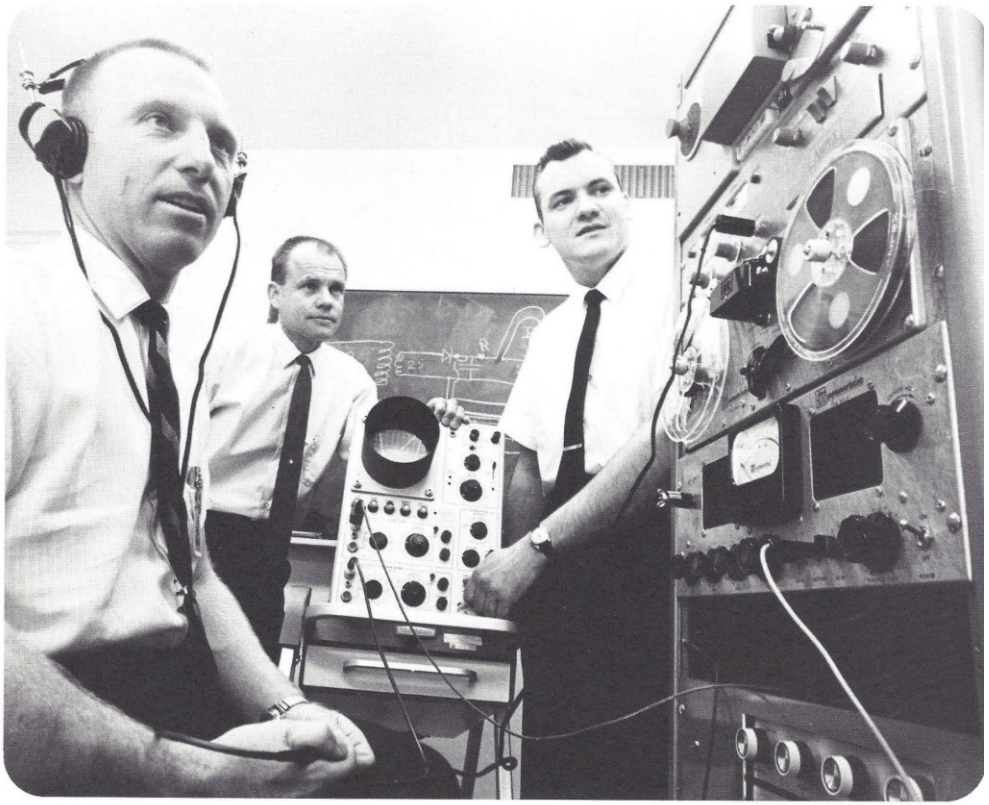
THE UBIQUITOUS OSCILLOSCOPE

One of the century's most important scientific contributions—an instrument largely responsible for the creation of today's amazing electronics industry—the oscilloscope has nevertheless been overshadowed in the public eye by more spectacular or flamboyant achievements.

Yet today, few areas of science or technology exist that do not depend on it.

An alert viewer of photographs may corroborate that statement. In the press, on television, in magazines, increased pictorial coverage is given to pictures of scientific achievements and programs. Study such photographs carefully. In the background, somewhere, is there not an oscilloscope? Odds are in your favor that it was produced by Tektronix.

In the product preference poll conducted by Electronics magazine among its subscribers this year, the oscilloscope drew more reader mentions than any other instrument. And, when asked to name the oscilloscope manufacturer they preferred, *92.8 per cent of the respondents answered "Tektronix."*



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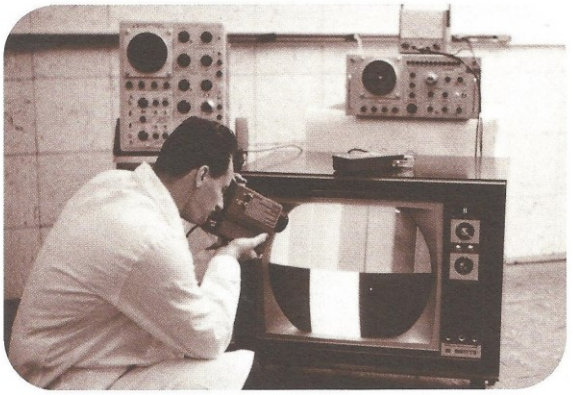
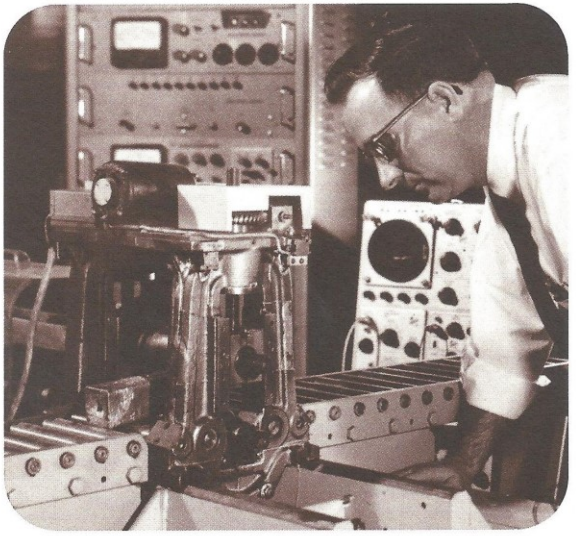
RARE INDEED is the technology that does not use oscilloscopes. The versatile measuring instrument is shown here in a variety of applications: (Top left) the gill movements of a goldfish are displayed on a storage oscilloscope, in a US Naval Research program. (Bottom left) an oscilloscope finds a job to perform in the research department of Menninger Foundation, Topeka, Kansas. (Top center) Tektronix equipment monitors color television signals at Sylvania Electric Products. (Bottom center) a miniature rolling mill for automation studies, at Republic Steel Corporation, makes use of an oscilloscope display. (Right) communication response of dolphins is tested, using Tektronix instruments, at the Communications Research Institute in Miami. (Sylvania photo copyright, 1964, Electronic Technician, Ojibway Press, Ojibway Building, Duluth, Minn. 55802. Other photos courtesy US Navy, Menninger Foundation and Republic Steel Corporation.)





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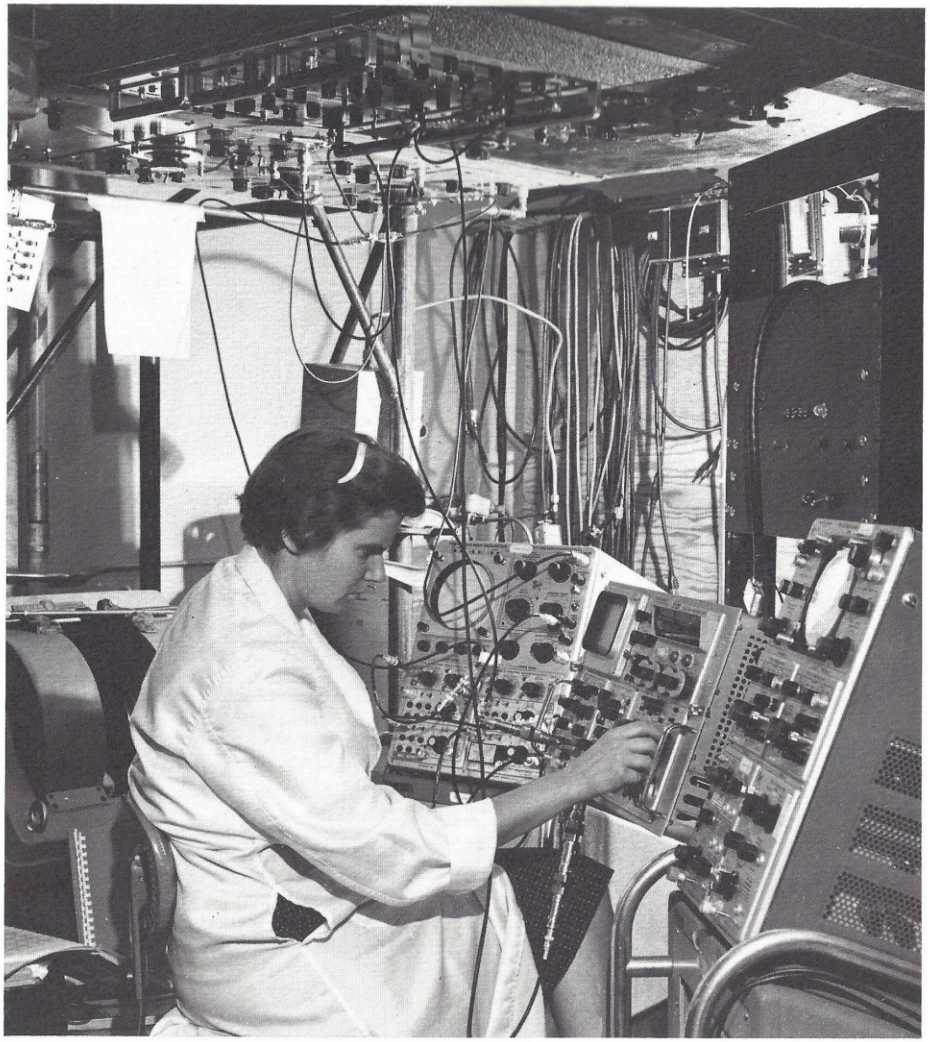

THE UBIQUITOUS OSCILLOSCOPE

New models of oscilloscope will stretch the market by doing things no previous instrument could do. An equally important factor is the so-called "human gap" —the gap between what oscilloscopes *already* can do and what people have learned to do with them. Outside the electronics industry—where the oscilloscope is the most important tool—increasingly, other disciplines are learning the "language" of electronic measurement.

Often a new application results from sudden insight by an oscilloscope owner, coupling his instrument's capabilities to entirely new kinds of problems. Or, often, it is the Tektronix field engineer who suggests how an oscilloscope might help.

Typical of thousands of "call reports" sent in by our FEs during the year are those on the next page, indicating the increasingly wide spectrum of uses to which people are putting this versatile instrument.

RESEARCH INTO plasma physics—the so-called "fourth state of matter"—makes use of three Tektronix oscilloscopes in this scientific laboratory. Controlled fusion of plasma particles, some physicists believe, could supply a source of energy to meet the world's needs for some 20 billion years.

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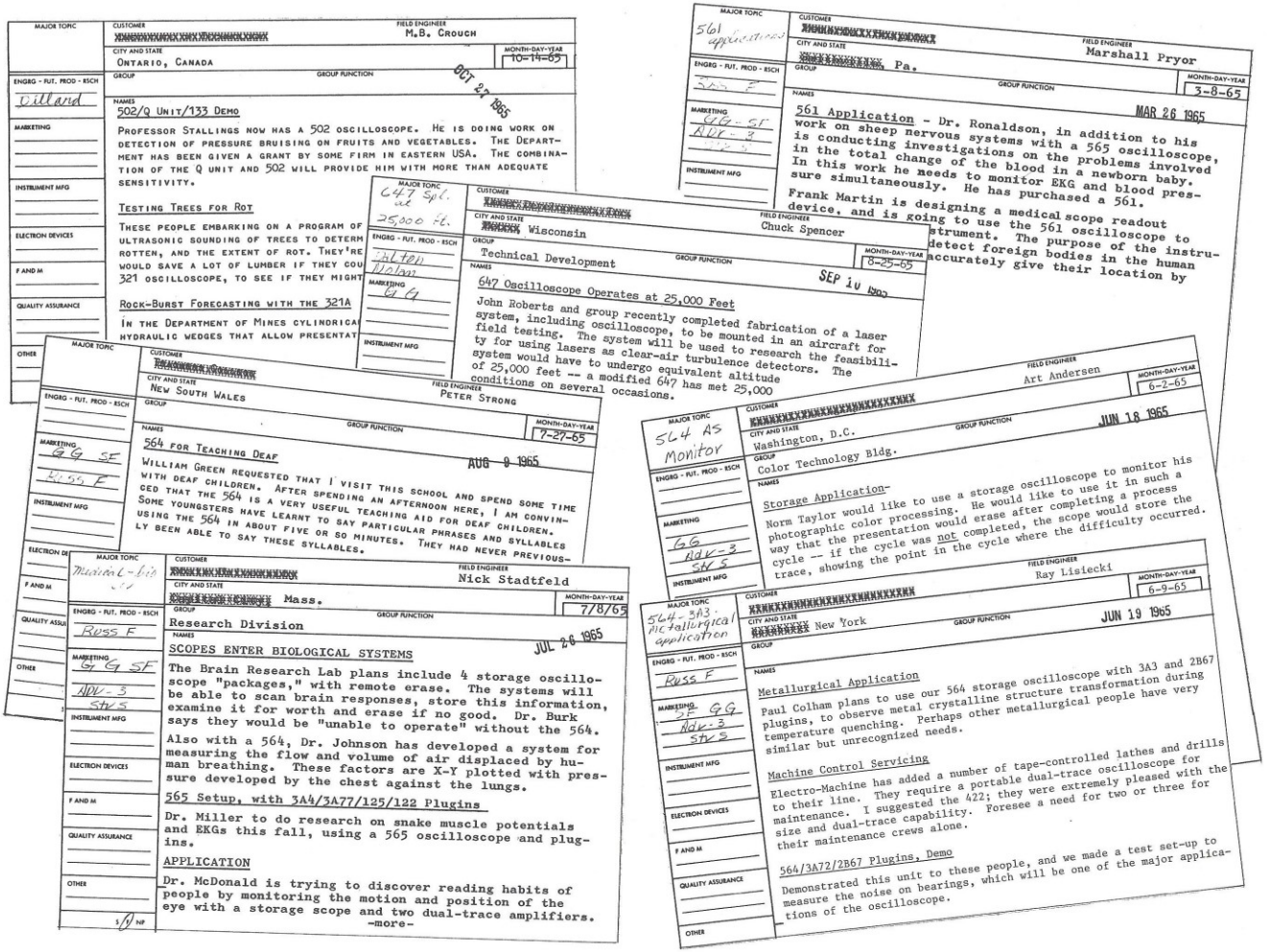

MAJOR TOPIC

CUSTOMER [redacted]

FIELD ENGINEER M.B. Crouch

CITY AND STATE Ontario, Canada

MONTH-DAY-YEAR 10-14-65

ENGRG - FUT. PROD - RSCH Dillard

GROUP

GROUP FUNCTION

OCT 27 1965

NAMES

502/Q Unit/133 Demo

Professor Stallings now has a 502 oscilloscope. He is doing work on detection of pressure bruising on fruits and vegetables. The Department has been given a grant by some firm in eastern USA. The combination of the Q unit and 502 will provide him with more than adequate sensitivity.

Testing Trees for Rot

These people embarking on a program of ultrasonic sounding of trees to determ rotten, and the extent of rot. They're would save a lot of lumber if they cou 321 oscilloscope, to see if they might

Rock-Burst Forecasting with the 321A

In the Department of Mines cylindrica hydraulic wedges that allow presentat

MARKETING

INSTRUMENT MFG

ELECTRON DEVICES

F AND M

QUALITY ASSURANCE

OTHER

MAJOR TOPIC 561 application

CUSTOMER [redacted]

FIELD ENGINEER Marshall Pryor

CITY AND STATE [redacted] Pa.

MONTH-DAY-YEAR 3-8-65

ENGRG - FUT. PROD - RSCH Sam F

GROUP

GROUP FUNCTION

MARKETING GG - SF Adv - 3 Stv 5

INSTRUMENT MFG

NAMES

MAR 26 1965

561 Application - Dr. Ronaldson, in addition to his work on sheep nervous systems with a 565 oscilloscope, is conducting investigations on the problems involved in the total change of the blood in a newborn baby. In this work he needs to monitor EKG and blood pressure simultaneously. He has purchased a 561.

Frank Martin is designing a medical scope readout device, and is going to use the 561 oscilloscope to strument. The purpose of the instru- detect foreign bodies in the human accurately give their location by

MAJOR TOPIC 647 Spl. at 25,000 ft.

CUSTOMER [redacted]

FIELD ENGINEER Chuck Spencer

CITY AND STATE [redacted] Wisconsin

MONTH-DAY-YEAR 8-25-65

ENGRG - FUT. PROD - RSCH Alfen Nolan

GROUP Technical Development

GROUP FUNCTION

MARKETING GG

INSTRUMENT MFG

NAMES

SEP 10 1965

647 Oscilloscope Operates at 25,000 Feet

John Roberts and group recently completed fabrication of a laser system, including oscilloscope, to be mounted in an aircraft for field testing. The system will be used to research the feasibility for using lasers as clear-air turbulence detectors. The system would have to undergo equivalent altitude of 25,000 feet -- a modified 647 has met 25,000 conditions on several occasions.

MAJOR TOPIC

CUSTOMER [redacted]

FIELD ENGINEER Peter Strong

CITY AND STATE New South Wales

MONTH-DAY-YEAR 7-27-65

ENGRG - FUT. PROD - RSCH

GROUP

GROUP FUNCTION

MARKETING GG SE Adv - 5 Stv 5

INSTRUMENT MFG

NAMES

AUG 9 1965

564 for Teaching Deaf

William Green requested that I visit this school and spend some time with deaf children. After spending an afternoon here, I am convinced that the 564 is a very useful teaching aid for deaf children. Some youngsters have learnt to say particular phrases and syllables using the 564 in about five or so minutes. They had never previously been able to say these syllables.

MAJOR TOPIC 564 As Monitor

CUSTOMER [redacted]

FIELD ENGINEER Art Andersen

CITY AND STATE Washington, D.C.

MONTH-DAY-YEAR 6-2-65

ENGRG - FUT. PROD - RSCH

GROUP Color Technology Bldg.

GROUP FUNCTION

MARKETING GG Adv-3 Stv 5

INSTRUMENT MFG

NAMES

JUN 18 1965

Storage Application-

Norm Taylor would like to use a storage oscilloscope to monitor his photographic color processing. He would like to use it in such a way that the presentation would erase after completing a process cycle -- if the cycle was not completed, the scope would store the trace, showing the point in the cycle where the difficulty occurred.

MAJOR TOPIC Medical - bio

CUSTOMER [redacted]

FIELD ENGINEER Nick Stadtfeld

CITY AND STATE [redacted] Mass.

MONTH-DAY-YEAR 7/8/65

ENGRG - FUT. PROD - RSCH Russ F

GROUP Research Division

GROUP FUNCTION

MARKETING GG SF Adv - 3 Stv 5

INSTRUMENT MFG

ELECTRON DEVICES

F AND M

QUALITY ASSURANCE

OTHER

NAMES

JUL 26 1965

SCOPES ENTER BIOLOGICAL SYSTEMS

The Brain Research Lab plans include 4 storage oscilloscope "packages," with remote erase. The systems will be able to scan brain responses, store this information, examine it for worth and erase if no good. Dr. Burk says they would be "unable to operate" without the 564.

Also with a 564, Dr. Johnson has developed a system for measuring the flow and volume of air displaced by human breathing. These factors are X-Y plotted with pressure developed by the chest against the lungs.

565 Setup, with 3A4/3A77/125/122 Plugins

Dr. Miller to do research on snake muscle potentials and EKGs this fall, using a 565 oscilloscope and plugins.

APPLICATION

Dr. McDonald is trying to discover reading habits of people by monitoring the motion and position of the eye with a storage scope and two dual-trace amplifiers.

-more-

MAJOR TOPIC 564 - 3A3. Metallurgical application

CUSTOMER [redacted]

FIELD ENGINEER Ray Lisiecki

CITY AND STATE [redacted] New York

MONTH-DAY-YEAR 6-9-65

ENGRG - FUT. PROD - RSCH Russ F

GROUP

GROUP FUNCTION

MARKETING SF GG Adv-3 Stv 5

INSTRUMENT MFG

ELECTRON DEVICES

F AND M

QUALITY ASSURANCE

OTHER

NAMES

JUN 19 1965

Metallurgical Application

Paul Colham plans to use our 564 storage oscilloscope with 3A3 and 2B67 plugins, to observe metal crystalline structure transformation during temperature quenching. Perhaps other metallurgical people have very similar but unrecognized needs.

Machine Control Servicing

Electro-Machine has added a number of tape-controlled lathes and drills to their line. They require a portable dual-trace oscilloscope for maintenance. I suggested the 422; they were extremely pleased with the size and dual-trace capability. Foresee a need for two or three for their maintenance crews alone.

564/3A72/2B67 Plugins, Demo

Demonstrated this unit to these people, and we made a test set-up to measure the noise on bearings, which will be one of the major applications of the oscilloscope.

THE VERSATILE OSCILLOSCOPE

To fully realize the span of oscilloscope uses, consider the well-worn observation that "Ours is a fast-changing world."

The oscilloscope is the major instrument for measuring changing phenomena. Its uses are limited only by the kinds and number of changes that man needs to know about. Today that number is vast, and growing. Thus the "oscilloscope market" is an agglomerate of very many markets, each with its own particular needs.

It is very difficult to conceive of an "event" that an oscilloscope couldn't someday measure.

A Tektronix laboratory oscilloscope can measure phenomena occurring in *a fraction of a millionth of a second,* or longer than a minute. It is very complex, but its principles are easy to learn. *The oscilloscope draws a graph of some "event" so someone can measure the amount of that event and how long it lasts.*

It has three major segments:

The CRT, or cathode-ray tube (like a TV picture tube), on whose fluorescent face the graph appears. A focused electronic beam from the CRT cathode makes the screen glow, a spot of light. This spot—which can be moved up and down or from side to side—draws the graph on the tube face, much as a pencil does on paper.

The time-base generator, whose electrical signal moves the spot across the screen at a uniform speed, left to right, repeatedly. The screen is ruled off like a sheet of graph paper. You can make the spot cross the screen at almost any rate—one second per ruled division, a hundred/millionth of a second (or less) per division.

At slow speeds you *see* the spot move. At very fast speeds, it appears as a solid line.

The vertical amplifier, which, when connected to a changing voltage, moves the spot up and down. You can make each vertical ruled division represent many volts, or a small fraction of one volt. The number of divisions the spot moves tells you the voltage of the signal —and thus the amplitude of whatever phenomenon that voltage represents: Heat, light, sound, gravity, pressure, acceleration, chemical reaction . . .

Thus the oscilloscope plots a graph of an electrical event—or of any phenomenon converted to voltage. This graph tells whether the voltage is changing positively or negatively; the amplitude and duration of the event (or any portion of the event) and the shape of the waveform.

Phenomena that happen over and over produce a continuous image on the screen. But the oscilloscope can also graph events that happen *randomly,* or only *once*: An explosion, the radiation of particles as an atom is split . . . Even if the event happens only once and lasts only a millionth of a second, special cameras can record the graph as it flashes across the screen—and some oscilloscope types can even store the graph on the screen, and erase it when it's no longer needed.

In summary: The oscilloscope graphs the changes in some event with relation to time—measuring the *amplitude* of the event on its vertical axis, and *how long the event lasts* on its horizontal axis.

TO READ AN AD:

The technical language of an oscilloscope advertisement may baffle the layman. Oscilloscopes vary greatly, but have four basic characteristics. Somewhat simplified, they are:

Sensitivity (expressed in fractions of volts per vertical division) tells you how *small* a signal the oscilloscope can measure. Some Tektronix instruments can picture signals as small as one millionth of a volt.

Risetime tells you how *fast* a change an instrument can record on its vertical axis. Our highest-*frequency* oscilloscopes (those with shortest risetime) can picture signals occurring in billionths of a second —like those associated with nuclear phenomena. An instrument's range of frequencies is called its *bandwidth* (expressed now in Hertz, or cycles per second.)

Sweep Range (expressed in time per horizontal division) tells you how fast and how slowly a CRT beam can cross the screen. The wider this range, the greater the variety of waveforms you can look at. On almost all Tektronix oscilloscopes, the ratio of slow to fast sweeps is several hundred million to one.

Intensity (expressed in foot-lamberts) refers to the brightness of the display. It depends on the density of electrons in the CRT beam, and on the tube's voltage. Displays of one-shot events (which can't be "rewritten" as repetitive signals can) must have high intensity to be seen or recorded.

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Oscilloscopes vary also in several other characteristics. Some are lightweight and *portable;* some are designed for stationary *rack-mount* installation. Some can make a wide variety of *general-purpose* measurements, often through use of interchangeable plugin units; others are *special-purpose,* like our TV waveform monitor. One model also provides *digital readout*—presentation of signal information in numbers as well as waveforms.

They vary also in other special features, that allow:

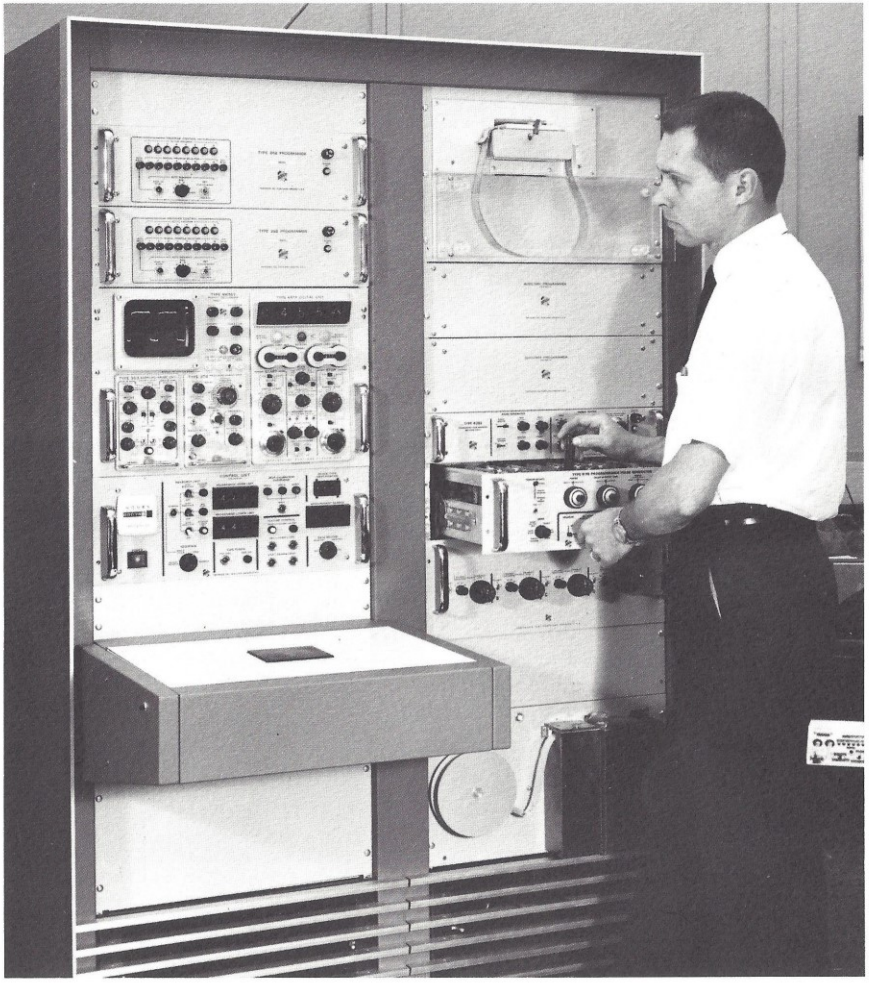
Comparison of simultaneous signals, by drawing two (or more) graphs at a time with a *dual-trace* or *dual-beam* instrument.

Storage, or retaining the waveform display after the signal ceases.

Spectrum analysis, by converting from a time base to a frequency base.

Sampling successive bits of a repetitive signal and assembling the samples into a graph of the waveform—thereby measuring events far too fast for conventional oscilloscopes.

And, oscilloscopes vary also in price. Our models range from $540 to $5200.



SYSTEMS—complex assemblies of coordinated instrumentation, including programmable oscilloscopes—are among the Tektronix products whose sales increased during the year. Used for testing transistors and integrated circuits, they can make a very large number of sequential measurements at extreme speeds.

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THE 454: A CASE IN POINT

The upper limits of a technology at a given moment are termed "the state of the art." From time to time, an instrument will emerge that can be called a-state-of-the-art achievement. The term is never applied lightly.

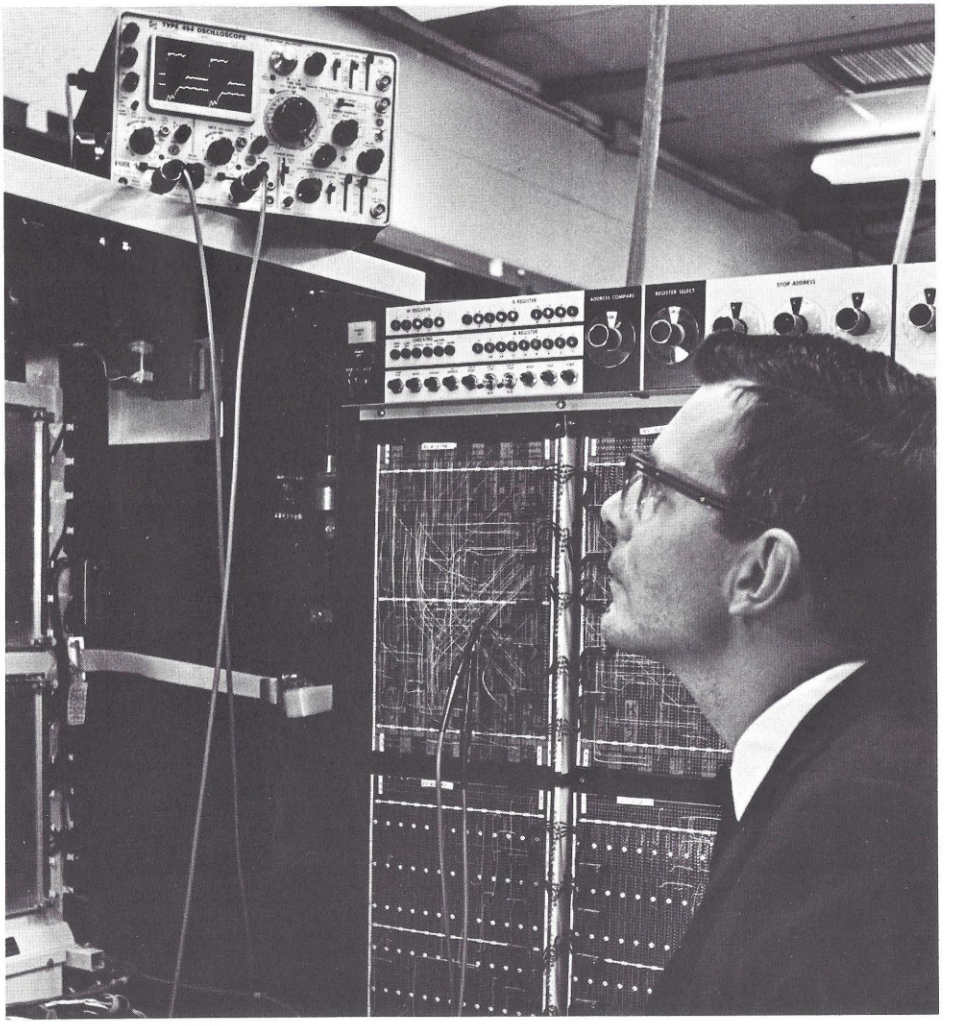
The Type 454 dual-trace portable, introduced in March, is a state-of-the-art oscilloscope.

Hailed by the electronics industry as a major advance, the 454 reasserted Tektronix' role as innovator and pace-setter in the demanding, competitive field of oscillography.

The 454 has a 150 MHz bandwidth (very few other oscilloscopes attain 100 MHz) and a 2.4 nsec risetime—with or without a probe. It has already received excellent response not only from the computer industry, for whom ruggedness and portability are essential, but also for general research applications, because of its advanced, versatile performance.

An oscilloscope is a complex, intricate and integrated *system;* each major segment and many minor ones must be specifically tailored to the intended performance requirements. Put another—and more trite—way, a 'scope is no stronger than its weakest link.

The 454's compact 30-pound package contains about 1500 electronic components and 700 mechanical parts, and as much variety in circuits as a giant electronic computer. And their accuracy must be *far greater* than the individual "on-off" circuits of a digital computer!



A TYPE 454 high-performance portable oscilloscope tests the circuitry of an IBM 360 computer.

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Because oscilloscope performance calls out unique and exceptional performance from so many of its segments, Tektronix in its 21 years has developed a highly vertically integrated operation—fancy words that say we've found it necessary, to attain superior performance or better service (or, less often, to gain cost advantage), to become our own major supplier.

The 454, typical of the technological advances for which Tektronix has been responsible, is worth analyzing to see just what it takes to make a state-of-the-art oscilloscope.

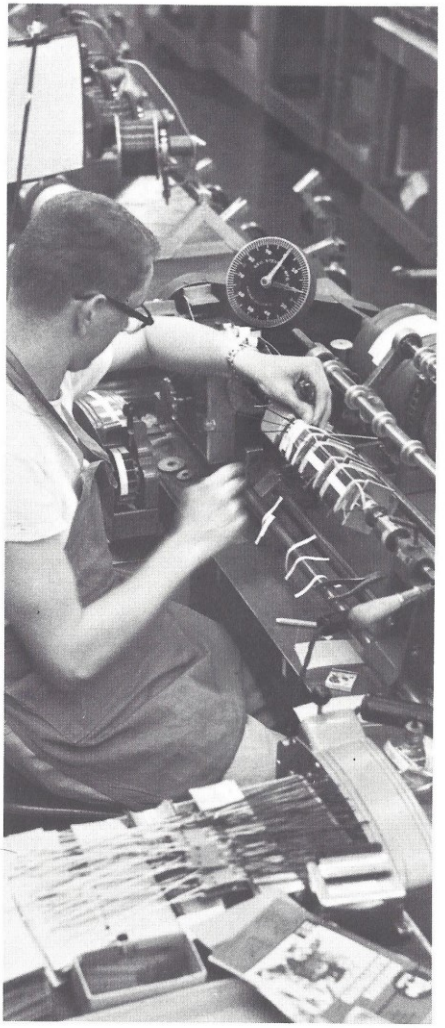
• *Probes,* devices that connect the oscilloscope to the circuit being measured.

For the scope's full measuring capability to be used, the signal must reach the instrument with the least loss or degradation. For most engineering applications, if you don't have performance at the probe tip—that is, at the circuit itself—the scope's specifications are meaningless. Thus the probe's risetime and bandwidth must exceed those of the scope itself.

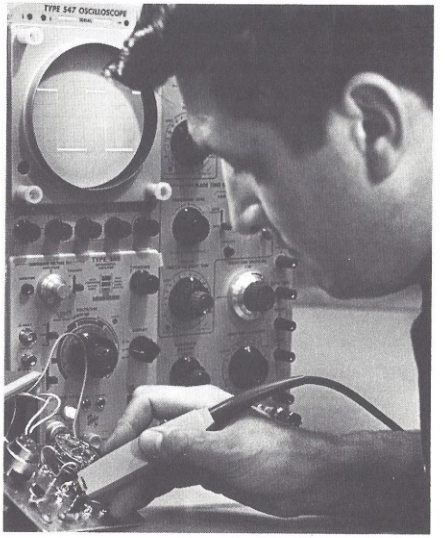
Observation of oscilloscopes in use hints strongly that, whatever make of scope a person buys, chances are he's using a Tektronix probe.

Our accessories group, responsible for probe design, also works with *transducers* of various kinds, devices that convert mechanical, chemical and other forms of energy into electrical energy, so an oscilloscope can measure it. We try to assure not only that the customer gets a superior instrument but also that he receives all the support we can give him in *using* that instrument. Through accessories development we are constantly improving his ability to connect to and easily use existing transducers.

Tektronix this year made its greatest advances to date in probe technology. With the "family" of state-of-the art probes specifically designed for the 454, and with our expanding ability to make use of a variety of transducers, we've gone a long way toward enabling the measurement of almost any phenomenon—from capturing a one-time-only nuclear burst to testing automotive engines.



AMONG THE IMPORTANT steps in the production of a state-of-the-art oscilloscope is transformer manufacture (left). To enable the user to take the scope's measurement capability to the circuit itself, Tektronix continues to add advanced models of current and voltage probes. Pictured below is the type P6046, a wide-bandwidth differential probe just introduced.



• *Cable.* Our probes, to achieve this superior performance, in turn require components with unique electrical and physical characteristics. One is special coaxial cable, produced by Tektronix.

Only a very few manufacturers in the entire world have the ability to make this kind of low-capacitance, thin-wire cable.

• *Ceramic and plastic parts.* Probes, and many oscilloscope components, also require unique parts made of plastic (for instance, tips for general or specific applications) or ceramic. Tektronix has its own advanced facilities for development of both materials, and for producing a wide variety of parts.

Whether the need is a complex cathode-ray tube or a new neon-bulb holder, the in-house ability to have it tailored to the instrument is a great advantage for the designer.

The 454 cathode-ray-tube envelope, made of ceramic, is produced by Tektronix.

• *The cathode-ray tube.* CRTs are intricate components, as complex as many instruments. Fourteen years ago, Tektronix—against strong advice from many in the industry—decided to build its own. By doing so, we greatly improved our ability to advance oscilloscope performance. Like all our CRTs, the tube for the 454 is specially designed to meet that particular instrument's requirements—including the ability to reproduce waveforms of extremely fast single-shot electrical events.

• *Transformers.* Tektronix, by manufacturing its own transformers to the exact requirements of the instrument, gains the maximum in efficiency. Our use of very high-quality iron in transformer laminations results in a high ratio of electrical performance to weight—an essential in portable instruments. The 454 transformer, like all of ours, is guaranteed for the life of the instrument—a guarantee no other scope manufacturer makes.

• *Component evaluation.* Today's technology accelerates; many components become obsolete by the time they're put into use. The instrument producer is barraged daily with new materials, new components and new claims. To assure that the optimum components are being used requires a thorough program of analysis and testing.

For instance, the 454 makes extensive use of plastic-encapsulated transistors, which give the customer a cost advantage. It was vital to make sure that their use would in no way compromise the required performance.

Component evaluation is heavily stressed here, for instrument reliability *is* what we sell.

• *Etched circuit boards.* The 454's portability and high performance benefit from extensive use of etched circuit boards, produced in our Electrochemistry plant, the largest specialized electrochemical facility in the Western United States.

Our probes, too, contain circuit boards, with very high density of subminiature electronic components.

• *Other components.* The 454's performance also relies on Tektronix-built precision capacitors, potentiometers, delay lines....

This year, a nagging problem was solved by the development of a line-voltage selector. Standard line voltage in the U.S. is 115 volts; in many other nations it is 230 volts. Existing methods of changing to the correct range were not satisfactory. The need was to develop our own; once again, the ability existed, in-house, to do the job.

The above are only a few examples of the critical skills required to produce the parts of the intricate electronic system that is our product. (And this doesn't even mention the prime role of the instrument design engineers, for whom these superb components are the raw material from which to create a new oscilloscope.)

In *all* our areas, "It has to be Tek quality," is an informal but demanding criterion; in meeting it, men and women with unique and highly developed skills play a wide variety of crucial roles in instrument development and production. It goes (maybe too often) without saying that Tektronix is very proud of them all.

ETCHED CIRCUIT boards are among the components manufactured at Tektronix. In the 454, boards provide critical spacing and alignment, enabling instrument portability as well as high performance.

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THE LABORATORY OSCILLOSCOPE

One electron weighs .000000000000000000-000000003 of an ounce. It would take over one billion of them to equal the thickness of this page. Electrons move at incredible speeds.

Yet man has put them to use.

His existence today, and his survival tomorrow, depend in large degree on the seemingly impossible task of manipulating, and measuring, the movement of electrons. One giant segment of industry is *called* Electronics; yet very few of man's endeavors today are *non*-electronic.

Voltage changes occurring hundreds of millions of times a second are one reason a high-speed computer "thinks" so fast. To measure such changes demands superb instruments. The laboratory oscilloscope is one such instrument.

A Tektronix oscilloscope can present a stable "picture" of electrical "events," or changes, occurring in a fraction of a millionth of a second, as well as those lasting longer than a minute. It enables a scientist or engineer to peer into a slender fragment of time and learn more about some particular change that matters to him.

Today, the kinds of changes that man needs to know about are countless. The major instrument for measuring them is the oscilloscope.

The oscilloscope draws a graph of some "event" so someone can measure the magnitude of that event and how long it lasts.

It has three major segments:

• The CRT, or cathode-ray tube (like a TV picture tube), on whose fluorescent face the graph appears. A focused electronic beam from the CRT cathode makes the screen glow, a spot of light. This spot—moved up and down and from side to side—draws the graph on the tube face, much as a pencil does on paper.

• The time-base generator, whose electrical signal moves the spot across the screen at a uniform speed, left to right, repeatedly. The screen is ruled off like a sheet of graph paper. You can make the spot cross the screen at almost any rate—one second per ruled division, a hundred/millionth of a second (or less) per division.

When this spot moves faster than the eye can follow, it becomes a *trace.* On a conventional oscilloscope, the trace, if it is repeated 20 or more times per second, appears as a solid line; on storage oscilloscopes, a *single* trace can be recorded as a line.

• The vertical amplifier, which, when connected to a changing voltage, moves the spot up and down. You can make each vertical ruled division represent many volts, or a small fraction of one volt. The number of divisions the spot moves tells you the signal voltage—and thus the magnitude of whatever that voltage represents: Heat, light, sound, gravity, pressure . . .

Thus the oscilloscope plots a graph of an electrical event—or of any phenomenon converted to voltage. This graph tells whether the voltage is changing positively or negatively; the amplitude and duration of the event (or any portion of the event) and the shape of the waveform.

Phenomena that happen over and over produce a continuous image on the screen. But the oscilloscope can also graph events that happen randomly, or only once: An explosion, the radiation of particles as an atom is split . . . Even if the event happens only once and lasts only a millionth of a second, special cameras can record the graph as it flashes across the screen. Or, some oscilloscope types store the graph on the screen, for as long as needed.

In summary: The oscilloscope graphs the changes in some event with relation to time—measuring the amplitude of the event on its vertical axis, and how long the event lasts on its horizontal axis.

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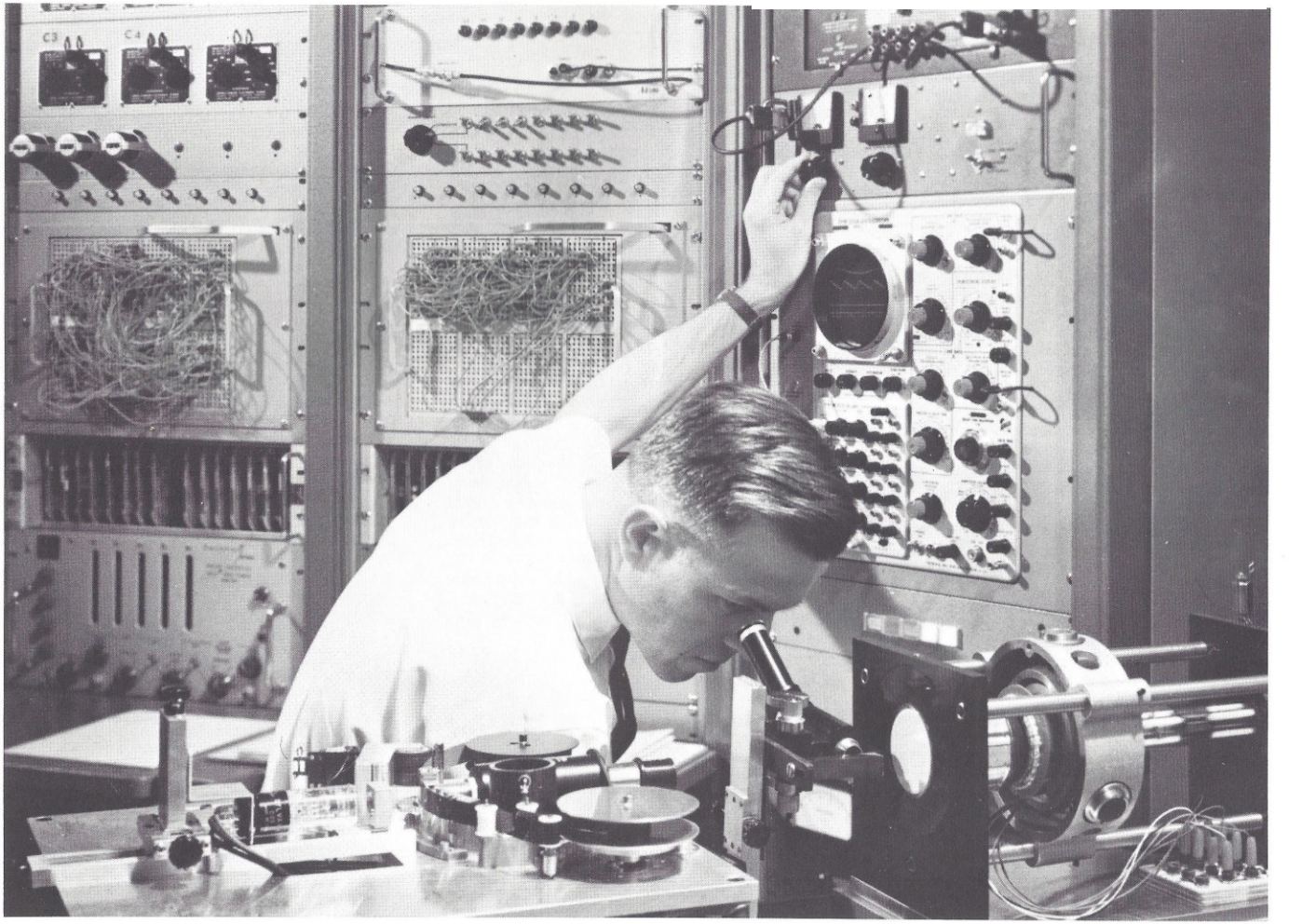
SYSTEMS that merge the potential of photography with the capabilities of electronics are under study at Eastman Kodak Company. A Tektronix oscilloscope is an integral part of the laboratory equipment. (Photo courtesy Eastman Kodak.)



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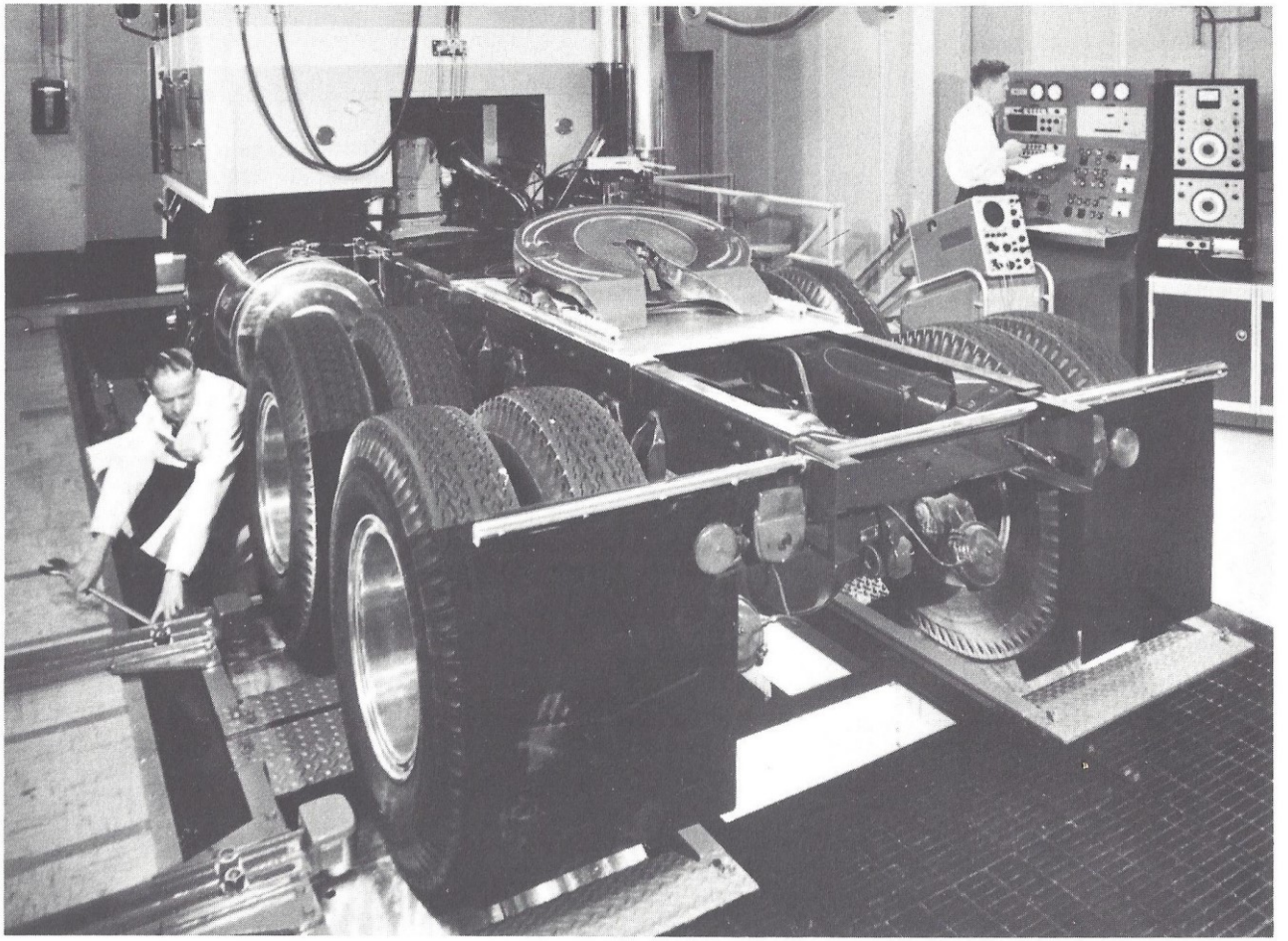

SEVERE TRUCK VIBRATION problem is duplicated in "bogey bop" test at Ford Motor Company. Increasing use is being made of oscilloscopes in automotive research laboratories. A Tektronix instrument is pictured. (Photo courtesy of Production Magazine and Ford Motor Company.)

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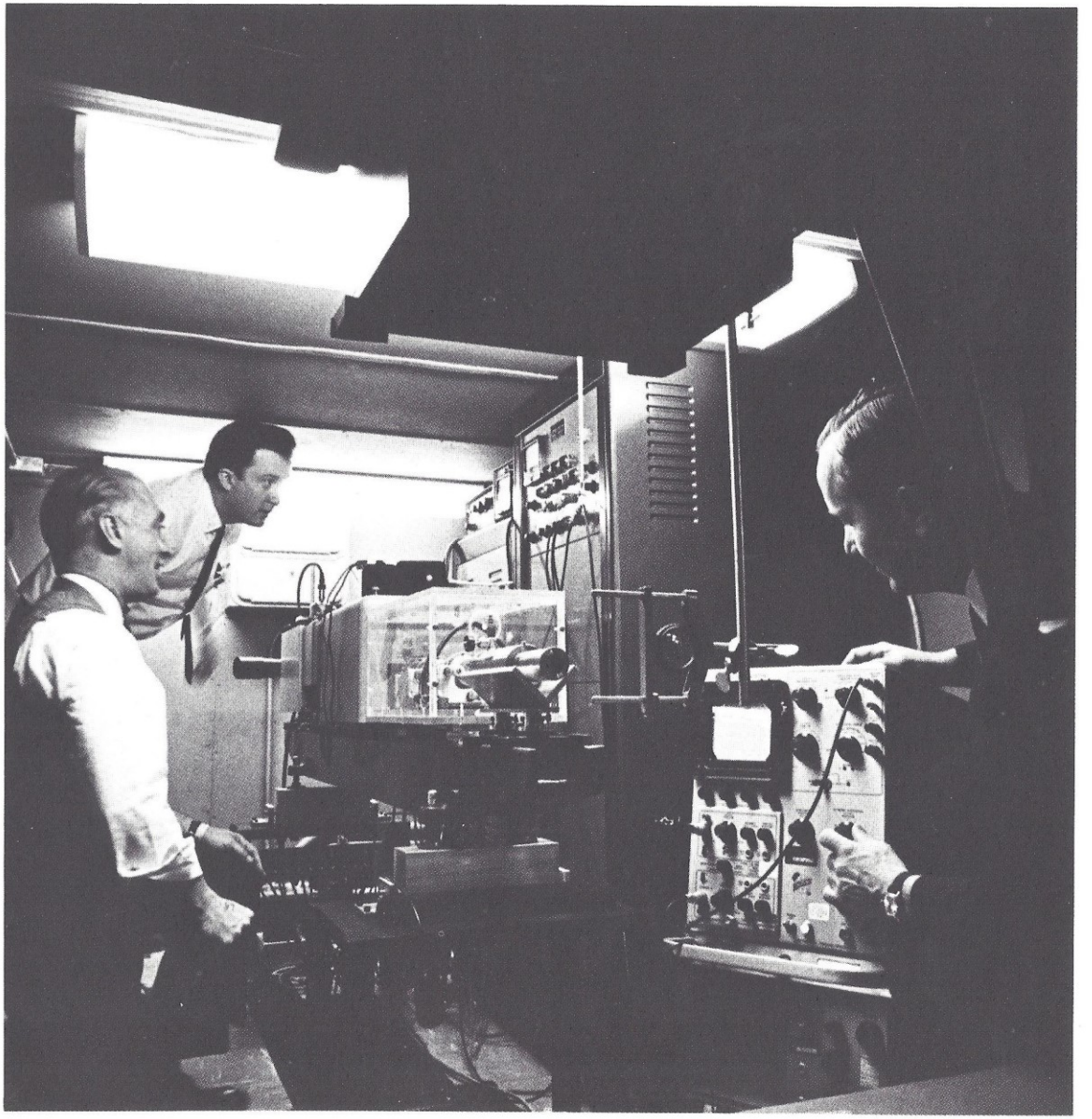
SPECTRUM-TUNED laser measures the location and concentration of gases and particles in the upper atmosphere. Tektronix oscilloscope is essential in this research activity. (Photo courtesy GCA Corporation.)



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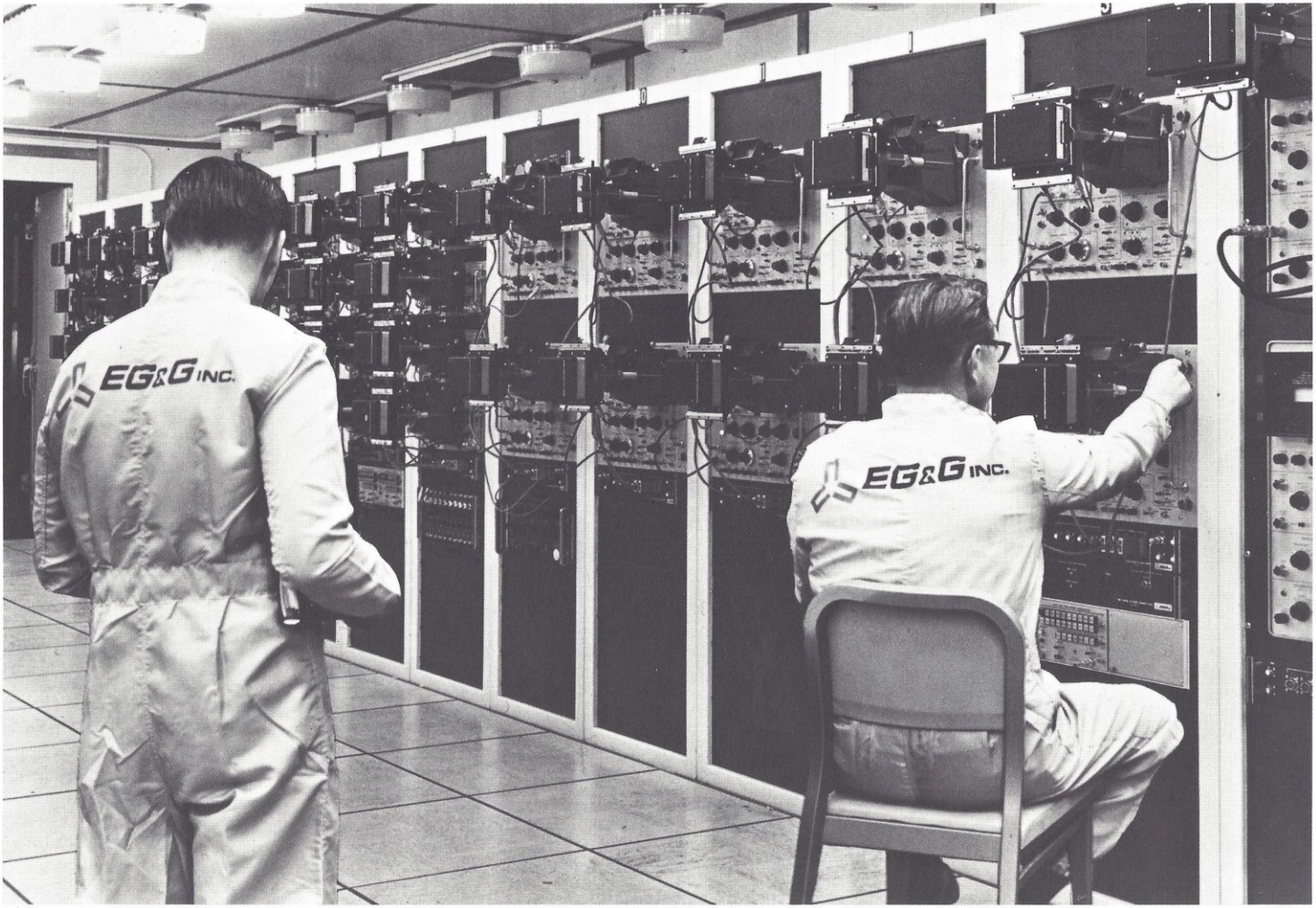
EXTENSIVE RECORDING equipment in the data room at EG&G, Inc. helps conduct vulnerability studies for the U.S. Air Force. Count the Tektronix oscilloscopes and scope cameras.



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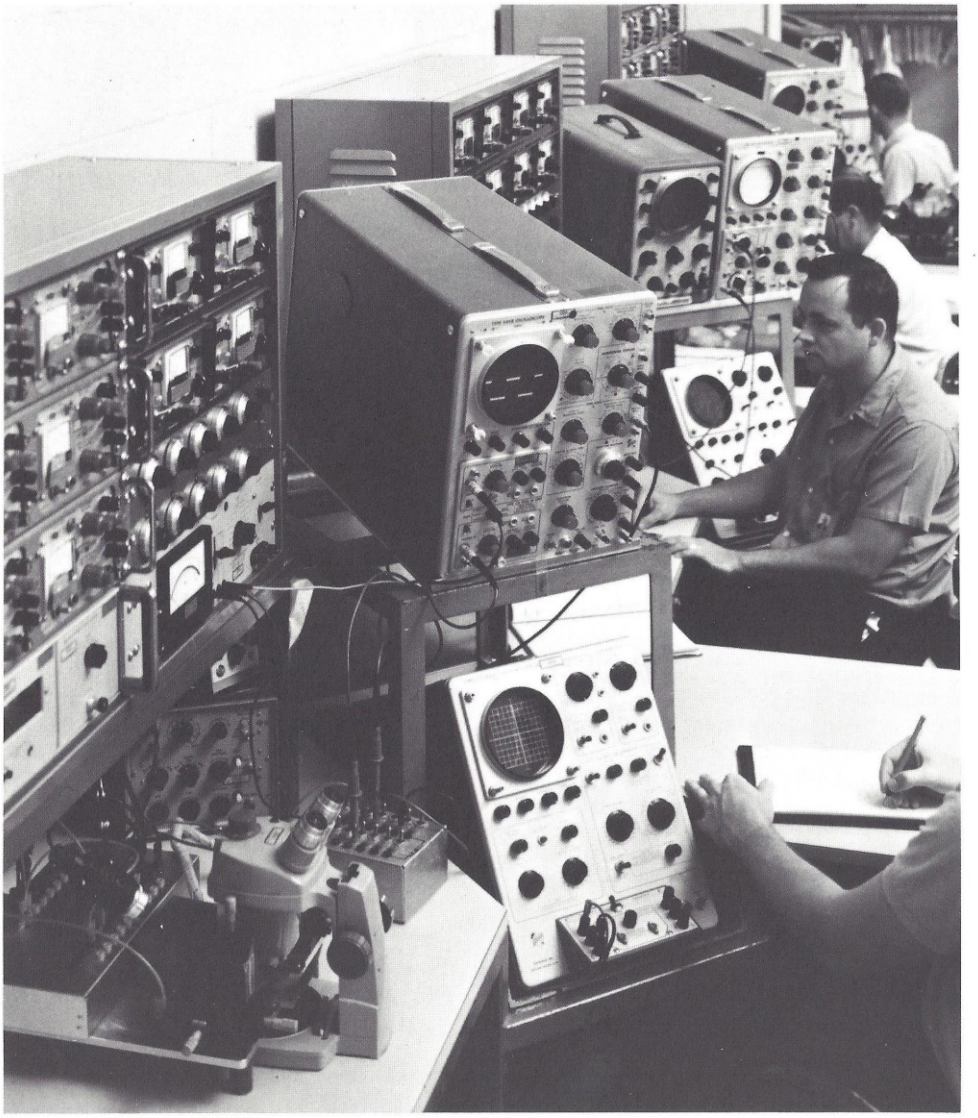

SOPHISTICATED INSTRUMENTATION is needed by Texas Instruments, Inc. for its semiconductor failure analysis laboratory. Eight oscilloscopes are pictured here; six are Tektronix instruments. (Photo courtesy Texas Instruments.)

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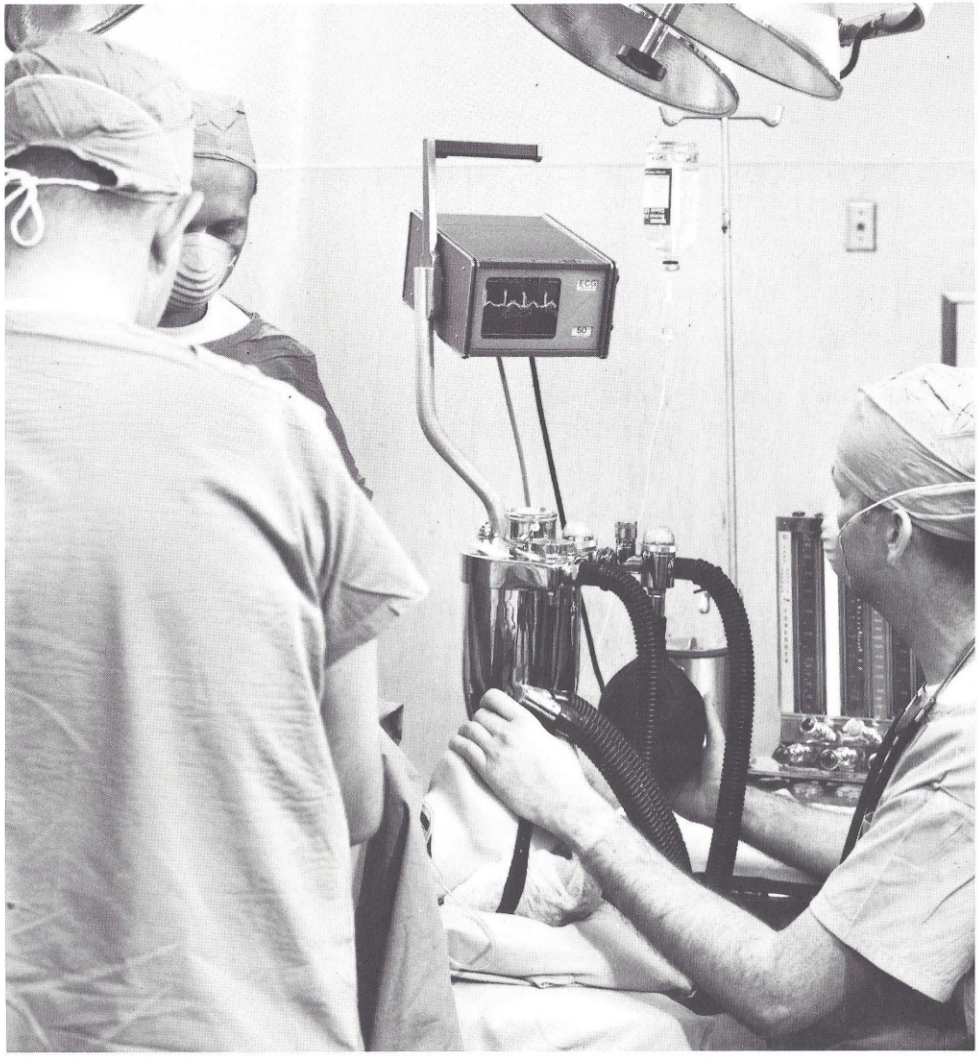
• *Medical electronics.* Indicative of Tektronix' attention to this market is the type 410 physiological monitor, to be introduced this month at San Francisco's WESCON electronics show. It meets needs of that profession that have been served by general-purpose oscilloscopes, and should be an important addition to medical instrumentation. The day draws nearer when an oscilloscope is as familiar to the physician as a stethoscope.



A CONTRIBUTION to medical electronics is the Tektronix type 410 physiological monitor, a special-purpose instrument introduced this month. It is shown here at the University of Oregon Medical School, displaying the heartbeat of a patient in surgery.

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LIKE ALMOST ANY TELEVISION studio you might walk into, Portland's KGW-TV relies on Tektronix TV instruments to help insure the quality of the transmitted video signal. Numerous type 529 waveform monitors are shown here.

• *Television instruments.* Two new all-solid-state instruments were introduced to meet the increased requirements of the television industry. They will, we are confident, become the industry's standards, as are the present Tektronix instruments. The type 528, a waveform monitor, complements the type 529; the type 520, a vectorscope, replaces the type 526. Both new instruments have taken into account the added requirements of color programming, which in a few short years has become not the exception but the rule in broadcasting.

The 520, in particular, which was brought out in the absence of any competing vectorscopes, typifies Tektronix' attitude toward product innovation. Our policy, to develop instruments whenever we can discern a present or future need and meet it, rather than merely react to competitive pressures, has had one result worth noting: Usually the thing that makes a Tektronix product obsolete is another Tektronix product.

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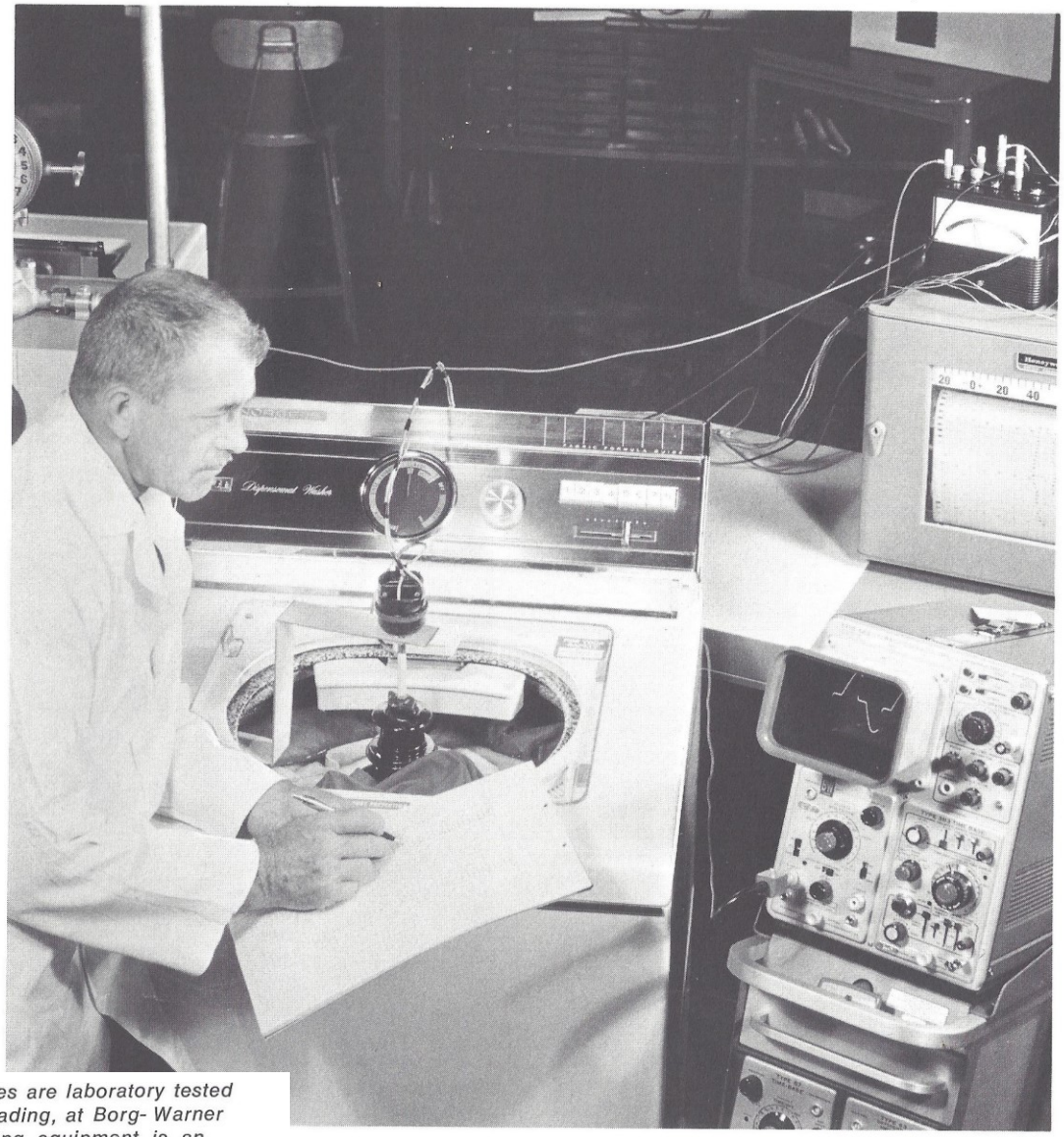

Automatic washing machines are laboratory tested for vibration, cycling and loading, at Borg- Warner Corporation. Electronic testing equipment is an increasingly familiar sight throughout the commercial world. (Photos courtesy Industrial Electronics magazine, BBC, Borg-Warner.)

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A NECESSARY TOOL in the manufacture of computers at National Cash Register Company, Dayton, Ohio, is the Tektronix oscilloscope. Several Tektronix instruments are in evidence in this photograph of the NCR production area.

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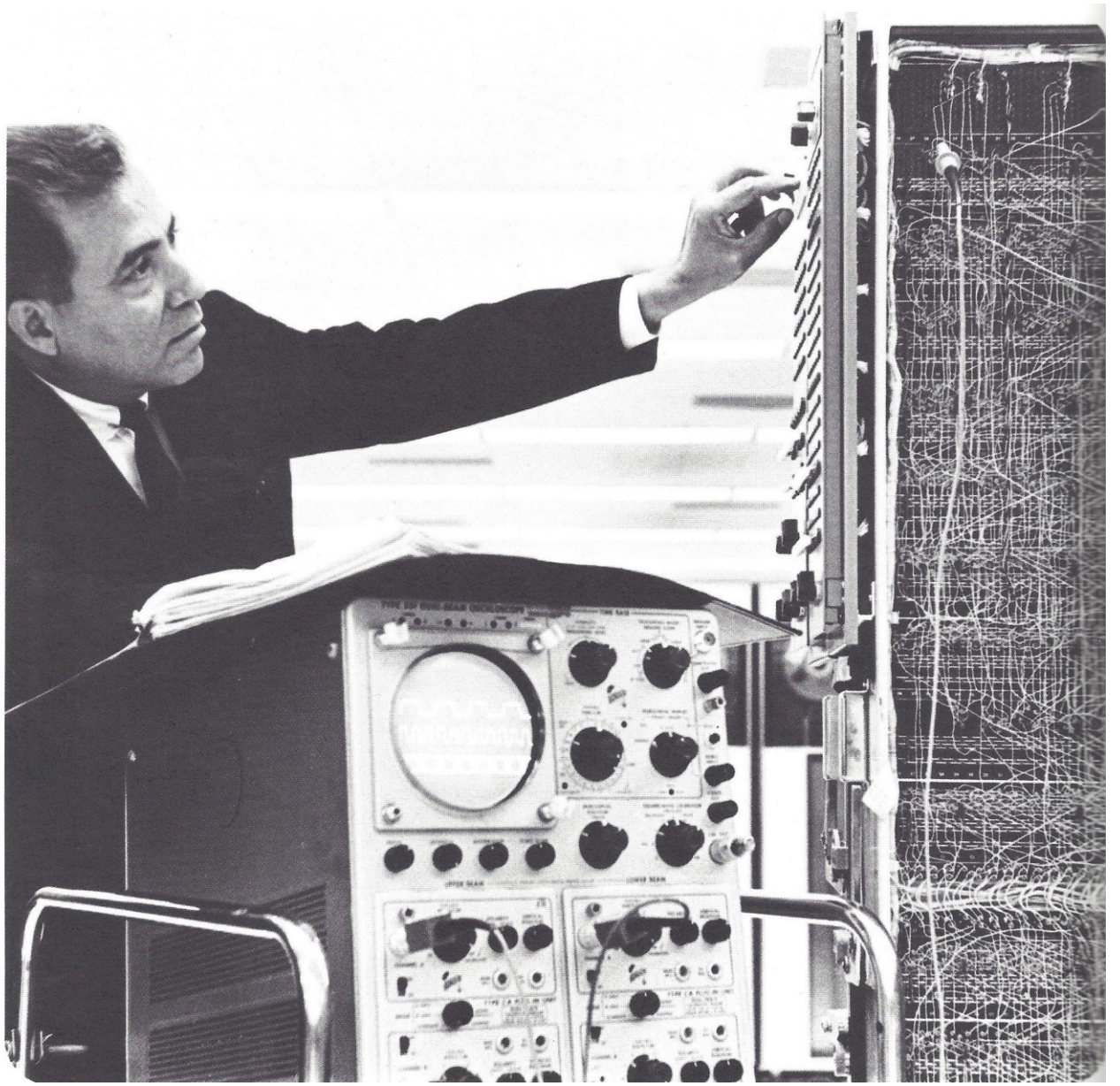
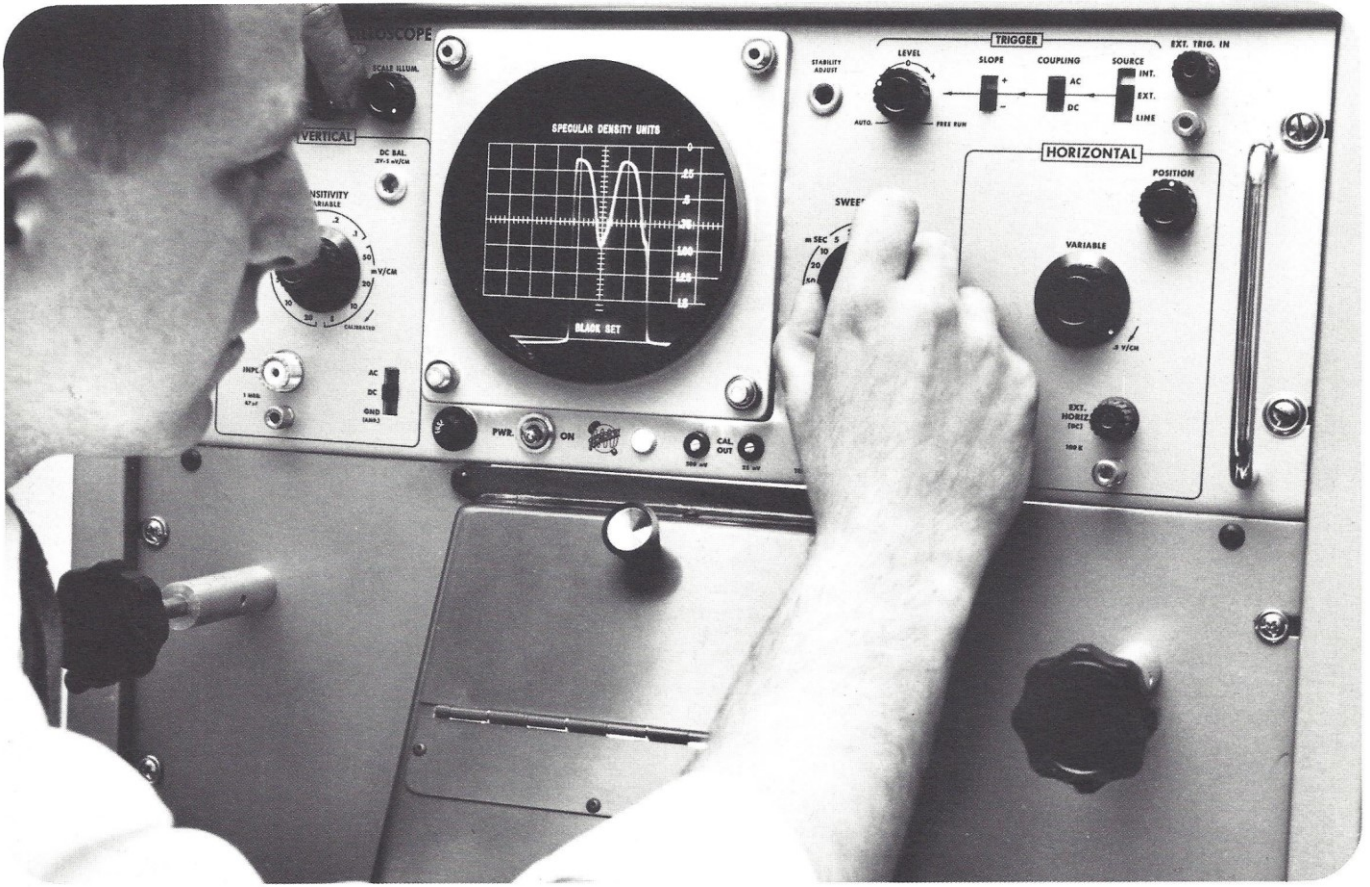
A VITAL TOOL of the computer industry is the Tektronix oscilloscope. Below, an IBM field engineer uses a dual-beam instrument for preventive-maintenance servicing of a computer.



1965 Tektronix Annual Report

A Tektronix rackmount model is used to measure transmission density of film, at Xerox Corporation. (Photos courtesy IBM and Xerox Corporation.)



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VIDEO-TAPE recorder is used for experimental color television work in the British Broadcasting Corporation's Engineering department, London. A Tektronix oscilloscope and a waveform monitor are included in the studio equipment.