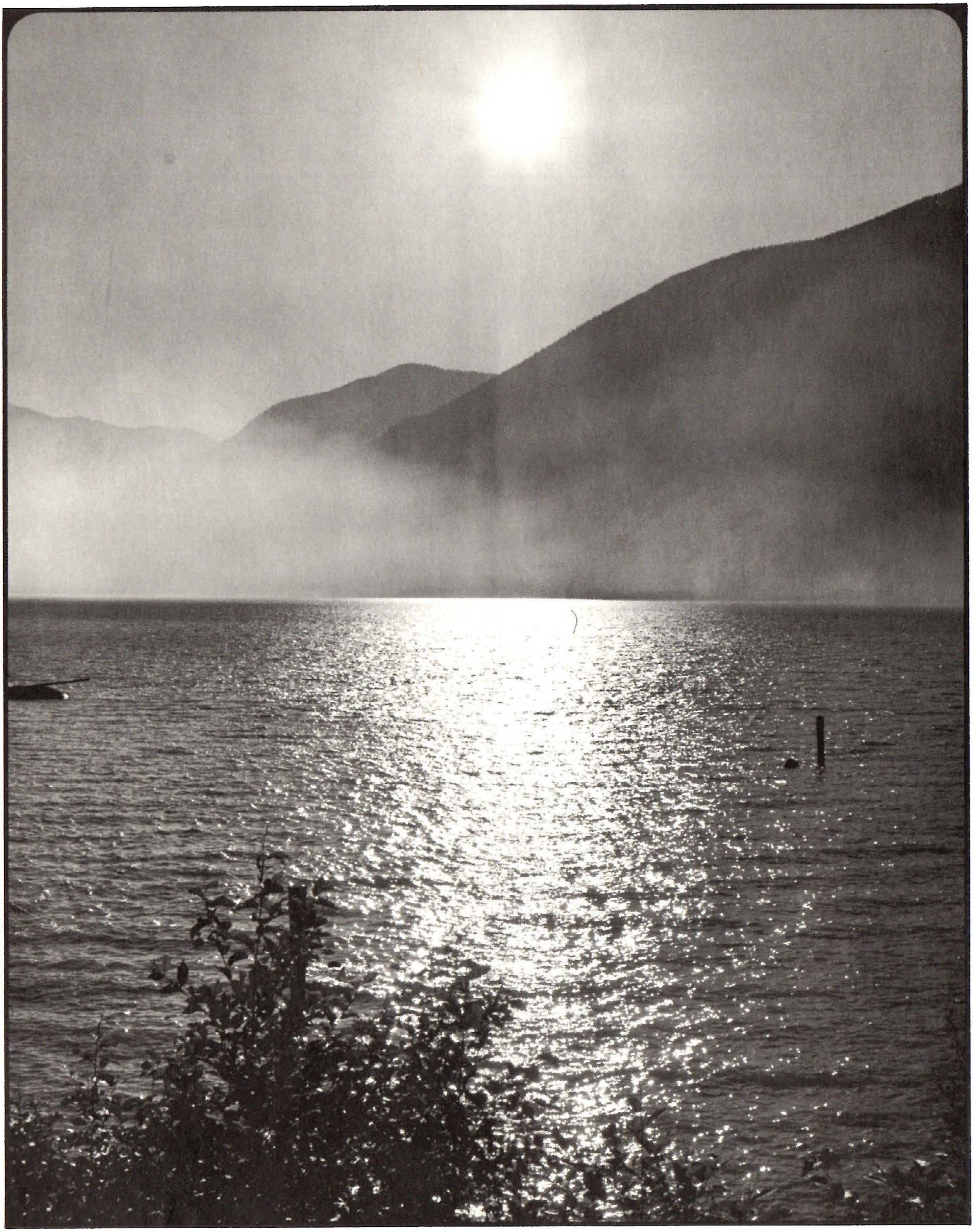
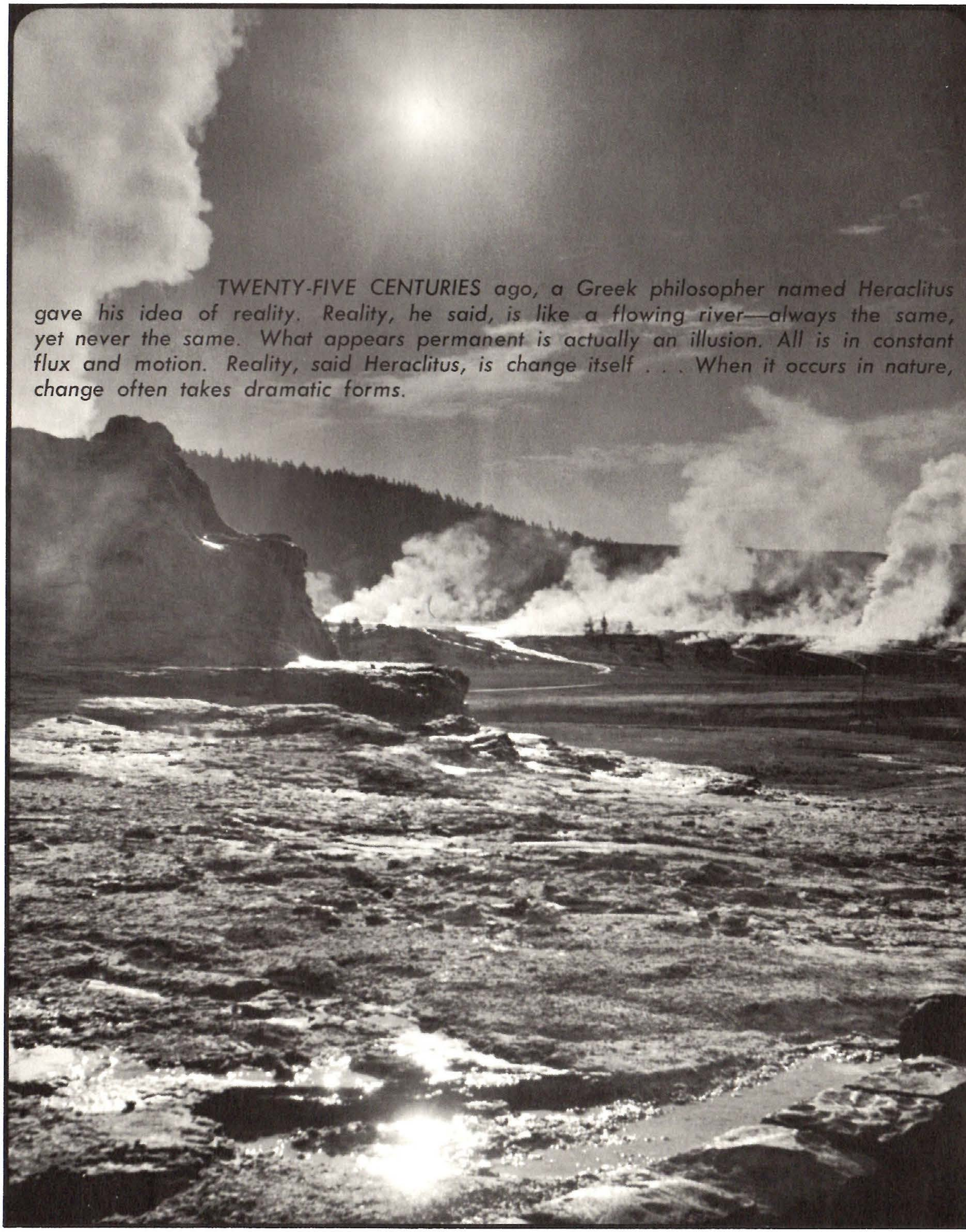
tek talk

THE TEKTRONIX EMPLOYEES MAGAZINE FALL-WINTER 1965





TWENTY-FIVE CENTURIES ago, a Greek philosopher named Heraclitus gave his idea of reality. Reality, he said, is like a flowing river—always the same, yet never the same. What appears permanent is actually an illusion. All is in constant flux and motion. Reality, said Heraclitus, is change itself . . . When it occurs in nature, change often takes dramatic forms.

Photos above and on cover by Josef Oswald.

tek talk

THE TEKTRONIX EMPLOYEES MAGAZINE **FALL-WINTER 1965**

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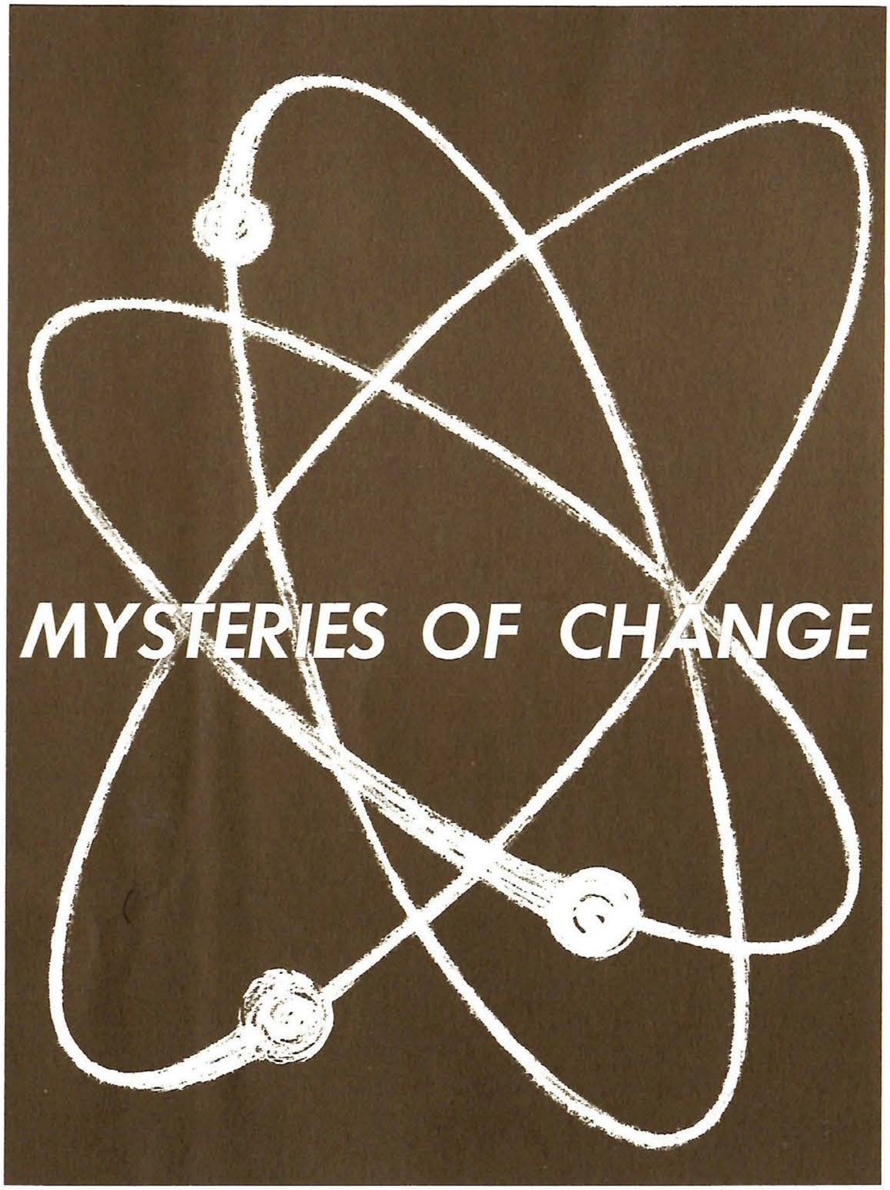
Employees publication of Tektronix, Inc., P. O. Box 500, Beaverton, Ore. 97005. Address mail to Communications department: Joe Floren, editor; Nancy Sageser, designer; Josef Oswald, staff photographer; Jane Martin, Willie Henning, Becky Weber, staff writers. Photomechanical production by Tektronix Photography department; printing by Printing department.



SOLVING THE MYSTERIES OF CHANGE

Twenty-five centuries ago, a Greek philosopher named Heraclitus gave his view of reality.

Reality, he said, is like a flowing river—always the same, yet never the same. What appears permanent is actually an illusion. All is in constant flux and motion. **Reality, said Heraclitus, is change itself . . .**

Now, 2500 years later, the frontiers of knowledge recede before the onslaught of thousands of scientists in hundreds of nations. If he could watch them, Heraclitus might smile and nod "I told you so." For he would note that a great part of their efforts are concerned with how things behave, act, shift, are transformed—in short, how they **change**.

He might blink to learn what we are finding out about matter—that it is composed in part of continuously zipping mites of substance called electrons. But then, how many of **us** can picture an electron — .000000000000000000000000009 gram in weight—or visualize its fantastic speeds?

The world will not hold still. Its secrets, those of the universe, and those of life itself, **are** the secrets of change.

Even if the ancients had fully realized just how changeable their world was, it would still have been a matter largely for philosophy or superstition. For few of the changes could be measured; and many of them didn't matter.

The fact, for example, that planets tended to change position in relation to fixed stars was noted by many early peoples. They found it interesting; but as to getting along in the world, the changes that mattered were more immediate ones—like increases or decreases in the size of their herds. By heaping stones in little piles, these people "measured" such changes.

As man has moved rapidly ahead, he has become concerned not only with more and more kinds of change, but also smaller and smaller ones. Changes that used to be of only idle interest, now matter. Ones that couldn't be measured are now routinely put to use. Our well-being, our livelihood, our existence today and our survival tomorrow depend on events far too small and rapid for us to hold in our minds. Man can no longer afford to overlook the infinitesimal.

In the minutest sliver of time, incredibly fast events occur, billions upon billions. To measure them, and to do so exactly, demands instruments of a capability never before called forth.

Who can comprehend a tenth of a billionth of a second? Yet changes that fast are what make a high-speed computer compute. What's more astounding, they can be precisely measured.

How fast **is** a ten-billionth of a second?

Let's assume an electrical event—some change in voltage—that lasts one ten-billionth of a second and happens once every second. Now let's slow time down so the **event** lasts a full second. At that time base, the former one second would last 315 years! If the event happens right now, as you read this, the last time it occurred (again, lasting one second) would have been just about the time England's Charles I was beheaded. The **next** time it happens, your great-great-great-grandchildren might observe it.

At this slow-motion time base, a bullet fired from a .45 pistol would require 15 years to cross a city street. It would take you almost 12 years to blink your eye once.

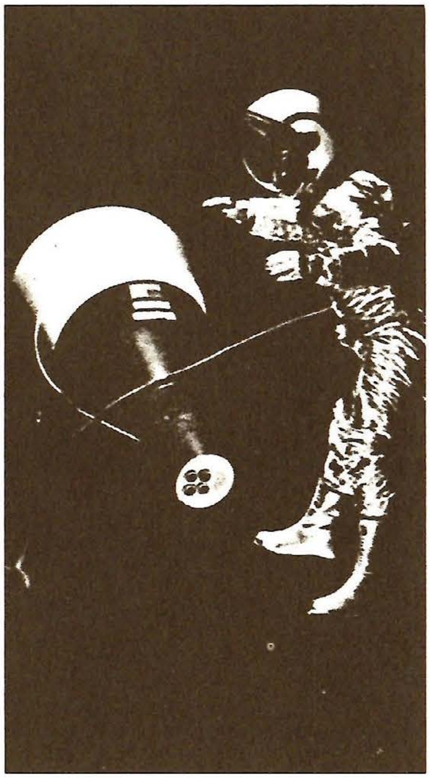
It's hard to realize that events lasting 1/10,000,000,000/second **can** be measured. But some electronic instruments can do it. A Tektronix laboratory oscilloscope does it superlatively well. Thus the same engineer who can't hit a slow pitch playing softball at the company picnic can, back in his lab, precisely measure changes occurring at fantastic speeds.

The fact that planets were straying around the heavens couldn't have mattered less a couple centuries ago. Today, what happens in outer space is of prime interest. The unknown holds promise—and threat. National security demands its investigation; so does business competition; and so, if nothing else, does man's illimitable curiosity to know what's around the next investigative corner.

Our vocabulary is becoming outdated. A "twinkling" means hardly anything any more. In an electronic world, all mechanical changes are "slow". A bullet doesn't "whiz"; it more or less pokes along.

Increasingly, the very fast changes concern us. Though they are small, they often are of vast importance. The fraction of a second of the first atomic explosion changed our world and lives far more than the centuries it took for glaciers to crawl across half the world and creep back again.

To leap further into space; to build a more intricate computer; to probe closer to the heart of matter; all depend on our increased ability to identify and put to use smaller and faster phenomena. It's hard today to imagine any major area of endeavor that isn't greatly concerned with measuring changes—often very small ones.



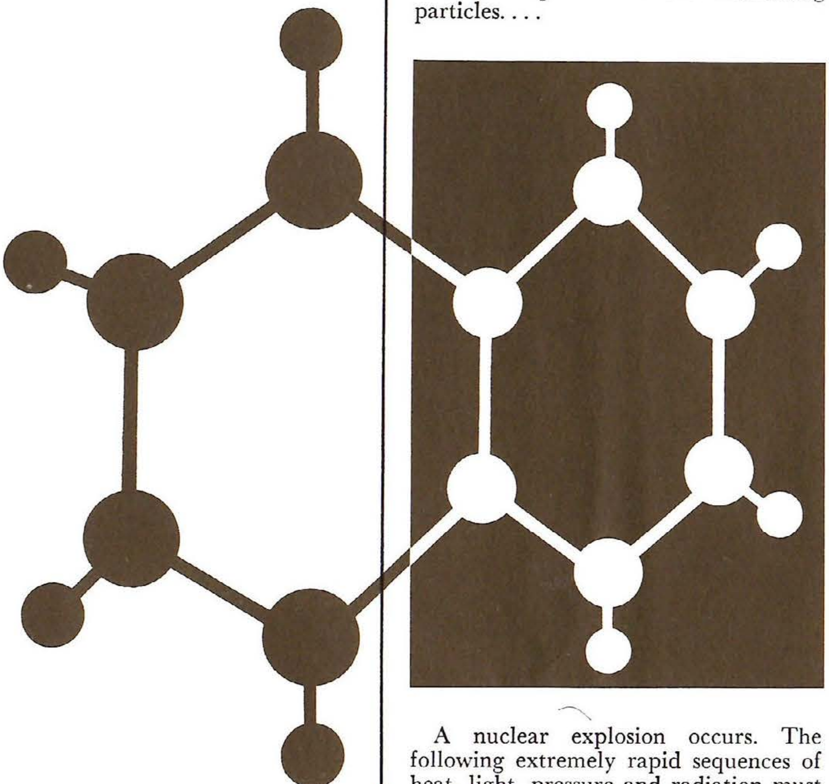
A man walks in space ..... Beneath him in the world he left behind, his landbound fellows read 274 separate continuous measurements, telling them more about what's happening to him than he knows himself. An oscilloscope monitors this telemetric data, which describes the thousands of changes going on each second: In his blood pressure, respiration and heartbeat; in the pitching and yawing of his spacecraft; in the activity of micrometeoroids.....

In a research center, scientists probe ever closer to the secrets of human memory and of human growth. Can life be produced in the laboratory? is still an awesome question, but the answer has changed from "possibly" to "probably"....

Scientists studying plasma physics—the so-called "fourth state of matter"—

seek, through controlled fusion of plasma particles, a possible source of energy to supply the world's needs for some 20 billion years. . . .

Physicists, in their hunt for the answer to "What is matter?", pummel the atom to learn the forces that operate within its nucleus, and the reactions that take place between interacting particles. . . .



A nuclear explosion occurs. The following extremely rapid sequences of heat, light, pressure and radiation must be measured. What happens in the first few millionths of a second? The answers may help us travel in space, and on earth; they may heat our homes and light our paths; prolong life, or end it abruptly. . . .

Body changes tell us about the processes of sickness and healing; of growth and of aging. Vibration—rapid change in position—can cure or kill; it can carry ideas to other men, or obscure them in noise; it can rend steel, or form it precisely. Chemical changes produce new plastics, paints, poisons. . .

The list goes on and on. Everything that happens in our daily lives is due to change: The colors we see, the sounds we hear, the pain we sometimes feel. All our senses **are** reactions to electrical or chemical changes.

Questions which would have seemed impudent a generation ago are being asked today, not as philosophical diversions but as practical problems in research, thanks to our vastly extended power to measure, and use change.

They are not exotic questions. The answer to any of them may change your tomorrow:

What is gravity? Does it have speed?

Can anything go faster than the speed of light? Is that speed constant?

Is our universe expanding?

How do we think?

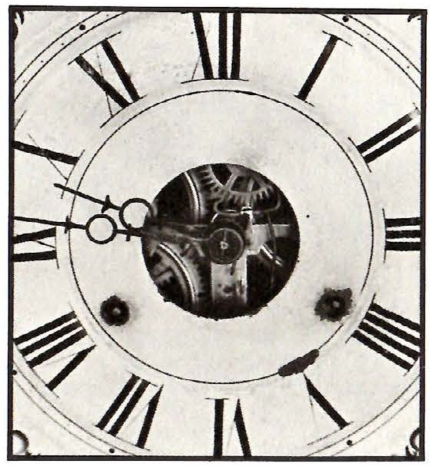
What is the nature of space? Of a nuclear reaction? Of life?

In our miles-per-hour, feet-per-second age, the idea of measuring change without reference to time seems clumsy. Yet that's what such change "measurements" were for most of man's history.

It wasn't until the 13th and 14th centuries that clocks measuring equal hours came into use. Up until then, "day" and "night", "morning" and "evening" pretty much sufficed. No one worried much about being on time, or saving time—or wasting time or killing time.

Clocks themselves are measuring devices, showing us a "picture" of change—a "picture" as unreal, yet as useful, as the waveform on the screen of a cathode-ray oscilloscope. Neither picture actually "looks" like the thing it measures. Both are invented analogs, visual equivalents of something that is not picturable—time on the one hand, electrical phenomena on the other.

Thus the oscilloscope lets us use our most important information-receiving sense—that of sight—to study otherwise invisible events.



Once time was divided into small constant segments, the idea of measuring change took on a good deal of sophistication. (Up until then, for example, you could tell who won a footrace, but not how fast he ran.)

So a new age in change measurement arrived with the clock: The **amount** of the change could be read against some interval of time. Graphs—which usually picture just this relationship—were, and are, one of the most useful recording techniques.

It was still difficult to measure very rapid events. Faster mechanical devices were developed, to record smaller and faster changes. But they were limited by their own weight; mechanical movement can't occur past certain speeds. About the upper limit on a pen recorder—a "fast" mechanical technique—is events occurring relatively slowly—about 15,000 times a second. (You'll notice we're saying this isn't very fast. Remember our high-speed computer, which uses changes 300,000 times that rapid!)

The application of the electron—virtually weightless—as a measuring technique signaled a new era—the era of measuring inconceivable changes.

Not only does electronic measurement allow investigation of electronic change—which includes all the **really** rapid phenomena—but even many mechanical changes occur far too fast for mechanical techniques to measure. Example: The beating of an insect's wing; the fracturing of a piece of steel.

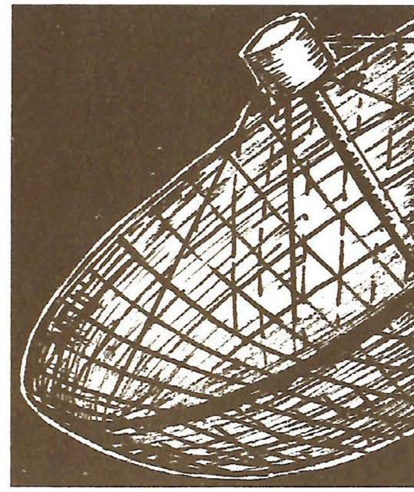
Because change is so prevalent; because so many kinds of change are vital to progress; and because so very many of these changes are infinitesimal in amount and time, electronic measuring devices are the key tools of today.

Chief among them—a tool that has been called as basic as the yardstick—is the cathode-ray oscilloscope. In a century distinguished by countless significant achievements, this instrument ranks among the technological milestones.

There are two basic types of change-measurement device. One is **digital**; the other **analog.**

Digital instruments (like the odometer in your automobile, that tells how many miles you've traveled) give a **numerical** reading, the result of single individual measurements.

Analog instruments, on the other hand, give you not a number but a **picture.** Radar is an analog instrument; the oscilloscope is another. (Some new scopes offer both analog **and** digital display.)



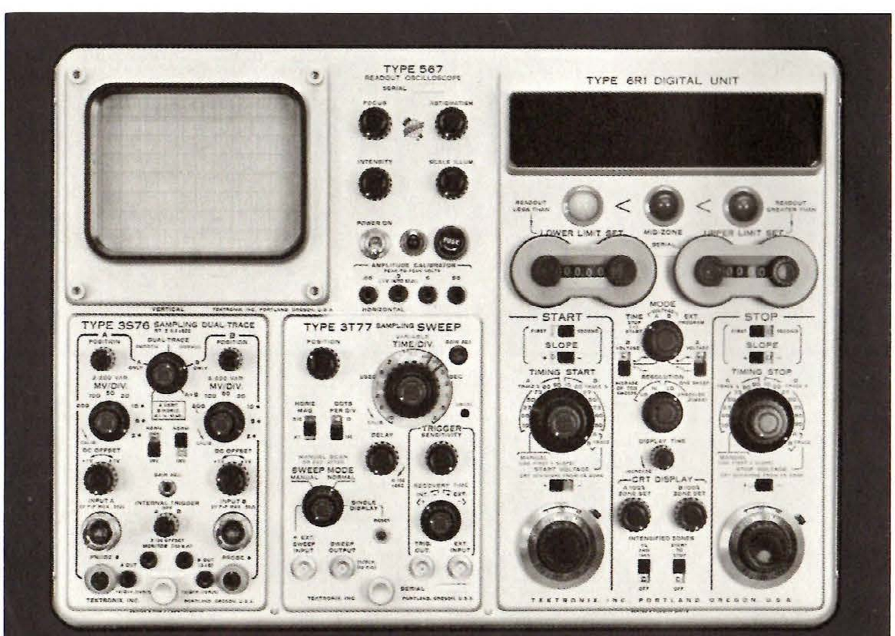
The scope can graph any electrical event, or any quantity that can be turned into an electrical signal. The waveform on its cathode-ray-tube screen depicts not only the **amount** of the event, but also its **duration** and (often very importantly) its **shape.** A scope provides a virtually **continuous** measurement of some very rapid change, a continuity other measuring devices only approximate.

Because a graph is a particularly meaningful type of information display, the oscilloscope is a particularly useful instrument. Just what is the advantage of a picture over a numerical reading? Let's compare an oscilloscope display with a motion-picture sequence:

In a filmed sequence, probably no single one of the frames is particularly important. But the sequence in its entirety provides meaningful information. The same is true of an oscilloscope display—or, for that matter, **any** graph.

Take a graph of the stock market: Chances are that it's not any one day's single measurement that's significant, but the steepness of a rise or the sharpness of a decline. Or a graph of a sales curve: It may be that no single month's total matters as much as the fact that a certain yearly pattern is repetitive, or cyclical.

So with an oscilloscope graph. Its shape tells you things that are as important as any one of the many single measurements you can draw from it. To summarize: An oscilloscope can measure changing phenomena that are



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SMASH! BANG!

SCOPE AT WORK

The contrast between an electronic instrument manufacturing operation and a steel foundry is great, and their environments so different that the leap from the relatively quiet Tektronix atmosphere to the jarring, whirring, siren-filled plant at Portland's ESCO Corporation is a drastic change. A 532 oscilloscope made the transition, however—and landed gracefully amid the din that is everywhere at ESCO.

The scope was purchased several years ago for use by research engineers performing metallurgical studies on steel. Their efforts were directed toward determining why certain alloys were holding up better in the field than others.

ESCO, for better than a half century, has been a leader in the production of high-quality alloy steel casting. They provide equipment for most of the country's major basic industries: Heavy construction and earth-moving equipment; log-handling and sawmill machinery; products for the pulp and paper industries, building construction, petroleum refineries and cement plants; rock-crushing and hammer-mill parts. In addition, ESCO now casts steel parts for use in aircraft and guided-missile installations and atomic power plants and is the West Coast's largest supplier of stainless steel mill products.

An oscilloscope is an instrument of great refinement. But even here, in the rough world of hard hats and molten steel, a scope can find a job to do—making sure certain alloys can withstand the grinding, abusive use customers often find for ESCO's products.

The 532 and a Q unit are being used with a special piece of test equipment, a large and sinister-looking device designed by the research engineering staff. Its purpose is to test steel alloy's resistance to being slammed with 24,000 foot-pounds of jarring energy, simulating what might happen to a steel part when used in the field.

They call it "the guillotine," and when it's in operation, the building shudders (so do the spectators) and the name seems quite appropriate.

It stands 12 feet high and is constucted of heavy steel framing. Weights up to heavier than a ton are hoisted up the shaft by cable and secured with a safety tripping device. Along the vertical frame, the distance the weight will fall is precisely calibrated. Below the weight, at floor level, a test bar of a specific alloy is placed in a vise-like holding device. (Actual cast parts also can be tested.)

The scope receives signals from a strain gauge (a device for converting mechanical energy to electrical energy) which is fastened to the test bar. The weight is released. As it hits the bar, impact values are read off the oscilloscope screen. If the test bar survives the initial crash, the weight rebounds and gives the bar several more stiff jolts, which are measured with the 532.

Before ESCO purchased the Tek scope, peak impact values could not be calculated when testing large pieces of steel. Nondestructive testing was impossible. Now, actual impact values may be read rapidly, and photographs made of each test with a Tekamera oscilloscope camera for study by the engineering staff.

Other impact testing machines have been widely used commercially for a long time, for testing relatively small samples. The most common is the Charpy (or Izod), which tests samples in the form of ¼" bars, using a pendulum system. The pendulum, weighing 60 pounds, is raised to a precisely measured height. The small test bar is placed at the exact midpoint of the arc. When the pendulum strikes it, the bar breaks; the foot-pounds of energy needed to break it are recorded on a calibrated scale. The maximum available energy is 240 foot-pounds. These machines work well for many applications, and ESCO uses one—but not for large pieces of steel.

The "guillotine" has important advantages.

ESCO castings are very thick in some sections. When the castings are heated throughout, the outer surfaces take on different physical characteristics from the core. The guillotine can handle well the large test bars typical of these large thick castings, and far beyond the capacity of the Charpy. Also, it doesn't always destroy the test sample, which gives researchers a chance to make more exhaustive tests.

Old-timers in the industry probably wonder at the creeping sophistication of the foundry.

In the ESCO metallurgical lab, an IBM computer is used to calculate minimum cost figures of the combinations of alloys used in ESCO furnaces. About 100 different steels and alloys are available for castings, and the company pours about 20 different chemistries a day through the immense furnaces. The computer analyzes all the cost of the elements—such as chromium, nickel, silicon and manganese—and figures the least expensive furnace charge to fit a specific customer's requirements.

It would take a person about 10 years to completely calculate one furnace load on an absolute minimum-cost basis. The computer performs the job in about three minutes!

Out on the foundry floor, a small sample of steel is taken from each furnace before pouring. While the foundrymen wait, the technician runs the sample through an electronic vacuum-spectrograph system to verify the composition of the steel. In minutes, the report is back to the waiting men; the giant ladles of molten steel are swung along the overhead conveyors and the pour is made.

Although Tektronix and ESCO are in many ways unlike, there are similarities. And they are probably the important ones that make a company "go". ESCO employees, like Tek's, share the profits. And they are extremely proud of the success that has come to their company (which began, in its present location, in 1913.)

Two bronze plaques hang in the reception area. One: "In appreciation of the friendly cooperation between employer and employee that has for years existed at ESCO, we the employees, present this plaque as a pledge of our continued loyalty."

The other, presented in 1957: "Our (employees) appreciation of company efforts to offer continuous yearly employment and to constantly and aggressively seek better methods to enhance employee relations."

ESCO, like Tektronix, is continuously looking for and finding new and imaginative ways to build reliable products . . . and they're building them better by using a scope to do a job nothing else could do. ■

THE NEW INSTRUMENTS

This year's enormous WESCON electronics show at San Francisco drew a crowd of 38,000 that set a record for attendance, but hardly for enthusiasm. There were those who said the show, despite its size and scope, fell short of being interesting.

But if the audience in general ho-hummed, you'd never have known it from the crowd that surrounded the Tektronix booth.

A layman observer might not have understood all the technical talk, but there was no mistaking the look on the faces around the Tek exhibit. It was the kind of look you see on kids' faces just before Christmas; it was the oh-boy-if-my-boss-would-only-buy-me-one-of-those-things look, and you didn't have to be an electronics technician to recognize it.

Unlike most years, when booth visitors tended to cluster around one or two particular instruments, this year the crowd spread evenly and thickly up and down the entire counter—just as interested in our two new portable oscilloscopes as they were in the state-of-the-art general-purpose-plus-storage 549, and as much in our array of pulse generators as in the self-seeking 3A5 plugin, or the 529 TV monitor, or, for that matter, almost any one of our 12 new instruments.

It isn't every year that we fill a 50-foot booth with new products. They were very well received—and so was the newly designed booth itself.

(The same booth and essentially the same instruments drew similar response at another giant electronics show, Boston's NEREM, this fall.

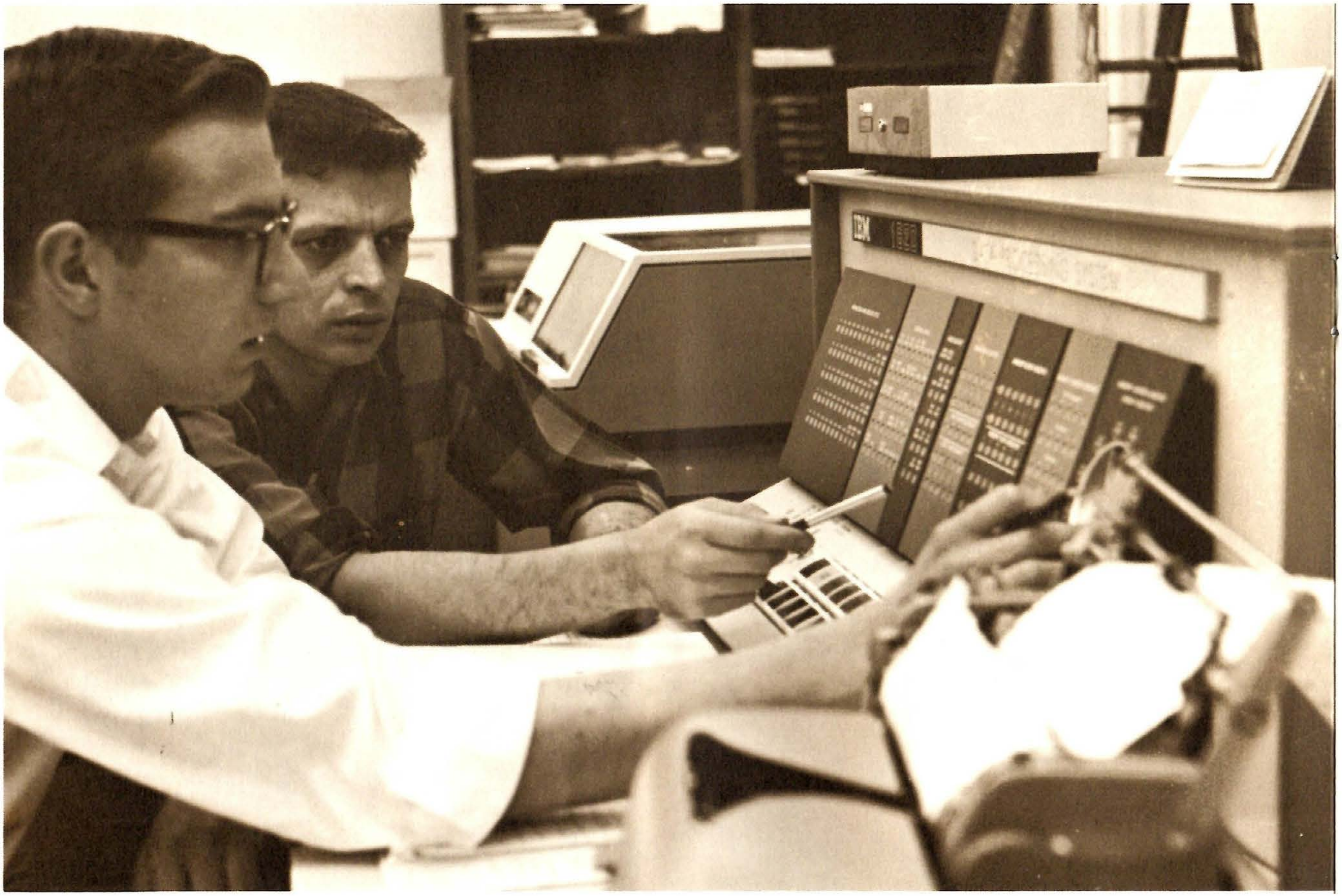
And WESCON-introduced products already are contributing significantly to the current order demand.)

Tektronix provided other WESCON exhibitors with fewer loaner scopes than in past years—in part because most of our production was needed to meet current orders. But the 453 portable, in particular, was strategically scattered throughout the show, to excellent advantage.

Not *all* its users were smiling, however:

"People are coming into my booth all right," grumped one. "But they're coming in to see your $#%#$% * oscilloscope!"

*insert appropriate technical language ■



MANY WAYS TO GIVE ...

FOUNDATION HELPS MEET EMPLOYEE RESPONSIBILITY TO THE COMMUNITY

One outgrowth of Tektronix' concern for the individual is the philosophy and practice of corporate giving. It's reflected in the work of Tektronix Foundation, in the product and non-product donation programs, and in the willingness of individual employees to devote their time and money to community projects.

President Howard Vollum sums up Tek's philosophy this way: "The company is dependent on the well-being of the community, because the company is made up of individuals and the **individuals** need the services the community offers. So, we have a responsibility to help finance community activities. It's not a selfless thing; but neither is it anything you can focus on where you get a direct return."

When Tektronix was first organized, giving was handled informally. Employees 'passed the hat' for United Appeal contributions and other worthy causes. In 1950 Tektronix, Inc. made its first **company** contribution. The company continued cash donations and started its own federated fund raising by conducting a single solicitation of employees each year. Tektronix Foundation was incorporated May 1, 1952.

The Foundation's purpose, as expressed in the articles of incorporation, is:

—To receive and administer funds for scientific, educational and charitable purposes, **all for the public welfare, and for no other purpose.**

—To receive and maintain a fund or funds and to administer and apply the income and principal thereof within the United States of America for scientific, educational and charitable purposes.

There were many reasons for establishing a Foundation to handle Tektronix' contributions. Howard comments on some of them:

"If the company had no regular way of giving, our major contributions would be to organized fund-raising

AMONG THE EDUCATIONAL institutions which have benefited from Tektronix Foundation cash grants is Reed College. Initial financing of its computer and data processing center (left) was made possible by a Foundation grant. Above, the former Martin-Marietta building near our Sunset plant was bought for $100,000 by the Foundation and given to Oregon Graduate Center for Study and Research.

drives. Through the Foundation we can contribute directly to specific projects. For instance, without the Foundation our scholarship program would probably consist of a contribution to, say, the National Merit Scholarship Fund, which administers scholarships throughout the US, and over a wide range of educational interests.

"But through the Foundation we're able to channel the same amount of money to kids from **this** area who are interested in **our** specific interests — science and mathematics.

"Another advantage of the Foundation is that funds can be used **when** they're needed. If Tektronix, Inc. distributed the funds directly, we'd have to decide each year where all the money donated that year would be spent. Through the Foundation the money can be held until a project comes up that we feel merits our support, and we can accumulate a balance in the Foundation funds that will make possible substantial contributions."

This long-range budgeting of donations can be seen in many areas. Probably the most graphic is Tektronix Foundation's recent contribution of $100,000 to purchase a site for the Oregon Graduate Center for Study and Research. Recognizing the growing need in the Portland area for a science-oriented graduate program, the Foundation decided several years ago to give financial assistance to its establishment. This year the Foundation purchased the vacated Martin-Marietta building next to our Sunset plants, and pledged it to the Graduate Center.

Substantial donations have been made to Oregon colleges and universities to assist their science building programs. In 1963-64 the Foundation donated $35,000 to Linfield college for a science building. Other donations include $100,000 pledged to Lewis & Clark college for its new science center, $36,000 to Willamette university for an addition to its science building, $45,000 to Medical Research Foundation of Oregon for establishment of a Primate center in Washington county, over $200,000 to Reed college . . .

The Foundation also makes it possible for Tektronix to respond to emergency needs in the community which can't be met by normal organizational methods of support. The Foundation often provides funds to help continue a research project that runs short of money, or that has a time lapse between contracts.

It provides 'seed money' to start projects—like the $40,000 donation to start Tualatin Valley Child Guidance clinic, near Beaverton. The Guidance clinic, in operation for several years now, has justified Tektronix' contribution by its psychological and counseling services to the community.

From its inception, the Foundation has adhered to the purpose of channeling funds primarily to scientific needs. The explanation given by trustees is this: Tektronix instruments go almost exclusively to science-oriented fields—medicine, military and civil research, and engineering. We have an obligation to put money back into those fields from which we realize our profits. Since its resources, like those of any contributor, are limited, it has been the policy of Tektronix Foundation to place more emphasis on that type of activity, although contributions to activities that are **not** science-oriented are **not** ruled out. For example, the Foundation annually donates thousands of dollars to such diverse organizations as UGN, Menninger Foundation and The Oregon Council on Economic Education, among others.

In its 13½-year existence, the Foundation has donated over $2 million to causes in the US, over 90 per cent in Oregon.

Another aspect of the Foundation program is its gift-matching plan. Tektronix was one of the first US companies to initiate this program. Early in 1955 the Foundation agreed to match the financial gift of any employee to the college or university of his choice, to support the general operations of the college for instructional purposes or for capital improvements. (It provided that gifts would **not** be matched to support athletic teams, since this is outside Tektronix' sphere of interest.)

Later the gift-matching program was expanded to encompass any accredited

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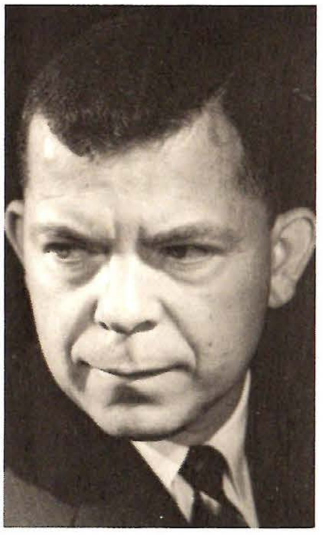
THE ELECTRONIC REVOLUTION






BILL WALKER NORM WINNINGSTAD LANG HEDRICK JOHN KOBBE

Back in the days when labor was done by hand, machines first began to appear in ones and twos, then in hundreds and then thousands. The people who designed, built and sold them might be thought of as the Mechanical Industry of that time.

Then more and more companies, to mechanize whatever it was they were doing, began to build their own machinery. The boundaries of the Mechanical Industry spread, grew more indistinct and finally vanished—simply because machines were **everywhere.** Thus the Mechanical Industry ceased to exist, melting into the fabric of a mechanized society.

Already the young electronics industry shows the same signs of "vanishing." Already it seems more appropriate to speak of electronics rather as an **influence.**

The upheaval that followed the machine was termed the Industrial Revolution. The upheaval that is accompanying the spread of electronics (its symbol: The computer) has been called the Electronic Revolution. A phenomenon of huge proportions, it is reshaping our entire society.

Like the Industrial Revolution, the onrush of electronics demands new measuring techniques and instruments. And the measurements must come **first.**

What drives this revolution ahead? Can anything slow it down? And where is it taking us all?

Engineers disagree as to particulars, but they share some hunches:

Electronic science has chosen ambitious goals. Among them: To duplicate the capabilities of the human brain itself. Goaded by such visions, bolstered by an affluent society, primed by an eruption of new scientific knowledge, spurred by automation, its creations become at once more sophisticated and less expensive, smaller, more reliable, more widespread—and far more incredible.

Already electronics abounds, woven into our lives. Yet its influence is only beginning. And technology won't stop while we get our bearings.

Can anything slow it down? Yes; there are some "brakes".

For one thing, creative insights can't be rushed. For another, it takes courage to gamble on a breakthrough, and dollars to develop and produce it. Communication takes time; so does the learning process. Man is just beginning to discover the many things he can do with the technology he **already** has at hand . . .

But, in spite of the brakes, the pace of the Revolution quickens. Its ultimate outcome may exceed even the wildest forecasts . . . .

What does it offer a company like Tektronix, which makes measuring instruments? The greatest of opportunities: A potential market that seems to have no boundaries.

What does it offer Tektronix? The greatest of challenges: To keep **ahead** of the technological onrush. For science and industry, stretching for tomorrow, hurl one seemingly impossible measurement demand after another.

Can their demands be met? The answer is clear: They **must** be.

On the following pages, Tek Talk explores with four engineering managers some ramifications of the Electronic Revolution. In this symposium, Lang Hedrick, John Kobbe, Bill Walker and Norm Winningstad look to the future and think out loud . . . .

How fast is the electronic revolution progressing?

Bill—You never know when to say an era is "here". Miniaturization, in a sense, is already "here"; look at your five-inch TVs and pocket radios. And computers, in volume, have been shrunk 100 to 1, or 1000 to 1, already. Yet, things are bound to get smaller and smaller.

I see no letup in the "revolution." Everything we do spawns a host of other things. It's true at Tek: Storage scopes, digital instruments and other breakthroughs have each led to further new developments to chase down.

There's almost **nothing** that can't eventually be done electronically: Housecleaning, driving a car, piloting a plane, doing dishes, lighting the home . . . . .

Norm—You can't say electronics will ever **replace** mechanical things; whatever has to be physically done must be done mechanically. But electronics **is** providing sophisticated control and precision; **that's** your revolution.

Lang—How pervasive is this "revolution"?

Let's take an example: Worldwide live TV is now feasible. It will further shrink the world—and it may even be a decisive factor in achieving world peace. Imagine the impact of a live color TV broadcast from the battlefront . . . .

Electronic means will let you reach all the people in the world; it's the most pervasive means of education because, ultimately, all it requires is a picture.

I can foresee a tremendous ability for self-education, also, through computerized translation and dialable computerized libraries.

The prerogatives of the pilot are being taken over by instruments. There will be planes and other vehicles with no crews, directed by some information-handling process. You'll even put your "car" on an automated road—and leave the driving to it . . . .

John—A variety of "household" electronics is already on the horizon, like electronic cooking. Also, there likely will be some sort of computer in the home—a "bookkeeper" to do your bills . . . .

Norm—Probably the guts of home appliances will stay about as they are, but increasingly sophisticated control and sequencing systems will use more electronics. Your washing machine may have a device that senses the load size, figures how much detergent to add and decides when the wash is clean . . . . but has the same old agitator and pumps.

Lang—In the medical field, I wouldn't be surprised to see electronic control of surgery; electronic interrogation of a central store of medical data; computer analysis of electroencephalograms, and so on . . . .

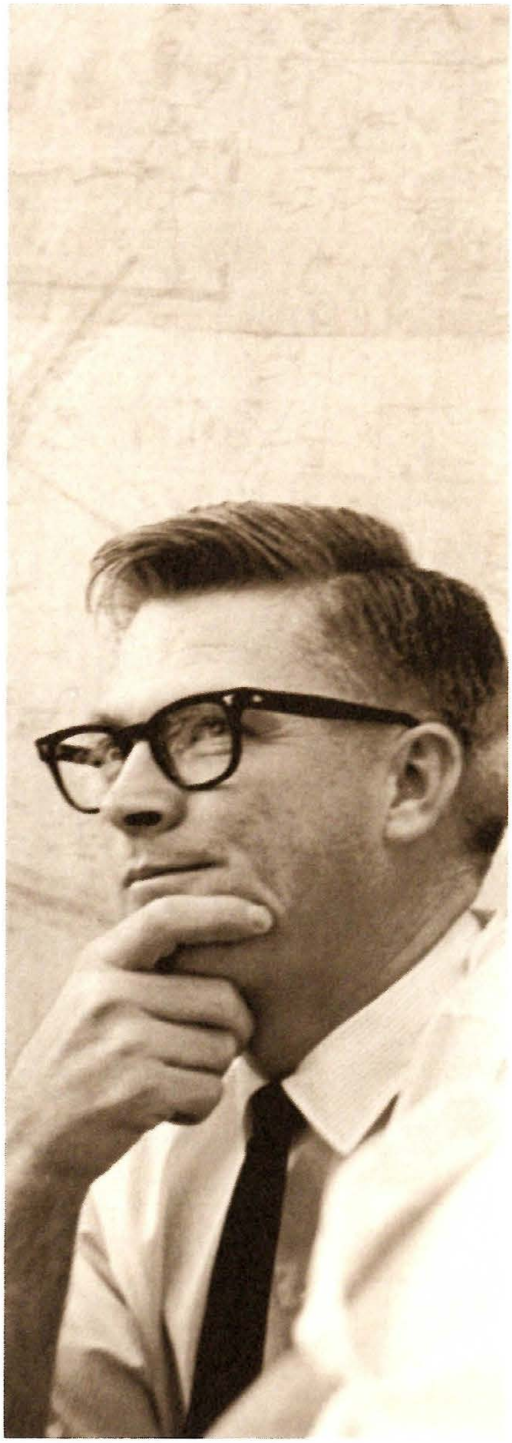
Bill—I can foresee the time when a guy, for processing purposes, will receive a number when he's born—which will become his license number, social security number and so on. He'll own a two-way, wristwatch-sized, 3D TV (maybe in color).

That is, unless there's a unique breakthrough in communications, some way to get more direct access to communication centers of the brain, so you don't have to go through the eyeball.

In computer development — and all automatic mechanisms — the ultimate we can visualize is the capacity the human himself has. And we're a **tremendous** long way from that.

If you drew a line on the floor, I could pretty accurately judge its distance from me; its length and width; its color. And, then: I could jump and land on it. To program a machine to do those things would be fantastically costly. To do the computing job humans do, we have something like 10^{23} active nerve cells, or computing elements.

The human brain and its capacity is like a carrot on a stick to the scientist and technician. If something **can** be done (by the brain), their question becomes: Why can't **we** do it?



"...the capacity of the human brain is like a carrot on a stick to the scientist and technician..."

"... we're going to run out of people to follow up all the leads..."

How fast will changes occur?

John—The electronics industry is an evolutionary rather than a revolutionary process. Major developments won't all of a sudden shake it up. Changes don't really occur so fast, comparing one year with the next. Of course, comparing 10-year periods you see a lot of change.

Look at the transistor, one of this century's major developments. It's still taken about 10 years to find its way into the industry—mostly because it didn't get priced down. The reliability and performance you get for your transistor dollar have greatly increased.

Bill—When I came to Tek in 1958 you couldn't buy a 100-megacycle transistor for under $30. Today manufacturers can spit out 100-mc transistors for nine cents apiece. That's in just seven years.

John—One limit on rate of change is cost of production. But, as new and automated methods are discovered, we'll have less expensive electronic products—in terms of more performance per dollar. (The number of hours you'd work to buy a radio in 1925 would now buy you four or five color TV sets; and color TV probably has 20 to 50 times as much circuitry.)

Another limit is developmental cost and the risks of gambling. General Sarnoff of RCA almost single-handedly brought in color TV, in spite of many doubters. I'm sure he did a lot for the world — but probably not as much for himself. A guy who tries hard to push into risky areas needs a large company behind him with lots of money, or he can easily go broke. In this case, the doubters also benefited who just sat back and watched him.

Bill—Anything you produce must be "economically feasible." But this term has a lot of implications:

Sales pressure can **make** something economically feasible without either its price **or** quality changing, and whether it's needed or not (like a new car). People's desires change. Color TV is the classic example—it meets no "need" that black-and-white TV doesn't. Yet in two years more color sets will be sold than black-and-white.

Will the rate of technical change accelerate?

John—It will go faster and faster in absolute terms, but not—I think—in percentage of growth.

And, although people **are** more willing to spend money, money alone won't buy creativeness. You need time. One guy's (or one company's) developments trigger another's. You couldn't get anywhere with your head in the sand. The learning and communicating processes can't be rushed; nor can creative ideas.

Norm—A case in point is our storage oscilloscope. First one engineer made a unique breakthrough, producing a first instrument that showed the potential of storage. But, to get consistent storage on 100 per cent of the screen, and to make it a repeatable instrument, took the fulltime efforts of 30 to 40 guys for several years, chasing down every detail!

Bill—Another limit on rate of change is the "human gap"—between what an instrument can do and what people have learned to do with it. With this "gap" in mind, Tek went to the Tool show in Chicago in September with instruments and transducers that solved mechanical measurement problems . . . Mechanical engineers are becoming increasingly aware of electronic measuring tools.

It's probably true also of the medical field. In the past, a physician got more information from a stethoscope than an oscilloscope—**even though the scope had more information**—because he was familiar with the one and unfamiliar with the other. That will change.

Lang—Electronic measurement is invading one new field after another. For instance, you never saw an oscilloscope in a telephone central before. But, in a recent visit to Bell Labs' new all-electronic switching system — which replaces mechanical phone relays — I saw several Tek scopes. This Bell development alone—an enormous increase in service at no increased customer cost—will consume great numbers of our instruments.

What specific advances or trends do you forecast as the Revolution continues?

John—More and more dollars, relatively, will go into the consumer (non-military) market. Of course, the military will continue to trigger a lot of developments, as it did radar and computers—usually paying exorbitantly for the result.

Bill—As to computers and similar developments, you'll see drastic reduction in size of elements. But until that happens, we'll have to make advances by brute force; there will be tremendous power requirements.

A likely source is "atomic" power, but it doesn't satisfy the need for portability. Another possibility is wholesale **broadcasting** of power through the air; but we need the air for too many other uses. I'd guess chemical power sources (batteries or fuel cells) will be the answer—for a while.

Norm—As companies build more and better electronic devices, we have them in a three-way stretch. To **build** the devices requires an oscilloscope for research and development — generally a "state-of-the-art" instrument in sensitivity and bandwidth. Then when the device gets into production they need another scope to **test** it. One with more and more automatic or automated features; one that performs a set measurement routinely . . . . Third, to **maintain** the device in the field requires still another scope, a state-of-the-art instrument in terms of power capacity and size.

With technology moving so fast, isn't it hard to keep ahead with measuring instruments?

Bill—Yes, but you **like** it that way. Now we have 20 to 50 new instruments somewhere between design completion and pilot production—**constantly.**

Lang—The problem is intensified by the need for a measuring instrument to be three times "better" than the thing it measures. That is, to measure

"...a scope in every home isn't as laughable as it used to be..."

"...money alone won't buy creativeness... creative ideas can't be rushed..."

100-mc phenomena you need an instrument with 300-mc capacity.

John—We need to watch the industry, anticipate it — slightly — and move when a significant change is seen. I think we're too small a company to depend on basic research; but we should encourage and use any creative ideas that do come.

How do you keep ahead? By visiting customers (or listening to people who do); by reading; by attending trade shows . . . . The routine-sounding things.

Lang—When you are intimately familiar with the components being made (transistors, diodes, microcircuits), you can better tell what the industry's likely future measurement requirements will be.

Bill—We know, for instance, that increased speed—in fast, small, reliable devices—is one direction we're going to have to go. You keep ahead sort of by "black magic" — by a lot of knowledgeable people sitting down and guessing.

Sometimes you get **far** ahead. Our 564 storage instrument was ahead of its time. Here we were at WESCON in August with a second-generation storage scope; and, competitively, there was nobody else around.

What sorts of measurement problems do you foresee?

John—A general need for us is to make it easier to obtain measurements, so less-trained people can make them, and trained people make them faster: More automatic features—and lighter instruments, easier to haul about and to operate.

Bill—The really tough thing (and it will get tougher) is to figure ways to hook up the scope to smaller and smaller electronic elements. It's hard even today for a designer of micro-miniaturized circuitry to go in and see what a particular circuit is doing. They're very small, extremely fast and often sealed. The "probe" for this job may have to be something like infra-red or electrostatic scanning.

The need I see is for a scope to have something like a human eye, able to focus from and receive signals at long distance. I can't visualize just what that element could be—but I have no doubt that someday somebody will come up with one.

Lang—Another need is to meet the increasing demand for forms of information (digital or printed) other than the CRT display.

John—Yes, but I don't think the market we're selling into now will be re-placed by, say, digital readout. The CRT graph lets your brain absorb more information faster than any other display. Some combination of conventional and automatic information is probably what the future will require.

Lang—Measurement needs will include some increase in the dynamic range (more megacycles, more millivolts and so on). But the **major** increases will be caused by invasion of non-electronic fields by electronic measurement — to run, or to service or to maintain something . . . . "A scope in every home" isn't as laughable as it used to be.

Another real problem will be what to **do** with the measurement once you've got it. Of course, you **look** at it; that's the conventional man-machine relationship. But, you may also want to **record** it in a document; or **send it on** (into a computer) for further processing or analysis; or even **control** the phenomenon being measured.

For a scope to make these determinations means automation of a high degree. I can imagine a scope-directed component-manufacturing machine. You walk up and (maybe by voice control) order a part to meet certain performance requirements. The machine takes this information, builds your component, measures it to see that it meets specifications and coughs it out for you.

Norm—When you talk about changing measurement needs, people may wonder about the future of the cathode-ray tube. They often ask me why we're not looking into the possibilities of solid-state (that is, non-vacuum tube) display.

One solid-state device might comprise many very small light-emitting elements in an array—maybe gas-filled bulbs 150 wide by 100 high (like those electric signs made of light bulbs). Another might have a **single** light-emitting source, like a laser. This would mean using a light beam, not an electron beam as in a CRT . . . . We're keeping an eye on both developments, so if **anyone** has them, we will.

But any solid-state system now costs more than a CRT; its only justification would be that it could do something economically that a CRT can't. (For instance, a laser—a very brilliant light source—might provide a high writing rate in high-frequency instruments).

As to lasers, we're watching closely the available methods to deflect the light beam. But now so much voltage is required for deflection that your amplifier won't take it. So there's no justification for laser displays at present — economically.

As to the other possibility — small light-emitters in an array—there is a need to drive them by some system, so they'll light up at the right time and the right place. The cost of these logic inputs is great. So is the cost of the arrayed bulbs. Suppose the bulbs were 100 across and 100 high (and even that wouldn't give the resolution that a CRT gives) and cost a dime apiece.

The only justification for this type of display would be for automatic storage functions and automatic breakdown of data into X and Y components, like a computer requires. The need here is for a complete automated analysis of the measurement, in a hurry and in great detail.

All you can **definitely** say about solid-state now is that it promises longer-life devices. Still, we already have CRTs that last 10,000 hours . . . . And there's no price advantage, when you consider not only the cost of the devices, but also the cost of driving them.

In the industry, solid-state displays are interesting curiosities. We're watching them. But today they don't compete even in performance, let alone cost.

What are the limits on conventional CRTs?

Norm—I like to use an analogy of the piston engine (as the CRT) and the jet engine (as the solid-state display). There are about 10,000 piston engines in aircraft today for every jet engine, because the mass market finds they're still economically far superior.

Why? The inexpensive application of the turbo-supercharger improved the efficiency of piston engines so much that turbine engines can't compete. This extension of life by the supercharger might be compared with extending the life of a CRT—to increase its writing rate without compromising deflection sensitivity . . . . .

Can this be done?

Norm—It hasn't, yet; but we have a leg up on it. You can say we're working on ways to "supercharge" the CRT . . . .

How many years might conventional CRTs have left?

Norm—There'll "always" be CRTs—way into the future—in less sophisticated oscilloscopes. As requirements on scopes become far more complex—say, to be integrated parts of a data-processing system—solid-state development will become economically desirable. But the present functions performed by CRT scopes will always have to be done.

Can we build these solid-state devices, when the time comes?

Norm—We sure think so. We now have a semiconductor group that could set up the beginnings — feasibility studies and so on. As to production facilities, they probably don't exist anywhere. So it becomes a matter of **someone** doing it—when the time comes. You can bet that will be more than 10 years.

What are our chief problems going to be, as we go into this Electronics Age?

Norm—Not enough people!

The first problem in technology—centuries ago — was to get human knowledge up out of the noise level. The next was to get people out of the potato fields, and educated. The third will be to get enough people to do all the things you need done. We're gathering scientific knowledge so fast that—even with a universally educated society, with automation freeing human beings, and regardless of the "population explosion" — we're just going to run out of people to follow up all the leads . . . .

John—On the other hand, it's good to have some "brakes." There always will be a need to have **more** of the **better** ideas. It's good to be forced to pick out the best ones.

The answer isn't just to get more people to do more things . . . .

Bill—Scope development must keep ahead of the industry, and ahead of the things it measures. Yet, we have our **own** problem in measurement and standards: How can we tell where we are with scopes? How, for example, do we measure the risetime of our fastest instrument—a risetime slightly over one ten-billionth of a second?

John—It **is** an unusal problem. When you push the state of the art and are building a measuring instrument, you still have only the state of the art to put **into** it—in components and technology. Thus you must make lots of compromises, not always convenient ones. By contrast, most consumer products don't need to go through this bootstrapping effort.

But that's what makes the scope business the great challenge, and the exciting thing, that it is. ■

IDEAS IN 3 DIMENSIONS

New instruments boil out of Engineering at what seems an ever-increasing rate. Smaller ones, more compact; high-performance ones, more complex. This takes effective organization; versatility in designing; feedback from the field—and a variety of skilled support groups for Engineering. One support activity is the Engineering Model Shop, a group of 37 people headed by Slim Sorenson.

Their major job is to make the tools to make the parts to build the first 20 or 25 Engineering instruments when a new product is being developed.

Slim's crew works very closely with Engineering groups such as TV and Conventional Scopes; Sampling; Digital Instruments & Systems; Low-Frequency & Biomedical Scopes, and Spectrum Analyzers, from the time a new product is proposed to the time it receives its engineering release to go into pilot production. This period comprises several steps: After product proposal and design completion comes the prototype release (usually of the first five instruments for design evaluation) and, finally, the engineering release (usually another 15 instruments for preproduction check). After this, the instrument is ready to be turned over to Manufacturing for pilot production (maybe 50 to 150 instruments, to determine producibility).

To produce the first 20 to 25 engineering instruments means improvising tools, such as jigs, dies and templates, for making the parts as fast as practical.

What parts? Just about everything that is mechanical and non-electronic—front panels, sub-panels, rails, castings, chassis, plastic parts, tube shields and others too numerous to list.

The original concept of the Model Shop has not basically changed. Its main goal is to enable engineers to see their ideas in three dimensions without undue delay.

The areas of the Model Shop are Product Development Support, managed by Les Wold, and Fabrication Support, managed by Fred Smith.

The Product Development group consists of model makers. Their function is, first, to support Engineering in development of products; second, to investigate new methods of prototyping and tooling. The prime requirement for a model maker is to be communicative, and to have a better-than-average knowledge of mechanics and the ability to create.

After a model maker is assigned to an engineering area, he responds directly to the engineers. He works with occasional supervision, and refers to his manager only those problems he can't handle.

The person must be a combination of a good machinist, fabricator and sheet-metal man who has lots of perception and isn't afraid to gamble on what he thinks will work; someone who is almost a designer—who can "make anything out of anything." Les Wold, who came to Tek in 1959, has worked in the Model Shop since 1960.

Fabrication Support works to set a schedule, to make the parts for the prototype instruments and evaluation models. They normally build the parts that were first made by Product Development.

The group consists of mechanical technicians and fabricators. After the design phase is complete, the mechanical technician—highly project-oriented—coordinates the product through its scheduled activities to engineering release. Other mechanical technicians build and coordinate projects from other areas, such as Reliability Engineering and Display Device Development.

The fabricators, the newer shop people, generally work from finished drawings and on scheduled activities, producing parts.

Fred Smith, manager, has a background in Model Shop work. He came to Tek and started in the shop in 1958. His job requires excellent ability in scheduling and workload predicting, to meet shop commitments.

The Model Shop uses the services of many other areas of the company, such as Metal & Plastics Tooling and Production, Electrochemistry, CRT Tooling and others, depending on the need. Mike Cavanaugh coordinates this relationship. He must continually check to keep parts on schedule, which includes contact with outside vendors for such things as sand castings, patterns or large fabricated machine units. Mike has been with Tek for ten years, which provides him with background on how various departments operate.

He must also keep up on the progress of all projects. This enables him to alert Fred and Les when a project is ready to proceed to scheduled builds.

Many Model Shop parts are started very early. An example was the building of castings for the 453 portable oscilloscope. Because of the time required to machine them, we gambled a couple months ahead on a design not yet completed. At design completion, adequate parts were ready; although changes were made later, only one part had to be entirely rebuilt!

What makes a group keep going under continuous pressure? Probably it is the philosophy of the Model Shop. Every new person is trained on the basis that he is in a free-thinking job, and is an individual. Everyone must and does accept responsibility.

Ample guidance is supplied to the new person. The door to management is always open. But he must gradually become more and more responsible, and make his own decisions to accomplish the job.

Each person is allowed the freedom he needs to do his job. When he becomes a model maker, he is expected to proceed with little or no supervision.

Another important aspect is his ability to communicate. When he has a question on a job, he goes to the person who's likely to have the answer, rather than go through a routine chain of command. This helps make him a real part of what's happening, and creates a high level of incentive.

The Model Shop's strong emphasis on individual judgment and action makes it a highly fluid and flexible operation. It offers Tektronix the valuable capacity to turn suddenly—if necessary, with all hands aboard—from one direction to another, at the drop of a suddenly "hot" project. ■

THE INDIVIDUAL

"If we draw our strength from the uniqueness of each individual, together we become more than the sum of our numbers"
—Tektronix philosophy statement, February 1962.

In the technically charged atmosphere of a Tektronix engineering department, information on new product advances is kept in a few valuable minds and in locked files. For a non-engineer to survive and grow here requires a good basic concept of the "inside" of an oscilloscope, the ability and desire to continue learning and a talent for working with people completely absorbed in doing the "impossible."

For a woman to hold an administrative post in such a group is a rarity. But Marge Guthrie, administrative assistant to Norm Winningstad (Display Device Development manager), acquired the job in 1959 while working for then Future Products Manager Dick Ropiequet, and has performed it admirably ever since.

Marge has been a secretary in engineering since 1955. But her job has changed considerably; personnel have changed, and projects and problems have changed. Somehow she's managed to keep up with what's happening and developed a valuable ability to relieve engineers of their many administrative chores that could clog their schedules and keep them from development projects. (Engineers who smile and admit readily over a cup of coffee that it may at times seem like working for several dozen prima donnas.)

Sitting in on meetings between project engineers and managers, Marge has been called the "objective balance" that keeps the conversation moving along constructively toward a solution.

Talking to an inventor who wants Tek to build transistorized false teeth, or another who's thinking of building a record player that flips records automatically and who thinks Tektronix should be interested—Marge may be the friendly person on the telephone who listens patiently before suggesting it may not fit into our product line.

MARGE GUTHRIE

still a fan

Rewriting and helping prepare technical papers for engineers, each of whom wants to preserve his individual style and have it "sound like him" is done often—and well; and she provides accurate policy information to busy personnel, who **know** "if you heard it from Marge, it's right."

Leaving the complexities of her job, Marge goes home to four children (ages 8 to 12) and husband Bob (Tektronix' CRT Manufacturing manager), whom she met at Hillsboro high school (Marge was a straight "A" student) and married while both were attending Pacific Univeristy in 1952.

Her two years of college math and chemistry have been a great aid in gaining an understanding of electronic terms. If most women aren't inclined to want to know a whole lot about the direct-viewing bistable storage tube, Marge is—and it's handy to have the man who created it a few yards down the hall.

The Guthries, who live in Hillsboro, are preparing to build a new home on a 100-acre farm with 50 acres still in timber and a lake big enough for boating, swimming, fishing or lolling beside. Avid hikers, they've trudged the high lake country hunting and fishing; Marge brought down her first buck (a 4-point) last deer season.

Those who rely on Marge for help every day emphasize her ability to understand highly technical information and translate it into simpler terms for persons who don't; to ask intelligent questions in an effort to solve a sticky adminstrative problem; and to handle thousands of details without a flutter.

After 10 years of watching engineers working on Tektronix instrument advances—many dramatic, others never heard of—she's still one of their greatest fans. ■

Ray Goolsbey, 22, spent his past summer vacations keeping bees. He's yet to graduate from Washington State university. But, suddenly this summer, he became a Tektronix junior engineer.

"When we find a student who has the capability," explains a Tek engineering manager, "we stuff him into the role of designer." Ray is one of four student summer employees thus stuffed this year. He's happy about it; so is Tek.

In some companies, Ray might have ended up doing more typical summer work, like handing pliers to engineers. But at Tek he has designed not only operational amplifiers—his own specialty—but also seven power supplies for a prototype digital instrument. And, on his own time, he's putting together an analog-computer plugin that will fit our scopes.

So, he seems to meet Tektronix criteria for selecting not only the bright young student but also the **right** young student: "We want people who show the ability to learn quickly; who have breadth of interest in electronics; and who have a distinct interest in hardware—**in making something work.**"

The somewhat laconic comment of Manager Jim Knapton (Digital Systems) indicates that's the kind of guy Ray is: "He really gets in and does things."

No one has ever seen a "typical" summer employee. Yet Ray is characteristic of the young men we hire, in most respects: In love with electronics (a "bug" since age 12; student IEEE chapter president at WSU); eager; and inventive. On the other hand, the fact that he's doing design work is not typical; most students are put into a thorough test-training program, learning about Tek and its instruments. It's not typical, either, that he's one of the about 20 per cent who'll become permanent employees.

Unlike some companies, whose main goal of summer employment is just to get certain technical chores done, our emphasis is on finding permanent job candidates, putting them into jobs where they show what they can do, and thoroughly exposing them and the company to each other. Thus, if the talk gets around to permanent hiring, no one is buying a pig in a poke.

Ray has been fascinated with electronics since he built his first transistor radio, at age 12, and fascinated with Tektronix since he saw his first Tek scope, at age 20. He's totally transistor-oriented, feeling that's the only way for a young engineer today **to** go. (One of these days — poof!" is how he prophesies the demise of the vacuum tube.)

Norm Silver, student employment program director, feels our long-range program is unusual, if not unique, in the industry, in the strong emphasis it places on two things: First, putting the capable youngster into a position of responsibility; second, in the intensive exposure of summer employees to the company, its areas, its products, its management, its philosophies.

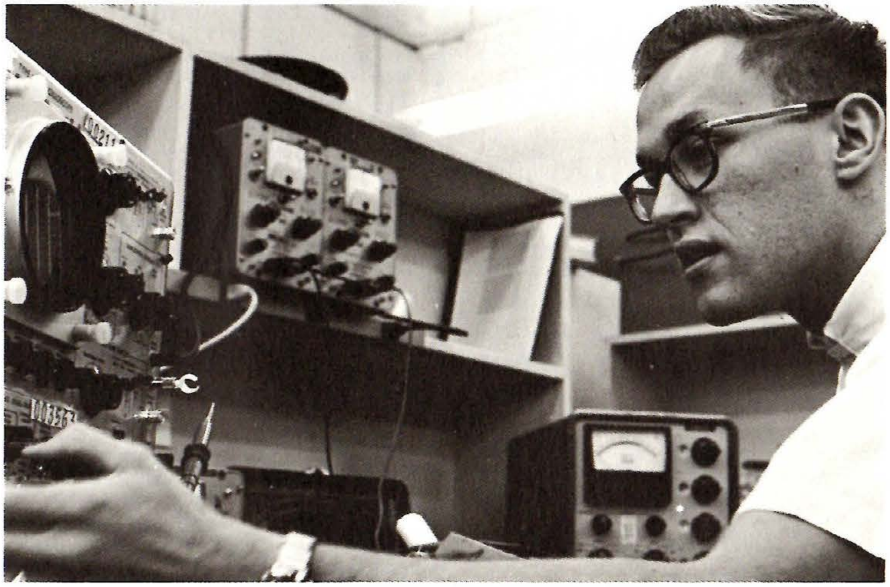
Ray is impressed: "They sure do look you over." He feels that grades shouldn't be the main criterion for picking a creative engineer; Tek agrees. (This isn't to say he's not a 3-point student in electrical engineering, because he is.)

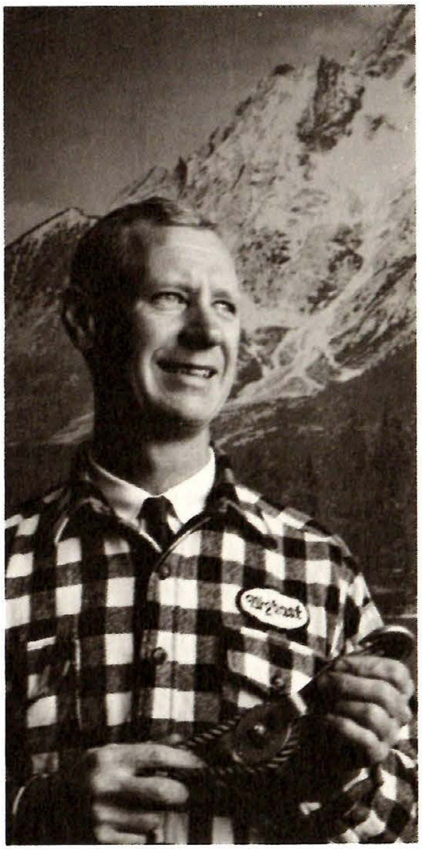
Candidates undergo a battery of special tests to determine their electronics potential, and are interviewed by a number of design engineers. The percentage of rejection is high. During their summer stay, they get a thorough company orientation: Films, tours, panel discussions and question-and-answer sessions with Tek managers. Most important, they're given all the responsibility they can handle, and the freedom to succeed—or fail.

"You're an equal here—not just a lowly technician," marvels Ray Goolsbey. "Nobody stands on top of you and says, 'This is just how it has to be done.' "

He'll be back, fulltime, in February.

RAY GOOLSBEY
suddenly this summer





DICK POOLEY

to the rescue

He's climbed only 54 peaks. And he's been up Mt. Hood only 26 times.

That's the way Dick Pooley (Facilities) ticks off his mountains. But if you back him to the wall he'll also talk about mountain rescue work, and you'll find he's a national leader in the field of rescue, search and climbing safety.

Dick was one of a handful of men who were instrumental in forming the National Mountain Rescue Association, in 1959. He was its first president, serving two years.

He belongs to two old-line Oregon mountain-rescue groups, the Hood River Crag Rats and WyEast Climbers, and to the greatly respected American Alpine Club. The man who nominated him for this select group—and for NMRA president—was famed climber Willi Unsoeld, member of the US Mt. Everest team.

Each year, his volunteer activity instructing, coordinating searches, and "general missionary" work in the many groups, including Mt. Hood Ski Patrol, costs him $400 to $500 out of pocket, and about 150 hours of his free time. It is a selfless effort. Why do it?

"Oh," Dick muses, as if no one had ever asked him before. "I guess I've got compassion for people; I **enjoy** helping them." He believes most mountain-rescue people have pretty much the same reasons—plus, in some cases, the desire to prevent restrictive legislation that might interfere with climbing—as he says, to keep the mountains free.

Dick came by his outdoorsmanship naturally. His grandfather, E.F. Pooley, was a Maine camper in the grand style. As a kid, Dick used to listen to his tales of the big woods and, as he puts it, "fell into" an understanding of the out-of-doors. Granddad Pooley died a very active man. He was 95.

Dick's general outdoors interest—now reflected in membership in a host of mountain, rifle and ski organizations (and leadership in most of them)—began early to focus on climbing. He went up Mt. Hood at 17, and has done it 25 times since.

For a long while, mountain rescue work in Oregon, Dick and some others felt, was too slow in its response to emergencies. Their efforts resulted, in 1955, in forming the Mountain Rescue and Safety Council of Oregon.

Later, an attempt to assure cooperative effort between Oregon's loose-knit association and a somewhat more advanced setup in Washington resulted in two years of joint meetings and eventual formation of the National MRA.

It's hard to assess the effectiveness of the volunteer mountain-rescue and safety program. But Dick cites one interesting statistic:

Based on thousands of man-hours spent at each activity, mountain climbing now is safer (has fewer major injuries) than high-school football.

This is remarkable, since the climber must not only contend with the ever-present fallibility of being human, but also tussle with weather and master tricky rock and snow conditions.

Is Dick also a conservationist? He says he sure is—and this time, by the way he warms to his subject, you know he's talked about the subject before:

"Today" he points out, "If you have enough money it seems you can buy or build anything—an indoor baseball stadium, anything . . . . But all the money in the world can't build a mountain, or bring back a wilderness area once it's gone.

"Unless we use our outdoors resources wisely, someday our grandchildren will ask us 'Grandpaw—What was a wilderness?' " ■

very small and extremely rapid. It can measure a far wider variety of phenomena than any other instrument. And it shows not only their amplitude and duration but also pictures their very nature.

Understandably, the oscilloscope first came into wide use in the electronics industry, where it is the basic tool. But, thanks to the fast-growing ability to transduce (change) heat, sound, gravity, pressure, motion, radio waves, strain, displacement, velocity, acceleration, magnetic flux and a host of other phenomena into electrical signals, many other disciplines have come to realize that this instrument is the most meaningful measuring device for **their** purposes also. So, increasingly, in one scientific, industrial and technological field after another, the oscilloscope is gaining users.

Other change-measuring instruments exist, many of them highly sophisticated. But, in general, they have limitations. Either:

1. They are designed for special purposes—to fit some particular need in a specific industry, for example—and thus are both costly to produce and limited in use; or,
2. They are mechanical, and thus "slow"; or,
3. They provide individual measurements, rather than a **continuous** picture of change.

Hence, the oscilloscope predominates.

How limited is its market? It is limited only by the number of changes that matter; by the horizons of man's curiosity, and by the ingenuity of the user.

It is extremely difficult to visualize any very rapid changes which an oscilloscope can't measure, or won't be able to measure.

Almost every significant electronic manufacturer, laboratory and university in the Free World has a Tektronix oscilloscope. And its ubiquitousness is extending into many other areas of endeavor ranging from technically simple to extremes of measurement sophistication:

- In a university research laboratory. A scientist inserts micropipettes—slivers of glass—into the brain cells of an insect. These small probes are connected to an oscilloscope; the slight voltages of the brain are recorded as he stimulates the insect's nerves.

- In a television studio. In TV—by now a somewhat prosaic electronic field—the dots, which make up the picture you see, change about four million times per second. If they don't, your picture is blurred. Tek scopes stand by as monitors to make sure it isn't.

- In a computer company, "teaching" an electronic brain to respond to the human voice.

- In a steel laboratory, checking for impurities in a new alloy.

- In a missile-monitoring station, recording the pressure on the skin of a skybound rocket.

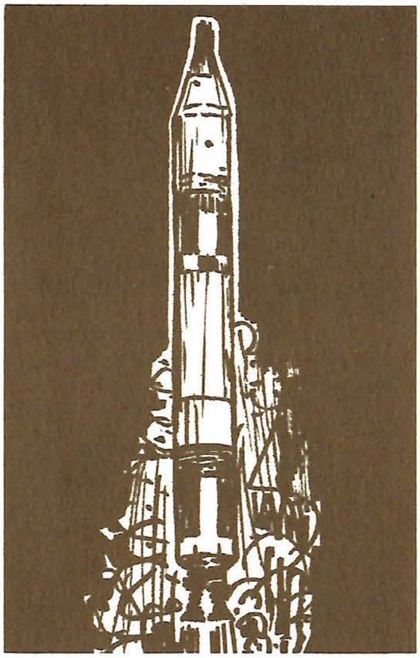
- In an operating room, depicting changes in a patient's respiration and heartbeat during surgery.

- In a chemistry lab, an automotive garage, a hydroelectric plant; coupled to a seismograph; checking for leaks in an oil pipeline; in a textile mill, a bank, a gymnasium;

- Designing and monitoring radar, or TV transmitters or receivers; testing integrated circuits; doing basic research into solar energy; studying acoustics; keeping an eye on automated machinery; testing weld joints; learning about lasers, or quantum mechanics, or infra-red phenomena, or impact testing . . . .

The computer industry, the single largest user, is within itself an example of the many uses to which an oscilloscope may be put. Scopes of varying types are essential tools in not one but a half dozen different phases of computer development:

During preliminary investigation of materials that will give electrical pulses; next, when those materials are formed into diodes, transistors or other devices; next, when circuits are designed to incorporate the devices; next, when the computers are built and tested; next, as monitors during the computer's actual operation, and, finally, in servicing and trouble-shooting the electronic "brains".



Where, then, would today's giant electronic computer industry be, were it not for the oscilloscope and its measuring, recording, picturing, monitoring, diagnosing and testing capacity? It's possible that it would be non-existent, still a gleam in the eye of some engineer, somewhere.

The same may be said for radar, television, the space race, the missile effort, satellite communications and many other whole areas of endeavor.

Yet, for all its economy, versatility and elegance, the oscilloscope may not be the ultimate measuring instrument. It's conceivable that someday, somehow, another technique could be devised to yield more meaningful measurements. But daily, oscilloscopy advances, and more and different kinds of display are added. Tektronix scopes can now provide hard photographic copies, digital readings or information printed on tape.

Vice-President Bob Fitzgerald once put it this way:

"The mission of Tektronix is to provide instruments that will enable the display, the measurement and the recording of electrical waveforms . . . **Whatever** shape these instruments take in the future, we intend to build them . . ."

But today, the oscilloscope has a running start—and a lengthening lead.

Where are the limits of measurement? How far can science go? Just about the time someone thinks he can say for sure, he learns a little more . . . .

And then, as like as not, his ideas **change.** ■

elementary, secondary or post-high school institution for any tax-exempt purpose. Through August 1965 Tektronix Foundation had matched $105,000 donated by employees.

Still another facet of the Foundation's program is its Lectureship Fund. The fund, started in 1961, pays expenses of outstanding scientists who come to Oregon for lecture series at Tektronix and at Oregon colleges. Among those lecturers who have been sponsored by the Lectureship Fund are: Dr. Felix Bloch, 1952 Nobel prize winner in physics; Dr. Kai Siegbahn from Uppsala university, Sweden; and Dr. Polykarp Kusch, 1955 Nobel winner in physics. To date, 28 men of science have lectured in Oregon through the Tektronix Foundation Lectureship Fund.

Another aspect of the Foundation's philanthropic activity is the products contribution program.

Some institutions engaged in scientific or other educational pursuits have needs for instruments manufactured by Tektronix.

When our field engineers hear of such a need, they visit the institution and, if the need appears justified, recommend that Tektronix give an instrument grant rather than a money grant.

This instrument grant can take several forms. Sometimes the instruments are given outright; others, especially obsolete ones, are sold at cost. In every case, the field engineer makes sure the gift serves a legitimate scientific and educational need.

This program was directly administred by Tektronix Foundation until 1961, when its administration was turned over to US Marketing. In fiscal 1965-66, $350,000 is budgeted to support it.

In addition to helping the schools obtain the equipment, Tektronix field offices and repair centers accept responsibility for maintaining it, and for technical training of the users.

Of course, the program is much more complicated than this illustration indicates. Because funds are limited, some requests must be turned down. Obsolete instruments—no longer in regular production—may satisfy the needs of a low-budget customer. Occasionally, freight-damaged instruments are available.

But in all cases the request is carefully explored to insure that an instrument donation, or partial donation, is in the best interests of the customer **and** Tektronix. And all the instruments administered by the products program go to non-profit institutions—colleges, hospitals, etc.

An adjunct to the products program is, for want of a better title, the **non**-products program.

As oscilloscope technology advances, parts become obsolete, tolerances become more critical, designs change.

Tektronix creates goodwill and fulfills needs in electronics-training classes by donating reject and obsolete parts to schools and other institutions, chiefly through the Oregon Museum of Science and Industry. Tektronix' Community Relations group administers this program.

Tek realizes no immediate return on the product and non-product programs. But introducing college students to Tektronix instruments in a laboratory atmosphere virtually assures they will consider Tek when they get ready to equip their own labs.

Finally, the company has encouraged executives and line employees alike to devote their personal time to responsible positions in the community. Employees are reimbursed for absences to serve on state and local court juries; they are granted leaves of absence, with job assurance on return, to serve in public office. In some instances they are allowed time off to attend directors' meetings of local organizations which serve community needs, or to participate in activities of public-service organizations.

An example of this type of employee service to the community is the United Good Neighbors loaned-executive program. Each year several Tektronix employees are released from their jobs to serve fulltime during the 11-week UGN fund-raising program as canvassers for the solicitation program; during the fund drive the employees receive their regular salaries. Through 1965, 23 employees have served as loaned-executives. Others have participated in organizational and training programs.

Another is Tek's sponsorship of a Junior Achievement company, in addition to its financial support of the Junior Achievement program. Employees volunteer their time as advisers to work with JA youngsters who, during the eight-month program, set up a company, sell stock, produce a product and sell it, then liquidate the company.

The youngsters gain invaluable experience and insight into the business world. What reward do the Tek employees receive for the time they spend? The knowledge that they are helping make their community a better place to live by shaping the lives of its young people. This same motive causes Tek employees to serve on school boards, sing in church choirs, work as den mothers and scoutmasters, serve on ski patrol mountain rescue teams . . .

"A company is dependent on the well-being **of** the community . . . and has responsibility **to** the community."

Tektronix meets **its** responsibility, with concern and vigor. ■

OREGON MUSEUM OF SCIENCE AND INDUSTRY, whose exhibits and educational programs cover the entire spectrum of scientific fields, received initial seed money and developmental funds from Tektronix Foundation.

teks

A BUNCH OF the boys were talking it up, and the talk got around to status symbols. What, they asked themselves, is the Ultimate Status Symbol? Is it this: To keep a Rolls-Royce in your garage; and when someone admires it, give it to him?

Nope, said Jack Hornor (Long-Range Planning). It's to have a swimming pool in your home—on the **second** floor.

And Bob Anderson (Advanced Engineering) topped it with: Hire a man to retire for you.

This probably has the makings of a new party game. As if anybody needed one.

WRITER BECKY Weber thinks it's time for Tek to have a contest. "It's time for Tek to have a contest," is how she puts it.

Her idea is that it be a "Happiness at Tek is —" contest. (Like that book you've all read called "Happiness is a Warm Puppy".) Her example: Happiness at Tek is coming to work late in the rain and finding a parking space right by the door.

Or, happiness is having a meeting called off. Or, happiness is pulling the bottom paper cup from the dispenser and not having the next half dozen spill onto the floor. Or — you tell us.

Include any visual aids you think would help your entry: Cartoons, photos, drawings, sculptures — anything so long as it doesn't wiggle.

After thinking of a lot of possible prizes (A lifetime supply of okra; the Electrochemistry building; $3000 in pennies) we chose this one: Your (personal) photo and name published **in this very spot** next issue.

Use the Standard Tek Entry Form:

Your name and department ______

Ages of children (if any) ______ Make of car ______

Brand of cigarette smoked (if any) ______ Your weight (if any) ______

HAPPINESS AT TEK IS ______

______

______

______

(complete in not more than 25 words, and send to Communications, 74/298)

DO YOU KNOW the legend of the Mt. St. Helens apes?

It started years ago, when some hikers came across two Swedish loggers who'd been in the hills for months. These hairy-chested fellows appeared to be hardly human; the hikers scooted for civilization, claiming there were apes in them thar hills. The legend persisted; one deep gulley at the peak's base is still called Ape Canyon.

But Ralph Pratt (Systems & Planning), who recently climbed St. Helens' north face, says the legend is false. He hiked all day and saw neither hide nor hair of any apes.

Here's a picture he shot at the summit, of his fellow climbers. And that thing at the far left is . . . . is . . . .

SINCE THE Tek safety program began (Its theme: "KNE — Knowing's Not Enough"), our accident frequency rate has dropped dramatically. But nothing is perfect. One gal in the assembly area had an accident: She stabbed her finger reaching into a papersackful of KNE safety buttons.

THE ANNUAL PICNIC came and went, and this question was asked by an employee who attended:

Q: How can you tell whether a teen-age kid is having a sudden stomach convulsion and needs first aid, or is doing the latest dance fad?

A: There is no sure way. (As a matter of fact, we hear that one of the winners in the picnic's teen-age dance contest was a bystander who had a packet of book matches ignite in his pants pocket. He was so good they gave him the prize even though he was 85.)

AMONG THE USERS of free Tek films are electronics classes in state and federal prisons. Their audience response cards sent to Beverly Gill (Communications) are kind of different.

One read: "We enjoyed the film. The boys would like to visit your plant." And a wistful postscript added: "—if ever possible."

AND EACH YEAR a midwest prison asks to view the film, "The Oscilloscope Draws a Graft." Figuring it's a Freudian slip, Bev sends them "The Oscilloscope Draws a Graph."

TEKTRONIX' 1965 annual report, in a section headed "The Ubiquitous Oscilloscope," pointed to the widespread use of this instrument. It said in part:

"In the press, on television, in magazines, increased pictorial coverage is being given to scientific achievements and programs. Study such photographs carefully. In the background, somewhere, is there not a (Tektronix) oscilloscope?"

About a month later, as if to emphasize the point, the cover of Life magazine, in full color, pictured a Tek 564 storage scope, in connection with a dramatic feature article on biological research.

Did Tektronix people get all excited at this worldwide publicity? Did they run to the newsstand and buy out all available copies? Did members of top management rush about the halls waving the magazine?

You bet your boots they did.

(The issue was September 10, for folks who like to chase down old copies of Life.)

THE WORLD OF TEKTRONIX IS A WORLD OF EXPLODING TIME. IN IT, A SPLIT SECOND IS A COMMONPLACE: EACH OF ITS FRAGMENTS, SOMETHING TO MEASURE. TO MASTER HIS WORLD, A WORLD THAT WON'T HOLD STILL, MAN MUST KNOW PRECISELY ITS CHANGING FACE. IN THIS QUEST, HE CAN NO LONGER AFFORD TO OVERLOOK THE INFINITESIMAL.