FORUM REPORT 7

The Reverse Forum

In November 1976, Bill Walker (Test and Measurement Group vice president) announced the formation of the Engineering Activities Council. The basic purpose of the Activities Council is to provide engineers with a forum in which to present directly, to multiple levels of management, what engineers themselves consider to be important in technology.

There have been seven forums ("Engineers Talk to Managers") so far. In the seventh forum, the presentation process was reversed: questions from engineers were presented through the Engineering Activities Council to a panel of five high-level managers.

*The panel members were: **Bill Walker** (group vice president, Test and Measurement Group), **Mike Brand** (manager, Test and Measurement Operations), **Wim Velsink** (vice president, Tektronix Laboratories), **Rich Reisinger** (manager, Corporate Planning) and **Larry Mayhew** (group vice president, Information Display Group).*

Chuck Frost (Public Affairs manager) and Harley Perkins (Engineering Services manager) were in the audience and answered a couple of questions.

Questions were solicited from previous Engineering Forum participants and compiled by the Engineering Activities Council. The co-chairmen for Forum 7 were Jon Mutton (IDP Engineering) and Mike Boer (Service Instruments Division Engineering).

Mike Boer (Service Instruments Division Engineering), co-chairman.

Jon Mutton (Information Display Products Engineering), co-chairman.

What is being done to reduce processing delays in groups that support Engineering, particularly those areas that don't get "brownie points" for it, such as ICM, Factory Service, Electrochem, Fab Lab, phase system, and accordion scheduling?

Mike Brand. I think that many of us have been concerned with why it takes so long to bring new products to market. This is a major corporate concern. Claude Tucker (IDS division manager) and I talked to a lot of people throughout the corporation. We got the same messages again and again. There are seven problem areas we believe need to be addressed.

(1) **The design and fabrication of circuit boards.** In the short term, we will be getting parts for A- and B-Phase instruments with two-week turnaround. We have short lines for metal and plastics and we are starting one for etched circuit boards. The short turnaround isn't free...we will need a little more discipline in the design areas. For example, a B-Phase metal part requires a block drawing. The short line will save us two weeks, but we must have a good drawing to work from.

The same is true for boards. You can have B-Phase boards in two weeks, but they have to be manufacturable — that is, the design parameters must already have been met. We think that's a pretty good tradeoff.

We have also put a lot of effort into computer-aided design. When the circuit board design can be digitized, we can save a lot of production time. T&M and IDG each have a CAD machine, but they are only one-port machines. We are making a major effort to get rid of this one-port entry problem. In addition, we're expanding our wirewrap facilities to speed up multi-layer board fabrication.

In general, there has been some progress in every area where we can find tools that make the process move faster.

We can improve our time-to-market by 30 percent, but it can't be done by any tricks. We will have to have very firm management techniques in the product groups. For example, the fact that we have 24-hour turnaround on simple two-sided boards doesn't help us a bit if we have 30 go-arounds for each board. Or, having a short line that will give you

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parts in two weeks doesn't help if we have 200 ECO's after Engineering Release. To make progress, we will have to improve all phases of new product introduction.

(2) **Poor product definition.** If we can't figure out what it is we are going to build, things spin around, we don't get approval, and the product has to be redesigned. This problem of product definition has to be solved by the product team. There's no easy way to get at it other than hard work and better planning.

(3) **The imposing size of our system.** When we try to develop a new product, whether it's through a phase system or manufacturing accordion lead time, it seems there is an enormous wall we have to climb over before that product can become a reality.

The phase system problem, frustrating to all of us, is a carryover from the time we were a smaller company. The phase system was designed for the engineering portion of new product introduction. With today's organization and with pressures to get the market sooner, we need a system that integrates manufacturing and marketing with engineering. Bob Banford, Deane Kidd, and Gary Graham (New Product Introduction) are working hard to design a system that addresses more than the engineering problem. The new system is based on the assumption that each product
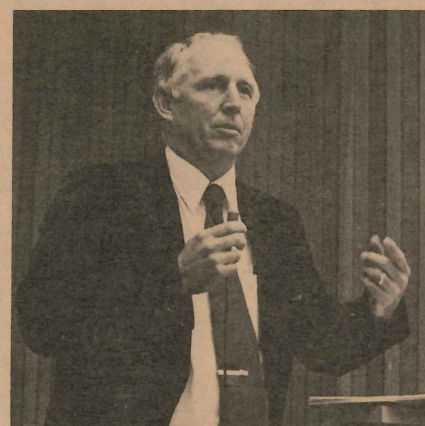
Mike Brand, Test and Measurement Operations manager.

manager is responsible for the product all the way to market which is only partly true today.

We've also had a problem with software because it doesn't seem to fit the phase system. Steve Baunach from IDG, along with some people from T&M, are working with Bob Banford to try to fit software and firmware into the phase system.

(4) **Risk taking.** The element of risk-taking seems to be missing now, and it needs to be reinstated.

(5) **A bad habit of understaffing projects.** Ironically, it starts in areas where we have an extra engineer and, rather than let him sit idle, we let him start a new project. This is a problem for support departments as well as design departments. We try to do too much, rather than focus on the things that we really need to do.

(6) **A failure to standardize common parts, packages, and circuits.** We seem to want to do everything as one-of-a-kind...a very expensive way to operate.

Product safety and reliability requirements are adding time to new product introduction. Reliability, a major corporate interest that calls for a major effort, does slow us down, particularly when we wait until Engineering Release to test an instrument for reliability and then have to go back and redesign it. However, I think we're adjusting to these safety and reliability requirements. We will need to put a lot of effort into making design tools more useful and more available. If we don't have tools where we need them, speak out. If we are to make changes, the initiative will have to come directly from the engineering group, because they will have to use those tools.

(7) **The final problem is how best to introduce products into manufacturing.** That is a problem we will probably always have to some extent. For example, let's take a process that we started in the FAB LAB where you make two boards at a time, or maybe five or ten, and then have to jump right into regular

production. It's very difficult to do that. It is easy to understand some manufacturing managers' reluctance to accept new processes.

We hope the short-line will make the transition to manufacturing a two-step process instead of a major leap. It is a problem that will require manufacturing involvement early enough to understand what's coming, and will require engineering to be more hesitant to hand over an incomplete process.

"If we are to make changes, the initiative will have to come directly from the engineering group..."

"I don't understand why you can't make it — we make it in the model shop and it's easy." That attitude may continue, but I think we can work on it.

Won't your insistence on more complete design slow us down?

Yes, to a degree. We look for a progression. I don't think we believe that A-Phase boards will be perfect, but by the time the instruments are B-Phase, there's always pressure to sell them. You'd be amazed at the poor quality that sometimes comes through. We really need to correct that, so that it doesn't block up the regular manufacturing line.

With all the requirements you're demanding, it doesn't sound like we will be any better off than continuing to work through regular production.

The tradeoff is this. Say that you're going through a regular manufacturing line with a large B-Phase build, and manufacturing doesn't know that the instrument has bugs until the boards start down the line. Then you have to start over with a seven or eight week lead time.

We want to catch those problems faster by having better communication between engineering and manufacturing. So, let's say that a board goes through the short line instead of the regular manufacturing

line, but with some errors like connections that go nowhere. Now, just a phone call can get the drawings back and get the problem corrected. But it's very tough for a manufacturing line to deal with that because they have long lead times and large volume requirements.

It seems that the real problem with circuit boards is design time. What are you doing about that?

We are working on the layout problem. We now have a rudimentary system with a 4081 Interactive Graphics Terminal and the Cyber computer. For example, a board that one division worked on for four weeks, we were able to design in one hour of CPU time. Also, we've got some R&D contracts with both Oregon State University and Stanford University and a major effort here on routing and placement as well as digitizing.

How are we going to improve our ability to introduce new things (like the HYPCON connector) into manufacturing?

The HYPCON is a classic example of how not to do it. We've probably made all the mistakes that can be made. The climate is much better now, and Manufacturing Engineering is much more involved. We're trying to get the production line manufacturing managers interested early enough to come over and see prototypes.

Sometimes what we do for boards in engineering quantities won't work in larger quantities. The transition to manufacturing is difficult. It may never be super easy, but I think that we have at least recognized the problem. As an illustration, Wim's manufacturing people spent a lot of time making crt's and semiconductor processes manufacturable. From my perspective, the transition to manufacturing is a lot easier today than it was even a year ago. Attitudes have changed and we have new people with technical skills to make the transition easier.

"We are trying to get the production line manufacturing managers interested early enough to come over and see prototypes."

Budgeting, financial information, and data processing in general are sources of problems to engineers. To many people, the information services organization appears not to be a service organization in any sense. For example, there seem to be no programmers to help anyone with their problems. Another example is the difficulty in obtaining order entry information to find out who our customers are.

Rich Reisinger. First, let me assure you that information, budgeting and data processing are sources of problems to people other than engineers. They are a major concern to corporate management and have been for several years.

The underlying problem is resource allocation. I suspect that none of us in this room ever has enough information. I know that's certainly true in my case, although sometimes I have plenty of irrelevant information. But when we add up the costs, we can see that there's no way the company can satisfy all the information needs. So that means priorities have to be set. Over the last several years, corporate management has been reviewing the major projects pursued by the Information Services department. My apologies to members of the corporate group in the room, but they're only mortal people and they all have their own sets of priorities. So somebody will not be satisfied with the allocation. I haven't been for six years. The problem is still a major concern. There was a lot of analysis and a lot of discussion of information this last summer.

In May, 1977, the corporate group went through a process like the one that resulted in this forum. A number of issues were submitted by managers throughout the
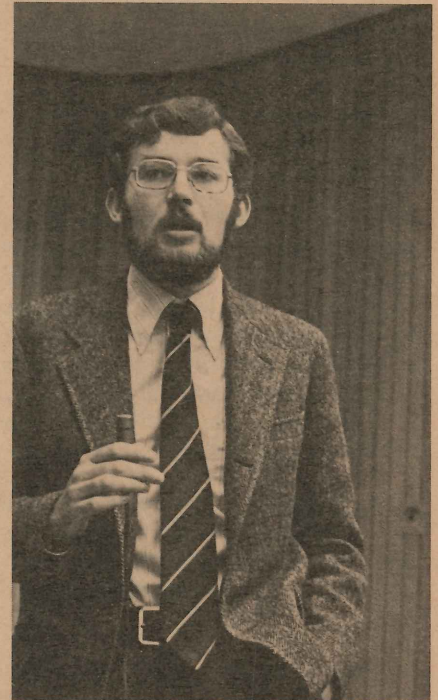
Rich Reisinger, Corporate Planning manager.

organization, and then the corporate group spent three days trying to aggregate them. They had the same problems the Engineering Council had aggregating questions for this forum.

But one issue stood out: the need to identify managers' information requirements.

I was responsible for writing a project plan to address that problem. It discusses what we have to do to identify and satisfy management's information needs.

Also, as a part of our strategic planning process, Larry Choruby (vice president of Information Services) has submitted a plan that defines the Information Services department strategy for the next five years.

Lastly, at a recent management meeting there was much discussion of information needs. A number of groups were appointed to discuss such questions as: How do we get good customer information out of order processing systems? What kinds of production cost information is useful to engineers? How do we access our data base? And how do we get an information system defined? So, you can see that we are focusing a lot of effort on the problem of supplying information.

The annual report states that for the last five years substantially higher rates of growth have occurred in administration and marketing than in engineering. Doesn't this indicate that the corporate group perceives greater value in these areas? If not, why not? And, isn't this one of the first signs of corporate arteriosclerosis?

Rich Reisinger. It is true that for the last five years marketing and administration expenses have grown faster than engineering expenses. However, during last year that trend reversed. Engineering expenses have grown faster in the last 52 weeks than either marketing or administration.

However, I don't think these trends indicate relative value, and I'm certain corporate management doesn't see that way either. It's really a question of what does this company need to do—where do we put our resources to accomplish our objectives? That's the question that corporate management addresses when it reviews strategic plans and when it sets its annual expense targets. There are good reasons why marketing and administrative expenses have grown over the past five years. Let's look at marketing first.

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Back in 1970-71, most corporate managers accepted the idea that the marketing in this company was weak relative to other activities, and it needed beefing up if we were going to be competitive in the marketplace. One factor that has led to increased spending in marketing is the fact that we've gotten into new markets that require a different approach to our customers. Information display is an example. That was a pioneering effort: we were trying to convince customers to use a new technology. That effort requires a greater marketing expense than we're accustomed to.

Over the last five years we've moved away from the image of a one-product company toward a much broader product line and customer base. As a consequence, we need a much greater variety of people selling our products. So we've had to expand our sales force.

Also, in the 60's our field engineers were both sales and service people, and they had a fairly consistent product line to deal with. But as our products became much more complex, we neglected the service side of the job. So in the 70's we split the sales force from the service side of

the business. And today our service organization is probably the best in the industry.

Also increasing marketing costs over the last three years was adoption of commission compensation for field salesmen. That compensation expense used to show up in profit share.

Finally, the creation of divisions and other organizational changes over the last couple of years have created new marketing positions that have added to expenses. Most money for new marketing expenses comes from reduced manufacturing costs. Because our gross margins have greatly improved over the last five years, much of the funding for increased marketing comes from manufacturing.

In the administrative area, there are two principal reasons why expenses have grown. One is the growing organizational size and complexity. The other is our response to the many government programs that add to our administrative burdens. Organizations like Facilities and Human Resources have to grow to support a larger organization. They also need to support EEO, the new pension law, DEQ and OSHA.

Furthermore, over the last few years we've increased our emphasis on employee training, and in the last two years we've put a lot of money into management training. Other administrative expenses were for new activities such as corporate planning.

Corporate management has defined some broad guidelines to support its corporate objectives. These guidelines include an expectation that spending on engineering (averaged over a long period) will be between eight and nine percent of net sales. That's consistent with the last 10 to 12 years. I think we will see marketing expenses level off close to where they are today.

There is one thing that is important to remember when you look at our engineering expense and compare it to other companies. You need to add

"...our...spending for engineering is roughly 9½ percent of sales. It makes us a leader in our industry."

about one percentage point to what is spent on engineering to account for the profit share that is paid to engineering personnel. So that puts our current level of spending for engineering at roughly 9-1/2 percent of sales. That's compared to Hewlett-Packard, for example, which is currently spending about 9 percent. It makes us a leader in our industry. The industry average for instrument companies is about 5-1/2 percent of sales...and the instrument industry is one of the highest spending industries in the country in terms of its average spending for R&D.

So, industry comparisons suggest to us that the level of expense is about right. But that is not the basis on which those expense guidelines are set. They're really determined by what is needed to accomplish the corporate objectives and the objectives of every business unit.

Larry Mayhew, Information Display Group vice president.

Growth can be achieved by ingenious application of technologies available on the open market or by development of proprietary technology bordering on the state-of-the-art, the GOTCHA! Which of these avenues does management see as most important?

Larry Mayhew. To answer this broad question, it's important to first define "engineering" and "science." When I was going to school, "engineering" was the process of applying known techniques and available raw materials to the production of something commercially significant. And "science" was the process of looking for new techniques and new raw materials and attempting to produce something that may or may not be commercially significant. In many cases, scientific endeavors are fruitless commercially.

It is inappropriate to say that one or the other is more important because we have to have both in order to survive over the long term. In the embryonic stage of a market's development, the product appeals to the people who are willing to take a chance. Customers buy at that time because of the innovations the product brings to the market, the GOTCHA. However, in the later stages of the market's development, when the technology rollover is slower, customers approach the purchase of the product more on a price-and-availability basis. Then we have to get down to the hard, sharp-pencil design-refinement process.

Much of the profit is made in the later phases of the marketing cycle; hence, participating in that part of the market cycle gives us the funds for more scientific research and for a greater engineering investment. That means that we must put some of our effort into refinements.

There is, then, no clear choice. Instead, there are tradeoffs between the technological GOTCHA at the early stages of marketing and the sharp-value engineering required later. We must have both to survive.

Now, the list of questions presented to this panel included a reference to cathode ray tube technology. I believe Tektronix is a significant leader in that field and I believe that we have an obligation to continue to be an innovator. We have to make sure that the applications of current technologies are only abandoned when they are no longer superior. The storage tube is a good example.

We did not share that innovation with other manufacturers when it was first available. Because they derive no benefit from its applications, they say it has shortcomings. We hear complaints from our competition and even from some of our customers. It would be irresponsible, however, to let that shake us into not paying attention to the real value it provides the customer. Still, while we have to make sure we don't abandon it prematurely, we also should recognize any new and superior technology. Our customers demand from us that we bring out the next step in technology whatever it may be. That requires a lot of investigation of those technologies... which we are doing.

"...investigations into new technologies are financed by the profits we generate..."

The investigations into new technologies are financed by the profits we generate and that is a product of the relative margin that each project provides. A good measure of innovation in a product in any stage of its life is the ratio between the customer's perception of the product's value (which is where we should price the product) and the cost of producing the product. We can take pride in a product that can be sold at a healthy price because, with a high margin, we have more funds to put back into research activity and into engineering activities.

There are many areas of integrated circuit technology in which the industry recognizes us as being innovative. In fact, in several areas we are the leaders. My personal concern is that we don't have the production volume to exploit those technologies as fully as the major semiconductor houses do.

Wim Velsink. I'd like to offer a couple of observations. If we have a proprietary technology position, that is a good thing for us. It increases our margin; product sales are easier; and it lets us maintain a competitive position and have a longer product life cycle without frequent redesign.

On the other hand, there are market requirements. A proprietary position without a market need for the technology doesn't do us any good. And if that marketplace need can be filled by a combination of mass-produced hardware such as ROM and RAM, then using proprietary technology doesn't get us anywhere either. So the answer is to join "engineering" and "science" and to look at every business unit on its own merits.

That applies particularly to IC technology. In some portable product lines we are increasing our involvement in IC's because we really can impact that market. In other areas where the products are based on standard, large-volume circuitry, it would be very difficult to greatly impact the market with new IC technology.

Wim Velsink, Tektronix Laboratories vice president.

One of the lighter moments in Forum 7, as Larry Mayhew (seated, second from the left) answers a question from the audience. Many of the people in the audience had participated in earlier forums as speakers or chairmen.

Given your definition of science and engineering, are we wasting ourselves more on the engineering side now than we were say five, or twenty years ago? Are we indeed more conscious of the dollar now than five years ago?

Larry Mayhew. I had my answer all figured out before you got to that last sentence. There's no doubt about it. We're more conscious of the dollar today than we were five years ago. And I think if we weren't, the company's performance wouldn't be what it is today.

I don't believe that we are more engineering-oriented than science-oriented today compared to five years ago. But that observation depends a lot on the eye of the perceiver. The values you as engineers bring to the judgement process have to be recognized so that the engineering viewpoint will affect corporate resource planning.

Do you think that we're more concerned about the dollars that are coming back on short term or the dollars that are coming back on long term investments?

There is a later question on that topic. But, let me answer it this way: rather than say we're more short-term oriented, I think we didn't worry about what was coming back at all.

Are market place demands inhibiting the creativity of our designs?

Bill Walker. That is one of those eternal problems that engineers are used to...where every solution is a compromise. You did not put all of your most creative solutions into your last product. You put some of your creative solutions in, but some of them were so creative you decided to leave them out. The nature of any process by which you trade off innovation for economic realities, marketability, and time to the market is a process of compromise.

"Compromise" has a bad connotation because we think that out of compromise comes the proverbial camel or other odd looking animal rather than what we want. That danger does exist. There's also a danger for any individual who puts things together that he may make the wrong compromises.

We do have a review process that puts up a lot of roadblocks. I believe that process has led us to better products than we have had in many years. We may get a little more frustration, but I'm not sure we do. It's hard to remember the frustrations of years like 1967, but some of us can remember them and if you worked on the 5031 you ought to remember the frustrations.

I believe there are fewer frustrations now and I believe the products that come from our present process are better. We have to maintain the attitude that no matter how large we get, in the early stages of innovation we have to remain flexible and open and we must work with new ideas and see if we can come up with even better ideas or a better product. Every idea, no matter how good, has to finally stand in the light of day, and we have to ask all the hard questions before the marketplace asks us these questions in a much harsher way. We need a review process that allows very free-flowing discussions in the early stages, much as we've had in these forums. But at some stage we must subject these ideas to harsh judgments and reach the best compromise.

By stripping away the design which we feel will not add the most to our growth, profitability and our other corporate objectives, we can provide all the necessary support for achieving those things that are truly important to us. I believe our review process works well, but we need your feedback to further improve it.

Most technologically-based companies have government R&D contracts and use the knowledge gained for their own profit. Has Tektronix considered seeking some of these contracts to fund part of our R&D effort?
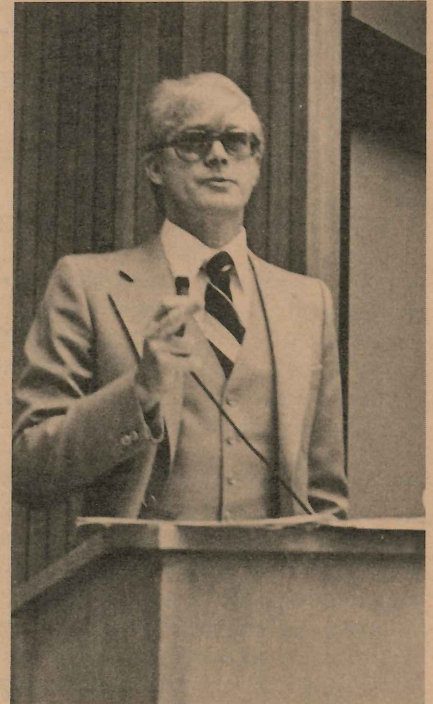
Bill Walker, Test and Measurement Group vice president.

Wim Velsink. The question of funding some research through governmental R&D contracts has come up from time to time and keeps coming up. There are five major problems with governmental R&D contracts: patents, accounting, renegotiation, flexibility and focus.

First, if you do research with government money, patents are in the public domain. At Tektronix we try to focus our development dollars so that we can obtain a proprietary position for the company.

Second, the government has definite opinions about accounting procedures, how they want to access our accounts and how much money we should make on the research contract. So, we would have to set up a separate accounting system for those areas of the company doing government research. That is costly as well as a pain.

As you may know, each year Tektronix goes through the renegotiation process. All monies that are received as payment for government contract work are added to that renegotiation pile and, by and by, the government gets tougher and meaner as the pile becomes a greater part of total sales.

Flexibility is a fourth concern. Once you're into a contract cycle, you're committed to continue, at least if you want a reasonably open relationship with people you are doing business with. So contract work does limit your allocation resources.

The same thing goes for focus. Contract work can draw on some of your very best resources in areas that you may need somewhere else tomorrow. That is especially true in a rapidly changing market. But if you're tied into a research contract for the next year or two, you're unable to shift your resources.

Those are the less appetizing aspects of government contracts. However, other companies do make use of that kind of funding. HP, for example, did most of their GaAs work on

government money. That was probably an excellent move for them.

We are in the middle of one government contract at the moment. In another area, government R&D money will pay for almost all project development costs. However, there we bypassed the drawbacks of contract work by basically selling a number of tubes to the government for a price that almost covered the development costs. In that case, we're really not in a contract yet. So, it is a far more attractive way of operating than just straight contract research.

We will be trying to make use of government R&D money when it is in line with our needs.

How does renegotiation work?

Chuck Frost. (Tektronix Public Affairs manager). The renegotiation Act of 1951 established the Renegotiation Board whose purpose was to recoup "excess" profits made by government contractors during the Korean War.

However, in September 1977 the Senate Banking, Housing and Urban Affairs Committee adopted the Cranston-Lugar bill which would deactivate the Renegotiation Board except in a national emergency at which time the president could reinstate the renegotiation process with an executive order.

Sen. William Proxmire and Rep. Joseph G. Minish have proposed amendments to the Renegotiation Act that would require product line renegotiation of sales to the federal government and would severely limit the "standard commercial article" exemption contained in the original act. Most of Tektronix' sales to the federal government have been exempt from renegotiation as sales of "standard commercial articles" or "classes" of articles as defined in the Renegotiation Act.

Tektronix has opposed efforts to expand the renegotiation laws to include standard commercial articles.

Larry Mayhew. Our biggest fear in the area of renegotiation is that by having one area of our accounting opened up, we will expose the rest of the company's books. The impetus behind the Renegotiation Act arose in the Second World War, because allegedly there were a lot of contractors exploiting short-term war requirements and because there was little significant competition in bidding processes.

The fears of widespread profiteering were perhaps justified at that time, but probably not today. I think the Renegotiation Act revision is not likely to pass, but the McClosky-Hanover amendment will get tacked onto the original act. This amendment will enable the government to enstate the Renegotiation Act only in national emergencies, but in a more severe form than it's in now.

Business units are often reluctant to fund projects which need long term R&D because they do not have an immediate return. Is there any consideration being given to alleviate this by direct corporate funding of R&D?

Also, what is being done to increase research in and cooperation with universities in order to tap new resources and technologies as other companies do?

Wim Velsink. First, I'd like to explain a little bit about the funding schemes that we presently have within Tek Labs. First of all, the Tek Labs budget is split about 70-30. About 70 per cent goes into the development contracts with the divisions. That includes related support. In other words, if the Monolithic IC area makes a monolithic chip and Hybrid Circuits makes a hybrid with it and trims it up and sells it, the money that Monolithic Circuits spends is counted as a part of this 70 per cent category.

But 30 per cent of the total is for research programs independent of the divisions. This 30 per cent is determined by three people — Bill, Larry and myself, once a year.

The only way in Tektronix that we have to sink cost is into the divisions. All costs eventually end up there because those are the points where the profits come in. The product-related development contracts, of course, are charged directly to the divisions. We go through the allocation process and, by-and-by, the Tek Labs Three Pages are generated, the division or business unit engineering managers sign for this expense, and say "yes" this is an acceptable expenditure for the development of that particular component or device.

Then there is some "99" (basic research) in the development groups. That expenditure is 15 per cent of the contract dollar and is sunk into the divisions ... based half on the previous year's contracts with Tek Labs, and half on the five year sales forecast. Then the last portion, the 30 per cent of the pie, is allocated to the division based directly on actual sales and indirectly on next year's profit.

Each panel member answered questions compiled by the Engineering activities Council as well as questions from the audience. The audience filled the building 50 auditorium in which the forum was held.

So, that 30 per cent of the total Tek Labs budget is pretty much shielded from annual renegotiations. We feel an obligation to keep all the people informed who should know what we're doing with that money, and also to solicit your feedback on how we're spending it.

But we also feel that we need to maintain continuity in the Applied Research groups. We want to be able to run for several years on some projects without having to show a pearl every six months to avoid being gunned out of the sky.

The second part of the question was what is being done to increase research cooperation with universities to tap new resources and technologies. We have a fair amount of that going on with Stanford and a number of eastern schools. Professor Lentz, University of Tubengin in Germany, comes here each summer. We have plans to do more of that. One of our 13 objectives is digital excellence, and one way to implement that is to develop very tight relationships with the top digital schools such as Carnegie, Mellon, Stanford and MIT.

One of the subquestions is why HP introduced 25 new products versus Tek's four last year. I did some digging on that and came up with the following statistics out of NPI minutes.

In fact, in FY600 we had 21 major product introductions and about 12 minor ones. In FY700 we had eight major and 24 minor. In FY800 we had 10 major and several minor ones.

Historically, we have periods where we have introduced many products followed by dry periods. A rapidly changing environment can contribute to product definition paralysis which in turn can partly account for those cycles. For example, the explosion of silicon technology (which has driven down RAM prices) made new processes possible and will make new VLSI processes available at a rate of change equal to what we are seeing today in memory technology.

"Rapid change makes targeting products a difficult job for all of us...It's like trying to shoot ducks flying at 100 miles an hour."

Rapid change makes targeting products a difficult job for all of us: engineering, marketing and management, too. It's like trying to shoot ducks flying at 100 miles an hour. On the other hand, over the long haul we have come out with some really outstanding products. We sometimes spread ourselves too thin and push along 20 or 30 products at the same time without the required engineering or support resources. We're better off trying to focus on a few biggies and do those well. We have been trying to implement that kind of philosophy.

Mike Brand. I'd like to add a comment about college contacts. We do have a fairly formal college contacts and research program that Harley Perkins has developed. He has a budget of about one-tenth of one percent of the engineering budget and he has a committee (Bob Nordstrom, Gene Chao and Tom Bohan) to work with him. That budgeted money has been allocated to a number of universities, some is for general support and some for specific research. The program is going quite well.

What co-operative programs do we have with schools in the area?

Bill Walker. Several people have earned MBA's through the cooperative program with the University of Portland. We also have cooperative programs with the Center for Graduate Studies in Science and Engineering, the masters program in EE with Oregon State University, and the BSEE at University of Portland. In addition, George Wilson taught an IC design class in Seattle, and Jim Smith taught I²L classes at Berkeley. As a part of the digital excellence program I mentioned earlier, we may send people to some of the big schools to teach and take classes.

Harley Perkins. (Engineering Services manager). We have a student at the Oregon Graduate Center. There isn't anything that limits anyone from going for a PHD with the existing cooperative programs that we have now other than the residency requirement (the candidate must live on campus for a year). That's easy to do with the Grad Center, but it's harder to do at OSU because the faculty wants to have contact with the student and they also want the student to have contact with other students. So we haven't found a way out of the year residency requirement for PhD, but there is no road block right now to anyone pursuing a PhD within the programs we already have.

We also have a contact with Portland State. Allen Hollister is a full-time professor this year. I think we're going to see more cooperation with local schools too.

An apparent dichotomy exists between the reward system for group and division managers which emphasizes short term performance, earnings/per share, and profit, and the need for long term technical development. What checks and balances insure long range goals are not sacrificed for the short term ones?

Larry Mayhew. There's always a conflict between long- and short-term goals. I think that the most critical management performance test is the balance struck between them, but it takes years to evaluate the validity of a given balance.

There may be some misconceptions about how upper-level management performance is evaluated. The division manager and group managers are all evaluated on the basis of performance against a five-year plan. Most other company employees are evaluated against an annual plan.

So there is a much longer cycle associated with managers' job evaluations. Some compensation programs referred to in the question run on an interlocking three-year basis, but they are definitely not short-term.

How does one take advantage of a perceived but unforecasted opportunity?

Bill Walker. The people to answer that are those who got the Microprocessor Lab (8001) program rolling in a short time, even though it wasn't in the five-year plan. An urgent, but well-conceived program can definitely get management's attention.

"Anyone who's familiar with what is going on in Japan has to be a little alarmed about their progress."

Is there concern about the Japanese business and government collaboration?

Larry Mayhew. Anyone who's familiar with what is going on in Japan has to be a little alarmed about their progress. In the area of information display area, their progress is really quite frightening. We are not likely to get the same level of government tax relief and investment incentive that the Japanese enjoy. So we're going to have to do it some other way. But, yes, we're definitely concerned about that.

What are the corporate plans to become a 1.5 billion-dollar company?

Wim Velsink. Exactly what the target in sales will be I don't know. I don't think anyone has looked at the aggregates yet. However, there is a five-year plan, it is very detailed, and it cost a lot of time and money to put together. Obviously, the company believes it is a very important process.

Are these corporate plans available to the engineering community?

Larry Mahew. Naturally, any document that sets down the company's strategy is very sensitive. We don't intend to withhold a definition of the goals affecting your job. The best way to access those goals is to talk with your manager. The document is restricted, so you won't receive it in a hardcopy form to take home and keep. If you can show relevance to your job and your performance, then it will be disclosed.

What do you attribute Japanese advances to?

Larry Mayhew. I believe that the Japanese people have the most exciting outlook right now of any country that I have visited. They seem to be very enthusiastic about life in general and about the atmosphere in which they find themselves. Their standard of living has risen rapidly over the last few years and I think that they believe that working is a very valuable part of their life. And I think once people make peace with the idea of working, it does have a very great affect on the productivity and the enthusiasm with which one approaches one's goals.

In some sessions that I've sat through lately, the whole tone of reference to the Japanese contribution to industry and technology has changed. They are significant, original, innovative thinkers, and the quality and utility of their manufactured goods is competitive on the world market. They are no longer cheap imitators of other people's ideas.

How can design teams plan ahead of marketing requirements?

Larry Mayhew. You are not alone in facing this problem, of course. To the extent that one is doing original work it should be out in front of the business unit's needs, but advance planning is hard if you don't know what the business unit needs.

The same problem exists for manufacturing and some other areas. Facilities is a good example. We're trying to pull together a corporate facilities plan. At the same time we're pulling together all the business unit plans that will make known, for the first time, their needs for facilities. We're going to have a lot of trouble doing that. So, we're still learning.

We're on our third five-year plan and we're still finding a lot of things we need to do better.

The number of questions from the audience, and the applause that followed the forum indicated strong interest in the topics discussed.

The storage tube has had significant impact upon Tektronix. But, now many are concerned that the atmosphere is not conducive to a similar development. Blame has been placed on a variety of factors including: lack of *esprit de corps* among the innovators, poor planning, insufficient facilities and little or no funding. Are corporate managers as concerned as the technical people are? How are you addressing the problem?

Bill Walker. Well, the corporate group people probably aren't as concerned as the innovators because they're probably not as close to the problem. They don't see the specific cases. I think the thing that always makes people concerned is being very close to a specific situation they can relate to directly. And it's the nature of any organization that as it gets bigger and bigger, upper level managers are more and more isolated from most such specific situations.

I'd like to take questions about morale and rewards and treat them as an environmental question. All I can do is tell you what *I* think about these things. But changing thoughts into organizations, attitudes and policies is an imperfect process. Nevertheless, I would like you to know "where I am coming from."

When I talk to Guy Fraser, our chief psychologist, about "morale", he refuses to use the word. He says the word has no meaning in psychology, you need to talk about specific things. I think, nevertheless, that we can use the word "morale" to mean a "feeling about our environment."

The thing I'd put at the top of the list of each individual's concerns about the working environment is how he perceives the value of his work. If employees see that their work has great value, then that's a very positive factor in how they feel about themselves and about the organization they're working for.

The second factor is how the individual perceives the attitudes of the people around him? Does he feel that he is recognized, appreciated and supported? Does he have enough freedom and authority to get on with the work? If he doesn't, frustrations are the result.

The third factor, the leadership role of the local manager, is very important. In a corporate organization everyone has a boss. Everyone depends to a great extent on the boss' personality, imagination, forward thinking, and positive outlook to create a good work environment.

"...we don't have a single 'Tektronix environment,' but hundreds of environments. From group to group their are vast differences..."

I think those three things, above all else, create environments. So, we don't have a single "Tektronix environment," but hundreds of environments. From group to group there are vast differences in how the people working in those groups feel about their environment.

If the question about creativity implies that there has been a net loss of creative people at Tektronix, I can't fairly answer the question because I don't agree with the implication.

It is true that creative people leave Tektronix sometimes. And it's also sometimes true that those creative people come back to Tektronix.

In the final analysis, we need not only creative people, but creative people who have useful contributions to offer. You can create puzzles and all kinds of things that may be fun, but to have value here their contributions have to be useful in terms of company objectives.

A creative person may feel that his work is not useful or that he isn't appreciated. He may not get the support he needs, so his frustration builds to the point that he finally says "Well, to heck with this, I'm going to pack it in and go where I will be appreciated."

In a community as large as Tektronix, that happens sometimes. We'd like for it not to, but it does happen. People are still people, whether they're creative or not creative. We all work with bosses and with peer groups.

Sometimes we like to think about the good old days, about how great it was before we got so big and had to formalize so many procedures. The one creation that has truly made a new industry for Tektronix in all those years is the storage tube.

As many of you know, the inventor was Bob Anderson. During the time that he was doing that work he wasn't free of frustration. He worked in an adversary environment. He didn't work with total support from top management and everybody else. In some ways he worked in a tougher environment than any of us work in today. Even after he solved the basic problems so that he could at least run a trace across the tube face and, in a dimly lit room, see that something had been written, he still was looking for someone in the company to "buy" his product. And, believe me, his frustration was plainly written on his face as he did this. Eventually, the storage tube was bootlegged into a custom instrument. No one can promise that innovation will be free of frustration. In fact, I believe it is one of the most frustrating roles anyone can play in any organization.

A lot of engineering people who work here are people who have gone elsewhere and come back. I believe that we have one of the best and most creative engineering climates that exists in the country. That's not to say that it's perfect, but it's pretty darn good.

Let's talk about the reward system next. Our reward system is really a very simple thing. What it is now is very close to what it was in the past.

We pay base salaries which we try to make competitive with the industry. Our base salaries are roughly 90 percent of the industry average. With a 20 percent cash profit share, actual take-home salary is somewhat better than the average in the industry. That's our basic reward system.

"Sometimes we like to think about the good old days, about how great it was before we got so big and had to formalize so many procedures."

We say we are a merit company, and we try to administer salaries so that those who make the greatest contributions make the most money. But the program is administered by people who are imperfect, so it doesn't always turn out to be ideal. But on the whole, I think it does work well.

We also have a stock option program. The stock option committee that makes the final commitment is a board of director's function. They meet twice a year now, but quarterly we're asking the managers who report to me to list their candidates for stock options. They in turn talk with the managers who report to them. The inquiry process goes on so that all levels of the company should be aware that there is going to be a stock option priority list prepared.

Candidate's names, then, come up from the engineering level through division managers and functional managers. Each of the managers reporting to me attaches priorities to his set of names and then I do the same for the names I receive. Last, Earl Wantland combines the lists he receives from all over the company, looks at the amount of stock available and arrives at amounts and names. It's a complex process that involves a lot of judgment even before the selections for stock options are made.

Another subquestion was about upward mobility for professional technical people other than EE's. It's hard for me to relate to that question, but I know it's been a question over the years. "EE's get top management jobs in the company rather ME's or chemical engineers or someone else," is what I hear.

When I'm looking for a manager, I write down the qualities that I need to fill the role. I don't start with "a man", or "a woman", or "black" or "white" or "ME, EE, CE" or whatever.

In some job roles, background factors may be important. Maybe the job calls for a marketing background. If it does, then you are certainly going to be looking at people who have a marketing background.

Whether you are an EE or not, you should ask yourself "what kind of a job do I want and what are the qualifications that will let me get that job." If you need an EE degree for a job, then you should get the degree or the background that we equate with the term "EE".

But, you may aspire to a job that doesn't require an EE background. For example, the person who's responsible for economic forecasting at Tektronix (he is in Rich Reisinger's group) is a mechanical engineer. That background evidently suited him for economic forecasting.

Rich Reisinger. Let's say we didn't hold it against him.

Bill Walker. So you see how open-minded everyone is.

There's no question of who's better than whom. Our educational programs, training programs and promotional opportunities are open to everybody. But certainly a manager has to try to select the person whose background fits that job. I hope I've answered all the questions on this topic. As I listened to the answers to the other questions I noticed that we do reflect back to the good old days a lot of times. There were some things that were nice...we had free coffee for instance...but if you really examine the past with a critical eye, you will see that in the late 60's we were almost a dying company.

Over the last five years we have been growing at 20 percent per year compounded. Five years before that, which we think of as the "good old days", we grew only 25 percent in five years.

We were losing market share to Hewlett-Packard. Our great innovativeness had led us to Hewlett-Packard's 180 series scopes which had greater bandwidth and better portability and were the first with solid state circuitry. We were trying unsuccessfully to diversify during that period of time.

In the eyes of the test and measurement industry, Tektronix is now a very vital company. It's growing like crazy, it's very profitable, and we're entering new product areas. I think we are much more vital today than ever before.

In spite of our problems and frustrations, we're doing well as a

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"I know you have frustrations and I know managers create some of them...but obviously you deal effectively with them."

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company. I'd like to take this opportunity to congratulate you, the engineering community, for your part in the progress we've made. I know you have frustrations and I know managers create some of them...but obviously you deal effectively with them.

Rewarding highly-paid managers excessively would seem to downgrade the morale of lower-paid personnel because their relative status is thereby reduced. In view of this, would you comment on the $2.5 million total income for the 50 individuals in the "executive incentive plan". The figure is from the 1977 annual report (p. 44).

Bill Walker. I think that that used to be a real issue, not only in engineering, but throughout the company.

The issue was this. There are a few people at the top of the company who have so much stock that they don't need any salaries, so they pay low salaries to the middle management who in turn pay low salaries to the engineers. Everybody gets low salaries because a few who are sitting on a pile of stock don't need the salaries.

That used to be an issue. Most of those stock-laden people were part of the original Tektronix management team and were really in on the action when the company was starting. Compression of salaries was a reality.

But, since Earl Wantland became the president of the company, he has tried to set up a salary structure that is balanced from top to bottom. He not only has looked at the non-exempt employee (the man or woman working on the production line) and made salary surveys and comparisons, but he has also surveyed salaries of our corporate officers and tried to make their salaries competitive with the rest of the industry. In my opinion, we are well paid. We are able to meet our obligations. We don't have to write overdrafts like Burt Lance did. Earl has brought balance into the corporate pay structure and I think that's to the engineers' benefit as well as to the managers' benefit.

The officers' salaries are listed in the annual shareholders brochure, the prospectus. So if you want to know what they are, they're public knowledge in most cases.

If profit sharing is sufficient compensation for the rest of the company, why isn't it for the company's upper management?

Bill Walker. The salary package is made up of a number of things including stock options. It was a compensation committee conclusion (we also got outside consultation) that that is a better total compensation package for upper level managers than any other package we can put together. The basic question you're getting at is "are you fat cats overpaid and are you sweating it out of our hides?" The answer is "no."

The panel members spent many hours working with the Engineering Activities Council and preparing answers to the questions the Council had compiled from dozens submitted by engineers around the company. Shown here, from left to right, are Rich Reisinger, Larry Mayhew, Bill Walker, and Mike Brand. Panel member Wim Velsink not shown.

Are we really addressing the long term needs of our business?

Bill Walker. I feel very comfortable that the long-term versus short-term tradeoffs of our business are being thoroughly looked at by our top management.

There are very definite short-term goals we want to meet. Not the least of these is the profit share. We have a structure that says profit share is important to employees as a part of their salary and to the retirees as part of their retirement income. And we have the responsibility to see that it's kept up.

So, short-term growth in earnings is very important and that's reflected in every annual budget. It's also reflected in the three-year earnings-per-share growth plan we have for some upper level executives. The five-year business plan is also an attempt to balance the long-range vs. the short-range... where are we going with our investments?

Now back to the options. Earl Wantland considered dropping the option program entirely because options are no longer as valuable as they once were. They're much more difficult for the individual to finance than they once were. We had many cases of individuals getting in too deep while trying to finance them.

But, we concluded that they still are a useful part of the portfolio we have to offer. Who gets stock options may not be visible to everyone, but the process of deciding who should get stock options does carry all the way down through the company. First-line managers do consider the individuals at the bottom of the engineering hierarchy. Those individuals never know they were considered, but the selection is made from people at all levels.

Also, we do use stock options sometimes as a recruiting tool to attract key employees into critical areas...particularly if they have to cancel a stock option in the company they are coming from. We try to give them an equivalent reimbursement with a stock option here.

A common complaint is that upper management makes decisions about problems at a project level without directly consulting the people involved in the project. When upper management makes a decision and presents it to the project people, the decision appears arbitrary . . . first because the project people weren't consulted and second because the decisions appear to be directives (they are not accompanied by supporting arguments).

Ironically, when engineers have pursued reasons behind apparently arbitrary decisions, they usually have been rewarded with clear and open discussion. Confidence at the project level, was thereby restored.

Isn't it possible to include project leaders in discussions about their projects? Extremely confidential material could be discussed separately, but otherwise at least the project leader should be present at such discussions. This might help bridge the gap in communications between upper management and people at the project level. It would reduce the engineers' feeling that management is unresponsive and the feeling that project level people are operating in the dark.

Larry Mayhew. You may sense an urgency in the organization that is much greater than you think we feel. But getting at the root of that anxiety is no less a concern to us than it is to you.

The mechanisms for addressing the problem vary quite widely throughout the company. We have one approach within IDG that has worked very effectively, but it doesn't eliminate the anxiety entirely. We use a team approach and try to deal with both product and market planning. We get the manufacturing, marketing and engineering people together with someone who can help assemble the numbers (the cost of the project and what its eventual profitability will be). That team isn't a decision making body. Each team member still has his own role to play and his authority to exercise.

In the process of trying to resolve issues between them, each team member gains an insight into why his peers' decisions aren't made the way he would make them. Any decision that's made strictly from an engineering point of view is going to be wrong. The same is true for manufacturing and marketing. Becoming better informed about the tradeoffs and the need for a broader perspective develops the kind of managers that we want to have long term.

If anybody wants to have any more information about how that system works, we'd be happy to share it with you.

Mike Brand. We're in a major transition period. When I first got involved with product planning, we really didn't have much planning. It was very difficult to get a decision. We then developed a more formal process. Bill Walker headed the planning, so we were able to get decisions. We may not have liked the decision, but at least there was an end point to the discussions.

Now, the divisions are doing most of the planning. Some are more successful at it than others. Learning won't happen overnight. Several factors are affecting the learning rate. Some people who have planning responsibility are inexperienced planners, and we're entering new markets.

This problem is one of the major time sinks. We do see a problem in the time lag between product concept and product approval. There's a lot of wheel spinning there. Unless it's a new business, divisions will make product planning decisions. Bill Walker and Larry Mayhew probably won't get involved unless it's a very big project or consideration of a new business. That's a recent development and I know a lot of frustration still exists. I really think that is the kind of thing divisions are going to have to face up to and address by themselves.

Special thanks to John Addis (7000 Series Engineering) and Clive Steward (Portables Engineering) for helping recreate the questions they asked from the audience.

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