Speaker

BOB POULIN

(Bob Poulin, Integrated Circuits Manufacturing Manager.)

People who work with integrated circuits live in a funny almost unbelieveable world of little things. A transistor, for example, is 3 x 3 1/2 mils in size. (The diameter of an average hair is 3 mils or .003 inches.)

Our raw material, which comes from ordinary sand that has been refined, is a silicon wafer 1 1/4 inches in diameter.

There are 90 people in the manufacturing area, 60 of which are direct employees.

We make every year some 250,000 monolithic ICs, about 50,000 hybrids and 20,000 diodes. The work is done in a clean room to avoid contaminates. It takes three to six weeks for each run which goes through 50 to 75 steps in the clean room.

There are 2 major kinds of ICs: Monolitic and hybrids. A monolitic IC is a circuit in which all componets are made in a single chip of silicon. A hybrid is a mixture in which some of the components are made in the surface of a piece of ceramic and other components are attached on the top.

ICs are difficult to design, but are often the key to an instruments performance. They're usually the last thing to be finalized in the product design. So new parts are frequently in short supply. Almost all part numbers are now in an inventory position.

Our ICs are pretty reliable. The reject rate from the test area is about 3 per cent return and about .05 per cent return from the field.

Character generator readout for the 7000 series is a good example of something that would not have been possible without our having the capability to make our own ICs. The character readout on the 576 would take about 40 conventional integrated circuits; the same thing is done with nine Tek-designed ICs.

In addition to making the ICs, we buy about 500,000 a year (twice as many as we make).

Things are getting smaller and smaller every year and more and more complex. It will mean a reduction in cost per circuit function and better instruments.

We don't expect an overnight revolution because of ICs. We do anticipate an expansion of about 20 per cent a year; some people feel that IC sales will increase to over $3 billion by 1975 from today's market of one-half billion dollars. I personally think that is a little optimistic.

The future holds an interesting and challenging world of little things.

(Questions not numbered were asked at the conference.)

1. If you have taken the Tek course on Integrated Circuits and have been employed by Tek for several years, what other qualification do you need to be accepted in production of IC's?

People selection criteria include: work and academic experiences, interest, skills and potential skills. The temperment and patience to work with a microscope and very tiny parts is helpful. Job competition is high with several candidates for every job.

2. Is it true that IC Manufacturing puts one price on all ICs made at Tek? (Manufacturing cost.)

No, one way to view costs is to account for the expense dollars by spreading them equally over all the parts produced. If the parts are very similar, the cost per part is a pretty good number. I do this for a handy indicator to test our detail cost figures. Every part number has a cost calculation based on production.

3. Does Tek ever intend to organize its accounting system so that we can accurately price components made in house? This would really be a big help in making the decision whether to make or buy.

The more I learn about cost accounting, the more I'm convinced that one must thoroughly understand the basis of a cost before using it. Tek is developing some different approaches to cost accounting that should be more beneficial than the present methods.

4. Do we just manufacture items that we can't buy outside, or do we manufacture whatever IC Engineering and the instrument engineer decide they want to?

Make or buy decisions can be complex. Our guidelines for IC products is "If you can buy it don't build it". There are some exceptions to that rule. ICs are designed to optimize the oscilloscope system, so design engineers are heavily involved in the decisions about what to make.

5. Do any other manufacturers of oscilloscopes use integrated circuits? If so, do they make or buy them?

It's fairly accurate to say that most scope manufacturers use ICs in their products, most of which are purchased. HP has their own IC operation.

6. What would the possibilities be to manufacture integrated circuits for sales outside Tek?

At the present time, there is no plan to market ICs. Principally because it doesn't make sense with our marketing organization and our corporate commitment to oscilloscope related products. With different input our actions could be different but I don't know if or when that might happen.

Do others want to buy ICs from Tektronix?

Yes, I think that is possible. Other oscilloscope manufacturers, for example, would probably want to buy them. We don't sell them, however, because they could turn right around and "bite" us since we've spent the time and money to design and build them.

I understand that any Tek-made component can be bought.

As far as ICs are concerned, that's true only for replacement parts.

7. Do integrated circuits have any relation to Electrical Components, if so, what is the relationship?

Would you list the active devices in current production at Tektronix?

ICs belong to the large family of electrical components. They perform a variety of circuit functions like switching and amplification. We make about 100 part numbers of monolithic ICs, hybrid ICs, and diodes.

8. Could you give us a job description of an Integrated Circuits Manufacturing manager?

My job is to produce reliable parts when needed at an ever decreasing cost.

Did we see nearly the whole area in the slides?

Yes. We don't have a very large area; only 14,000 square feet.

How many chips are there on a wafer?

From 200 to 600 per wafer. The simple transistors would be in the thousands.

Where are the errors made that cause rejects?

Everywhere. The operation is so complex and the variables so many that we can never have 100 per cent yield.

You said you had a good inventory of nearly all ICs. How many M40s do you have? There seems to be a shortage.

We have 16 in stock after the last delivery. They're not out of engineering yet. This is like a two-sided circuit board and is difficult to make. We are also short on attenuators.

If the M40 is tough, what about the ones for the 7904. Will you have trouble?

Most likely.

Do you think your area will expand?

I think it will. The industry might grow three-fold in the next four years. We'll probably grow about 20 per cent a year.

What is the original mask for ICs that you work with?

It is about 30 inches across and reduced 500 times.

What is the cost of the original wafer?

About $1.50.

How many sources do we have for the wafers? Are the costs going down and do we have delivery problems.

We have three sources. Costs on the 1 1/4 inch wafers are going down; we expect them to be phased out eventually in favor of

larger wafers. There are no delivery problems because the wafers are off-the-shelf items.

I understand we pay $36 for one type of IC we buy. Why?

Probably because of the yield. The manufacturer might have built 1000 to get one good one.

What goes wrong?

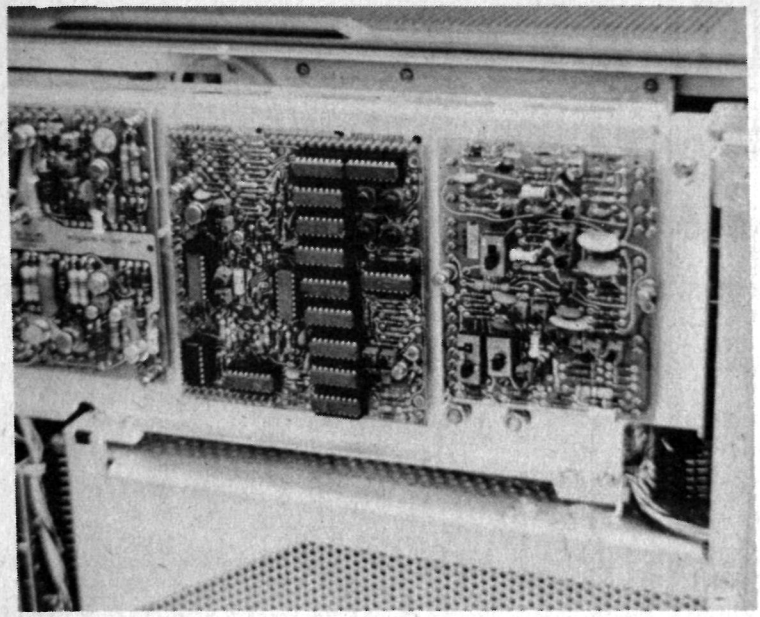
There are lots of problems. We have to identify, isolate and correct each problem.

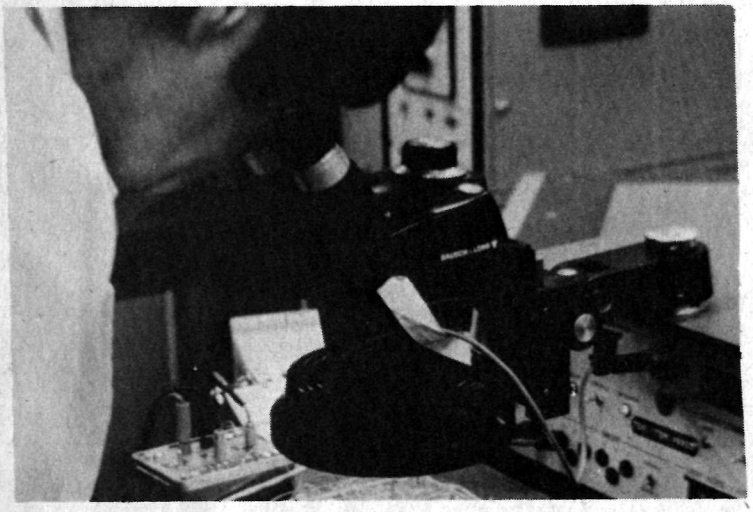
Do you encourage tours through your area? How many do you allow?

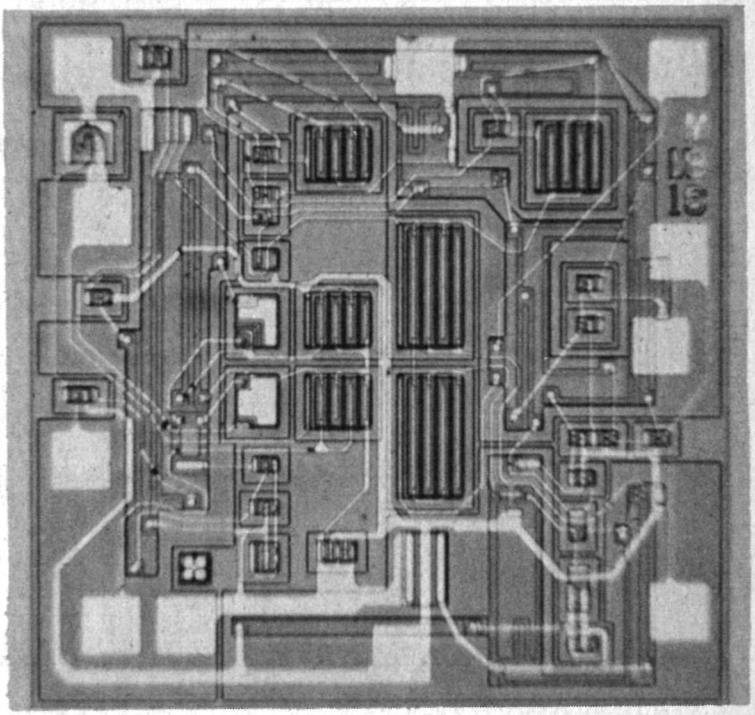
We haven't been able to in the past. We can now and would be happy to do so. The maximum would be one tour a week with 12 to 15 people in each tour. To schedule one, contact our secretary, Marcelyn Jandreau, ext. 7981.

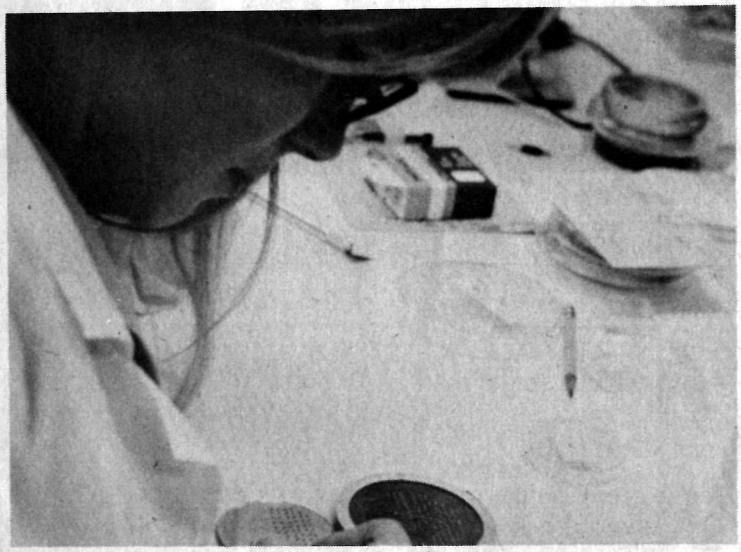
What is the overall cost for the IC department a year?

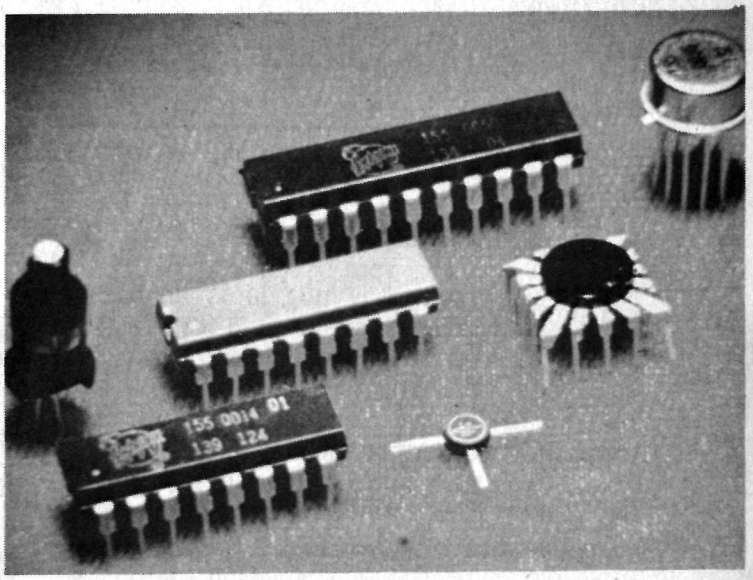
The manufacturing area has operating expenses of about $900,000 a year. I don't have the figures for the engineering area, but they would be somewhat higher.











(CLOCKWISE, FROM TOP) the character generator readout board in the 7000 series mainframe, hybrid ICs in the 454A vertical output amplifier, a sweep circuit, an array of various ICs made at Tek, die being arranged on a plate for visual inspection, and an automatic wafer probe electrically testing each circuit on a wafer.