

July 25, 1989

1989

cc Dave ✓ Will ✓  
Gene ✓  
Tim ✓  
Jane ✓  
+  
Maryletta

Murlan's manufacturing experience--an engineer's perspective

Beginning last September, I took a rotational assignment as line manager for the 11400 manufacturing line. One can talk cross pollination, but until I spent nearly a year in manufacturing, I was only kidding myself. This has been an excellent and eye opening experience for me. I believed that I 'understood' the needs of manufacturing as I designed and introduced new products. While I had good communication with the line during the NPI process and felt that most engineers are designing with manufacturability in mind, I find that manufacturability goes to the roots of the product concept.

Quality/reliability must be built in. Assembly of cables, chassis parts, fasteners, components need to be mistake proofed. Testing is a four letter word. So much time is wasted, the board should run as assembled, the instrument should run as finalized with only adjustments required to bring it into spec. Shake and burn-in waste time and need to be eliminated (screws should be mistake proof tightened, often, when removing a board for repair, the screws don't get retightened). SMT has the potential of reducing the number of sequences, eliminating hand added parts (inherent installation errors), reducing board size, lower cost, enhanced performance, etc.

Definition of quality is a point of confusion. My emphasis on the line is that quality means the product meets specs and satisfies the customer needs by being able to make his measurements for many years. Quality is less the difference of the color of the mating rear panels. One concern is the tolerance of parts--both electrical and mechanical. I've seen the line spend extra time tightening one set of screws first, then another to achieve proper fit. Or worse, reassembling parts to get uniform gaps (this is false quality). Or technicians selecting components. Yuch!

ESD is of great concern, perhaps reaching paranoia. But we do see static damaged parts and manufacturing now requires the strict use of straps for all production staff and visitors (including engineers). It is so easy to zap a part and end up with a potential warranty failure and associated customer discontent. Mike O'Shanecy investigated one IC exhibiting significant failures, both on the line and in the field. He traced the cause to one inserter machine that uses 10 volts to check if a part has been installed properly.

The 11403 was introduced this Spring. Our engineers worked in concert

with manufacturability issues as presented by line technicians, and with customer needs. This introduction went smoothly. Good improvements were made over the older products in the acquisition board and 6 other boards were combined into 3. Total manufacturing time was reduced because the product is easier to build, turn-on and run through QC CATs.

Which leads me to discuss field failures. We (Tek) spend far and away too much money and lose good will by having products fail at the customer site. And many of our products don't work properly in the hands of our own sales people, which demoralizes them severely. Failures take on the form of improper operation due to either HW breakdown or SW difficulties or bugs. A leading indicator of field failures is the ability to pass CATs first time and to pass our random corporate audit. I'm sorry to say, but neither the 11400 or 11800 lines do well in either the field or in CATs and audit.

For the first year after a product is introduced, warranty repairs are done by the line. This helps us get a handle on problems immediately. We try to do 24 hour turnarounds, ship by overnight air, and in general expedite. For the 11401 and 402, the board requiring the most attention on the line and the most grief in the field is the acquisition board (reduced significantly with the 11403 improvements). Tracking a problem is extremely difficult for our well trained technicians, and nearly impossible for the field. The field replaces the customers board for a cost of about \$3,000. It is then returned to the line for repair by our technicians. For the 11800, the timebase is in the same category. Sometimes boards are replaced that are not defective. And the 11800 has an error reporting message that unnecessarily alarms the customer and causes much loss of credibility. Work is in process to cause only hard failures to give error messages.

Field updates have cost us a bundle, and are often unimplementable by our service centers. For example, during the 11800 update, EPROMS were installed incorrectly, and a number of instruments were returned to manufacturing to fix. Two sets of EPROMS in the instrument have the same U numbers. And there are 20 EPROMS to install and possibly get a lead bent. Let's use electronically alterable, or disk based or ROM pak firmware in the future.

And we see many failures in such components as the Motorola VCO or the Tek-made sample and hold or variable delay ICs. Some of our specs are too tight or difficult to interpret (the measurement of the real time clock is one example).

I learned that schedulers, buyers, and mod processors perform important and invaluable tasks that often go unrecognized until there is a screw-up.

Having parts JIT all the time and in the right place is essential. There is a balance between having parts arriving JIT versus having a safety stock. No parts on hand (or defective parts) stops segments of the line which in theory needs to shutdown the entire line. Practically, every effort is made to get the parts, or improve the yields.

The need for a significant reduction in MCOS is causing us to evaluate ways to do things better. We are streamlining or eliminating procedures. We are looking for more people involvement and support. Change is accepted by some and cause for concern by others. In general, the line needs less people to do more. And this leads to job elimination and is scary. I've had to reassign 4 people just before Christmas. Fortunately, they found nearly equal jobs. We are now encouraging people to take other jobs. Engineering plays a significant role in MCOS, and good market analysis is essential for defining the right product for the customer's needs.

I'm in the process of doing focal point reviews to 32 people. People are really interested in doing a quality job. They want to help solve problems and make the line run smoothly. They are committed to running a JIT line and certainly gave me justified heck when I tried to circumvent JIT. Quality is paramount in their eyes and achieving output without it leads to distrust and discontent. Change is encouraged by some and drives others wacko.

Each person on the line is special and I have felt fortunate to have worked with and learn from each one. I appreciate the help I actually received and many helpful suggestions from the managers. And I have learned much by working with all areas associated with the manufacturing process. I recommend that all engineers become familiar with a manufacturing line and the support system that goes with it. I now have many more fine contacts in manufacturing that will enhance the total communication path and help me develop the more manufacturable product.

If I were asked to summarize the two most important issues with which the engineering/manufacturing/marketing team must be concerned, I say quality and MCOS. Quality goes back to the initial design and market requirements. Meeting MCOS goals is essential to our survival. Of course, we need to be making the correct products to increase our sales.

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MTF*

*1 wk - 10 days  
catalog  
call company  
9-5  
[11-1200]*

**Tektronix**  
COMMITTED TO EXCELLENCE

**INTER-OFFICE  
COMMUNICATION**

*Conrad*

*Gary #629-3242*

*Sil 20*

To: Staff Date: July 21, 1989  
From: Dave Armstrong  
Subject: STAFF MEETING NOTICE



*11:30*

DATE: Tuesday, August 1, 1989  
TIME: 3:00 - 5:00 p.m.  
PLACE: Bldg. 39, Conf. Room S-20

*all things are  
Cadnetix Schematics  
guidelines, etc.*

*Tell Folks*

*ALL New CKT Bds*

*set of slides avail*

*Agenda: 45 min. Carolyn Strong  
come up on ORCAD.*

- |                        |   |
|------------------------|---|
| 45 min. Carolyn Strong | Status & Future of Schematics in LID                |
| David Powe             |   |
| 15 min. Murlan Kaufman | Experience in Manufacturing                         |
|                        | Equipment removal from moving carts along East wall |

Please plan to attend promptly at 3:00 p.m.

*1st come 1st serve -> East wall - Talk to Maryletta  
by Fri - also get rid of stuff*

Dave  
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|-----------------------|-----------------------|
| Staff:                | Attendees:            |
| Gene Andrews          | Tom Cocks 39-618      |
| Cliff Baker           | Ray Kazlauskas 39-130 |
| Tim Bennington-Davis  | Roger Loop 39-327     |
| Butch Berquist        | Steve Ratner 47-247   |
| John Hazard           | Riley Stock 39-327    |
| Ron Henriksen         | Carolyn Strong 39-327 |
| <u>Murlan Kaufman</u> | David Powe 39-283     |
| Steve Liepe           |                       |
| Wayne Wilburn         |                       |
| Kirk Wimmer           |                       |
| Vee Buck              |                       |
| Anna Mohney           |                       |

*5/11 252*