

On The Forefront: October, 2000

by Phil Zarrow

Contract Assembly Terms and Concepts

As anyone who has not been sequestered in a cave can observe, the trend towards outsourcing electronic assembly continues to grow at a rate of between 10 to 25% annually (depending upon whose statistics you want to believe). The degree of outsourced electronics ranges from firms who contract out over-capacity work to firms that do not (and, in some cases, never will) assemble production boards.

In my consulting practice, I do a lot of work with both contract manufacturers and original equipment manufacturers (OEMs). Much of this work deals with the relationship between OEMs and their contract assemblers. This ranges from helping an OEM select the appropriate contract assembler, with special consideration to the volume and mix of the product, to mediating and troubleshooting existing OEM/Contract Assembler relationships. This month, I would like to discuss a few important industry terms related to contract assembly.¹

DCAR - Dysfunctional Contract Assembly Relationship (a.k.a.: “Marriage from Hell”): One of the most predominant problems I have observed among outsourcees is a mismatch between the OEM and the CA chosen. There appears to be a tendency for many OEMs to bring their work to one of the top-tier contract assemblers. After all, these guys are the epitome of success so they must be doing everything right. In many cases, this direction is appropriate. However, there are quite a few examples of where an OEM has been attracted (exclusively) to a 1st or 2nd tier CA only to find, further down the road, that they feel they are being “ignored”². Obviously these EMSI firms didn’t get to where they were by providing poor service to their clients - quite the contrary. However, in almost every case, the OEMs have presented low-volume / high mix runs to facilities that are geared for medium to high volume / low mix. Now, while many of the 1st and 2nd tier contract assemblers have lines and portions of facilities geared towards low volume, for the most part these are for assemblies that will eventually “grow” into large run contracts, though there are some (intended) exceptions.

If you have products that characteristically are low to medium volume / medium to high mix, don’t overlook the smaller contract assemblers. Small does not necessarily mean lower quality (just as high speed equipment certainly does not assure high quality). Many of the smaller contract assemblers have excellent capabilities and have the agility - in equipment, processes, material flow and discipline - to excel in high mix situations.

¹ Thus proving to my editors and publisher I really am cognizant of our editorial calendar.

² Their words, not mine.

Level:	Annual Sales:
First Tier	> \$1 Billion
Second Tier	\$500M - 990M
Third Tier	\$250M - 500M
Fourth Tier	\$100M - 250M
Fifth Tier	\$ 50M - 100M
Sixth Tier	< \$50M

DFM - Design for Manufacturability: Designing a product to be produced in the most efficient manner possible (in terms of cost, resources and time) taking into account how the product will be processed, utilizing the existing skill base (and avoiding the learning curve) to achieve the highest yields possible.³ The design of the board, specifically the board layout, is another very strategic area with regard to the relationship. Ideally, from the contract assembler's perspective, you will relinquish the task of board layout to the design staff (in-house or subcontracted) of the contract assembler. If you are outsourcing a board that has been designed in-house and/or was previously in production, it would be very nice if it were designed in such a way that the assembler can actually build it with the equipment, processes and materials the contract assembler has incorporated. Suffice it to say that it would be ideal if a document were created and implemented by the contract assembly facility that defined the parameters required by that particular facility to accommodate PCBs for assembly. While a great deal of standardization of many of the factors has evolved over the years, particularly with regard to assembly equipment, there are still many inherent nuances particular to certain processes and equipment. Seems like such a document would be quite logical and commonplace. It is very logical and not at all commonplace.

Virtual Manufacturer: This is a manufacturer of electronic products that does not do any production⁴ PCB assembly in-house, but rather, contracts it all out. In the last few years, Virtual Manufacturing has expanded to entire products that are untouched by the OEM whose name they bear - with not only assembly, but box-build, serialization, sales, distribution and service all accomplished by contract firm(s) and personnel.

PME - "Popular Mechanics" Engineer⁵: Most of the aforementioned "virtual manufacturers" firms that are outsourcing have process engineers on staff. Many of these process and manufacturing engineers, though perhaps not currently producing have

³ Zarrow, Phil and Kopp, Debra, *Surface Mount Technology Terms and Concepts*, Newnes/Butterworth-Heinemann, 1997

⁴ Prototyping and pre-production may be done in-house, as well as design and board layout.

⁵ I learned this term from a colleague who is an extremely competent and experienced technical director of one of the top-tier contract assemblers. Anyone who has ever worked in contract assembly can relate.

extensive hands-on experience and backgrounds in SMT assembly. Then there are the guys who get all their information from books and magazine articles (including this one) and then go off and tell the contract assembler what they should be doing and how they should be doing it. Hey, you know who you are.

DPM - Defects Per Million: Likely the simplest way of quantifying the quality level being attained. This is simply the number of defects found divided by the total number of opportunities for defects. Unlike a “first pass yields” figure, this equation measures an attained quality level regardless of the complexity of the assembly, and it isn’t rocket science. This data should be enumerated and made accessible, ideally for each part of the process (for example, printing, placement and post reflow). It is vital for process troubleshooting and also provides a process performance “scorecard”.

ISO-9002 Certification: Mythically believed to be a positive sign of quality capability of a PCB assembler. Typically proclaimed in festive banners affixed to buildings and company letterhead. In reality, ISO-9002 certainly can *contribute* to the quality of product produced by an assembler. It requires strict documentation of processes and procedures and creates an important paper trail. By itself, it is not a guarantee of quality, just that the equipment is calibrated and everything is well documented. It is thus possible for an ISO-9002 certified facility to produce garbage, though it will be very well-documented garbage.

WS - Workmanship Standards: We all have our own perceptions of quality - what is acceptable and what is not. A good set of Workmanship Standards sets forth this information. Workmanship Standards should contain both text and graphics to characterize the level of quality of the assembly, rework and anything else being purchased from the assembler. I like to see my outsourcing clients bring their own Workmanship Standards to the party. This way the contract assembler and the client can come to a “meeting of the minds” at the outset of the relationship. This is far better than surprises and disagreements further down the pike. A manufacturer looking to outsource need not make a science project out of deriving a set of workmanship standards. IPC-610 (for initial assembly) and IPC-700 (for rework) make an excellent start. There are also other commercially available generic workmanship standards. I emphasize the word *start* as either party may want to augment the presented standards to meet their particular requirements.

There are some, in our industry, that say Contract Assembly growth will flatten out in the near future and that concern for quality will be the catalyst. I don’t see this on the horizon right now. I’ve seen many cases where the quality attained by the contract assembler far exceeded the capabilities of the OEM (and, of course, I’ve seen the opposite). The most important factor in a successful contract assembly relationship is communication. It is important that the components of communication, such as DFM Guidelines and Workmanship Standards as well as DPM reporting be established from

the outset. Divorce between an OEM and Contract Assembler is expensive. Remember, we're all in this together.

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