ABSTRACT:

The new approach is basically a validation (on a confidence level) that the company is well managed and technically sound enough to produce high grade military product and compete as a "world class" manufacturer with a minimum of interference from the government.

This approach not only addresses how the manufacturer is meeting requirements, but goes further in researching why the manufacturer is performing the operation and the manufacturer's plan(s) for continuous improvement. This process takes more effort "up front" from the manufacturer and the validation team.

The MIL-I-38535 QML Program is taking advantage of the fact that U.S. microcircuit manufacturers understand that it is in their best interest to produce high quality product through the use of process controls and continuous improvement. Today, a company can no longer survive in a global market by "just meeting the spec."

As late as the early eighties, most American microcircuit companies had a lock on the military market with little incentive to improve because they usually were able to sell everything they produced. As an example, one JAN MIL-M-38510 supplier was losing about 80% of their devices in the high temperature test. When questioned by our engineering staff on why they would tolerate such a high fall out that could indicate a reliability problem, their answer was "We can sell the rejects as MIL-STD-883 compliant product." Certain companies were found to be guilty of skipping required military screening steps and we were told that at least one company was "salting" shipments. Salting is mixing reject devices with good devices. The basic climate was of mutual industry/government suspicion and distrust.

The concept embodied by QML such as allowing the company to self direct and take responsibility for their program would not have worked in this climate.

As the American microcircuit manufacturers began to experience more competition here and overseas, the old ways of doing business were challenged. Manufacturers found that the quality levels of the past were no longer acceptable. Their boasts of 99% good parts shipped started to look ridiculous when the competition was talking in 100 parts per million (ppm) levels. For example, 99% at 100 good parts equals 10,000 bad parts out of one million parts shipped.

As a result of changes in the business climate brought about by "quality" competition, the QML approach of doing business was developed. This approach takes advantage of the conditions of continuous quality improvements through the use of "up front" process controls that ensure product quality is designed and built in, rather than screening out poor quality parts. Companies that refuse to take this approach will not survive in a global market. "Just meeting the spec" is no longer enough.

This QML way of doing business required DESC to rethink our approach. Our old approach was "if the company screens and inspects enough and just follows the mil-spec recipe, then automatically, quality product will be the result." If you wanted to achieve a higher quality product, just perform more screens and inspections. Unfortunately, sometimes the end result was that if the product had quality or reliability problems, the manufacturer would shift the responsibility to the government/user and claim "I met all the mil-spec requirements, it's not my problem that the product has quality or reliability problems."

Improperly applied, the mil-spec can be a baseline for mediocrity. For example, the mil-spec allowance for destructive bond pull is a minimum of 3.0 grams pull for acceptance of 1.25 mil aluminum wire bond. Even though the manufacturer may have data that bond lifts below 8.0 grams...
indicate a process or material problem, that manufacturer can say "OK to ship - it meets mil-spec." Under the new approach, the manufacturer is responsible for action and disposition of product out of his own defined process control limits. These limits are based on statistical process control data and sound engineering studies.

The following are some examples of DESC's new versus the old approach to auditing a company. The new term for audit is validation because we are validating a working system.

Old Approach - Basically the auditor would ask and get an answer to the question what is the manufacturer doing that meets the minimum military specification requirements? Typically the manufacturer would pull the JAN (MIL-M-38510) program plan off the shelf, and ask what changes were needed to update. More often than not, the JAN product was produced as the exception the manufacturer's system with its own unique set of requirements.

New Approach - Before DESC visits the manufacturer's plant, we require that a system is implemented across the board for all products produced on their line (military and commercial). Typical questions are now: How is the manufacturer meeting requirements? Why is the manufacturer performing the operation, and what is the plan for continuous improvement? It is no longer acceptable for the manufacturer to tell us he is performing an operation just to meet the mil-spec. There needs to be a technical answer that shows the manufacturer has characterized and understands the process well enough that he knows what the process is providing in terms of product quality and reliability.

Old Approach - DESC would go through each process step on the traveler for conformance to the manufacturer's procedures and the military requirements. We were concerned about the JAN military compliant product. Other military and commercial product was considered "off limits."

New Approach - DESC now performs critical item sampling to develop a confidence level that the manufacturer is well managed and technically competent to control and improve his own program. There is now a concern for process controls that apply across the board to all product. We review for enhancements to reduce cycle time, improve yields, and eliminate unnecessary testing.

Old Approach - DESC's primary emphasis was on screening out defects and end-of-line testing for acceptance of lot quality. Under the theory that if the product is subjected to enough screening and testing a high quality, reliable device would be the result. The basic thinking was if five screens plus five end-of-line inspections equaled a given quality level, then more screens and end-of-line inspections equaled a higher quality level. We found the part that went through screening is almost never a better part, only a survivor, usually at best the worst for wear. At worst, a latent defect could have been introduced through the screening action. Basically, screening is an admission of failure. Screening is performed because:

  o There is something in the process/materials that causes a defect that the manufacturer tries to screen out.

  o There is not sufficient information or control over the process/materials input parameters to ensure "perfect product" every time.

The problem with end-of-line inspection (QCI) is that by the time the problem is found, it is too late. The user ends up with the following results:

  o Product lot jeopardy.

  o The government usually ends up pressured to waive the compliance issue brought about by the failure.

  o Parts end up in government systems. These systems end up with the problems. The government pays the repair bill.

New Approach - The primary concern is for control of process input parameters through the use of statistical process control (SPC). We are now asking "What is the manufacturer doing to eliminate screening and end-of-line testing through use of his SPC program?".

Old Approach - Major changes had to be approved by DESC (prior to shipment of product). This approach often led to an excuse to hold up product and blame it on the government.

New Approach - The manufacturer has the responsibility through the technology review board (TRB) to qualify and approve major changes. Desc is notified of these changes through a quarterly TRB
summary and reserves the right to request supporting data.

In this new approach, when possible, DESC encourages the adoption of the manufacturer’s best commercial practices in meeting military requirements. For the record here is my definition of best commercial practices: Those practices that are found to meet or exceed military reliability and quality requirements. These practices would be applied across the board and transparent to the end user. DESC does not approve just anything the manufacturer decides to do for his commercial product.

In conclusion:

- This new approach is basically a validation (on a confidence level) that the company is well managed and technically sound enough to produce high grade military product and compete as a “world class” manufacturer with a minimum of interference from the government. A trust with validation approach.

- The government really just taking advantage of the fact that U.S. microcircuit manufacturers now understand that it is in their best interest to product high quality product through the use of process controls and continuous improvement. A company can no longer survive in a global market by “just meeting the spec.”