**M2. MILITARY STANDARDS ON QUALITY
"SPECIFICATIONS: A COMMUNICATION AID"**

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ABSTRACT

The acquisition process requires communication from the using commands to the AFSC, to the contractor and to the plant representative. Also the original equipment manufacturer must communicate with his contractors/suppliers. The specifications are one of the tools used to describe the design requirements, the management procedures and the materials and processes used to manufacture configuration items. The acquisition divisions have been required to streamline the acquisition process and part of this streamlining is to tailor specifications. This is benefiting both the contractors and the Air Force since it makes the acquisition engineers only call out what is required. This has sent the contractors the message that the Air Force is willing to eliminate non value requirements. We have also realized that it is impractical to specify many design limits and test conditions before the design has matured. This has resulted in development of MIL-Prime specifications which have been written with a lot of blanks that the contractors must fill in as the design matures. The MIL-Prime and specification tailoring compliment each other and both require the Air Force and the contractor to evaluate and reach an agreement on the requirements before starting to build production hardware.

We quality assurance engineers must rely on specification quality assurance provisions to establish how functional and workmanship requirements are to be verified. This is also how we tell the AFPROs or DCAS representatives what they shall monitor in their surveillance of the contractor quality program. The management specifications MIL-Q-9858 and related MIL-STDs will be addressed briefly. The paper will primarily concentrate on the need to use specifications to establish and communicate technical requirements.

BACKGROUND

Total Quality Management (TQM) is receiving a lot of press recently. Our out-going Secretary of Defense Dr Carlucci was quoted to have said we must break with the traditional

notion that quality means conforming to specifications. Instead, quality means meeting all the user's needs including costs, schedule, reliability, maintainability, and all other elements that contribute to a systems value over a lifetime. That sounds innocent enough but that combined with other actions on specifications such as MIL-Prime and acquisition streamlining/tailoring has many program directors at Aeronautical Systems Division (ASD) unfortunately convinced that specifications and standards are something they do not want on their program. However, specification and standards will continue to be an integral part of our acquisition process. We can not adequately communicate with our customer - logistics and using commands, our contractor, and our in-plant representatives (AFPRO, DCAS), without the aid of specifications and standards (S/S). In the ASD Systems Engineering Directorate, we do not support eliminating Specifications/Standards but do support changing how specifications are developed for each new program. This paper discusses some of the newest ways S/S are being applied to improve communication within the government-defense industry community. I will discuss:

- (a) MIL-Prime Specifications.
- (b) S/S tiering.
- (c) S/S Tailoring.
- (d) Verification by Process Control.

MIL-PRIME

MIL-Prime Specifications are boiler plate specifications with blanks in them. Early in the development program the blanks get filled in with both government and contractor participation. They become contractual after they have been developed. The MIL-Prime Specifications contain a lot of referenced specification in their appendixes and supporting handbooks. The referenced specifications are used as guides to develop the MIL-Prime Specifications. The appendixes and handbooks by both direct statements and by referencing S/S provide valuable knowledge obtained from earlier programs. The MIL-Primes are primarily of subsystems. In this way of developing the specifications they get tailored

to contain, from the long list of referenced specifications, only the requirements that are needed for a specific program application. This we feel is a more intelligent way to develop a specification and gives contractor the flexibility to develop more innovative solutions. MIL-Primes are ASDs approach to developing a "Living Specification", we have developed fifty-six MIL-Prime Specifications to date. Even though it relatively is a small number, it is a giant step forward in communicating our requirements.

SPECIFICATION/STANDARD TIERING

To avoid gold plating and duplication we now must consciously call out all specifications and standards that we want on our contracts. In the past, we automatically required the contractor comply with all referenced S/S to the third tier. The current limitation to only the first tier drives us toward a much more detailed Prime Item Development Specification. Let us discuss the example of MIL-STD-454 "General Requirements for Electronic Equipment". It consist of 75 separate one or two page requirements applicable to various electronic equipments. The Design and Test methods are call out by reference in these individual requirements of MIL-STD-454 so you have not adequately communicated to the contractor until you also define the applicable paragraphs of each referenced specification. If, for example, you wanted to address microelectronic devices, you can not just specify Requirement 64 of MIL-STD-454; you must also specify compliance with the desired design requirements paragraphs of MIL-M-38510. For testing you must go into MIL-STD-883 and select the applicable items-sections-paragraphs. It is a great deal more work to prepare the contract this way but when it is done most of the non value tasks will have been eliminated. It forces both the government and contractor to know what is on contract. We are also providing the opportunity to our contractors to intelligently tailor tasks in our non MIL-Prime specifications and standards. This is especially true of programs which have a Demonstration Validation phase. Here again we are using specifications and standards to better communicate with our prime contractor.

At ASD, contracting officers are required to use a rather extensive check list to be sure they are ready to negotiate a contract. One of these check list items is AFSC Form 2395. It has a block of specifications and standards that are commonly included to establish workmanship requirements. The list now needs to be greatly expanded as it was established before we were limited to first tier specifications. It is the Air Force quality engineers' responsibility to ensure that the required specifications and standards are included in the appropriate Prime Item Development Specification. This is the way

the acquisition program offices communicate with and support the AFPROs and DCASs. MIL-Q-9858A demands that a contractor's design, testing and manufacturing actions be governed by written procedures that his quality program must monitor. These instructions can be more readily prepared when contractors recognize that military standards already describe essential tasks and how they are to be accomplished. If the contractor determines that the action is not adequately covered by existing standards he must supplement them or generate the appropriate instructions and be prepared to keep them current.

SPECIFICATION/STANDARD TAILORING

Tailoring is the process by which individual requirements (sections, paragraphs, or sentences) of the selected specification, standards, and related documents are evaluated to determine the extent to which they are most suitable for a specific system and equipment acquisition. These requirements are then modified to ensure that we achieve an optimal balance between operational needs and cost. I have previously indicated that the way we write MIL-Prime specifications forces tailoring before they can be contractually applied. The previous example of how we are now handling specification tiering is also a tailoring process. Another condition frequently encountered is where the introduction of newer tools/techniques of doing business make some requirements of existing specifications unnecessary or duplicative. For example if the contractor has implemented an effective SPC program and we have imposed MIL-P-28809A "Printed Wiring Assemblies" we may wish to delete or modify paragraph 4.5.1 "Soldered Connections Inspections." If the contractor can show that his soldering processes are under control and the variations in the critical characteristics well within established limits we may agree to use SPC data as the basis for accepting product in lieu of 100 percent inspection of the solder joints.

In addition to tailoring technical requirements, there is a need to tailor the quality management tasks. Examples where tailoring may be wise are:

(a) MIL-STD-1520C, paragraph 4.5 "Material Review Board (MRB)" could be tailored to require attendance of the MRB for only those organizations who make decisions, e.g., appropriate design engineer, quality inspector and the MRB chairman. The other organizations should be provided copies of the actions agreed to, but they do not need to be present at the MRB.

(b) MIL-STD-980 "Tool Accountability" paragraph 20.1 can be tailored to require tool accountability at specific locations, e.g., final assembly and all flight line activities

instead of a blanket across the board requirements.

VERIFICATION BY PROCESS CONTROL

In Section 4 of our specifications/standards we have traditionally had four methods to verify our design, functional and manufacturing requirements. They were inspection, demonstration, analysis and tests. We have recently added process control in the new MIL-Prime System Specification as another alternative. If the contractor can show that his processes are stable and has adequately identified characteristics to monitor, he may use the evidence of controlled processes in lieu of inspections and tests. The characteristics should be those that FMECA, hazard analysis, design of experiments, historical data or other analysis indicate to have most impact on product quality. Here again to aid in communication, the process specification shall address what characteristics of processes will be controlled and the acceptable level shall be stipulated. If the process mean is within specification limits, it can be calculated as: $Cpk = \frac{\text{process mean} - \text{nearest spec limit}}{3 \times \text{sigma}}$, manufacturing variability. Control charts generated by the operator or computer-generated data from machines under adaptive controls provide visibility and promote worker involvement. This has been shown to be a significant aid in producing a quality product.

SUMMARY

The need to communicate between user, procuring agency (Program Office, AFPRO and DCAS) and contractor personnel has not been changed by the new initiatives. The lessons learned which in part are reflected in the S/S and in part in management techniques that encourage communication between shop floor and management must be integrated into our contracts. We have repeatedly seen that when a program starts to have financial problems government and contractor engineers can not do everything they agree is technically desired. Contractor management takes over and restricts their engineers to accomplish only what is clearly a contractual requirement. The S/S must be used by all the acquisition groups to communicate what they are required to do. Even though some program managers may think that S/S are not necessary for their programs, it is obvious that they can not communicate the design and fabrication requirements without intelligent applications of S/S. The new S/S initiatives are meant to assist in developing the best contract possible using both government and contractor knowledge.