**MRL Deskbook Section 6,**

**Applying MRLs in Contract Language**

**6. Applying MRLs in Contract Language**

**6.1 Introduction**

Like all other requirements, assessments of manufacturing readiness based on the MRL criteria must be included in contract language to be effective. During the initial stages of acquisition and Product Life Cycle planning and risk identification, a determination should be made of the manufacturing requirements in the planned program. If hardware is being manufactured, the two key drivers in determining the manufacturing requirements are the current phase of acquisition and Product Life Cycle and the overall complexity of the hardware.

This section is intended to highlight the use of Manufacturing & Quality Industry Standards as the basis for contractual actions for both the government and industry. Proper implementation of the applicable Manufacturing & Quality Industry Standards will help ensure successful achievement of the target MRL value when applying the MRL process.

Once manufacturing requirements are identified, the team can then assess whether manufacturing readiness will be a significant discriminator for the source selection. Discriminators are those key requirements or program risks that separate offerors from each other during the proposal evaluation process.

For government entities, if manufacturing readiness will be a discriminator between offerors, then appropriate language should be incorporated in Section L (Instructions, conditions, and notices to offeror’s or respondents) and Section M (Evaluation Factors for Award) of the Request For Proposal (RFP) so it can be used during the source selection process. If manufacturing requirements exist, assessments of manufacturing readiness should be included in the resulting SOW, so they can be a formal part of the contract. Although most of the discussion in this section is oriented towards competitive acquisitions, this recommendation for SOW language also applies to sole source programs with manufacturing requirements. The acquisition team must determine the target MRL for the completion of the phase (e.g., MRL 8 for Milestone C). Once this is determined, the acquisition team can develop requirements, analyze and assess program risks, develop the overall acquisition strategy for the program, and develop the appropriate RFP and contractual language (Sections 6.3 and 6.4). These examples are meant to be tailored to reflect the complexity of the current phase of acquisition.

For industry entities, this section is intended to present some ideas and strategies to ensure assessments of manufacturing readiness based on the MRL criteria and how they are treated effectively as a part of Product Life Cycle activities. It contains methods and examples on how to effectively implement the process for conducting an assessment of manufacturing readiness contractually. These examples are meant to be tailored to reflect the complexity of the current phase of the Product Life Cycle.

**6.2 Strategies for Competitive RFP Language**

If manufacturing readiness is a requirement and a source selection discriminator, the RFP should require the offeror’s proposal to document the results of an assessment of manufacturing readiness against the MRL criteria appropriate for the current phase of the program. Statement of Objectives (SOO), if applicable, may be utilized. The key decision factor should not be the current MRL, but the risk of achieving the final MRL target. Based on the assessment, the offeror’s proposal should identify the current MRL and then give an explanation of how the target MRL for each program element will be achieved by the end of the acquisition phase (e.g., MRL 8 for Milestone C). This information should be used to assess the risk of achieving the target MRL by completion of the proposed phase. The best approach to assess this risk is by assessing the contractors understanding of steps necessary to evaluate their MRL, the steps necessary to achieve the target MRL (e.g., Manufacturing Maturation Plans), and the risk associated with achieving those steps.

Section L of the RFP (Instructions, conditions, and notices to offeror’s or respondents) will specify the content and any required format the offeror must submit to substantiate the process to achieve the target MRL. This will reduce the likelihood of misunderstandings between the offeror and government when discussing the program’s manufacturing risks and plans.

For industry entities, these same concepts can be applied to the supplier base.

**6.3 Suggested Section L & M Inputs**

Using assessments of manufacturing readiness in source selection requires language in three key sections of the RFP: Section L (Instructions, conditions, and notices to offeror’s or respondents), Section M (Evaluation Factors for Award), and SOW. Language should be inserted in Sections L and M only if manufacturing readiness will be a discriminator in the source selection.

## **6.3.1 Instructions, conditions, and notices to offeror’s or respondents (Section L):**

Manufacturing Readiness Level Demonstration. The offeror's proposal shall identify those elements being assessed for manufacturing maturity and risk and their Target Manufacturing Readiness Level (MRL) using the criteria and process identified in the DoD Manufacturing Readiness Level Deskbook (available at www.dodmrl.com). The offeror shall describe the approach used to assess the MRL Criteria. The offeror shall address in Manufacturing Maturation Plans (MMPs) how risks identified in the MRL Assessment, against the Target MRL Criteria, will be managed to ensure required manufacturing maturity will be achieved.

*(Note: DFARS Subpart 215.304 requires that the manufacturing readiness of offerors be considered during source selection for ACAT I programs.)*

Manufacturing Plan. The offeror shall describe:

1. How their manufacturing management system meets the requirements of AS6500.
2. The major assembly sequence chart and anticipated manufacturing process flow.
3. The manufacturing build schedule, including drawing release; tooling design, build, and proofing; key supplier deliveries; and fabrication, assembly, and delivery schedules.
4. Facility requirements and layouts.
5. The offeror’s plans to provide the needed manpower, facilities, and equipment for expected delivery rates.

Quality Systems. The offeror shall describe how their quality system assures product quality; achieves stable, capable processes; prevents defects; and employs effective methods for conducting root cause analyses and implementation of corrective actions.

Supplier Management. The offeror shall describe their:

1. Approach to selecting and managing key suppliers.
2. Processes for integration of key supplier activities into the overall program plan to assure that supplier activities support the overall program performance.
3. Specific supplier risks to the program and plans for mitigating those risks.
4. Plan for preventing the intrusion of counterfeit parts in factory equipment and delivered products.

## **6.3.2 Evaluation Factors for Award (Section M):**

Manufacturing Readiness Level Demonstration. The offeror’s proposal will be evaluated on the maturity of their proposed manufacturing capability, the adequacy of their supporting documentation to justify this capability, and the adequacy of the offeror’s process and plans to achieve the target MRL as described in the Manufacturing Readiness Level Deskbook.

This sub-factor is met when the offeror's proposal identifies the elements being assessed for manufacturing readiness and their current MRLs. As described in the proposal, the offeror’s MRL assessment process is consistent with the MRL Deskbook. The offeror addresses in Manufacturing Maturation Plans (MMPs) how risks identified in the MRA, against the Target MRL Criteria, will be managed to ensure required manufacturing maturity will be achieved.

Manufacturing Plan. This sub-factor evaluates the proposed methods, schedules, and resources for producing the required products. This sub-factor is met when the offeror’s proposal:

* 1. Describes how their manufacturing management system meets the requirements of AS6500.
  2. Describes the major assembly sequence and manufacturing process flows.
  3. Includes an integrated, achievable schedule incorporating design, tooling, supplier, fabrication, assembly, and delivery milestones.
  4. Describes facility requirements and layouts.
  5. Describes achievable plans to provide the needed manpower, facilities, and equipment for expected delivery rates.

Quality Systems. This sub-factor evaluates the offeror’s planned quality assurance system. This sub-factor is met when the offeror’s proposal describes policies and practices that will:

* 1. Assure product quality.
  2. Achieve stable, capable processes.
  3. Prevent defects.
  4. Result in effective root cause analyses and corrective actions.

Supplier Management. This sub-factor evaluates the offeror’s proposed supplier management program. This sub-factor is met when the offeror’s proposal:

1. Describes how key suppliers are selected and managed.
2. Describes how supplier activities will be integrated into the overall program plan.
3. Lists specific supplier risks and achievable plans for mitigating those risks.
4. Describes effective plans for preventing the intrusion of counterfeit parts in factory equipment and delivered products.

**6.4 Core SOW Inputs**

When imposed contractually, AS6500 requires the conduct of MRL assessments prior to major milestone and technical reviews. It also requires organizations to:

* Identify MRL targets
* Document manufacturing risks
* Include critical suppliers in MRL assessments
* Develop and implement manufacturing maturation and risk reduction plans for threads that are not at the target MRL
* The standard encourages the use of MRL criteria to support Manufacturing Feasibility Assessments and Production Readiness Reviews.

## For additional guidance on AS6500, refer to MIL-HDBK-896A, “Manufacturing Management Program Guide.” (Note: MIL-HDBK-896A can also be used as guidance by industry entities for their supplier base.)

## **6.4.1 Manufacturing Management Program**

The contractor shall establish and maintain a Manufacturing Management Program that meets the requirements of SAE AS6500 and flow this requirement down to major/critical suppliers. The contractor and major/critical suppliers shall document this program as part of their Manufacturing Plan. The contractor shall include its plans for Production Readiness Reviews (PRRs) and Manufacturing Readiness Level (MRL) Assessments in the Manufacturing Plan.

Suggested Data Item Description (DID):

DI-MGMT-81889A, Manufacturing Plan

## **6.4.2 Quality Management System Requirements**

The contractor shall establish and maintain a Quality Management System (QMS) that meets the requirements of a recognized Industry Standard (e.g., AS9100, ISO 9001, IATF 16949, etc.). The quality system shall ensure delivery of product that complies with all technical requirements. The Contractor shall document how the QMS is implemented with any unique requirements within the Quality Assurance Program Plan. Major/critical suppliers and suppliers with design authority shall be required to establish and maintain a Quality Management System (QMS) in accordance with Industry Standard requirements. Suppliers without design authority shall be compliant to a recognized Industry Standard (e.g., AS9003, Inspection and Test Quality System), as a minimum.

Suggested DID:

DI-QCIC-81794, Quality Assurance Program Plan, contractor format acceptable

## **6.4.3 Manufacturing Readiness Levels and Assessments (MRLs)**

The contractor shall conduct assessments of manufacturing readiness in accordance with AS6500 and use the definitions, criteria, and processes defined in the Manufacturing Readiness Level Deskbook as a guide. Assessments will be conducted at the locations and frequencies specified in Appendix TBD. They will be led by the government program office at the prime contractor’s facilities. The prime contractor shall lead the assessments at suppliers and include government participants. The selection of supplier assessments should be determined by the government and prime contractor using the MRL Deskbook, Section 4.3 as a guide. The contractor shall develop and implement Manufacturing Maturation Plans or their equivalent for criteria in which the MRL is lower than the target MRL. The contractor shall monitor and provide status at all program reviews for in-house and supplier MRLs and shall re-assess MRLs in areas for which design, process, source of supply, or facility location changes have occurred that could impact the MRL.

Suggested DID:

DI-SESS-81974, Assessment of Manufacturing Risk and Readiness

## **6.4.4 Quality and Manufacturing Metrics**

***NOTE: The Government program office and industry shall select the appropriate metrics for each life cycle phase from those listed below in italics and provide the specific performance measure for each metric.***

In accordance with AS6500, the contractor shall maintain a manufacturing surveillance process. The contractor shall submit quality and manufacturing metrics at the agreed upon frequency that report the contractor’s and major/critical suppliers’ performance and progress. Metrics shall include cost, schedule, and quality metrics to monitor the effectiveness of the contractor’s manufacturing, quality, and supplier management programs. Metrics shall be selected from, but not limited to, the following: *design release performance (schedule and quality), waivers and deviations, purchase order releases, supplier delivery performance (schedule and quality), tooling and test equipment (design, fabrication, test, and qualification progress), manufacturing schedule performance for fabrication and assembly, work instruction and planning package completions compared to need dates, touch labor performance, traveled/out of station work, MRL maturity, Material Review Board actions and dispositions, process yields, process capabilities, and Scrap/Rework/Repair.* Metrics shall be presented at design, technical, and program management reviews. The contractor shall provide on-line access of these metrics to the government.

**6.5 Other Deliverables**

Implementation of assessments of manufacturing readiness utilizing the MRL criteria may require some deliverable documentation from the contractor and, if so, should be included in the SOW. Specifically, a plan for implementing assessments and any potential MMPs may be deliverable documents. Generally, requirements for official, deliverable data items should be minimized, unless the program office determines it is necessary. A plan to describe implementation of assessment approaches, schedules and responsibilities, etc., may be desired. There are several options for obtaining this plan. Preferably, the contractor’s plans for implementing assessments of manufacturing readiness utilizing the MRL criteria may be included in a Manufacturing Plan, Data Item Description (DID) DI-SESS-81974, Manufacturing Plan, which may itself be either a deliverable item or not. Additionally, the SOW may include the Data Item Description (DID) DI-SESS-81974, Assessment of Manufacturing Risk and Readiness. These DIDs can be formal Contract Data Requirements List (CDRL) items.

If MMPs are being generated as a result of maturity shortfalls, the program office needs to determine if they need these plans to be deliverable items. Preferably, the MMPs may be documented as part of the program’s normal Risk Management process, which should include documented risk mitigation plans, which may or may not be deliverable. Alternatively, DID DI-SESS-81974 may be included in the SOW as a formal CDRL as this includes MMPs as deliverables if the target maturity level is not attained.

**6.6 MRLs Relationship to AS6500 and Quality Standards**

**6.6.1 Quality Standards and MRL Criteria**

A number of Aerospace and Industry Standards are available for implementing quality management systems (MRL criteria in the Quality thread). SAE AS9100 *“Quality Management Systems”* includes requirements for aviation, space and defense organizations. AS9100 can also be used for other industry sectors and their sub-tier suppliers. Other Quality Industry Standards include ISO 9001 and IATF 16949. These Standards are applicable to all phases of the acquisition and Product Life Cycle and applicable for contractual requirements for any program having manufacturing scope.

The International Aerospace Quality Group (IAQG) standards were developed by the IAQG to provide supporting information for organizations and industry sectors applying the 9100 standard. The IAQG is responsible for three quality management systems standards; AS9100 *“Aviation, Space, and Defense Organizations”*, AS9110 *“Aviation Maintenance Organizations”*, and AS9120 *“Aviation, Space and Defense Distributors”*. In addition, the IAQG has developed numerous standards for quality management and quality management systems to provide additional guidance for specific clauses of AS9100, AS9110, and AS9120 standards (refer to Figure X.X).

|  |
| --- |
| ***IAQG Quality Management Systems Standards*** |
| * ***9100, Quality Management Systems – Requirements for Aviation, Space, and Defense Organizations*** * ***9110, Quality Management Systems – Requirements for Aviation Maintenance Organizations*** * ***9120, Quality Management Systems – Requirements for Aviation, Space and Defense Distributors*** |
| ***IAQG Standards (additional standards for guidance)*** |
| * ***9101, Quality Management Systems – Audit Requirements for Aviation, Space, and Defense Organizations*** * ***9102, Aerospace First Article Inspection Requirement*** * ***9103, Variation Management of Key Characteristics***   ***\*\*Reference AS9100 Annex C for a complete listing of available IAQG standards\*\**** |

Figure 6.1 – IAQG Standards

NOTE: AS9100 Annex B contains a listing of ISO standards available for industry and organizations requiring additional guidance which are independent of AS9100 requirements.

**6.6.2 Requirements for Activities Related to MRL Threads in AS6500 and AS9100**

Requirements for AS9100 and AS6500 standards have common affiliations to the MRL criterion (refer to Figure Y.Y). Neither standard satisfies all MRL criterion but are recommended as an additional resources for performing an MRL Assessments.

| MRL Thread | AS6500 Requirement | AS9100 Rev D Requirement |
| --- | --- | --- |
| Technology and Industrial Base | 6.4.1 Supply Chain and Material Management | 8.4 Control of Externally Provided Processes, Products, and Services |
| 6.4.2 Manufacturing Technology Development | 6.1.2.b The organization shall plan  7.1.3 Infrastructure |
| Design | 6.2.1 Producibility Analysis | 8.1.a Operational Planning and Control |
| 6.2.1c Design Trade Studies | 8.3 Design and Development of Products and Services |
| 6.2.2 Key Characteristics | 8.3.5e Design and Development Outputs  8.4.3.h Information for External Providers  For reference only; additional information on this topic can be found in AS9103 |
| 6.2.3 Process FMEAs | 8.1.b.2 Operational Planning and Control |
| Cost & Funding | 6.4.3 Cost | Use of AS9100 should result in improved quality, cost, and delivery performance. |
| Materials | 6.4.1 Supply Chain and Material Management | 8.4 Control of Externally Provided Processes, Products, and Services |
| 6.5.8 Supplier Management | 8.4 Control of Externally Provided Processes, Products, and Services |
| Process Capability & control | 6.4.4 Manufacturing Modeling & Simulation | N/A |
| 6.5.3 Continuous Improvement | 10.3 Continual Improvement |
| 6.5.4 Process Control Plans | 8.5.1.a.2.Note 2 Production and Service Provision  8.5.1.3 Production Process Verification |
| 6.5.5 Process Capabilities | 8.1.b.2 Operational Planning and Control  8.5.1.3 Production Process Verification |
| Quality Management | 6.3 Manufacturing Risk Identification | 6.1 Actions to Address Risks and Opportunities  8.1.1 Operational Risk Management |
| 6.5.2 Manufacturing Surveillance | 7.1.5 Monitoring and Measuring Resources  7.4 Communication  8.5.1 Control of Production and Service Provision |
| 6.5.3 Continuous Improvement | 10.3 Continual Improvement |
| 6.5.7 FAIs/FATs | 8.5.1.3 Production Process Verification  For reference only; additional information on this topic can be found in AS9102 |
| 6.5.8 Supplier Management | 8.4 Control of Externally Provided Processes, Products, and Services |
| 6.5.9 Supplier Quality | 8.4 Control of Externally Provided Processes, Products, and Services |
| Manufacturing Workforce | 6.4.6 Manufacturing Workforce | 7.1 Resources |
| Facilities | 6.4.7 Tooling/Test Equipment/Facilities | 7.1.5.2 Measurement traceability  8.5.1.1 Control of Equipment, Tools, and Software Programs  8.5.1.2.c Validation of Control of Special Processes |
| Manufacturing Management | 6.4 Manufacturing Planning | 8.1 Operational Planning and Control |
| 6.4.5 Manufacturing System Verification | 8.5.1.3 Production Process Verification |
| 6.5.1 Production Scheduling and Control | 8.1 Operational Planning and Control |
| 6.5.2 Manufacturing Surveillance | 7.1.5 Monitoring and Measuring Resources  7.4 Communication  8.5.1 Control of Production and Service Provision |

**Figure 6.2. Mapping of MRL Threads to AS6500 & AS9100 Requirements**

**6.6.3 Additional Quality Considerations for Government Entities**

Contractual requirements must meet the Federal Acquisition Regulations (FAR) and Defense Acquisition Federal Acquisition Regulations Supplement (DFARS).

* Contract Quality Requirements - shall meet all requirements of FAR-Part 46, Subpart 46.2
* Government Contract Quality Assurance - shall meet all requirements of DFARS-Subpart 246.4

The FAR and DFARS can be used as additional resources for performing MRL Assessments.