# Program Risk and DoD Manufacturing Readiness Assessments

Section E1.1.14 Knowledge-Based Acquisition of Department of Defense (DOD) Directive 5000.1 states:

*"Program Managers (PMs) shall provide knowledge about key aspects of a system at key points in the acquisition process. PMs shall reduce technology risk, demonstrate technologies in a relevant environment, and identify technology alternatives, prior to the design readiness review. They shall reduce manufacturing risk and demonstrate producibility prior to full rate production."*

There are many ways a PM can satisfy the many "shall" statements specified in the directive. WILLCOR has strong background in thorough, systematic, and objective risk assessments used to identify, reduce, and ***predict*** technology and manufacturing risks. To assist PMs in fulfilling DOD 5000 requirements, WILLCOR performs risk-based Manufacturing Readiness Assessments (MRAs) in accordance with the requirements promulgated by DOD to identify and mitigate manufacturing and production risks. A MRA compares a program, system, subsystem, or item's manufacturability at various stages of development against a well-defined set of criteria for a given phase of the Acquisition Cycle.

In addition to identifying manufacturing and production risks, a MRA will identify a product's Manufacturing Readiness Level (MRL). MRLs are measures used to assess the manufacturing maturity of a given technology and were designed to be congruent with DOD Technology Readiness Levels (TRLs). MRLs are applicable to any system from a rifle to a tank, and were intended to provide decision makers with a common basis of understanding of manufacturing maturity at various stages of the DOD Acquisition Cycle.

DOD 5000.02 emphasizes the need to assess manufacturing feasibility at several stages and within many contexts. There are several steps in the acquisition cycle that require an evaluation of manufacturability and attendant risks. At the **Analysis of Alternatives** (AoA) stage, manufacturing feasibility and risk of alternatives should be evaluated (MRLs 1-3). DOD 5000.02 directs an assessment of manufacturing feasibility and risk of the proposed materiel solution for use in the **Milestone A** decision (MRL 4). It also states to conduct assessments to identify manufacturing risks and ensure manufacturing processes have been demonstrated in a relevant environment in conjunction with the Preliminary Design Review (PDR) for use in the **Milestone B** decision (MRL 6). An assessment should be conducted to ensure the maturity of critical manufacturing processes has been demonstrated in a representative environment in conjunction with the **Critical Design Review** (CDR) (MRL 7). Finally, an assessment should be conducted to ensure that manufacturing processes have been effectively demonstrated in a pilot line environment and that there are no significant manufacturing risks for use in the **Milestone C** (MRL 8) or **Full Rate Production** decisions (MRL 9).

In performing an MRA, WILLCOR engineers use an automated tool, the Technical Risk Identification and Mitigation System (TRIMS), in conjunction with knowledgebases of expert questions developed by the DOD Joint Defense Manufacturing Technology Panel

(JDMTP) to ensure objectivity and repeatability. There exist knowledgebases for MRLs 4 through 9, each consisting of approximately 500 expert questions to assess the readiness of a program. The output of an MRA is a report in accordance with the format specified by DOD and identifies risks at two levels: issues originating from compliance with specific questions, and compliance with MRL definitions. The following areas (referred to as "Threads" in MRL/MRA parlance) are specifically analyzed and documented in a Manufacturing Readiness Assessment:

- Technology and the Industrial Base
- Design
- Materials
- Cost and Funding
- Process Control and Capability
- Quality Management
- Manufacturing Personnel
- Facilities
- Manufacturing Management

MRAs are conducted by answering a series of questions at multiple levels of the organization developing the system for DOD. Questions at the senior staff level are more broadly based than the detailed, more probing questions, found at the level of either the Program Manager or the mid-level Manager. All questions are designed to determine the risk associated with the manufacturability of the product at the given phase of the Acquisition Cycle.

The Assessment process normally begins by providing the manufacturer with access to a web-based version of TRIMS utilizing the appropriate question set for the target MRL. After the manufacturer has answered all questions, WILLCOR engineers visit the facility and discuss and verify the answers with management and production personnel. Whenever possible, process documents are reviewed and manufacturing personnel are interviewed to verify that processes are documented and implemented. The results of the document review and interviews are all recorded in the TRIMS tool. Because the process is evaluated using an automated tool with a standardized question set, repeatability is ensured. This enables the Program Manager to objectively evaluate risk, particularly if development spans multiple performers and tiers of supply.

WILLCOR was instrumental in the development of MRAs and MRLs. Using the detailed knowledge gained from hundreds of factory surveys, production reviews, and risk assessments, WILLCOR engineers assisted the JDMTP in developing requirements, procedure, expert questions, and an early assessment tool called MRL Assist.

Our engineers are recognized manufacturability and producibility subject matter experts (SMEs), who provide unique talents in direct support to DOD acquisition program managers. In the course of its 12 year history, WILLCOR has performed numerous Manufacturing Readiness Assessments, failure analyses, and production "get well" tasks. If your program is at a critical stage in its acquisition we can help.

Please contact David Smith at david@willcor.com for more information.