

Manufacturing Readiness Level (MRL)

By Joseph Feord

For the past several years, a dedicated group of manufacturing experts from the DOD, various Defense Agencies and Industry representatives have been creating a standardized measurement system to bring manufacturing capability on par with product design technology. They have created a robust set of metrics, criteria and threads that provide rigor and direction to consider manufacturing and production issues early and often through a development cycle.



No longer will technology alone drive development. After reviewing several major weapon systems programs, the DOD is setting precedent via the Weapons Systems Acquisition Reform Act (WSARA) and the DODI 5000.02 that more information and evidence for producibility will be demonstrated earlier in a program. No longer will major funding be released for engineering development until the program team can show evidence that the product can be produced at the costs and timeframe quoted and promised. MRLs were devised to provide a standardized mechanism that will enable program teams to comply.

In a recent workshop of government and industry representatives in late October, 2009, years of hard work was reviewed and it appears as though the MRL procedures are closing in on official release. While some companies and some DOD Agency departments have already adopted the MRL methods, we are still awaiting official word and adoption policy from our senior DOD leaders.

On April 22, 2010, the GAO published its report titled "BEST PRACTICES: DOD Can Achieve Better Outcomes by Standardizing the Way Manufacturing Risks Are Managed" wherein they supported the adoption and application of MRLs. In the report it was stated:

"To ensure that DOD is taking steps to strengthen and improve the producibility and manufacturing readiness of technologies, weapon systems, subsystems, or manufacturing processes, we recommend that the Secretary of Defense do the following:

- * Require the assessment of manufacturing readiness across DOD programs using consistent MRL criteria as basis for measuring, assessing, reporting, and communicating manufacturing readiness and risk on science and technology transition projects and acquisition programs.
- * Direct the Office of the Director, Defense Research and Engineering to examine strengthening the MRL criteria related to the process capability and control of critical components and/or interfaces prior to milestone C, or equivalent, for low-rate initial production decision.

- * Direct the Office of the Director, Defense Research and Engineering to assess the need for analytical models and tools to support MRL assessments.
- * Assess the adequacy of the manufacturing workforce knowledge and skills base across the military services and defense agencies and develop a plan to address current and future workforce gaps."

While MRL's were created for defense programs, they warrant a look from commercial manufacturers as well. The MRL system employs a comprehensive matrix of threads and sub-threads that encompass what is required to have achieved a specific level of manufacturing readiness. The objective is to minimize risk while bringing forth transparent knowledge.

DP MRL

Manufacturing Readiness Level (MRL) is a standardized measurement of manufacturing maturity and risk for a given technology solution. MRL assessments are critical to ensuring that technology can be produced at the best value and on-time. These specific definitions and threads have been created in standardized language and format.

Munro & Associates, Inc. and Design Profit, Inc. have collaborated through an Internal Research and Development (IRAD) to embed the MRL definitions in their commercially available Design Profit (DP) software tool. MRL was a natural addition to the DP software. DP reveals and rolls up critical metrics for any given design concept. Competing designs can be rapidly compared to determine the lowest risk, highest value solution. It was created to bring downstream consideration into the picture earlier in program development. The great part about the DP MRL tool is that it combines the power of the existing DP tool with the latest MRL definitions. DP MRL goes beyond the standard MRL spreadsheets as it enables multiple evaluators, anywhere around the globe, to perform assessments simultaneously. DP MRL tracks the assessments and combines and rolls up results in an organized, transparent fashion.

Design Profit® MRL is a robust tool for executing a manufacturing readiness assessment using the DOD MRL definitions. DP MRL is easy to use and captures traceable, supporting evidence. It combines MRL's with other standardized metrics that expose, quantify and predict cost drivers and risks from early concept, analyses of alternatives (AoA), all the way through full rate production (FRP).

All key critical components and operations can be identified and their

Design Profit® EXECUTIVE SUMMARY DoDI 5000.02 Analysis of Alternatives (AoA)

	Pre-Concept	AoA - Design 1	AoA - Design 2	AoA - Design 3
TRL	4	4	5	2
MRL	3	3	3	2
Parts	142	94	104	85
Steps	930	748	818	680
Actual Time (min)	397.87	339.96	361.08	231.60
No. of Operators	77.861	66.723	69.539	44.641
Fasteners	51	33	39	26
Ergo Dangers	77	63	57	62
Poka Yoke Issues	68	44	34	46
Total Weight	1.89 lb	1.77 lb	1.80 lb	0.90 lb
Piece Cost	\$5,098.22	\$4,974.24	\$4,781.98	\$3,488.29
Total Labor Cost	\$551.06	\$479.00	\$505.47	\$329.38
Q Burden	\$1,066.69	\$1,066.69	\$1,057.84	\$883.15
Total Cost	\$6,715.97	\$6,519.92	\$6,345.29	\$4,700.83
Investment Cost	\$83,925	\$56,000	\$70,925	\$120,500
Annual Savings	N/A	\$4,705,054	\$8,896,231	\$48,363,432

MRLs tracked. Standard forms with DOD MRL definitions and threads are built into the DP software structure to guide the users through the evaluation. All threads are evaluated based on the current level of information available. DP MRL provides detailed queries to help the user define the readiness level.

Flexibility is built in to allow multiple evaluators to be simultaneously assigned to any combination of systems and threads. The software model will roll-up evaluations and identify conflicting components and operations. DP MRL provides customization for unique company requirements and allows for assessment teams to attach files to support TRL/MRL claims. DP MRL will build confidence in your ability to perform assessments, identify weaknesses and demonstrate risk versus other key program metrics.

DODI 5000.02 with Corresponding TRL and MRLs

