



INSTITUTE FOR DEFENSE ANALYSES

**DMSMS Considerations and
Manufacturing Readiness Levels**

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About This Publication

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**DMSMS Considerations and
Manufacturing Readiness Levels**

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Executive Summary

Diminishing manufacturing sources and material shortages (DMSMS) management is a multidisciplinary process to identify risks resulting from obsolescence, loss of manufacturing sources, or material shortages; to assess the potential for negative impacts on schedule or readiness; to analyze potential mitigations; and then to implement the most cost-effective resolution. Parts management is an engineering discipline for selecting parts for use in a Department of Defense system (or equipment) and take into account considerations that affect the design, production, operation, support, and disposal throughout the life cycle of the system. In March 2022, a Parts and Material Management Conference (PMMC) will cover both topics. The Institute for Defense Analyses (IDA) prepared or substantially helped craft seven briefings for this event.

Three of the briefings will be used for training; they will be presented by DOD practitioners.

- Standardization-related Document (SD) 22 is DOD's overarching DMSMS guidance. DOD published an updated SD-22 (written by IDA) in January 2021 and IDA is preparing another update. NS D-32993 is a substantially modified three-hour training course on the SD-22 processes.
- Development of a DMSMS Management Plan (DMP) is an important early step in DMSMS management. The January 2021 and forthcoming SD-22s formalized DMP development guidance. NS D-32973 is new DMP preparation training.
- DOD prime contractors perform many DMSMS procedures and even more parts management procedures. NS D-32996 makes minor revisions to existing training on DMSMS contracting and adds preliminary parts management contracting material.

IDA will present the remaining four briefings in technical sessions. These briefings cover the results of specific subtasks from several IDA projects performed in the last two years.

- NS D-32929 provides a detailed explanation of often-misunderstood DMSMS management interfaces with product, product improvement, supportability, and technology roadmaps. This material is a large part of the forthcoming SD-22 revision.

- NS D-32956 describes how to improve the content of manufacturing readiness assessments (MRAs) through a more rigorous consideration of DMSMS management and parts management in the assessment criteria. MRAs are regulatory requirements throughout DOD's acquisition process.
- NS D-32930 delves into cybersecurity and hardware assurance (HwA) considerations associated with implementing resolutions to DMSMS issues. IDA will also moderate a plenary panel on this subject at the PMMC. IDA plans to use these events to help formulate future policy recommendations.
- NS D-32962 defines new DMSMS resolutions and estimates their average cost. These changes contribute to a more accurate estimate of cost avoidance from proactive DMSMS management and also provide program offices with an initial estimate of resolution cost when no other information is readily available.

DMSMS Considerations and Manufacturing Readiness Levels

**Parts and Material Management
Conference
Denver, CO**

**Jay Mandelbaum and Christina Patterson
8 March 2022**

IDA

Objective

- **Raise awareness of diminishing manufacturing sources and material shortages (DMSMS) considerations pertaining to manufacturing planning to minimize the impact of DMSMS issues on the manufacturing of a system**
- **Encourage—**
 - **The more thorough application of DMSMS considerations for manufacturing readiness assessments**
 - **Improved coordination of manufacturing and DMSMS management communities**

Outline

- **Background**
- **Approach**
- **What are Manufacturing Readiness Levels (MRLs)?**
- **Assessment of How MRLs Reflect DMSMS Considerations**
- **Recommended DMSMS Consideration Changes**
- **Conclusion**

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Background

- **Office of the Secretary of Defense (OSD) executives (OSD Director for Enterprise Engineering and OSD DMSMS Lead) in charge of DMSMS management and manufacturing indicated that “adding obsolescence considerations to the manufacturing readiness levels (MRLs) has merit”**
- **This interest by leadership reflected the fact that DMSMS guidance has improved significantly since the MRL criteria matrix and user’s guide were formulated**
- **The DMSMS Management Working Group established a strategic effort to examine the degree to which DMSMS considerations are incorporated in MRLs**

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Outline

- Background
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Approach

- Formed a core team of DMSMS and manufacturing subject matter experts augmented by the advice of additional experts, as necessary
- Reviewed the MRL criteria matrix and user's guide
- Generated suggested changes to the criteria matrix and user's guide
- Integrated and synthesized suggested changes with that of a parallel MRL redundancy effort
- Submitted final report to OSD DMSMS lead

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Outline

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- **What are Manufacturing Readiness Levels?**
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What are Manufacturing Readiness Levels?

(1 of 3)

- MRLs represent criteria for assessing and managing manufacturing risk for the development and acquisition of a Department of Defense (DOD) system
- Organized around nine threads (each with at least one subthread):
 - A. Technology and Industrial Base
 - B. Design
 - C. Cost and Funding
 - D. Materials
 - E. Process Capability and Controls
 - F. Quality
 - G. Manufacturing Workforce
 - H. Facilities
 - I. Manufacturing Management

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What are Manufacturing Readiness Levels?

(2 of 3)

MRL Threads and Sub-Threads

- | | |
|-----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| A. Technology and Industrial Base
A.1 Industrial Base
A.2 Manufacturing Technology Development | E. Process Capability and Control
E.1 Modeling & Simulation
E.2 Manufacturing Process Maturity
E.3 Process Yields & Rates |
| B. Design
B.1 Producibiity Program
B.2 Design Maturity | F. Quality
F.1 Quality Management
F.2 Product Quality
F.3 Supplier Quality/Management |
| C. Cost and Funding
C.1 Production Cost Knowledge
C.2 Cost Analysis
C.3 Manufacturing Investment Budget | G. Manufacturing Workforce
G.1 Manufacturing Workforce |
| D. Materials
D.1 Maturity
D.2 Availability of Materials
D.3 Supply Chain Management
D.4 Special Handling | H. Facilities
H.1 Tooling/STE/SIE*
H.2 Facilities |
| | I. Manufacturing Management
I.1 Manufacturing Planning & Scheduling
I.2 Materials Planning |

*All undefined acronyms will be defined on the last slide.

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What are Manufacturing Readiness Levels?

(3 of 3)

- **Criteria Matrix**
 - The rows are the threads and subthreads
 - The columns represent 10 levels of manufacturing readiness that range from pre-acquisition through production
 - In the cell at the intersection between a thread and level of manufacturing readiness is criteria for assessing and discussing manufacturing maturity and risk
- **User's Guide**
 - Guidance in support of MRL threads and subthreads
 - Includes information by subthread on the purpose, sources of information, examples of "objective evidence," questions (related to the MRL criteria), additional considerations, and lessons learned

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Outline

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Assessment of How MRLs Reflect DMSMS Considerations

- DMSMS concepts already recognized in the MRL criteria matrix
 - **B. Design**—
 - **B.1 Producibility Program**: assessment of DMSMS changes for producibility (MRL 10)
 - **B.2 Maturity**: stable product design with limited changes, for example due to obsolescence (MRL 10)
 - **C. Cost and Funding**—
 - **C.1 Production Cost Knowledge (Cost Modeling)**: inclusion of obsolescence solutions in cost modeling (MRL 7)
 - **D. Materials**—
 - **D.2 Availability of Materials**: identification/survey of global trends, identification of gaps, and closure strategy for DMSMS and obsolescence gaps (MRLs 1- 3); and concept of assessing future DMSMS risk (MRL 6) and identification of mitigation strategies (MRL 7)

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Assessment of How MRLs Reflect DMSMS Considerations

- **Potential omissions of key DMSMS functions from the MRL criteria matrix that could impact manufacturing**
 - Monitor the system for DMSMS issues; resolve issues identified
 - Monitor test equipment for DMSMS issues; resolve issues identified
 - Design for DMSMS resilience
 - Avoid selecting parts (initial and replacement) with current or near-term DMSMS risk
 - Ensure DMSMS risk mitigation is captured in cost modeling
 - Continuously track consumption of the obsolete item to determine if life-of-need buy assumptions remain valid

Need a methodical left to right progression of DMSMS-related concept as move from lower to higher MRLs

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Overview of MRL Criteria Matrix Rows (Threads & Subthreads) Impacted

- | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>A. Technology and Industrial Base</p> <ul style="list-style-type: none"> A.1 Industrial Base A.2 Manufacturing Technology Development <p>B. Design</p> <ul style="list-style-type: none"> B.1 Producibility Program B.2 Design Maturity <p>C. Cost and Funding</p> <ul style="list-style-type: none"> C.1 Production Cost Knowledge C.2 Cost Analysis C.3 Manufacturing Investment Budget <p>D. Materials</p> <ul style="list-style-type: none"> D.1 Maturity D.2 Availability of Materials D.3 Supply Chain Management D.4 Special Handling | <p>E. Process Capability and Control</p> <ul style="list-style-type: none"> E.1 Modeling & Simulation E.2 Manufacturing Process Maturity E.3 Process Yields & Rates <p>F. Quality</p> <ul style="list-style-type: none"> F.1 Quality Management F.2 Product Quality F.3 Supplier Quality/Management <p>G. Manufacturing Workforce</p> <ul style="list-style-type: none"> G.1 Manufacturing Workforce <p>H. Facilities</p> <ul style="list-style-type: none"> H.1 Tooling/STE/SIE H.2 Facilities <p>I. Manufacturing Management</p> <ul style="list-style-type: none"> I.1 Manufacturing Planning & Scheduling I.2 Materials Planning |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

KEY: Matrix Criteria & User's Guide Changes; User's Guide Changes ONLY

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B. Design:

Summary of Recommended Changes

- **B.1 Producibility Program**
 - Introduce the use of DMSMS minimization techniques early in design (MRLs 1-3) and carry through to support DMSMS resilience of the design (MRLs 4-10)
 - Ensure that DMSMS resilience risk is considered as part of trade studies regarding producibility (MRLs 6-7)
 - Implement DMSMS resilience improvements (MRL 8)
 - Analyze DMSMS resilience improvements (MRL 9)
 - Ensure design modifications are assessed for DMSMS resilience (MRL 10)
- **B.2 Design Maturity**
 - Identify design resilience starting at preferred system concept and the need to validate DMSMS resilience throughout the life of the product (MRL 4)

Related to: **DMSMS FUNCTION: Design for DMSMS Resilience**

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C. Cost and Funding:

Summary of Recommended Changes

- **C.1 Production Cost Knowledge (Cost Modeling)**
 - Ensure that initial cost models include high level technology refreshment considerations (MRL 3)
- **C.2 Cost Analysis**
 - Ensure that cost projections consider ongoing cost reduction initiatives and technology refreshment (MRL 10)

Related to: **DMSMS FUNCTION: Ensure DMSMS risk mitigation is captured in cost modeling**

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D. Materials:

Summary of Recommended Changes

- **D.2 Availability of Raw Materials**
 - Initiate mitigation planning in addition to assessing components for future DMSMS risk (MRL 6)
 - Ensure implementation of DMSMS mitigation strategies (MRL 7)

Related to: **DMSMS FUNCTION: Monitor the system for DMSMS issues; resolve issues identified**

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E. Process Capability and Controls:

Summary of Recommended Changes

- **E.3 Process Yields and Rates**
 - Ensure that yield and/or rate improvements remain consistent with life-of-need buy assumptions (MRL 9 and 10)

Related to: **DMSMS FUNCTION: Continuously track that the Life-of-Need (LON) Buy assumptions hold**

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H. Facilities:

Summary of Recommended Changes

- **H.1 Tooling/STE/SIE**
 - Ensure DMSMS mitigation strategies for components are in place and are being implemented (MRL 7)
 - Ensure continuation of DMSMS mitigations (MRLs 8-10)

Related to: **DMSMS FUNCTION: Monitor test equipment for DMSMS issues; resolve issues identified**

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I. Manufacturing Management: ***Summary of Recommended Changes***

- **I.2 Materials Planning**
 - Establish parts selection process that minimizes DMSMS risk (MRL 5)
 - Use parts selection process to minimize DMSMS risk throughout the life cycle (MRL 6)

Related to: **DMSMS FUNCTION: Avoid Selecting (Initial and Replacement) with Current or Near-term DMSMS Risk**

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Outline

- **Background**
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Conclusion and Way Ahead

- **Conclusion**
 - The strategic objective team identified recommended changes for the MRL criteria and User's Guide
- **The MRL working group (WG) has received and reviewed these recommended changes**
 - The plan is to not incorporate any DMSMS-related changes to the MRL criteria matrix
 - Although the MRL WG will consider making changes to the User's Guide, that will not likely change behavior

The recommended changes reflect best practices for considering DMSMS when assessing manufacturing readiness; rejecting them introduces a risk that program offices may move forward in the acquisition process before they are ready

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BACKUP

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B. Design:

B.1 Producibility Program (1 of 8)

MRL Level	Criteria Statement	Rationale for Changes
1	<p>Hypotheses developed for cause-effect relationships between technology variables and producibility. Requirement established to use DMSMS minimization techniques in the system's operational design concept.</p>	<p>The existing criteria matrix recognizes the fact that DMSMS impacts manufacturing maturity. Therefore, DMSMS resilience (i.e., DMSMS minimization techniques) should be included throughout the producibility program subthread wherever there is a criterion associated with design for producibility. DMSMS resilience at the earliest maturity levels should also incorporate the necessary enabling concept of DMSMS minimization requirements.</p>

Related to DMSMS FUNCTION: Design for DMSMS Resilience

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B. Design

B.1 Producibility Program (2 of 8)

MRL Level	Criteria Statement	Rationale for Changes
2	<p>Studies performed to test hypotheses regarding cause-effect relationships between technology variables and producibility. Elements identified which have a potential impact to producibility (i.e., materials, processes, capabilities, limitations). Requirement established to minimize DMSMS in the design of all potential material solutions.</p>	<p>Need to continue the concept that requirement should be in place to minimize DMSMS in potential material solution designs.</p>

Related to DMSMS FUNCTION: Design for DMSMS Resilience

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B. Design:

B.1 Producibility Program (3 of 8)

MRL Level	Criteria Statement	Rationale for Changes
3	System concept elements evaluated for manufacturability and producibility using experiments, modeling, and simulation. Initial performance attribute established to minimize DMSMS.	As initial performance attributes are established they should include minimizing DMSMS in designs.
4	Initial producibility, and manufacturability, and DMSMS resilience assessments in selection of preferred materiel solution completed. Results considered in AoA documented in AS key components/technologies.	Selection of a preferred materiel solution should also include initial DMSMS resilience considerations.

Related to DMSMS FUNCTION: Design for DMSMS Resilience

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B. Design:

B.1 Producibility Program (4 of 8)

MRL Level	Criteria Statement	Rationale for Changes
5	Producibility, and manufacturability, and DMSMS resilience assessments of key technologies and components initiated. Ongoing design trades consider manufacturing processes and industrial base capability constraints, and DMSMS resilience. Manufacturing processes assessed for capability to be tested and verified in production. Manufacturing processes assessed for influence on O&S.	An assessment of DMSMS resilience of key technologies and components should also be initiated and ongoing design trades should consider DMSMS resilience.

Related to DMSMS FUNCTION: Design for DMSMS Resilience

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B. Design:

B.1 Producibility Program (5 of 8)

MRL Level	Criteria Statement	Rationale for Changes
6	<p>Producibility assessments and producibility, and DMSMS resilience trade studies (performance vs. producibility vs DMSMS risk) of key technologies/components completed. Results used to shape AS, SEP, LCSP, manufacturing and producibility plans, and DMSMS resilience planning for EMD or technology insertion programs. Preliminary design choices assessed against manufacturing processes and industrial base capability constraints. Producibility enhancement efforts (i.e., DFM, DFA, etc.) and DMSMS resilience activities (i.e., MOSA) initiated.</p>	<p>DMSMS resilience should be a factor of trade studies for key technologies and components. DMSMS resilience should also be part of planning, to include its insertion in the LCSP, for EMD and technology insertion; therefore, DMSMS resilience activities should be initiated by this level of maturity.</p>

Related to DMSMS FUNCTION: Design for DMSMS Resilience

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B. Design:

B.1 Producibility Program (6 of 8)

MRL Level	Criteria Statement	Rationale for Chans
7	<p>Detailed producibility and DMSMS resilience trade studies using knowledge of key design characteristics and related manufacturing process capability completed. Producibility enhancement efforts (i.e., DFM, DFA, etc.) and DMSMS resilience activities ongoing. Manufacturing processes reassessed as needed for capability to be tested and verified. Manufacturing processes reassessed as needed for potential influence on O&S.</p>	<p>DMSMS resilience should be part of the completed trade studies and DMSMS resilience activities should be ongoing.</p>

Related to DMSMS FUNCTION: Design for DMSMS Resilience

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B. Design:

B.1 Producibility Program (7 of 8)

MRL Level	Criteria Statement	Rationale for Chans
8	Producibility and DMSMS resilience improvements implemented on system. Known producibility risks and issues managed for LRIP.	By this maturity level, DMSMS resilience-related improvements should be implemented.
9	Prior producibility and DMSMS resilience improvements analyzed for effectiveness during LRIP. Producibility and DMSMS resilience risks and issues discovered in LRIP managed for FRP.	Need to ensure that DMSMS resilience impacts on the build-baseline have been identified and addressed.

Related to DMSMS FUNCTION: Design for DMSMS Resilience

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B. Design:

B.1 Producibility Program (8 of 8)

MRL Level	Criteria Statement	Rationale for Chans
10	Design producibility improvements demonstrated in FRP. Process producibility improvements ongoing. All modifications, upgrades, DMSMS-related and other changes assessed for producibility and DMSMS resilience.	DMSMS-related changes should be assessed for DMSMS resilience in addition to producibility.

Related to DMSMS FUNCTION: Design for DMSMS Resilience

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B. Design:

B.2 Design Maturity

MRL Level	Criteria Statement	Rationale for Chans
4	Form, fit, and function constraints, and manufacturing capabilities, and DMSMS resilience identified for preferred systems concept. SEP, LCSP, and T&E Strategy recognize the need for the establishment/validation of manufacturing capability, DMSMS resilience, and management of manufacturing risk for the product lifecycle. Initial KPPs identified for preferred systems concept. System characteristics and measures to support required capabilities identified.	The existing criteria matrix discusses form, fit, and function constraints for the preferred system concept. There are form, fit, and function constraints associated with DMSMS resilience as well. That also implies that DMSMS resilience should be recognized in the LCSP in addition to the other documents mentioned.

Related to DMSMS FUNCTION: Design for DMSMS Resilience

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C. Cost and Funding:

C.1 Production Cost Knowledge (Cost Modeling)

MRL Level	Criteria Statement	Rationale for Chans
3	Manufacturing cost estimates for system concepts developed. Initial cost models developed which include high-level process steps, technology refreshment considerations, and materials.	Technology refreshment, which is the periodic replacement of early generation or out-of-date technologies, enables continued supportability. Technology refreshment is a common occurrence in DOD systems. Production cost models do not always take this into account. Technology refreshment should be made explicit.

Related to DMSMS FUNCTION: Ensure DMSMS risk mitigation is captured in cost modeling

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C. Cost and Funding:

C.2 Cost Analysis

MRL Level	Criteria Statement	Rationale for Chans
10	FRP cost goals met. Cost projections consider ongoing cost reduction initiatives ongoing and technology refreshment.	The existing criteria imply accurate cost projections are based only on planned cost reduction initiatives. The impact of technology refreshment on cost projections could be significant and, therefore, technology refreshment considerations should be included.

Related to DMSMS FUNCTION: Ensure DMSMS risk mitigation is captured in cost modeling

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D. Materials:

D.2 Availability of Raw Materials

MRL Level	Criteria Statement	Rationale for Changes
6	Availability risks and issues addressed to meet EMD build. Long-lead items identified. Components assessed for future DMSMS risk, mitigation planning initiated.	In MRL 7, mitigation efforts are started, so planning is necessary at MRL 6.
7	Availability risks and issues addressed to meet LRIP builds. Long lead procurements identified and mitigated. DMSMS mitigation strategies for components in place and are being implemented.	At MRL 7, while the strategies are in place, resolutions to DMSMS issues have begun to be implemented.

Related to DMSMS FUNCTION: Monitor the system for DMSMS issues; resolve issues identified

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E. Process Capability and Control:

E.3 Process Yields and Rates (1 of 2)

MRL Level	Criteria Statement	Rationale for Chans
9	LRIP yield and rate targets achieved. Yields and rates required to begin FRP refined using LRIP results. Yield and/or rate improvements ongoing, as necessary, consistent with life-of-need buy assumptions.	The criteria matrix already recognizes that manufacturing will be impacted if a DMSMS issue occurs, but it does not recognize how yield can lead to the reoccurrence of DMSMS issues. Yield at higher levels of assembly impacts the adequacy of previous life-of-need buys of components in the assembly (because faulty assumptions could have been made in determining the quantity to buy). Faulty assumptions that overestimated yield could lead to the unnecessary reoccurrence of a DMSMS issue that wouldn't have happened if DMSMS assumptions about yield matched actual yield.

Related to DMSMS FUNCTION: Continuously track that Life-of-Need (LON) Buy assumptions hold

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E. Process Capability and Control:

E.3 Process Yields and Rates (2 of 2)

MRL Level	Criteria Statement	Rationale for Chans
10	FRP yield and rate targets achieved. Yield and/or rate improvements ongoing, as necessary, consistent with life-of-need buy assumptions.	Yield impacts the adequacy of life-of-need buys that have been made. The problem is that inadequate yield could lead to the unnecessary reoccurrence of a DMSMS issue that would not have happened if DMSMS assumptions about yield matched actual yield. If a DMSMS issue reoccurs, manufacturing will be impacted.

Related to DMSMS FUNCTION: Continuously track that Life-of-Need (LON) Buy assumptions hold

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H. Facilities:

H.1 Tooling/STE/SIE (1 of 3)

MRL Level	Criteria Statement	Rationale for Changes
7	<p>Design and development efforts for production tooling and STE/SIE initiated with STE/SIE validation plans complete. Manufacturing equipment maintenance strategy developed.</p> <p>DMSMS mitigation strategies for components in place and are being implemented.</p>	<p>Tooling, test, and inspection equipment have DMSMS issues just like the system itself, in fact, such equipment are especially prone to serious DMSMS issues. The processes to identify, assess, and resolve DMSMS issues are therefore applicable to tooling, test, and inspection equipment; once established, those processes are continuously used throughout the supply chain for the life cycle of the system. This parallels the words from MRL 7 in the Availability subthread.</p>

Related to DMSMS FUNCTION: Monitor test equipment for DMSMS issues; resolve issues identified

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H. Facilities:

H.1 Tooling/STE/SIE (2 of 3)

MRL Level	Criteria Statement	Rationale for Changes
8	<p>Tooling, test, and inspection equipment proven on pilot line and additional requirements identified for LRIP. STE/SIE validated as part of pilot validation IAW validation plan. Manufacturing equipment maintenance demonstrated on pilot line. DMSMS mitigation ongoing.</p>	<p>At this level of maturity a process should have been established that will then continuously identify, assess, and resolve DMSMS issues throughout the supply chain for tooling, test, and inspection equipment for the life cycle. This parallels the words from MRL 8 in the Availability subthread.</p>

Related to DMSMS FUNCTION: Monitor test equipment for DMSMS issues; resolve issues identified

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H. Facilities:

H.1 Tooling/STE/SIE (3 of 3)

MRL Level	Criteria Statement	Rationale for Changes
9	All tooling, test and inspection equipment proven in LRIP and additional requirements identified for FRP. Manufacturing equipment maintenance schedule demonstrated. STE/SIE validation maintained as necessary. DMSMS mitigation ongoing.	This parallels the words from MRL 9 in the Availability subthread.
10	Proven tooling, test and inspection equipment in place to support maximum FRP. Planned equipment maintenance schedule achieved. STE/SIE validation. DMSMS mitigation ongoing.	This parallels the words from MRL 10 in the Availability subthread.

Related to DMSMS FUNCTION: Monitor test equipment for DMSMS issues; resolve issues identified

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I. Manufacturing Management:

I.2 Materials Planning (1 of 2)

MRL Level	Criteria Statement	Rationale for Chans
5	Make/buy evaluations initiated and include production considerations for pilot line, LRIP, and FRP needs. Lead times and other materials risks and issues identified. Parts selection process that minimizes DMSMS risk established.	Materials planning relies on parts selection. That part selection process should take DMSMS risk into account, otherwise there will be manufacturing maturity risks associated with materials availability and design that are already recognized in the criteria matrix and augmented by the suggested changes.

Related to DMSMS FUNCTION: Avoid Selecting Parts (Initial and Replacement) with Current or Near-term DMSMS Risk

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I. Manufacturing Management:

I.2 Materials Planning (2 of 2)

MRL Level	Criteria Statement	Rationale for Chans
6	Most material make/buy decisions complete, material risks and issues identified, and mitigation plans developed. BOM initiated. Part selection process that minimizes DMSMS risk in use throughout the life cycle.	Materials planning relies on parts selection. The parts selection process should take into account DMSMS risk and should be established for MRL 5. That process should be in use and continue to be used throughout the life cycle.

Related to DMSMS FUNCTION: Avoid Selecting Parts (Initial and Replacement) with Current or Near-term DMSMS Risk

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Abbreviations

- STE – Special Test Equipment
- SIE – Special Inspection Equipment
- O&S – Operating and Support
- AS – Acquisition Strategy
- SEP – Systems Engineering Plan
- LCSP – Life-Cycle Sustainment Plan
- EMD – Engineering and Manufacturing Development
- MOSA – Modular Open Systems Architecture
- DFM – Design for Manufacturing
- DFA – Design for Assembly
- LRIP – Low Rate Initial Production
- FRP – Full Rate Production
- T&E – Test and Evaluation
- KPP – Key Performance Parameter
- IAW – In accordance with
- BOM – Bill of Materials

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14. ABSTRACT Manufacturing Readiness Levels (MRLs) provide a standard set of criteria for measuring the manufacturing readiness for or conversely the manufacturing risk posed to a system under development in a defense acquisition program. The existence of DMSMS issues can impact the manufacturing readiness for a system. Given this linkage between DMSMS issues and manufacturing readiness, how well do the MRLs consider DMSMS issues as a factor that contributes to manufacturing risk? This presentation will describe an effort that reviewed the MRL criteria and its corresponding User's Guide to: <ul style="list-style-type: none"> Identify existing DMSMS-related material; and Recommend the insertion of additional DMSMS-related material. The inclusion of this additional DMSMS-related material within the MRL criteria and corresponding User's Guide would ensure program offices adequately consider DMSMS management and DMSMS issues in assessing the manufacturing readiness of their systems.					
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