



INSTITUTE FOR DEFENSE ANALYSES

**A Risk-Based Approach for
Diminishing Manufacturing Sources
and Material Shortages (DMSMS)
Management of Materials and
Mechanical Items in Your
Bill of Materials (BOM)**

Jay Mandelbaum
Christina M. Patterson

October 2014

Approved for public release;
distribution is unlimited.

IDA Document D-5326

Log: H 14-001230



The Institute for Defense Analyses is a non-profit corporation that operates three federally funded research and development centers to provide objective analyses of national security issues, particularly those requiring scientific and technical expertise, and conduct related research on other national challenges.

About This Publication

This work was conducted by the Institute for Defense Analyses (IDA) under contract HQ0034-14-D-0001, Project DE-6-3405, "Fostering Proactive Diminishing Manufacturing Sources and Material Shortages (DMSMS) and Parts Management," for the Office of the Defense Standardization Program Office through the Defense Logistics Agency. The views, opinions, and findings should not be construed as representing the official position of either the Department of Defense or the sponsoring organization.

Acknowledgments

The authors would like to thank Dr. Robert J. Atwell for reviewing this document.

Copyright Notice

© 2014 Institute for Defense Analyses
4850 Mark Center Drive, Alexandria, Virginia 22311-1882 • (703) 845-2000.

This material may be reproduced by or for the U.S. Government pursuant to the copyright license under the clause at DFARS 252.227-7013 (a)(16) [Jun 2013].

INSTITUTE FOR DEFENSE ANALYSES

IDA Document D-5326

**A Risk-Based Approach for
Diminishing Manufacturing Sources
and Material Shortages (DMSMS)
Management of Materials and
Mechanical Items in Your
Bill of Materials (BOM)**

Jay Mandelbaum
Christina M. Patterson



A Risk-Based Approach for DMSMS Management of Materials and Mechanical Items in Your Bill of Materials (BOM)

**DMSMS Annual Conference
San Antonio, Texas
December 1-4, 2014**

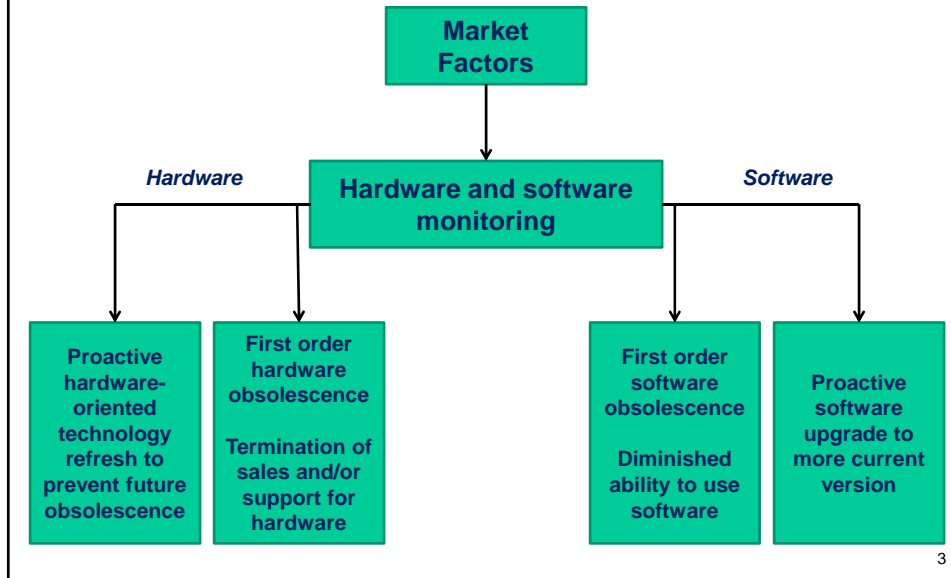


**Jay Mandelbaum
Christina Patterson**

Overview

- **Scope**
 - Materials and mechanical items that are identified in a BOM,* e.g.,—
 - Adhesives
 - Insulating Material
 - A Diesel Engine
 - A Fender
- **This presentation will address—**
 - DMSMS mechanisms
 - Questions and decisions facing a program in determining—
 - To what extent to apply DMSMS management
 - When to start
 - A risk-based framework

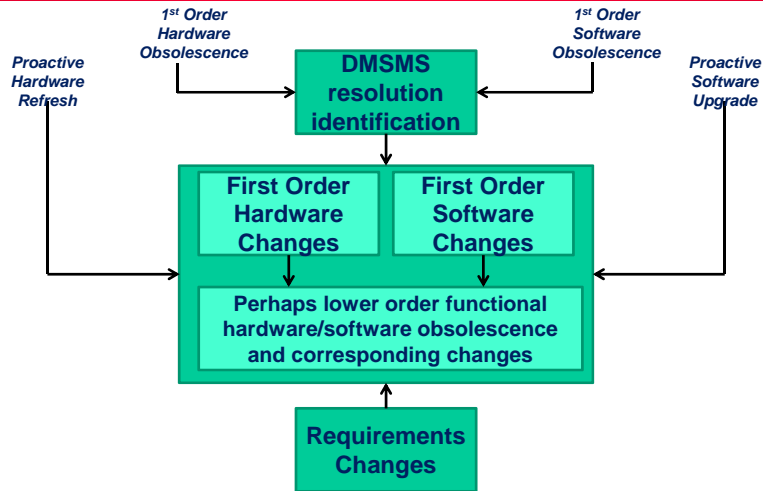
DMSMS Mechanisms (1 of 2)



First Order Hardware Obsolescence Mechanisms for Materials and Mechanical Items

- **Use of hazardous materials**
 - May become unavailable or hard to get (e.g., Freon)
- **The supplier goes out of business**
 - Not financially viable
- **The supplier's business case is no longer viable**
 - Tungsten rhenium wire or some exotic material
- **Use of supply-constrained materials**
 - Supply limited by regulation or supplier policy
- **The tooling is no longer available**

DMSMS Mechanisms (2 of 2)

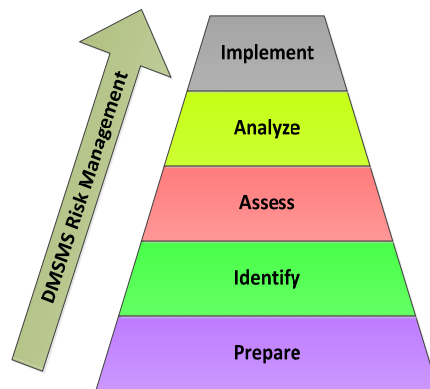


Materials and mechanical items DMSMS mechanisms are similar to electronic items, but product life-cycle time is longer

5

DMSMS Management Overview

- **Prepare:** Establishment of a DMSMS management program infrastructure
- **Identify:** DMSMS monitoring and surveillance
- **Assess:** DMSMS impact assessment
- **Analyze:** Resolution determination
- **Implement:** Implementation of DMSMS resolutions



6

Prepare: Establishing Strategic Underpinnings

- Two questions to be answered by program management
 - To what extent should a program apply DMSMS management to materials (including critical materials* in the supply chain) and mechanical items?
 - When should a program's efforts begin in these areas?

* Critical materials include hazardous, exotic, and supply-constrained materials

Responses to these questions assume that resources are constrained and a risk-based approach should be pursued

7

Prepare: Prioritizing DMSMS Effort as Part of Establishing Strategic Underpinnings (1 of 3)

- Two elements of prioritization
 - Prioritize the systems/sub-systems of interest
 - No changes to strategic underpinnings when mechanical items and materials are considered
 - Determine the items (including critical materials in the supply chain) in the sub-systems of interest to be monitored
 - This is where strategic underpinnings for monitoring materials and mechanical items (and electronic items too) should be explicitly considered

Three determinations should be made when establishing strategic underpinnings; two of which apply to materials and mechanical items identified in a BOM

8

Prepare: Prioritizing DMSMS Effort as Part of Establishing Strategic Underpinnings (2 of 3)

- Determine the items (including critical materials in the supply chain) in the sub-systems of interest to be monitored
 - Items that are listed in a BOM
 1. Determine the heuristic algorithms to use to identify the families of materials and mechanical items (and electronics too) to definitely monitor
 2. Determine whether to further analyze uncategorized items
 - Critical materials that appear in lower level tiers of the items listed on the system's BOM
 3. Determine whether to investigate critical materials in the supply chain

Ultimately, program management must decide whether or not resources should be applied to DMSMS management to reduce risk to an acceptable level

9

Prepare: Prioritizing DMSMS Effort as Part of Establishing Strategic Underpinnings (3 of 3)

- Determine when DMSMS management effort for materials and mechanical items (including critical materials in the supply chain) should begin
 - Early monitoring provides—
 - A larger window of opportunity to do something about an issue
 - The availability of a larger selection of less expensive resolutions
 - A smaller likelihood of schedule or readiness impacts
 - Only high risk materials and mechanical items are monitored; if the risk is high, proactive monitoring should begin early in the life cycle
 - Material and mechanical item monitoring is integrated with electronics item monitoring
 - Designs containing high risk materials or mechanical items can be revised before it is much more costly to make changes later

BEST PRACTICE:
Begin proactive DMSMS management for materials and mechanical items at the same time as for electronic items

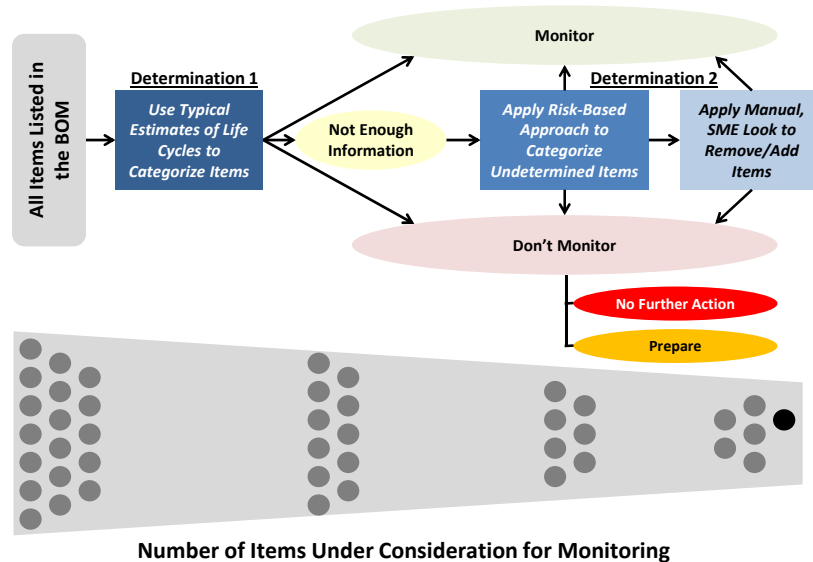
10

Identify: Two Different Approaches

- **Materials and mechanical items (and electronics items too) that are listed in a BOM**
 - Applies to the first two determinations from the strategic underpinnings on what to monitor
 1. Apply the heuristic algorithms to identify the items to definitely monitor
 2. Further analyze (as appropriate) uncategorized items where the heuristics did not provide a definitive answer
 - There are other potential benefits for the program
- **Critical materials that appear in lower level tiers of the system**
 - Applies to the third determination from the strategic underpinnings on what to monitor
 3. Investigate how critical materials in the supply chain or in a manufacturing process may alter the status of items being proactively monitored

11

Identify: Item Data Preparation Overview



12

Identify: Framework for a Risk-Based Approach— *Determination 1* (1 of 2)

- Apply heuristic algorithms to categorize the items as—
 - *Definitely monitor*: Item types with a high propensity for DMSMS issues, e.g.,—
 - Electronic COTS assemblies (e.g., networking gear, computers, active components, radiofrequency components, programmables, memory, microprocessors, ASICs, hybrids, and custom electronic assemblies)
 - Sole-source items that are in low demand
 - Custom passive items
 - Materials with chemical properties that are a function of the design, are sole source, or otherwise threaten the environment
 - Electro-mechanical items
 - *Don't Monitor*: Item types that are standard industrial items, e.g.,—
 - Mechanical components
 - Connectors
 - Cabling
 - Consumables
 - *Not enough information to determine whether to monitor*

Results in an initial categorization of items listed in the BOM

13

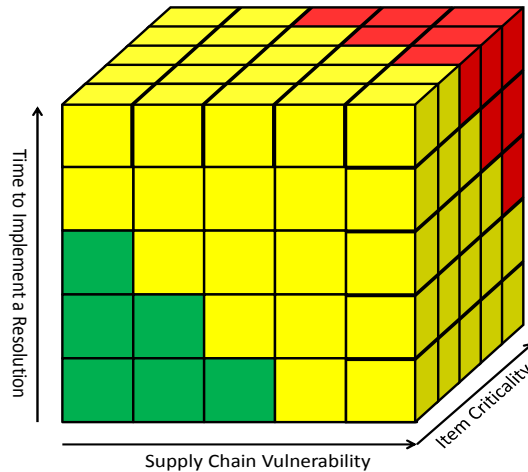
Identify: Framework for a Risk-Based Approach— *Determination 1* (2 of 2)

- Options for deciding what to do about the uncategorized items from Determination 1
 - Monitor ALL uncategorized items (Low risk, High monitoring cost)
 - Conduct further analysis of uncategorized items to determine what to monitor; Commence Determination 2
 - Do not monitor any uncategorized items (High risk, Low monitoring cost)

BEST PRACTICE:
The middle option—Optimizes risk and monitoring cost, but there are start-up expenses

14

Identify: Framework for a Risk-Based Approach— *Determination 2* (1 of 3)



Where is proactive monitoring of uncategorized items important?

15

Identify: Framework for a Risk-Based Approach— *Determination 2* (2 of 3)

Item Criticality	Supply Chain Vulnerability	Time to Implement Resolution
<ul style="list-style-type: none"> Critical safety item Mission criticality Item essentiality code High demand (perhaps 10%) High cost 	<ul style="list-style-type: none"> Source related Financial health of supplier Persistent backorders (over period of time) Long customer wait-time (perhaps top 10%) Recent significant price increase Time since last order (perhaps if more than 3 years) Low demand Life cycle of the item 	<ul style="list-style-type: none"> TDP availability for mechanical item or availability of material specification for engineered material Source controlled Manufacturing difficulty Long lead time to requalify Manufacturing cycle time Availability of tooling and test equipment Cost to implement resolution Defense unique

Apply the risk cube to determine those previously uncategorized items that are high risk; this is where the principal start-up expenses would be incurred

16

Identify: Framework for a Risk-Based Approach— *Determination 2* (3 of 3)

- Manually adjust the “Monitor” and “Don’t Monitor” lists, based on—
 - An assessment of considerations that are not available from an automated database
 - Any known vulnerabilities, such as items on the platform:
 - That members of the DMT know to be a problem
 - Where there are pending environmental or safety regulations that may limit their availability and use in any area of the world where the system operates

Could apply whether or not the risk cube is conducted

17

Identify: Analysis of Item Availability

- Most predictive tools do not cover materials and mechanical items; product discontinuation notices are also not usually issued in these cases
- Therefore, for materials and mechanical items on the “Definitely Monitor” list—
 - Conduct research and/or vendor surveys to identify any issues
 - No need to modify content of vendor surveys in use today
 - Determine the appropriate frequency of vendor surveys for materials and mechanical items, based on a function of obsolescence risk, resources, and criticality/safety

18

Assess

- **Should a resolution to the problem be pursued?**
 - Compare days of supply with expected time to implement a resolution
 - If item is obsolete, comparison will identify whether resolution can be deferred or not
 - If the item is not obsolete and the time for a resolution is long, as appropriate, increase the on-hand inventory (and maintain at a higher level) or take action to reduce the time to realize a resolution
- **Which problem should be addressed first?**
 - To include consideration as to whether a problem is a common issue that will be addressed by an external organization
- **At what level should a resolution be applied?**

19

Analyze

- **For issues being addressed by an external organization, the program only needs to monitor that the resolution remains on track**
- **The same resolution types apply**
 - No solution required
 - Approved part
 - Life of need buy
 - Repair, refurbishment, or reclamation
 - Extension of production or support
 - Simple substitute
 - Complex substitute
 - Development of a new item or source
 - Redesign – NHA
 - Redesign – complex/system replacement

There may be a different distribution of resolution types

20

Questions?



21

REPORT DOCUMENTATION PAGE

*Form Approved
OMB No. 0704-0188*

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.**

1. REPORT DATE (DD-MM-YY) October 2014		2. REPORT TYPE Final	3. DATES COVERED (From - To)		
4. TITLE AND SUBTITLE A Risk-Based Approach for Diminishing Manufacturing Sources and Material Shortages (DMSMS) Management of Materials and Mechanical Items in Your Bill of Materials (BOM)			5a. CONTRACT NO. HQ0034-14-D-0001		
			5b. GRANT NO.		
			5c. PROGRAM ELEMENT NO(S).		
6. AUTHOR(S) Jay Mandelbaum, Christina M. Patterson			5d. PROJECT NO.		
			5e. TASK NO. DE-6-3405		
			5f. WORK UNIT NO.		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Institute for Defense Analyses 4850 Mark Center Drive Alexandria, VA 22311-1882			8. PERFORMING ORGANIZATION REPORT NO. IDA Document D-5326		
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) Defense Standardization Program Office Defense Logistics Agency 8725 John J. Kingman Road Fort Belvoir, VA 22060			10. SPONSOR'S / MONITOR'S ACRONYM(S) DSPO		
			11. SPONSOR'S / MONITOR'S REPORT NO(S).		
12. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT The programs of the Department of Defense (DOD) have traditionally focused their Diminishing Manufacturing Sources and Material Shortages (DMSMS) management efforts on electronic items. From a risk-based perspective, this is a decision based on the realization that the relatively short life cycles of electronic items virtually guarantee obsolescence at some point, if not multiple points, during the life cycle of DOD systems. DOD guidance and government and private sector data bases and predictive tools have focused predominately on DMSMS management of electronic items as well. The reality, though, is that DOD systems contain items other than merely electronic ones and any item type can experience obsolescence. Facing budget constraints, a program's decision to pursue a more comprehensive approach to DMSMS management is not without challenges. This briefing describes how a program can apply a risk-based approach to identifying which materials (including critical materials located in the lower tiers of the supply chain) and which mechanical items cause the most potential concern. Therefore, the program should be proactively monitored.					
15. SUBJECT TERMS Diminishing Manufacturing Sources and Material Shortages, DMSMS, DMSMS management, materials, critical materials, mechanical items					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT UU	18. NO. OF PAGES 16	19a. NAME OF RESPONSIBLE PERSON
a. REPORT U	b. ABSTRACT U	c. THIS PAGE U			19b. TELEPHONE NUMBER (Include Area Code)

