



DCMA

Introduction to Manufacturing Readiness Levels (MRLs)

REV#13 SEPT 29, 2016

CBT Code: MFGDL006

CLPs: 1

Approx. Length:

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Industrial Engineer



- Purpose of Manufacturing Readiness Levels (MRLs)
 - About this Course
 - Benefits AS6500
 - Overview
- What are Manufacturing Readiness Levels (MRLs)
 - MRL Evaluation Criteria
 - Definitions / Descriptions / Considerations
 - Experience in DOD / Commercial Environment
- SAE AS6500
- MRLs and Surveillance Process
 - Manufacturing Readiness
 - MRL Relationship to System Acquisition Milestone
- Manufacturing Program Support
- Manufacturing Development Program Surveillance
 - MRA / Deliverables
 - Benefits
 - Findings and Concussions
- MRL/MRA Resources
- Questions



About this Course

- Upon completion of this course, you will be able to comprehend how the MRL process is a critical step to ensure programs has both the required manufacturing capability and resources to achieve program success. During the surveillance process; assessing manufacturing maturity and risk; involving technology, and resources. Understanding how cost and schedule are directly impacting the program viability and success.
- Intended Audience:
 - Industrial Specialist (1150)
 - Industrial Engineers (0896)
 - Any other DCMA employee wanting to gain knowledge of MRLs



- Promote basic understanding of the Manufacturing Readiness Levels
- Providing an additional tool for risk determination under Manufacturing Development Program Surveillance
- Develop a proactive and aggressive approach to accurately conduct risk determination for Cost, Schedule, and Program Success



A Manufacturing Management standard will benefit both DoD and Industry:

- **Provides a quick “Snapshot, Consistency, and Insight to Accurately track the Program Performance**
- Provides a vehicle to contractually communicate manufacturing requirements
- Promotes more consistent customer requirements
- Better enables contractors to implement best manufacturing practices by providing a customer requirement against which to budget
- More consistent application of best practices will result in reduced costs, higher schedule confidence, and more robust products



An Opportunity:

- An Experienced Industrial Specialist to use the MRLs tool in a Program Environment
- A new Industrial Specialist to use the MRL tool in a Geographic Environment (“Mom and Pop shops”)
- Use MRLs as a tool to manage and mitigate Manufacturing Risk

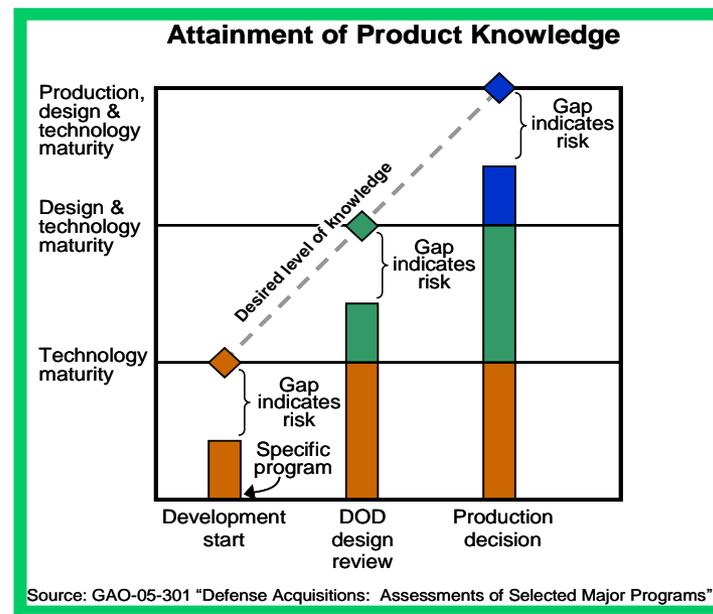


Are you ready? It's a matter of Maturity....

Manufacturing Maturity!

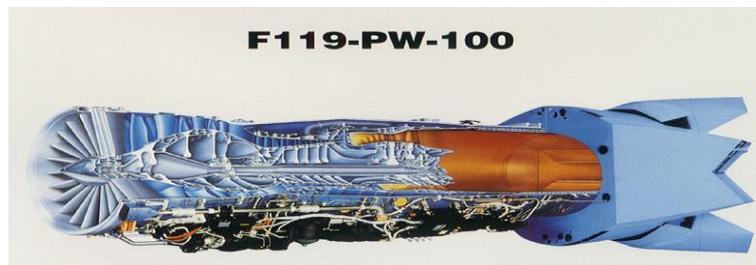
Knowing what you need to know....

at specific knowledge points!



Is the Design ready?

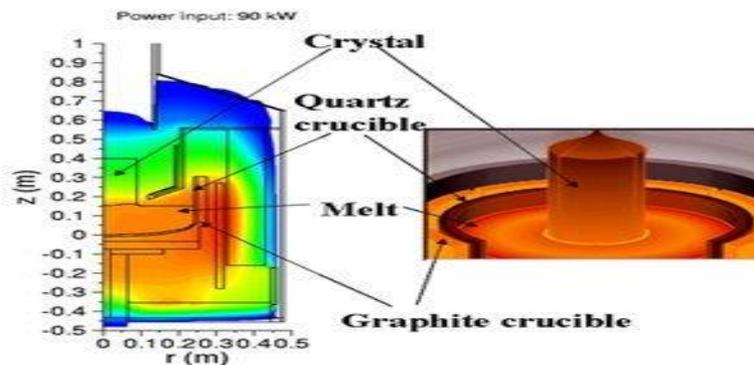
Is the Design Stable?



Is it Producidble?



Have Key Design Characteristics been identified?



Are Materials ready?

Are Materials Available?



Have they been
Characterized?



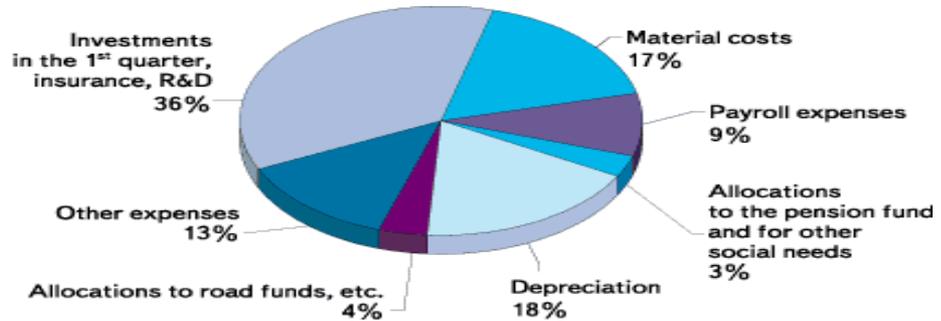
Are there any Special Handling
issues?

HAZMAT



Are resources and cost ready?

Are all Production Costs understood?



Have Design-to-Cost Goals been established?

Primary Emphasis - Affordability

- PEO (Ships) DD(X) Family
- PEO (Carriers) CVN 21
- PEO (Ships) LCS
- PEO (Subs) SSN
- PEO (Ships) LPD 17 DDG 51
- PEO (T) F-18 Family EA-18G
- PEO (IWS) Missiles Weapons Munitions
- PEO (IW) N-UCAS

Is Funding in place to cover production maturation?

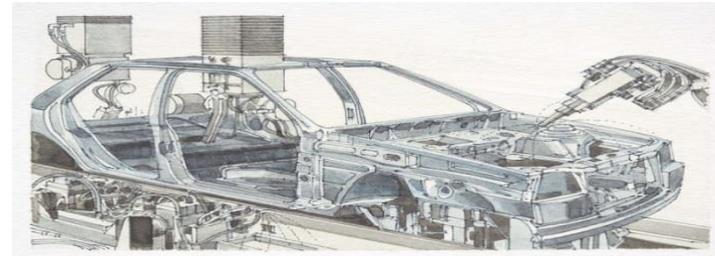


Are Processes ready?

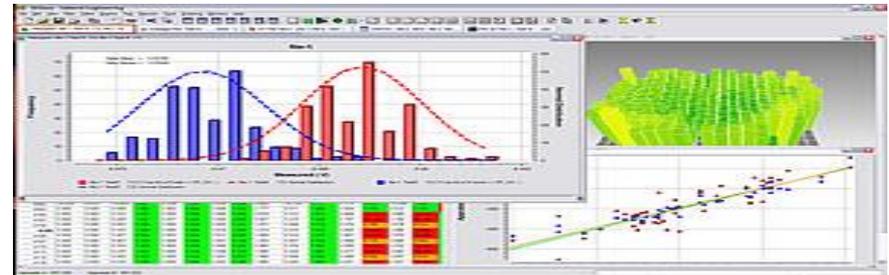
Have Critical Processes been identified?



Have Critical Processes been demonstrated?



Are those Processes Stable and In Control?



Are Manufacturing Personnel ready?

Are there any Special Skills required?



Are your folks Trained and Certified?

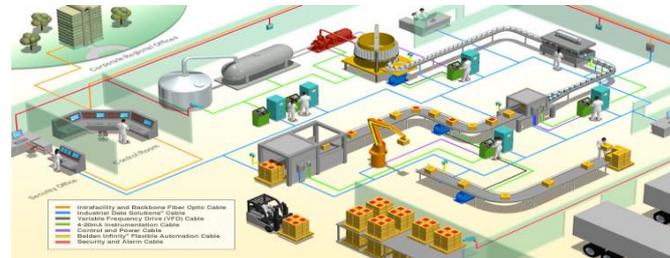


Is the Workforce Stable?



Are Facilities ready?

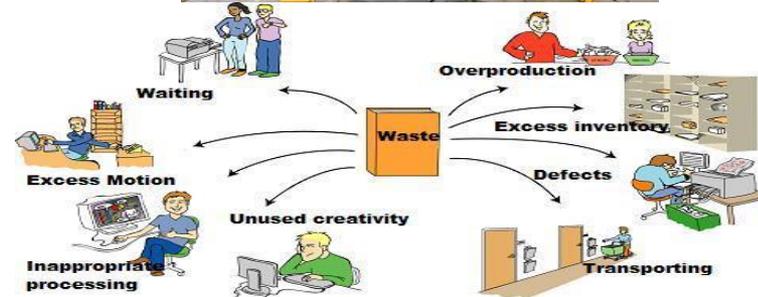
Are the Facilities in place?



Can the Facilities support production rate?



Will the Facilities Layout support Lean Production?

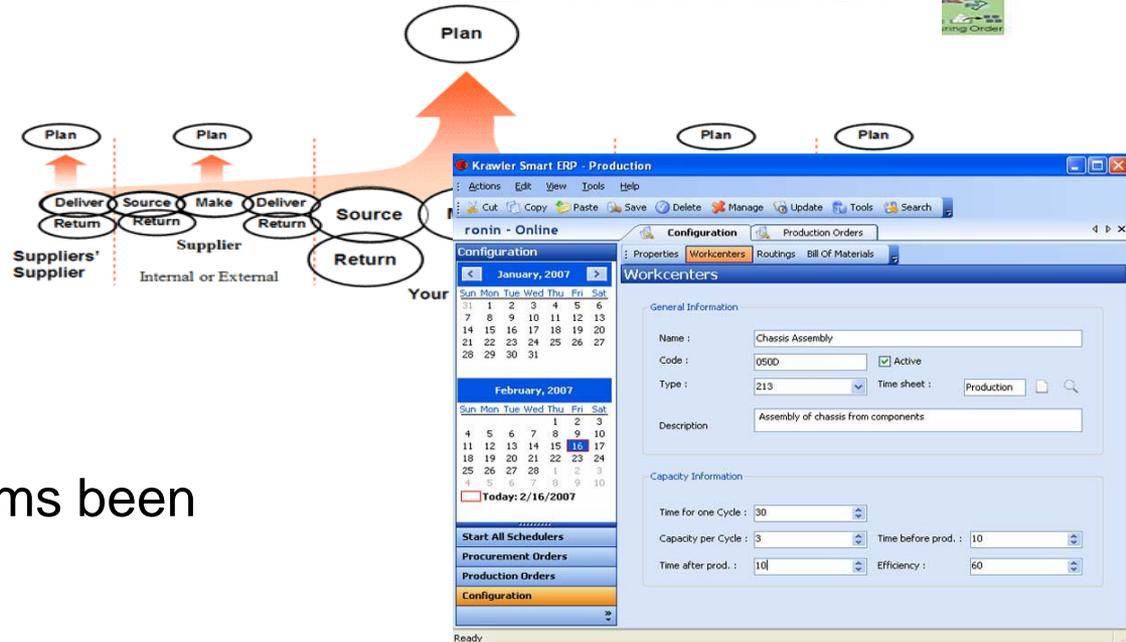
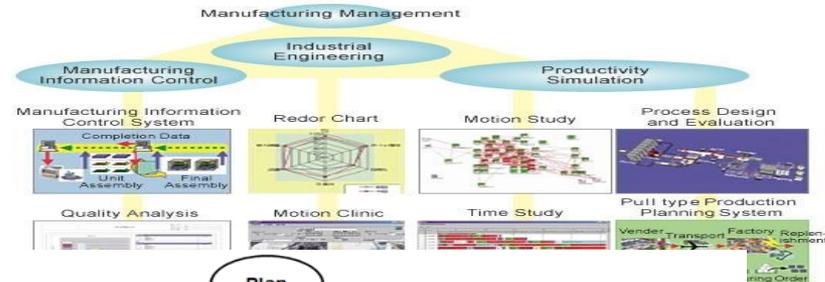


Is the Manufacturing Planning ready?

Has a Manufacturing Plan been completed?

Is the Supply Chain integrated into the plan?

Have Long Lead items been identified?



Can help manage cost, schedule and performance risk by examining the maturity of:

- Design Producibility (“The measure of the relative ease of [manufacturing](#)”) and Stability – Example: Ford Model T
- Can be built to a predictable program schedule
- Can be built at predictable cost
- Manufacturing processes and tooling
- Workforce skills and training
- Supply chain capabilities



- **MRLs** were designed to provide a maturity model based on well developed criteria and are patterned after TRLs (method of estimating technology maturity of Critical Technology Elements) that will in identifying the maturity of their manufacturing efforts on a program or a technology
- Common language and standard for:
 - Assessing the manufacturing maturity of a technology or product and plans for its future maturation
 - Understanding the level of manufacturing risk in trying to produce a weapon system or transition technology into a weapon system application
- Designed to:
 - Complement TRLs
 - Help set the agenda for manufacturing risk mitigation
 - Establish an expectation of achieving manufacturing maturity at critical decision points

NOTE: FY04 - Joint Defense Manufacturing Technology Panel (JDMTP) formed MRL Working Group to develop basic MRL definitions and criteria



- **Nine areas** were developed to help assess the current MRL
 - A - Technology and Industrial Base
 - B - Design
 - C - Cost and Funding
 - D - Materials
 - E - Process Capability and Control
 - F - Quality Management
 - G - Manufacturing Workforce
 - H - Facilities
 - I - Manufacturing Management

What is the Matrix?



Req Phase		CR	Tech.		Dev.		Sys. Dev.	Sys. Dem.	LRIP - FRP	FRP
Thread	Sub-Thread	MRL 4	MRL 5	MRL 6	MRL 7	MRL 8	MRL 9	MRL 10		
Technology & Industrial Base	Technology Maturity									
	Technology Transition to Production									
Design	Manufacturing Technology Development									
	Production Program									
Cost & Funding	Design Maturity									
	Production Cost Knowledge (Cost modeling)									
Materials	Cost Analysis									
	Manufacturing Investment Budget									
	Maturity									



MRL	Definition
1	Manufacturing Feasibility Assessed
2	Manufacturing Concepts Defined
3	Manufacturing Concepts Developed
4	Capability to produce the technology in a laboratory environment.
5	Capability to produce prototype components in a production relevant environment.
6	Capability to produce a prototype system or subsystem in a production relevant environment.
7	Capability to produce systems, subsystems or components in a production representative environment.
8	Pilot line capability demonstrated. Ready to begin low rate production.
9	Low Rate Production demonstrated. Capability in place to begin Full Rate Production.
10	Full Rate Production demonstrated and lean production practices in place.



MRLs 1 & 2

Research

- Manufacturing Concepts Identified
- Basic Research
- Advance Research
- Advance Technology Development



MRL 3

Produce in Lab. Environment

- Mfg. Feasibility Determined
- Mfg. Process Identified
- Key Processes Identified
- Producibility Assessments Initiated



MRL 4

Produced Components in Relevant Environment

- Mfg. Process Emerging
- Producibility Assessment On-going
- Mfg. Cost Drivers Identified



MRL 5

Produced System in a Relevant Environment

- Mfg. Processes Demonstration in a Relevant Environment
- Cost Drivers Analyzed
- Log Terms Items Identified
- Equipment in a Relevant Environment



MRL 6

Production Representative Environment

- Mfg. Processes in Development
- Producibility Improvement Underway
- Trade Studies
- Supply Chain Management in Place



MRL 7

Pilot Line Demo, Ready for LRIP

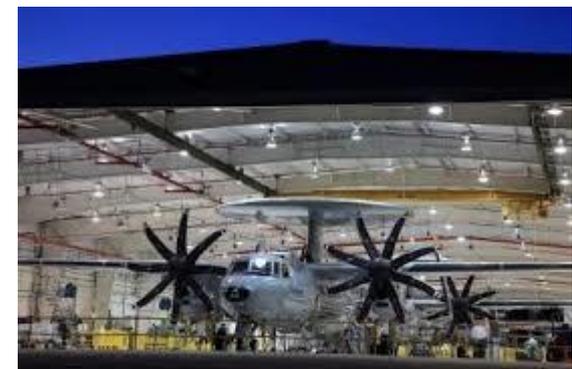
- Process Maturity Demonstrated
- All Materials Ready for LRIP
- Mfg. Processes Proven
- Supply Chain Stable for LRIP



MRL 8

LRIP in Place, Ready for FRP

- Mfg. Processes Operating at Target Quality, Cost and Performance
- Supply Chain Established and Meeting Lead Times



MRL 9 & 10

FRP, Lean

- Lean/Six Sigma Production in Place
- Meeting or Exceeding Cost, Schedule and Performance Goals



MRL 1 Manufacturing feasibility assessed	MRL 2 Manufacturing concepts defined	MRL 3 Manufacturing concepts developed	MRL 4 Capability to produce the technology in a laboratory environment	MRL 5 Capability to produce prototype components in a production relevant environment	MRL 6 Capability to produce a prototype system or subsystem in a production relevant environment	MRL 7 Capability to produce systems, subsystems or components in a production representative environment	MRL 8 Pilot line capability demonstrated. Ready to begin low rate production	MRL 9 Low rate production demonstrated. Capability in place to begin full rate production	MRL 10 Full rate production demonstrated and lean production practices in place
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Production relevant environment:

An environment normally found during MRL 5 and 6 that contains key elements of production realism not normally found in the laboratory environment (e.g. uses production personnel, materials or equipment or tooling, or process steps, or work instructions, stated cycle time, etc.). May occur in a laboratory or model shop if key elements or production realism are added.

Production representative environment:

An environment normally found during MRL 7 (probably on the manufacturing floor) that contains most of the key elements (tooling, equipment, temperature, cleanliness, lighting, personnel skill levels, materials, work instructions, etc) that will be present in the shop floor production areas where low rate production will eventually take place.

Pilot line environment:

An environment normally found during MRL 8 in a manufacturing floor production area that incorporates all of the key elements (equipment, personnel skill levels, materials, components, work instructions, tooling, etc.) required to produce production configuration items, subsystems or systems that meet design requirements in low rate production. To the maximum extent practical, the pilot line should utilize rate production processes.



- Full MRL criteria matrix can be found at www.dodmrl.com

Acquisition Phase		Pre Material Solution Analysis (Pre MSA)			Material Solution Analysis (MSA)	Technology Development (TD)	
Technical Reviews					ASR	SRR/SFR	PDR
Thread	Sub-Thread	MRL 1	MRL 2	MRL 3	MRL 4	MRL 5	MRL 6
	Technology Maturity	Should be assessed at TRL 1.	Should be assessed at TRL 2.	Should be assessed at TRL 3.	Should be assessed at TRL 4.	Should be assessed at TRL 5.	Should be assessed at TRL 6.
A - Technology and Industrial Base	A.1 - Industrial base			Potential sources identified to address technology needs. Understand state of the art.	Industrial base capabilities surveyed and known gaps/risks identified for preferred concept, key technologies, components, and/or key processes.	Industrial base capabilities assessment initiated to identify potential manufacturing sources. Sole/single/foreign source vendors and vendors of technologies with potential obsolescence issues have been identified and planning has begun to minimize risks.	Industrial base capabilities assessment for MS B has been completed. Industrial capability in place to support manufacturing of development articles. Plans to minimize sole/foreign sources and obsolescence issues complete. Need for sole/single/foreign sources justified. Potential alternative sources identified.
	A.2 - Manufacturing Technology Development		New manufacturing concepts and potential solutions identified.	Manufacturing technology concepts identified through experiments/models.	Mfg Science & Advanced Mfg Technology requirements identified.	Required manufacturing technology development efforts initiated, if applicable.	Manufacturing technology efforts continuing. Required manufacturing technology development solutions demonstrated in a production relevant environment.
B - Design	B.1 - Producibility Program			Relevant materials/processes evaluated for manufacturability using experiments/models.	Initial producibility and manufacturability assessment of preferred systems concepts completed. Results considered in selection of preferred design concepts and reflected in Technology Development Strategy key components/ technologies.	Producibility and manufacturability assessments of key technologies and components initiated as appropriate. Ongoing design trades consider manufacturing processes and industrial base capability constraints. Manufacturing processes assessed for capability to test and verify in production, and influence on Operations & Support.	Producibility assessments and producibility trade studies (performance vs. producibility) of key technologies/components completed. Results used to shape Acquisition Strategy, Systems Engineering Plan (SEP), Manufacturing and Producibility plans, and planning for EMD or technology insertion programs. Preliminary design choices assessed against manufacturing processes and industrial base capability constraints. Producibility enhancement efforts (e.g. Design For Mfg, Assembly, Etc. (DFX)) initiated.
	B.2 - Design Maturity	Manufacturing research opportunities identified.	Applications defined. Broad performance goals identified that may drive manufacturing options.	Top level performance requirements defined. Trade-offs in design options assessed based on experiments. Product lifecycle and technical requirements evaluated.	SEP and Test and Evaluation Strategy recognize the need for the establishment/validation of manufacturing capability and management of manufacturing risk for the product lifecycle. Initial potential Key Performance Parameters (KPPs) identified for preferred systems concept. System characteristics and measures to support required capabilities identified. Form, fit, and function constraints identified and manufacturing capabilities identified for preferred systems concepts.	Lower level performance requirements sufficient to proceed to preliminary design. All enabling/critical technologies and components identified and considers the product lifecycle. Evaluation of design Key Characteristics (KC) initiated. Product data required for prototype component manufacturing released.	System allocated baseline established. Product requirements and features are well enough defined to support preliminary design review. Product data essential for subsystem/system prototyping has been released, and all enabling/critical component have been prototyped. Preliminary design KCs have been identified and mitigation plans in development.



- Industry Associations and companies are supportive of DoD Manufacturing Readiness efforts and support policy
 - Participated in Three DoD-Industry Workshops
- OEMs and Second Tier Suppliers are using the first or second generation definitions, published in the Technology Readiness Assessment Guide
- Many companies have developed their own manufacturing maturity measures.
 - Rockwell Collins Manufacturing Maturity Index
 - Sikorsky Production Readiness Index
- Other companies have adopted our MRLs, and are using them within the company's gated development process.
 - **Lockheed Martin Missiles and Fire Control**
 - **Raytheon (Tucson)**
 - **Pratt & Whitney**
 - **General Electric Power Systems**
 - **Boeing (EMRLs for MDA, MRLs for FCS)**
 - **Goodrich**
 - ... **and the list is growing**



- Air Force
 - MRAs completed on 19 Air Force Advanced Technology Demonstrations using the manufacturing readiness level (MRL) criteria; additional 13 are in process
 - Used MRL criteria to perform MRAs on two ACAT 1 Programs
- Army
 - Uses MRLs on all 6.3 Programs that have manufacturing or producibility issues tied to Army Technology Objectives- Manufacturing (ATO-M)
 - Army also uses MRLs and MRAs on selected SBIR Projects
 - Army to incorporate MRLs and MRAs into the management aspect of planned Commercialization Pilot Program.
- MDA
 - Applies related scale (EMRLs) to manage high risk prototype- production technologies

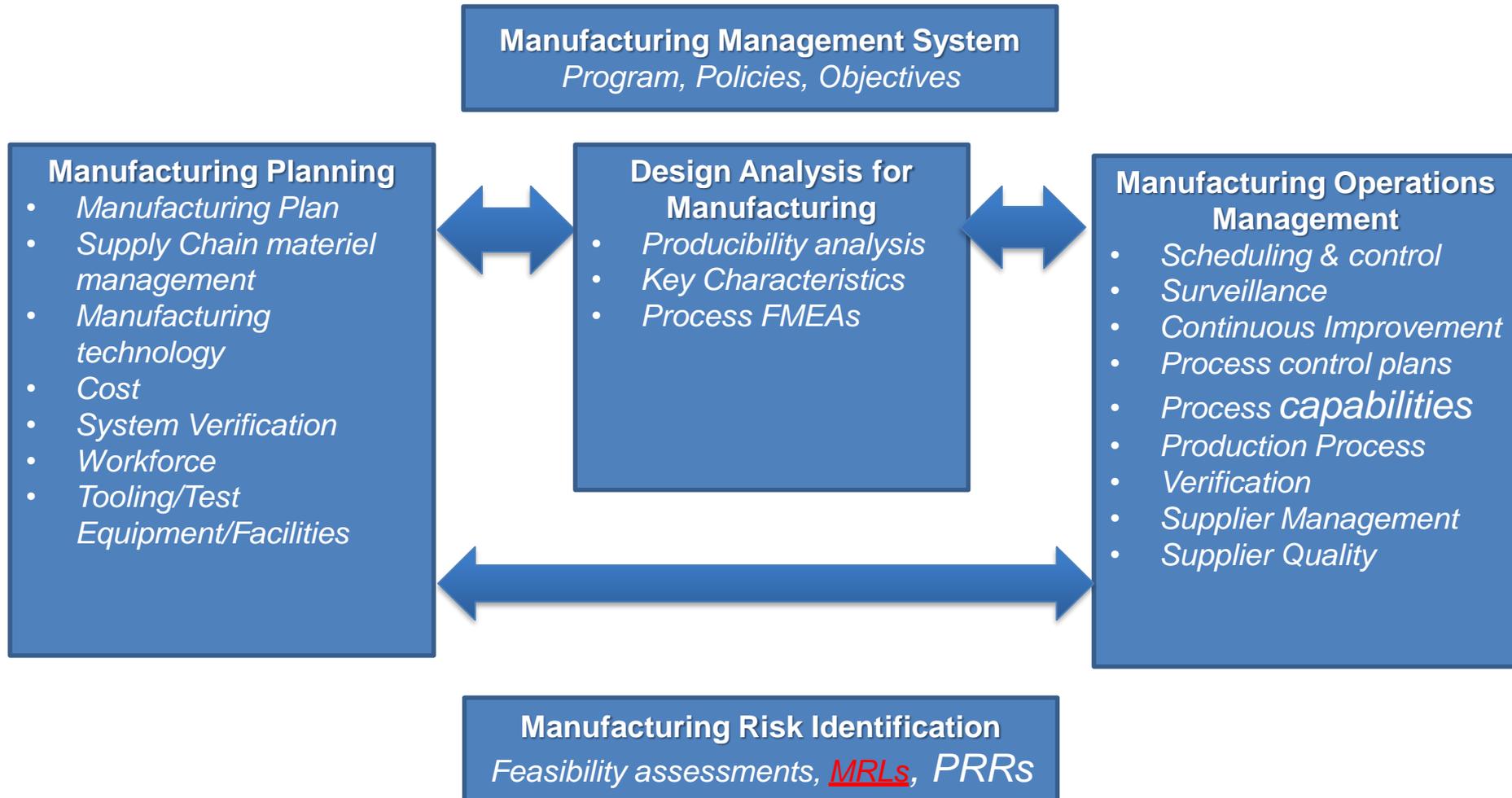


- The standard provides common definitions for 36 manufacturing-related terms with sources identified
 - DoD
 - Commercial
 - Mixture
- Definitions represent consensus agreements between government and industry
- Consistency across programs, services, and companies



- AS6500 is the manufacturing equivalent or supplement to AS9100 and ISO9000
- Covers all aspects of Production and includes requirements for quality assurance and Engineering with the manufacturing functional community.
- Includes requirements from development thru production and requires the use of manufacturing readiness levels (MRLs)
- The Air Force is requiring its use on all ACAT1 programs and it is highly recommended on all others
- It will be required as a contract line item and not as a DFARS requirement



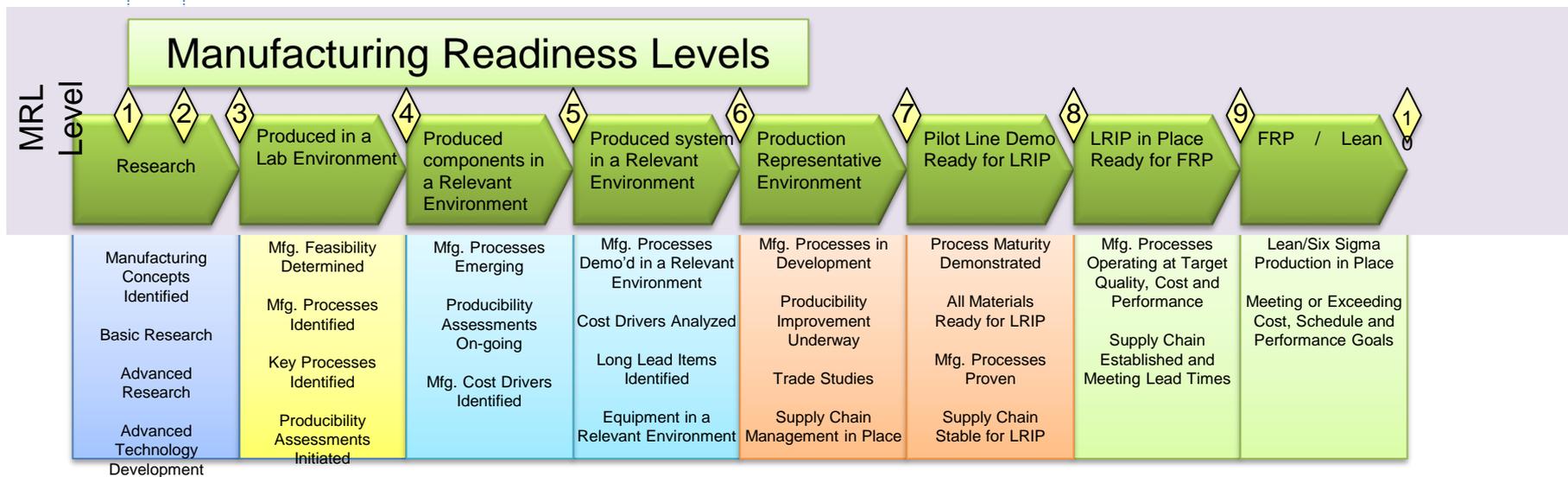
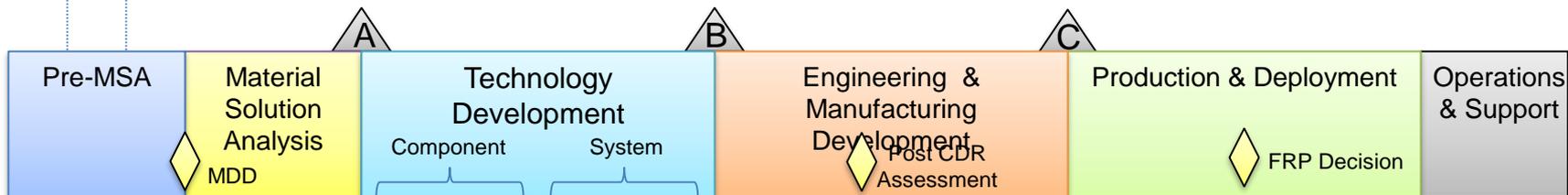


- Consensus among Congress, OSD, CSAF, GAO:
“Advanced weapon systems cost too much, take too long to field, and are too expensive to sustain”
- GAO study of 54 weapons programs:
 - Core set of 26 programs: RDT&E costs up by 42% (\$42.7B total) and schedule slipped by 20% (2.5 years on average)
- V-22 Osprey:
 - The development budget was first planned for \$2.5 billion in 1986
 - Increased to a projected \$30 billion in 1988.
 - Between 2008 and 2011, the estimated lifetime cost for maintaining the V-22 grew by 61 percent, mostly allocated to maintenance and support
 - Composite Materials make up 43% of the airframe, including wings prop rotor blades.
 - New technology not available to manufacture composite wings



- Products made by immature manufacturing processes generally:
 - Cost more
 - Are prone to quality problems
 - Experience schedule delays
 - May not perform the same
 - Are less reliable in service





- MRLs are not a report card
 - MRL 7 might not be meeting the program milestone
 - MRL 3 might be on track with the program's milestone
- MRLs are a tool to manage and mitigate manufacturing risk
 - A common language used to assess manufacturing maturity
 - Provide insight not oversight



- **Requirement:** Instruction 204 paragraphs 3.2.5 and 3.2.9 require the manufacturing specialist to support the Program Support Plan (PSP) and Development Plan surveillance respectively.
- **Regulations:**
- FAR 42.302(a)(67)
 - “Support the program, product, and project offices regarding program reviews, program status, program performance and actual or anticipated program problems”
- FAR 42.302(a)(40)
 - “Perform engineering surveillance to assess compliance with contractual terms for schedule, cost, and technical performance in the areas of design, development, and production.”



- **Major Programs in DCMA:** 209 as of 12 September, 2014
- **DAES Programs in DCMA:** 78 as of 12 September, 2014
 - 15 currently rated high risk
 - 13 currently rated moderate risk
 - 16 are software only
- Of the 62 current DAES programs in DCMA with a manufacturing component, approximately 45 percent are rated moderate to high risk.



- Development Program Activities
 - Milestone A
 - Program starts Technology Development
 - Up to 50 percent of costs are set
 - Milestone B
 - Program is initiated
 - Program starts Engineering and Manufacturing Dev.
 - 75 to 80 percent of costs are set
 - Budget is set
 - Milestone C
 - LRIP Starts
 - 95 of costs are set



• Development Program Risks

1. Is the technology mature enough to build the product ?
2. Does the contractor have experience with this type of product?
3. Does the contractor have the resources to build the product?
 - Facilities
 - Equipment
 - Personnel
 - Financial
4. Does the contractor have a reasonable plan to manufacture the product?
5. Can the subcontractors answer questions 1-4 successfully



- **How does this affect me?**
 - Schedule
 - Cost
 - Program Viability/Success

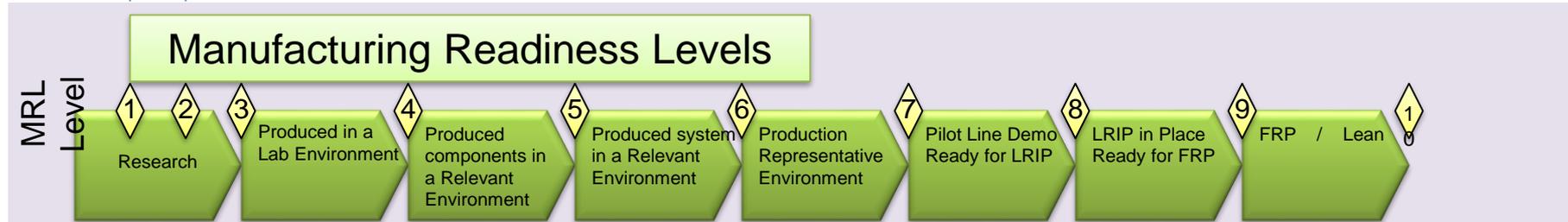
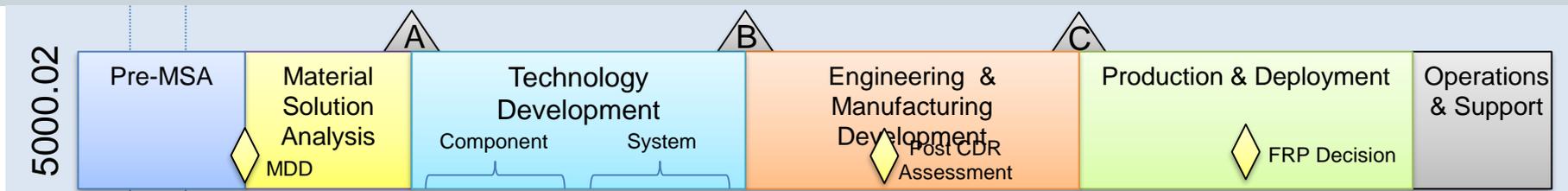
- **What can we do?**
 - Be an active member of the PST.
 - Contact ACO – If required.
 - Know your program
 - Be an honest broker of risks and information on the program
 - Start early
 - Be aggressive
 - Accurately complete your sections of the PAR



- **How do I know if a program is at risk?**

- Does their plan look reasonable?
- Are they meeting their internal schedules?
- Is the buying office, contractor and the contract in synch?
- Can the contractor answer your questions comfortably and with confidence. If not why not? Is there something not being said?
- Has the program/contractor met all of the goals outlined in the following Manufacturing Readiness Level (MRL) timeline? (Even if MRLs are not called out in the contract, the MRLs can be used accurately for risk determination)





Consideration	Manufacturing Concepts Identified Basic Research Advanced Research Advanced Technology Development	Mfg. Feasibility Determined Mfg. Processes Identified Key Processes Identified Producibility Assessments Initiated	Mfg. Processes Emerging Producibility Assessments On-going Mfg. Cost Drivers Identified	Mfg. Processes Demo'd in a Relevant Environment Cost Drivers Analyzed Long Lead Items Identified Equipment in a Relevant Environment	Mfg. Processes in Development Producibility Improvement Underway Trade Studies Supply Chain Management in Place	Process Maturity Demonstrated All Materials Ready for LRIP Mfg. Processes Proven Supply Chain Stable for LRIP	Mfg. Processes Operating at Target Quality, Cost and Performance Supply Chain Established and Meeting Lead Times	Lean/Six Sigma Production in Place Meeting or Exceeding Cost, Schedule and Performance Goals
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MRL Exit Criteria	<ul style="list-style-type: none"> ✓ Assess at TRL 1-3 ✓ Identify IB Sources ✓ Characterize Basic Materials for Mfg. ✓ Identify Material Concerns ✓ Identify Funding ✓ Identify Advanced ManTech Initiatives ✓ Coordinate with Technology Plan 	<ul style="list-style-type: none"> ✓ Assess at TRL 4 ✓ Identify IB Gaps ✓ Assess DFX. ✓ Baseline Materials & Issues ✓ Funding/Budgeting for Trade Studies ✓ Identify ManTech or Other Initiatives ✓ Coordinate with Technology Plan ✓ TDS should include Mfg./QA 	<ul style="list-style-type: none"> ✓ Assess at TRL 5 ✓ IB Analysis Finished ✓ KPPs Allocated ✓ Key Characteristics Identified ✓ SEP includes Mfg./QA ✓ Funding to meet next level ✓ ManTech Initiatives Initiated ✓ Early Supply Chain assessment 	<ul style="list-style-type: none"> ✓ Assess at TRL 6 ✓ IB Capability Assessment ✓ Initial Trade Studies ✓ Quality Thresholds Established ✓ Funding to meet next level ✓ ManTech Solutions Developed in Relevant Env. ✓ Acq Strat includes 	<ul style="list-style-type: none"> ✓ Assess at TRL 7 ✓ IB Monitored ✓ PEP Completed ✓ Materials Being Proven ✓ Funding to meet next level ✓ ManTech Solutions Demonstrated ✓ Supply Chain Being Assessed ✓ BOM Identified ✓ QA Data Collected 	<ul style="list-style-type: none"> ✓ Assess at TRL 8 ✓ Est. Multi-Sources ✓ Pilot Line Builds Validated ✓ Materials Proven ✓ Funding to meet next level ✓ ManTech Solutions Validated ✓ Quality Characteristics Validated ✓ BOM Supports LRIP 	<ul style="list-style-type: none"> ✓ Assess at TRL 9 ✓ IB Supports Sched. ✓ CPI Ongoing ✓ Materials in Control ✓ Funding to meet next level ✓ Quality Validated with LRIP Articles ✓ Make/Buy Supports FRP ✓ IB Capabilities Assessment 	<ul style="list-style-type: none"> ✓ Monitor and Manage all Key Characteristics at a Six Sigma Level ✓ Funding to Meet Six Sigma Goals ✓ No Make/Buy Changes ✓ Key/Critical Suppliers all meet Six Sigma Goals
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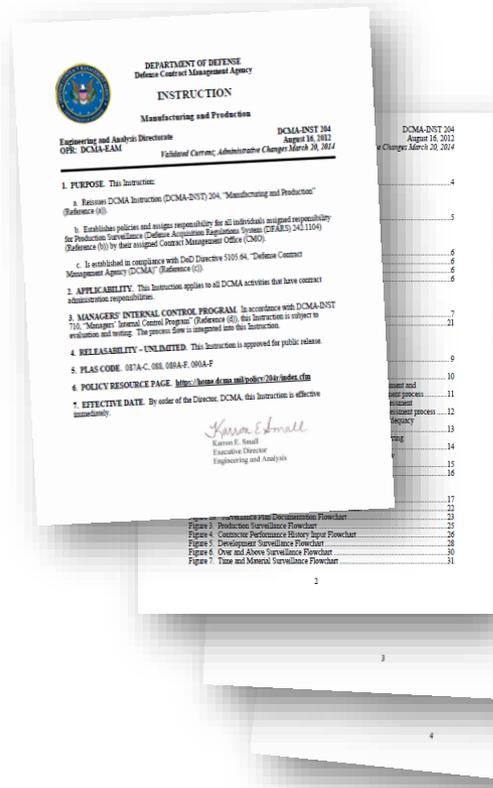
- **Why is this important?**

- We are DoD's method of independently assessing program manufacturing risks – **(MRL is a tool to perform consistent evaluation)**
- Performing this surveillance in the development program will payoff multiple times in production (schedule and cost)
- DCMA's history of where we did get involved in development surveillance has proven its value to DoD



What is an MRA?

AS SEEN ON
M&P
Instruction



Instruction 204, “3.2.9.2. When Program Offices utilize the Manufacturing Readiness Level (MRL) criteria and conduct Manufacturing Readiness Assessments (MRA) the Technical Specialist should formally request participation in the planning and execution of the assessments. When the Program Office does not utilize the MRL process and instead conduct other review such as Production Readiness Review, the Technical Specialist should formally request to participate in the planning and execution of such readiness reviews”



What is an MRA?

- Assessment of a program's readiness to manufacture and produce to its intended design
- A tool to develop and implement:
 - Manufacturing risk mitigation plans
 - Business strategies
- Results in:
 - An assignment of MRLs to key system components
 - The development of a manufacturing maturation plan as required

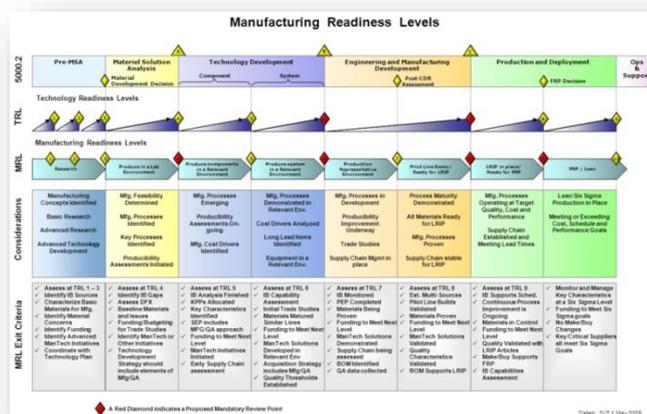
Identifying manufacturing issues earlier in technology development



Provide briefing and/or written report

- **Assess type and significance of risk to cost, schedule or performance**

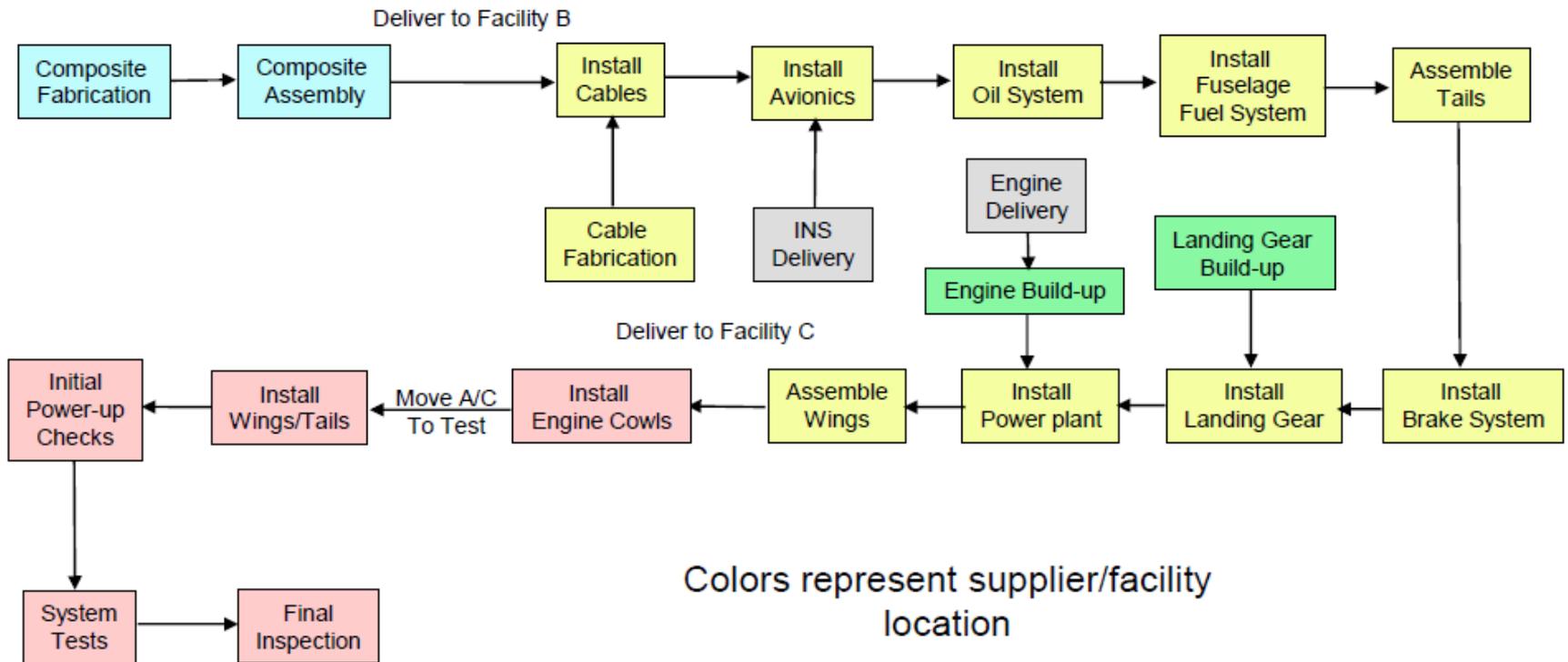
- Identify current MRL/target MRL
- Identify key factors where manufacturing readiness falls short of target MRL
 - Define driving issues
- Identify programs and plans to reach target MRL



- Who needs this data?
 - Industrial Specialist
 - Quality Specialist
 - Engineering
 - CMOs
 - ACO / PCO



- Large programs can require multiple MRAs



A Manufacturing Management standard will benefit both DoD and Industry:

- **Provides a quick “Snapshot, Consistency, and Insight to Accurately track the Program Performance**
- Provides a vehicle to contractually communicate manufacturing requirements
- Promotes more consistent customer requirements
- Better enables contractors to implement best manufacturing practices by providing a customer requirement against which to budget
- More consistent application of best practices will result in reduced costs, higher schedule confidence, and more robust products



- Process is more effective if company is actively engaged in the assessment
- System integration and test operations are often ripe for maturation efforts
- Resources required to conduct an MRA will vary significantly
- Subject matter expertise is needed to “do it right”



- Looking at transitioning technology to production
 - Must incentivize good decision-making processes;
 - Unlike TRLs, going backwards on MRLs might be productive
- A low MRL number may or may not meet the program's milestone
 - Is there time to raise the level?
 - Is there a new manufacturing process being pursued?
 - Replacing a manual process with an automated process
- Encouraging repeatability, faster cycle time, etc.
- Identify opportunities to validate manufacturing processes
 - Avoid accepting analogous process claims during the design phase and claiming fabrication is maturing
- May never build enough units to reach MRL 10
 - Achieve a Six Sigma or equivalent process
 - Stable line, may require a multi-product factory



Found at www.dodmrl.com or www.dodmrl.org

- MRL Deskbook – the “how to” of MRAs
- MRL Criteria
- MRL definitions
- MRL users guide (TBD)
- Under AF ManTech's MRA Tool
 - Air Force ManTech MRA Questions
- SAE- AS6500





Contact us: askmanufacturing@dcma.mil

Visit our 360: <https://360.dcma.mil/directorate/EA/SitePages/EAM.aspx>



BACKUP SLIDES

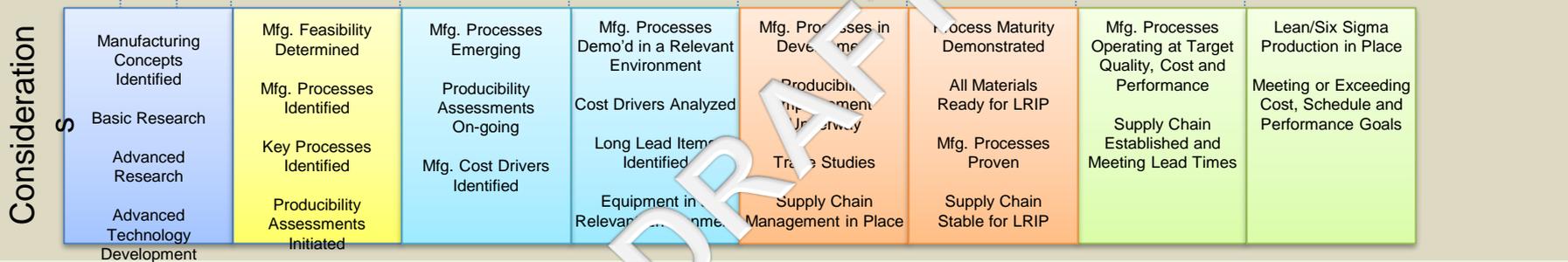
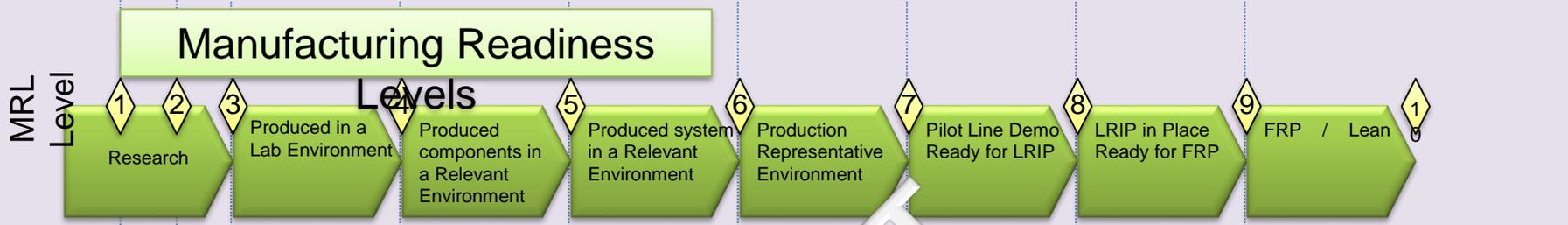
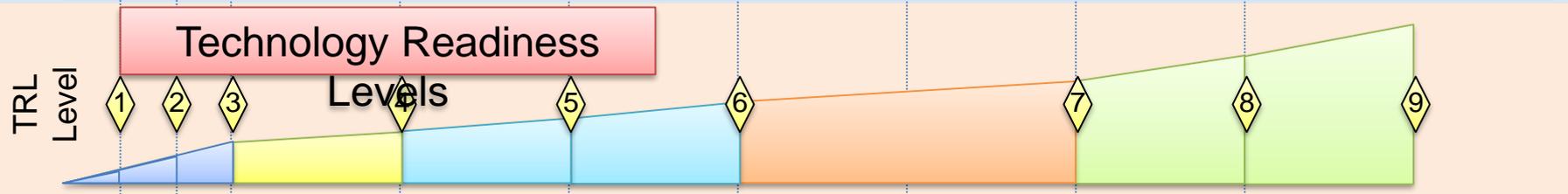
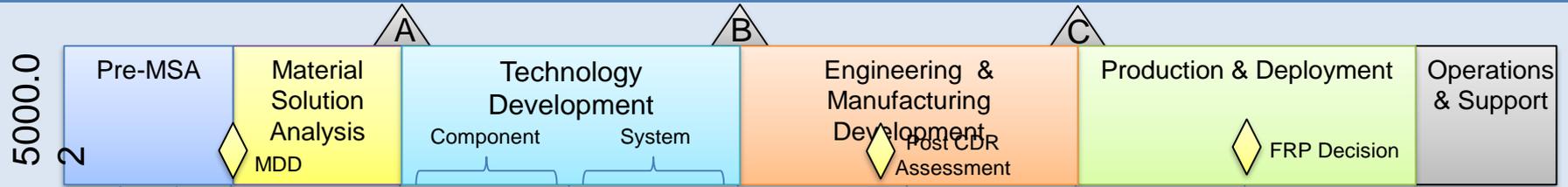


ACRONYM	MEANING
ACAT	Acquisition Category
ACO	Administrative Contracting Officer
ATO-M	Army Technology Objectives Manufacturing
CSAF	Chief of Staff Air Force
DAES	Defense Acquisition Execute Summary
DFARS	Defense Federal Acquisition Regulation Supplement
DoD	Department of Defense
EMRLS	Engineering Manufacturing Levels
FAR	Federal Acquisition Regulation
GAO	U.S. Government Accountability Office
IE	Industrial Engineering
IS	Industrial Specialist
MDA	Missile Defense Agency
MPS	Major program Support
MRAS	Manufacturing Readiness Assessment
MRLS	Manufacturing Readiness Levels
OEM	Original equipment Manufacturer
OSD	Office of the Secretary of Defense
PC&C	Process Capability and Control
RDT&E	Research Development Test & evaluation
SBIR	Small Business innovation Research
TBD	To be determine
TRLS	Technology Readiness Levels



DEFINITIONS	
ACAT	An acquisition program is categorized based on the criteria in the DoDI 5000.02.
AS6500	Manufacturing Management Program
AS9100	Aerospace standard based on the ISO 9001 quality system requirements
Cost	The value of money that has been used up to produce something
DFAR	A supplement to the FAR that provides DoD-specific acquisition regulations that DoD government acquisition officials
FAR	Federal Acquisition Regulation
FRP	Full Rate Production
Funding	The act of providing financial resources, usually in the form of money to finance a project.
LRIP	Low Rate Production
Milestone A	Milestone Decision Authority (MDA) led review at the end of the Materiel Solutions Analysis (MSA) Phase.
Milestone B	Milestone Decision Authority (MDA) led review at the end of the Technology Maturation & Risk Reduction (TD) Phase.
Milestone C	Milestone C (MS C) is a Milestone Decision Authority (MDA) led review at the end of the Engineering and Manufacturing Development (EMD) Phase
MOM & POP Shops	A small, independent, usually family-owned, controlled, and operated business that has a minimum amount of employees
MRAs	Manufacturing Readiness Assessment
MRLs	Manufacturing Readiness Levels
PC&C	Process Capacity and Control
Producibility	Ease of manufacturing an item in large enough quantities
Producible	Able to produce
PST	Program Support team
RDT&E	Research Development Test and Evaluation
Surveillance	the act of carefully watching someone or something
TRLs	Technology Readiness Levels





MRL Exit Criteria

<ul style="list-style-type: none"> ✓ Assess at TRL 1-3 ✓ Identify IB Sources ✓ Characterize Basic Materials for Mfg. ✓ Identify Material Concerns ✓ Identify Funding ✓ Identify Advanced ManTech Initiatives ✓ Coordinate with Technology Plan 	<ul style="list-style-type: none"> ✓ Assess at TRL 4 ✓ Identify IB Gaps ✓ Assess DFX. ✓ Baseline Materials & Issues ✓ Funding/Budgeting for Trade Studies ✓ Identify ManTech or Other Initiatives ✓ Coordinate with Technology Plan ✓ TDS should include Mfg./QA 	<ul style="list-style-type: none"> ✓ Assess at TRL 5 ✓ IB Analysis Finished ✓ KPPs Allocated ✓ Key Characteristics Identified ✓ SEP includes Mfg./QA ✓ Funding to meet next level ✓ ManTech Initiatives Initiated ✓ Early Supply Chain assessment 	<ul style="list-style-type: none"> ✓ Assess at TRL 6 ✓ IB Capability Assessment ✓ Initial Trade Studies ✓ Quality Thresholds Established ✓ Funding to meet next level ✓ ManTech Solutions Developed in Relevant Env. ✓ Acq Strat includes Mfg./QA 	<ul style="list-style-type: none"> ✓ Assess at TRL 7 ✓ IB Monitored ✓ PEP Completed ✓ Materials Being Proven ✓ Funding to meet next level ✓ ManTech Solutions Demonstrated ✓ Supply Chain Being Assessed ✓ BOM Identified ✓ QA Data Collected 	<ul style="list-style-type: none"> ✓ Assess at TRL 8 ✓ Est. Multi-Sources ✓ Pilot Line Builds Validated ✓ Materials Proven ✓ Funding to meet next level ✓ ManTech Solutions Validated ✓ Quality Characteristics Validated ✓ BOM Supports LRIP 	<ul style="list-style-type: none"> ✓ Assess at TRL 9 ✓ IB Supports Sched. ✓ CPI Ongoing ✓ Materials in Control ✓ Funding to meet next level ✓ Quality Validated with LRIP Articles ✓ Make/Buy Supports FRP ✓ IB Capabilities Assessment 	<ul style="list-style-type: none"> ✓ Monitor and Manage all Key Characteristics at a Six Sigma Level ✓ Funding to Meet Six Sigma Goals ✓ No Make/Buy Changes ✓ Key/Critical Suppliers all meet Six Sigma Goals
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