



# U.S. ARMY COMBAT CAPABILITIES DEVELOPMENT COMMAND – AVIATION & MISSILE CENTER

Failure Modes, Effects, & Criticality Analysis: Laws, Regulations  
and Guidance Documents for Army Aviation Programs

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# CCDC VISION AND MISSION



## VISION

To be the scientific and technological foundation of the Future Force Modernization Enterprise through world-leading research, development, engineering and analysis.

## MISSION

To provide the research, engineering, and analytical expertise to deliver capabilities that enable the Army to deter and, when necessary, decisively defeat any adversary now and in the future.





# MISSION



**Deliver collaborative and innovative aviation and missile capabilities for responsive and cost-effective research, development and life cycle engineering solutions.**



# BY THE NUMBERS



**12,054**  
FY19 Strength



**3,036**  
Civilian

**23**  
Military

**~8,995**  
Contractor

## Core Competencies

### Technical Domain:

- Active and Passive Air Defense Sensor Technology (S&T)
- Aerial Autonomy
- Aerospace and Aerodynamics
- Capabilities Engineering
- Materials and Structures
- Fuzing, Guidance, Controls and Seekers
- Propulsion, Explosives, Energetics, Warheads

### Capabilities Engineering:

- Software Engineering
- Weapons Assurance
- Modeling and Sim Design, Dev, VV&A
- Configuration Management
- Engineering Prototype Design and Dev
- Maintenance, Life Cycle Cost Reduction, and Logistics Engineering
- Manufacturing Tech and Production Support
- Multidiscipline Acquisition and Project Engineering
- Quality Engineering and Management
- Reliability, Availability, and Maintainability
- Sustainment, Industrial Base, and Obsolescence
- Systems Engineering, Integration, and Interoperability
- Test and Evaluation
- Air Defense Radar (Reimbursable)
- Airworthiness

## FY19 Funding

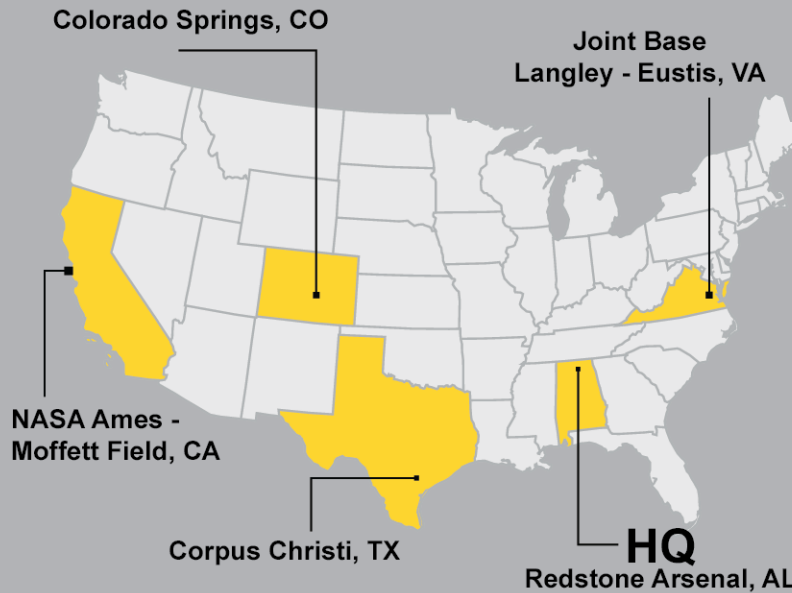
**\$3.8B**

**6%**  
Aviation S&T

**7%**  
Missile S&T

**59%**  
Army

**28%**  
Other







# PRIORITIES



## #1: People

People are the Army's greatest strength and its most important weapon system.



## #2: Readiness

The Army must be ready to defeat any adversary, anywhere, whenever called upon, under any condition.



## #3: Modernization

The Army must modernize to remain lethal and ready to fight tomorrow, against increasingly capable adversaries and near-peer competitors.



## #4: Reform

The Army will improve the way we do business, including how we implement our top priorities, to make the Army more lethal, capable, and efficient.





# S&T PRIORITIES ALIGNED WITH THE ARMY MODERNIZATION STRATEGY



**LONG RANGE  
PRECISION FIRES**



**NEXT GENERATION  
COMBAT VEHICLE**



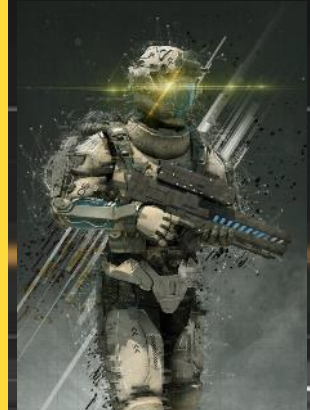
**FUTURE  
VERTICAL LIFT**



**ARMY  
NETWORK**



**AIR & MISSILE  
DEFENSE**



**SOLDIER  
LETHALITY**

## Supporting Army and Joint Readiness now and in the Future MDO Environment

### RESEARCH ISO FUTURE FORCE

Driving the discoveries and innovations which will be critical to realizing new capabilities for the Army of 2030 and beyond.

### ANALYSIS

Conducting objective experimentation and systems analysis to support the equipping and sustaining of our Warfighters.

### ENGINEERING

Providing lifecycle engineering expertise to support fleet development and readiness across warfighting battlefield operating systems.



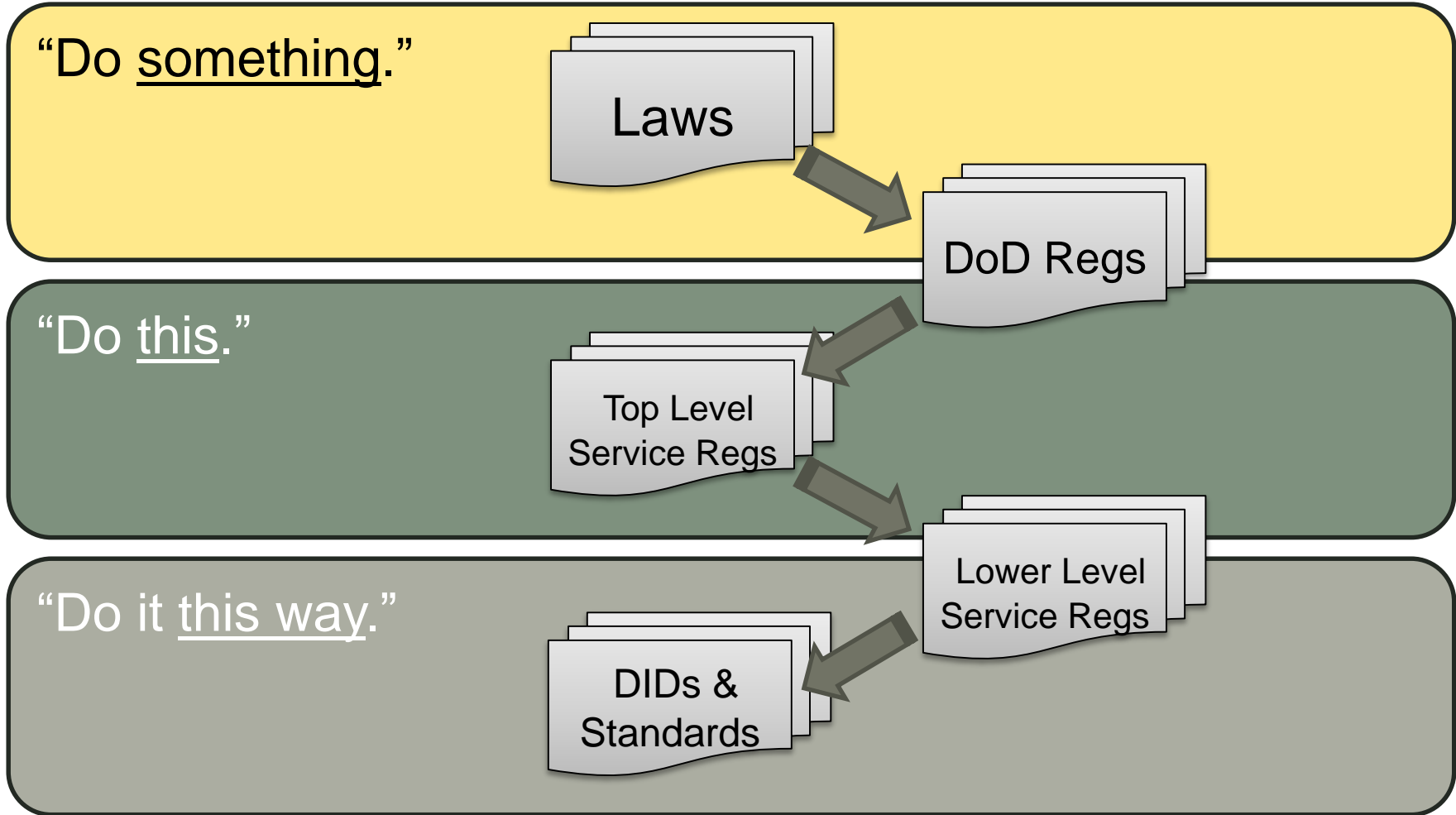
# ARMY AVIATION FMECA REGULATIONS & GUIDANCE



- There are numerous requirements on when, why and how to perform a FMECA
- Program RAM engineers should assist their Program Office in balancing the tension between:
  - Requirements
  - Engineering Best Practices
  - Cost
  - Schedule
  - Program specifics (ACAT, MBSE, Digital Thread, etc.)
- Caveats
  - The following information is only specifically applicable to US Army Aviation programs.
  - When tracing FMECA requirements, there is not always a direct or clear parent-child relationship between laws/regulations/guidance/manuals
  - Reliability-Centered Maintenance (RCM) requirements must also be considered, due to the close relationship between FMECAs and the RCM Process
    - RCM is also an Army Requirement for all programs



# FMECA REGULATORY DOCS (GENERIC)



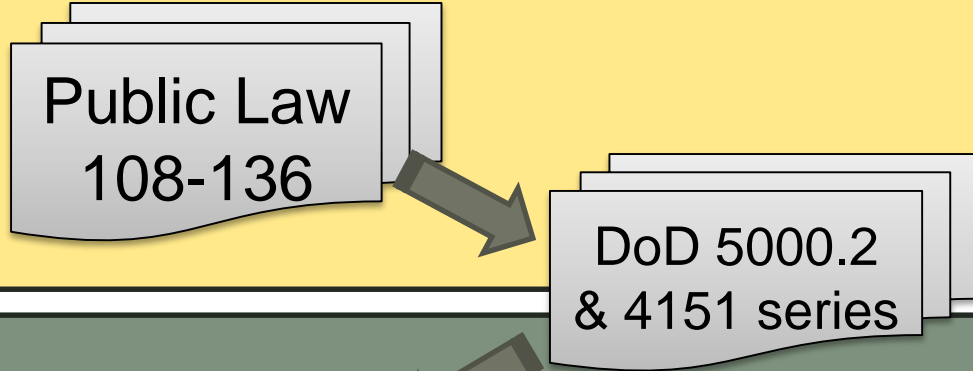




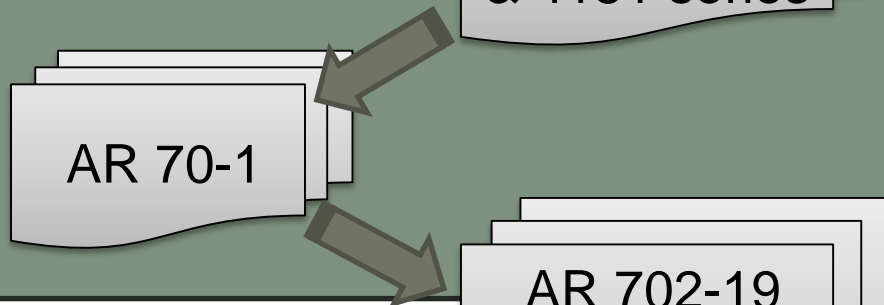
# ARMY AVIATION FMECA REGULATORY DOCS



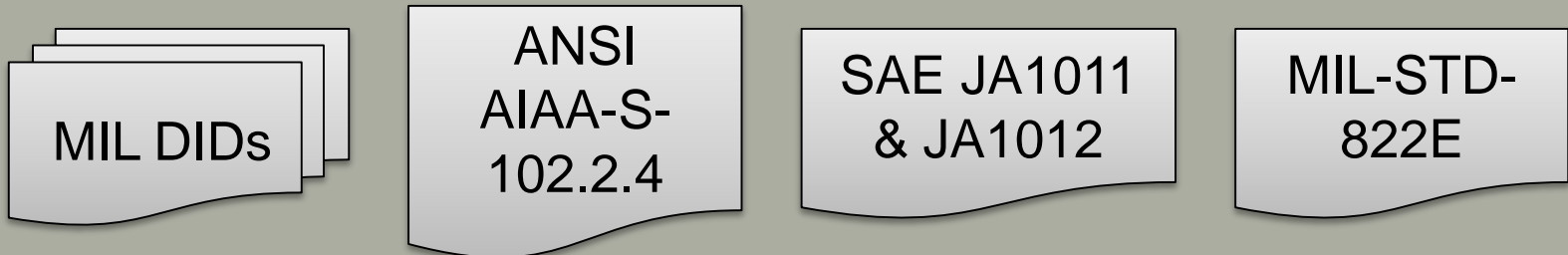
“Do something.”



“Do this.”



“Do it this way.”





# PUBLIC LAW 108-136



PUBLIC LAW 108-136—NOV. 24, 2003

NATIONAL DEFENSE AUTHORIZATION ACT  
FOR FISCAL YEAR 2004



# PUBLIC LAW 108-136, SECTION 802



10 USC 2382  
note.

## SEC. 802. QUALITY CONTROL IN PROCUREMENT OF AVIATION CRITICAL SAFETY ITEMS AND RELATED SERVICES.

(a) **QUALITY CONTROL POLICY.**—The Secretary of Defense shall prescribe in regulations a quality control policy for the procurement of aviation critical safety items and the procurement of modifications, repair, and overhaul of such items.

(b) **CONTENT OF REGULATIONS.**—The policy set forth in the regulations shall include the following requirements:

(1) That the head of the design control activity for aviation critical safety items establish processes to identify and manage the procurement, modification, repair, and overhaul of aviation critical safety items.

(2) That the head of the contracting activity for an aviation critical safety item enter into a contract for the procurement, modification, repair, or overhaul of such item only with a source approved by the design control activity in accordance with section 2319 of title 10, United States Code.

(3) That the aviation critical safety items delivered, and the services performed with respect to aviation critical safety items, meet all technical and quality requirements specified by the design control activity.

(c) **DEFINITIONS.**—In this section, the terms “aviation critical safety item” and “design control activity” have the meanings given



# PUBLIC LAW 108-136, SECTION 802



PUBLIC LAW 108-136—NOV. 24, 2003

117 STAT. 1541

such terms in section 2319(g) of title 10, United States Code, as amended by subsection (d).

(d) CONFORMING AMENDMENT TO TITLE 10.—Section 2319 of title 10, United States Code, is amended—

(1) in subsection (c)(3), by inserting after “the contracting officer” the following: “(or, in the case of a contract for the procurement of an aviation critical safety item, the head of the design control activity for such item)”; and

(2) by adding at the end the following new subsection: “(g) DEFINITIONS.—In this section:

“(1) The term ‘aviation critical safety item’ means a part, an assembly, installation equipment, launch equipment, recovery equipment, or support equipment for an aircraft or aviation weapon system if the part, assembly, or equipment contains a characteristic any failure, malfunction, or absence of which could cause a catastrophic or critical failure resulting in the loss of or serious damage to the aircraft or weapon system, an unacceptable risk of personal injury or loss of life, or an uncommanded engine shutdown that jeopardizes safety.

“(2) The term ‘design control activity’, with respect to an aviation critical safety item, means the systems command of a military department that is specifically responsible for ensuring the airworthiness of an aviation system or equipment in which the item is to be used.”.



# DoDI 5000.02, ENCLOSURE 3



## Department of Defense INSTRUCTION

NUMBER 5000.02

January 7, 2015

Incorporating Change 4, August 31, 2018

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USD(A&S)

SUBJECT: Operation of the Defense Acquisition System

“The Program Manager will formulate a comprehensive R&M program using an appropriate strategy to ensure reliability and maintainability requirements are achieved. The program will consist of engineering activities including for example: *...failure mode, effects and criticality analysis...*”

– **Enclosure 3, para 12.a, 31 AUG 2018**





DoDD 4151.18



Department of Defense  
**DIRECTIVE**

NUMBER 4151.18

March 31, 2004

USD(AT&amp;L)

SUBJECT: Maintenance of Military Materiel

“Initial maintenance programs shall...(b)e developed concurrently with materiel design, beginning with an analysis of **failure modes and effects**. The programs shall consist of applicable and effective tasks for addressing the failure modes and effects using **reliability-centered analysis**...”

– para 3.2.1, 31 MAR 2004

See also:

**DoDI 4151.22 “CBM+ for Materiel Maintenance”**

**DoDM 4151.22-M “Reliability Centered Maintenance (RCM)”**



# AR 700-127 “INTEGRATED PRODUCT SUPPORT”



## 6–5. Reliability centered maintenance analyses, failure mode, effects, and criticality analysis, and fault tree analysis

CAPDEVs and MATDEVs will use the **RCM** process and **FMECA** to analyze the most effective approach to maintenance... ..The RCM process will be applied and implemented for all materiel at the earliest opportunity and throughout the life cycle.

- a. CAPDEVs and MATDEVs will use the **RCM** process to determine optimum failure management strategies, including maintenance approaches, and establishing the evidence of need for both reactive and proactive maintenance tasks to analyze the most effective approach to maintenance as outlined in **DODD 4151.22**.
- b. The **RCM** and **FMECA** processes will be applied and implemented for all materiel throughout the life cycle in accordance with current Army standards and guidance.
- c. The MATDEV will plan, develop, program and implement **RCM** processes and outputs.
- e. The **FMECA** will be conducted in accordance with **ANSI AIAA–S–102.2.4**, and be included in the design analysis section of the LCSP.”

See also:

**AR 702-19** “Reliability, Availability, and Maintainability”

**AR 750-1** “Army Materiel Maintenance Policy”

**DA PAM 700-127** “Integrated Product Support Procedures”



# DoD DATA ITEM DESCRIPTIONS (DIDs)




Quick Search
ASSIST


Data updated: 01 Nov 2019. [Basic Search](#)

Enter search criteria in one or more of three text fields: Document ID, Document Number, Find Term(s). Filter search results by selecting Status or FSC/Area from drop-down lists, or by checking the box and specifying a range of document dates. Click a label for a detailed description and sample search results.

**Document ID:** 
**Document Number:** 
**Status:** Active ▼

**Find Term1,Term2,...** 
**For** Any Term ▼
 **In** Title or Keywords or Scope ▼

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  **Document Date:** 04-Nov-2018 **Through** 04-Nov-2019

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Filter		Values			
Status:		Active			
Any Term In Title or Keywords or Scope:		fmeCA fmea			
Img	Document ID	Status	FSC/Area	Doc Date	Title
Y	MIL-STD-3034A NOT 1	A	PSSS	15-Apr-2019	Reliability-Centered Maintenance (RCM) Process
Y	DI-ILSS-80111A NOT 1	A	PSSS	15-Oct-2019	Reliability-Centered Maintenance Analysis Data (No S/S Document)
Y	DI-PSSS-80980B	A	PSSS	15-Aug-2016	Reliability -Centered Maintenance (RCM) Failure Modes and Effects Analysis (FMEA) Report
Y	DI-SESS-81495B	A	SESS	16-May-2019	Failure Modes, Effects, and Criticality Analysis

**Note: Model-Based Systems Engineering capabilities & tools are currently being developed by OUSD SE.**



# ANSI/AIAA S-102.2.4-2015



ANSI/AIAA S-102.2.4-2015

## Standard

### Capability-Based Product Failure Mode, Effects and Criticality Analysis (FMECA) Requirements

See also:

**MIL-STD-822E** "System Safety"

**SAE JA1011** "Evaluation Criteria for RCM Processes"

**SAE JA1012** "A Guide to the RCM Standard"



# ARMY AVIATION FMECA REGULATIONS & GUIDANCE - SUMMARY



- When searching for your service-specific (or program-specific) regulatory and guidance documents, a wide initial net must be cast
  - Search documents for key terms (control-f)
  - “FMECA”, “FMEA”, “RCM”, and other search words are useful
  - Read all called out references as well
  - Take into account MBSE processes being used by USG/DoD and Contractors.
- Remember that a SAR will not meet the intent of a FMECA
  - SARs do not capture all Cat 1 failures (e.g. loss of mission)
  - SARs do not enable you to select the most effective and safe maintenance strategies or other mitigating efforts

“The **RCM** and **FMECA** processes will be applied and implemented for all materiel throughout the life cycle in accordance with current Army standards and guidance.”  
- AR 700-127





## **Web Site**

<https://www.avmc.army.mil/>

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[usarmy.redstone.ccdc-avmc.mbx.pao@mail.mil](mailto:usarmy.redstone.ccdc-avmc.mbx.pao@mail.mil)