

# AMRDEC

## CORE TECHNICAL COMPETENCIES (CTC)





## THE AVIATION AND MISSILE RESEARCH DEVELOPMENT AND ENGINEERING CENTER

The U. S. Army Aviation and Missile Research Development and Engineering Center (AMRDEC), a subordinate organization to the Research, Development and Engineering Command (RDECOM), is the Army's focal point for providing research, development and engineering technology and services for aviation platforms and missile systems across the life cycle. AMRDEC has a long history of providing unparalleled service to its aviation and missile customers, while always striving to provide the greatest service to its ultimate customer, the Warfighter, by providing technology and weapon system solutions to ensure his/her victory on the battlefield.

### **MISSION:**

Deliver collaborative and innovative technical capabilities for responsive and cost effective research, product development, and life cycle systems engineering solutions

### **VISION:**

Be a Warfighter-focused valued team of world leaders in aviation and missile technologies and life cycle systems engineering

# 6-1-2A. AVIATION SYSTEMS TECHNOLOGIES

## **BASIC RESEARCH & CONCEPTS DEVELOPMENT**

Work undertaken to acquire new knowledge with DoD relevance, but without any specific applications in view. Basic research includes analyses of properties, structures and relationships with a view to formulating and testing hypotheses, theories or regularities pertaining Army Aviation S&T.

## **SUSTAINMENT**

Lead the development of technologies and concepts to effectively and affordably sustain the Army's rotary-wing fleet, and to strive for a "zero-maintenance" aircraft.

## **CONCEPT DESIGN**

Create conceptual designs of advanced vertical lift platforms in response to notional or evolving user needs; evaluate aircraft concepts from responses to solicited and unsolicited proposals; assess the impact of incorporating advanced technologies; develop design and assessment methods to perform these tasks.



## **AVIONICS & NETWORKS**

Develop resilient architectures for affordable and effective integration and certification of complex mixed critical cyber-physical mission systems. This includes a high throughput, long range, low drag off-board network communication capability.

## **ENGINES**

Develop/optimize sources of reliable propulsion for aviation platforms that emphasize fuel efficiency across spectrum of operations (high/hot or high/cold), affordability, durability, high specific power/specific weight, high power density/energy density, and variable output speed capability.

## **AUTONOMY & TEAMING**

Develop and proliferate autonomy, aiding, and teaming technologies and capabilities in order to make the Warfighter more efficient, survivable, and effective. Enhance and expand aerial manned-unmanned teaming concepts to enable single operator-unmanned team operations.

## **SURVIVABILITY**

Develop and transition affordable, integrated, balanced aviation survivability solutions to improve the ability to avoid detection, tracking, and engagement in a complex spectrum threat battlefield environment and survive given a hit/crash.

## **ENGAGEMENTS & EFFECTS**

Increase single-ship and team-based mission effectiveness through sensor and weapon concepts and technology applications for a reduction in the sensor-to-shooter timeline, enhanced situational awareness, and increased survivability and lethality.

## **HUMAN SYSTEMS INTERFACE**

Optimize human performance in the aviation environment. Apply human performance concepts to manage workload and optimize performance in complex aviation environments. Develop crew station design principles to enable complex operations for manned and unmanned aviation crew stations.

## **STRUCTURES**

Discover, develop, demonstrate, and transition efficient, durable, and affordable rotorcraft structural concepts and technologies.

## **DRIVES**

Develop/optimize rotorcraft drives and power transmission (gearbox) technologies that improve power density to increase payload/range capability, reduce costs to increase aircraft affordability, provide multi-engine variable-speed transmission capability, increase component life, and reduce internal noise to increase pilot endurance and reduce hearing loss.

## **ROTORS**

Conduct advanced R&D as the nation's leader in rotorcraft aeromechanics, rotor systems and associated technology development. Develop and insert these new technologies for application to military helicopters, tilt-rotor aircraft, and other advanced vertical lift aircraft.

## **SUBSYSTEMS**

Develop technologies that enable the aircraft and occupants to operate and survive in a hostile military environment. Efforts are primarily in the area of vulnerability reduction, specifically in conventional threat protection (ballistics), crashworthiness, fuel containment, and directed energy weapon protection.

## **COMPUTATIONAL AEROMECHANICS**

Provide accurate and validated computational modeling and simulation capability for rotorcraft fluid dynamics, structural dynamics, flight dynamics, and acoustics.

## **EXPERIMENTAL AEROMECHANICS**

Conduct cutting-edge basic and applied research to enable fundamental understanding of rotorcraft fluid dynamics, structural dynamics and acoustics, and develop critical experimental data for validation of computational methods.

## **VEHICLE MANAGEMENT SYSTEMS**

Enhance handling quality requirements and flight simulation/control concepts for vertical lift aircraft to enhance maneuverability and stability in complex military environments, including autonomous control of multiple UAVs/twin lift.

## **AIRWORTHINESS ASSURANCE**

Deliver responsive airworthiness assessments and solutions throughout the system life cycle. Sustain the leadership and engineering expertise necessary to provide valued products to our aviation customers.



# 6-1-2B. MISSILE SYSTEMS TECHNOLOGIES

## **BASIC RESEARCH**

Basic research is a systematic study directed toward greater knowledge or understanding of the fundamental aspects of phenomena. Basic research is executed without thought of a practical end goal, without specific applications or products in mind. In the context of Missile System Technologies, it applies to all component and subsystem technologies necessary to perform the missile research, development and engineering mission.

## **PROPULSION**

Provide missile and rocket propulsion expertise, both air breathing and non-air breathing, for the Army and its elements. This includes all activities involved in the design, analysis, and fabrication of propulsion unit hardware, propellant formulation, mixing of propellant ingredients, loading/casting of solid rocket motors and testing and demonstration of missile and rocket propulsion components and subsystems. Propulsion also includes the integration of propulsion components and subsystems into missile and rocket systems and



their demonstrations in static and flight test, monitoring the health of propulsion components through stockpile reliability programs, and the demilitarization of these components at the end of their life cycle.

### **ELECTRONICS, GUIDANCE, NAVIGATION, CONTROL & SENSORS**

Provide missile electronics, guidance and sensors expertise for the Army and its elements. This includes all activities involved in the design, analysis, and fabrication of electronics, guidance and sensors hardware and software algorithms, and testing of missile electronics, guidance and sensors hardware and software algorithm components and subsystems.

**Electronics** includes all electronics onboard and on the ground used to communicate with the missile, process sensor input, perform guidance calculations, provide output to control actuators, acquire, lock-on and track target, and arm and initiate the warhead.

**Guidance, navigation and control** includes technologies needed to launch, guide, navigate, and control the missile and provide missile fire control. This includes designing, analyzing, building, integrating and testing of guidance, navigation and control software/algorithms/hardware, and fire control sensors.

**Sensors** includes the designing, analyzing, building and testing any and all sensor software and hardware across the whole electro-magnetic and acoustic spectrums needed to find, identify and track the target, and communicate with the missile. A key sensor area is the development, analysis, and testing of all Army Air Defense radars for surveillance and fire control, to include advanced radar hardware. This includes advanced radar hardware, signal processing, and non-cooperative target recognition algorithms. This also includes the designing, analyzing, building and testing of target acquisition and tracker algorithm and software.

Electronics, Guidance and Sensors includes the integration of components and subsystems into missile systems and their demonstration in laboratory and flight test.

### **AERODYNAMICS & COMPUTATIONAL METHODS**

Provide aerodynamic prediction, analysis and modeling for missiles and other air vehicles across the engineering life cycle through the use of ground and flight test data, semi-empirical prediction techniques and fully-coupled Navier-Stokes computational fluid dynamics.

### **LETHALITY**

Perform research, design, development, test, evaluation, integration and weaponization of fuzing, warhead (both lethal and non-lethal), protection systems and payload delivery technologies for Army missile systems. This includes threat vulnerability analysis and missile system effectiveness analysis of warheads and payloads, and the demonstrations of lethality systems in static, captured dynamic and flight test.

### **LAUNCHERS & STRUCTURES**

Provide missile and rocket launcher solutions and expertise for the Army and its elements. This includes all activities involved in the design, analysis and fabrication of launchers and associated electronics for both ground and air launched missiles, integration of launchers on both ground and air vehicles and their demonstrations.

Provide materials solutions and expertise for existing and future missile systems and aviation platforms to the Army and its elements. Performing research and development with respect to composite structures and materials application as applied to missiles, launchers, and aircraft, including design studies of new system concepts, prototype fabrication, and performing various mechanical analyses. Included among those are failure analysis, dynamical analysis, structural analysis, fatigue life estimation, and vibration testing.

### **CONCEPT DEVELOPMENT**

Capture and understand the Army's current and future missile system requirements and needs; develop and analyze various missile component configuration alternatives against various technical and performance parameters to select an "optimized" material approach.

## 6-1-2C. CROSS CENTER ENGINEERING SPECIALTIES

### **SYSTEM ENGINEERING, INTEGRATION & INTEROPERABILITY**

Provide expertise to execute the traditional application of Systems Engineering “Vee” activities to enable the realization of successful systems. Apply appropriate application of SE processes in: development of system engineering plans, entrance and exit criteria, performance specification development, requirements management, risk management, and technical performance measures.

### **SOFTWARE ENGINEERING**

Provide world-class system and software engineering life cycle management support to our customers and Warfighters.

### **RELIABILITY, AVAILABILITY & MAINTAINABILITY**

Plan, develop, implement, and manage RAM and System Assessment Programs for AMCOM Weapon Systems, SRP/Surveillance Programs, Reliability Improvement Programs, CBM/Reliability Centered Maintenance (RCM), and research into advanced technologies and methodologies.







## **SUSTAINMENT, INDUSTRIAL BASE, & OBSOLESCENCE**

Develop and maintain an adequate industrial base, including organic and commercial capabilities, to support production, sustainment, operations, and future systems' requirements. Apply supply chain, diminishing manufacturing sources and material shortages, and obsolescence management.

## **QUALITY ENGINEERING & MANAGEMENT**

Throughout product life cycle, provide interdisciplinary quality functions and best practices to reduce product and program risk, and ensure customer satisfaction and confidence by establishing sound quality requirement, verification of product and procedural compliance, and focusing on continuous improvement to reduce product and process failures, defects, and variability.

## **SYSTEM SAFETY**

Specialty within system engineering that supports program risk management. It is the application of engineering and management principles, criteria and techniques to optimize safety.

## **MANUFACTURING TECHNOLOGY & PRODUCTION SUPPORT**

Provide manufacturing expertise and production engineering and develop and transition technology and processes for the affordable, timely production and sustainment of missile and aviation systems. Provide parts, materials, and assembly processes expertise to assure performance in military applications.

## **MULTIDISCIPLINE ACQUISITION & PROJECT ENGINEERING LEADERSHIP**

Provide senior acquisition leaders and key technical experts who collaborate across functional boundaries to develop synergistic, innovative total system solutions in direct support of AMRDEC core missions and reimbursable customers.

## **TEST & EVALUATION**

Employ life cycle T&E knowledge and skills to develop and manage effective T&E programs for customers to assess performance against their technical and operational requirements.



## **MAINTENANCE, LIFE CYCLE COST REDUCTION & LOGISTICS ENGINEERING**

Impact weapon system design for sustainment to keep them reliable, operational, sustainable, and affordable throughout their life cycle. Expertise in engineering and sustainment of TMDE and the utilization of the organic maintenance system for weapon systems sustainment. Provide expertise to systematically identify and implement changes resulting in cost reduction/savings, which improve the Army's buying power. Programs/ Efforts to support this include Technical Evaluation/should costs, OSCR, VE, AWCF obsolescence, and spares competition (Tech Loop).

## **MODEL & SIMULATION DESIGN, DEVELOPMENT, VERIFICATION, VALIDATION & ACCREDITATION (VV&A) & ANALYSIS**

Deliver collaborative and innovative engineering solutions in the areas of system design, development, integration, analysis, and modeling and simulation to advance aviation, missile, and defense capabilities.

## **ENGINEERING PROTOTYPE DESIGN & DEVELOPMENT**

Rapid design, development, fabrication, integration, and delivery of mechanical and electrical components, subsystems, and systems through collocation of multifunctional teams, reconfigurable facilities, and unique and streamlined processes.

## **CONFIGURATION MANAGEMENT**

Develop and execute centralized weapons system configuration management programs that include preparing, releasing, controlling, ordering, marking and delivering the engineering data.

## **CYBERSECURITY**

Risk management process to protect Army Aviation and Missile interests, DoD operational capabilities, and DoD individuals, organizations, and assets from the DoD Information Enterprise level, through the DoD Component level, down to the IS level.



<b>Core Technical Competency</b>
<b>6-1-2A Aviation Systems Technologies</b>
1. Basic Research and Concepts Development
2. Sustainment
3. Concept Design
4. Avionics & Networks
5. Engines
6. Autonomy & Teaming
7. Survivability
8. Engagements & Effects
9. Human Systems Interface
10. Structures
11. Drives
12. Rotors
13. Subsystems
14. Computational Aeromechanics
15. Experimental Aeromechanics
16. Vehicle Management Systems
17. Airworthiness Assurance
<b>6-1-2B Missile Systems Technologies</b>
1. Basic Research
2. Propulsion
3. Electronics, Guidance and Sensors
4. Aerodynamics and Computational Methods
5. Lethality
6. Launchers and Structures
7. Concept Development

<b>Core Technical Competency</b>
<b>6-1-2C Cross Center Engineering Specialties</b>
1. System Engineering, Integration and Interoperability
2. Software Engineering
3. Reliability, Availability, and Maintainability
4. Sustainment, Industrial Base, and Obsolescence
5. Quality Engineering and Management
6. System Safety
7. Manufacturing Technology and Production Support
8. Multidiscipline Acquisition and Project Engineering Leadership
9. Test and Evaluation
10. Maintenance, Life Cycle Cost Reduction and Logistics Engineering
11. Model and Simulation Design, Development, Verification, Validation and Accreditation (VV&A), and Analysis
12. Engineering Prototype Design and Development
13. Configuration Management
14. Cybersecurity



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