

# Forward Area Air Defense/Counter-Rocket, Artillery and Mortar Command and Control (FAAD/C-RAM C2)

Real-time battle management / engagement operations supporting Short Range Air Defense (SHORAD), Counter-Rocket, Artillery, Mortar (C-RAM) & Counter-Unmanned Aerial Systems (C-UAS) missions

Northrop Grumman's FAAD/C-RAM C2 is a battle-proven, fielded command and control system, actively employed by the U.S. Army, North American Aerospace Defense Command (NORAD), U.S. Marine Corps, U.S. Air Force and foreign allies. Its open, modular architecture provides a strong foundation that enables easy integration with available sensors, effectors and warning systems to launch rapid, real-time defense against short range and maneuvering threats.

## SHORAD Mission

In 1986, Northrop Grumman was selected by the US Army to develop a Short Range Air Defense (SHORAD) command and control system, and in 1993, Northrop Grumman fielded the Forward Area Air Defense (FAAD) Command, Control and Intelligence (C2I) system. Since then, FAAD C2 has been the U.S. Army SHORAD C2 program of record protecting cities like Washington DC and US and joint forces deployed around the globe.

## C-RAM Mission

During Operation Enduring Freedom/Operation Iraqi Freedom, Central Command (CENTCOM) issued a Joint Urgent Operational Need (JUON) statement to counter enemy rocket, artillery and mortar (RAM) threats. In response, Northrop Grumman enhanced the FAAD C2 system with C-RAM capabilities and deployed the system to theater within twelve months of initial development. Northrop Grumman has expanded its scope supporting the C-RAM mission



to include sense, warn and intercept capabilities, system training and more. Since 2005, the C-RAM System of Systems is credited with saving hundreds of lives in theater.

## C-UAS Mission

Our adversaries are continually developing asymmetric threats to use against our military forces – most currently unmanned aerial systems (UAS). CENTCOM once again issued a JUON with the specific goal of countering the UAS threat in 2016 and Northrop Grumman swiftly responded with enhanced FAAD/C-RAM C2 features, enabling further integration with various C-UAS sensors and effectors, including electronic warfare (EW) and directed energy (DE), to accomplish the C-UAS mission. Since then, integration with DE effectors has expanded beyond lasers to include high powered microwaves.

## Future Missions

In 2017, the Army issued a new initiative to revitalize the U.S. Army's SHORAD capabilities to further counter emerging threats and protect the maneuver force. IM-SHORAD is the interim maneuver solution providing initial capability as quickly as possible while the Army develops the objective M-SHORAD solution. FAAD/C-RAM C2 is the Army directed C2 system for IM-SHORAD. Once the FAAD/C-RAM C2 capabilities converge into the Integrated Air and Missile

Defense Battle Command System (IBCS), that convergence will allow integration of all available sensors and effectors to defeat current and future threats.

### **Non-Proprietary Open Interfaces**

Our open, multi-domain, system-of-systems vendor-neutral architecture enables integration and interoperability across diverse platforms and systems, facilitating rapid and cost effective technology insertion and modernization at the speed of need. In today's rapidly changing environment, it is no longer feasible to use different interfaces with each different type of sensor or weapon. Northrop Grumman created generic, non-proprietary open interfaces that sensors, effectors and warning systems can quickly, easily and cost effectively implement. While integration time greatly depends on the complexity of the interfacing system, there have been cases where companies were able to implement the interface within a few days, allowing integration with FAAD/C-RAM C2 to be accomplished in a matter of weeks. The interfaces are designed to be backward compatible so that future versions of FAAD/C-RAM C2 will maintain compatibility with systems that implemented older versions of the interface.

### **Modular, Open Architecture Supports Real-time Situational Awareness**

Real-time situational awareness of the battlespace is critical in executing any mission whether it is air defense, C-RAM, C-UAS, fixed site or mobile. FAAD/C-RAM C2, through its use of open, non-proprietary architecture, is effectively sensor, effector and network agnostic. Due to the nature of adaptive threats, there is no one sensor that can detect all possible targets and no one effector that can defeat all possible threats. FAAD/C-RAM C2's agnostic architecture and ability to quickly integrate with a diverse set of sensors and effectors allows the C2 to adapt in sufficient time to enable the system-of-systems to be relevant in the battlespace. Its primary functions are to correlate/fuse data from multiple heterogeneous local and external track sources to generate a real-time situational awareness (SA) of the battlespace, enable early warning and provide the decision tools and data to deploy the appropriate effectors in order to defeat the threat. Sensors

supported include radar, EW, acoustic and electro optical/infrared cameras and both kinetic (missile and guns from .50 cal to 30mm) non-kinetic (DE and EW) effectors.

### **Fratricide Prevention**

Friend/foe identification and fratricide prevention have been incorporated into FAAD/C-RAM C2 since it was first fielded in 1993. As new threats emerged, with corresponding advancements in countermeasures, Northrop Grumman updated the fratricide prevention algorithms. Real-time airspace clearance must take into account not just the relative positions at the time the engagement is ordered but the potential positions of nearby tracks throughout the timeframe of the entire engagement. For effectors with adjustable flight path capability, FAAD/C-RAM C2 utilizes air track avoidance (ATA) to calculate alternate waypoints which allows interceptors to fly safely around non-hostile tracks on their path to intercept the hostile threat.

### **Assisted Battle Management**

FAAD/C-RAM C2's Assisted Battle Manager combines the results of battlespace availability, sensor and effector allocation, defensive doctrines, and fratricide prevention into a single coordinated regional engagement plan. This process takes the known, prioritized threat set, considers the areas of impact, calculates sensor and effector resource availability, and creates an efficient engagement plan that assigns and schedules guns, missiles, lasers, and associated sensors and communications systems to defeat hostile aircraft or RAM threats.

### **Exportability**

All interfaces and capabilities are subject to export compliance regulations and may not be available to all customers. Currently, FAAD/C-RAM C2 is only available internationally via Foreign Military Sale.

### **For more information, please contact:**

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