



**Counter – Rocket, Artillery, Mortar (C – RAM)
and Base Defense Presentation to the
2009 AUSA Fires Symposium
17 – 19 Mar 2009**



C-RAM Capability



- **C-RAM is a System-of-Systems, not a single system . . . it is primarily comprised of DoD systems, most of which were already in existence and in use along with selected commercial off the shelf (COTS) hardware**
- **The Army C-RAM Program Office but it works across the military services to develop this capability from several component systems, creating a “system-of-systems”**
- **The currently fielded capability uses the following systems, many of which were modified to enhance their performance in the C-RAM role**
 - Existing Air Defense Command and Control systems
 - Existing field artillery and air defense sensors
 - A U.S. Navy-developed interceptor
 - A USAF Base Defense Security Systems
 - A COTS warning system
 - Existing sensors at a FOB, including the USMC HALO and US Army UTAMS
- **The C-RAM C2 hardware and software ties it all together and links to various Response systems via U.S. Air Force, U.S. Marine Corps, and Army Battle Command Systems**



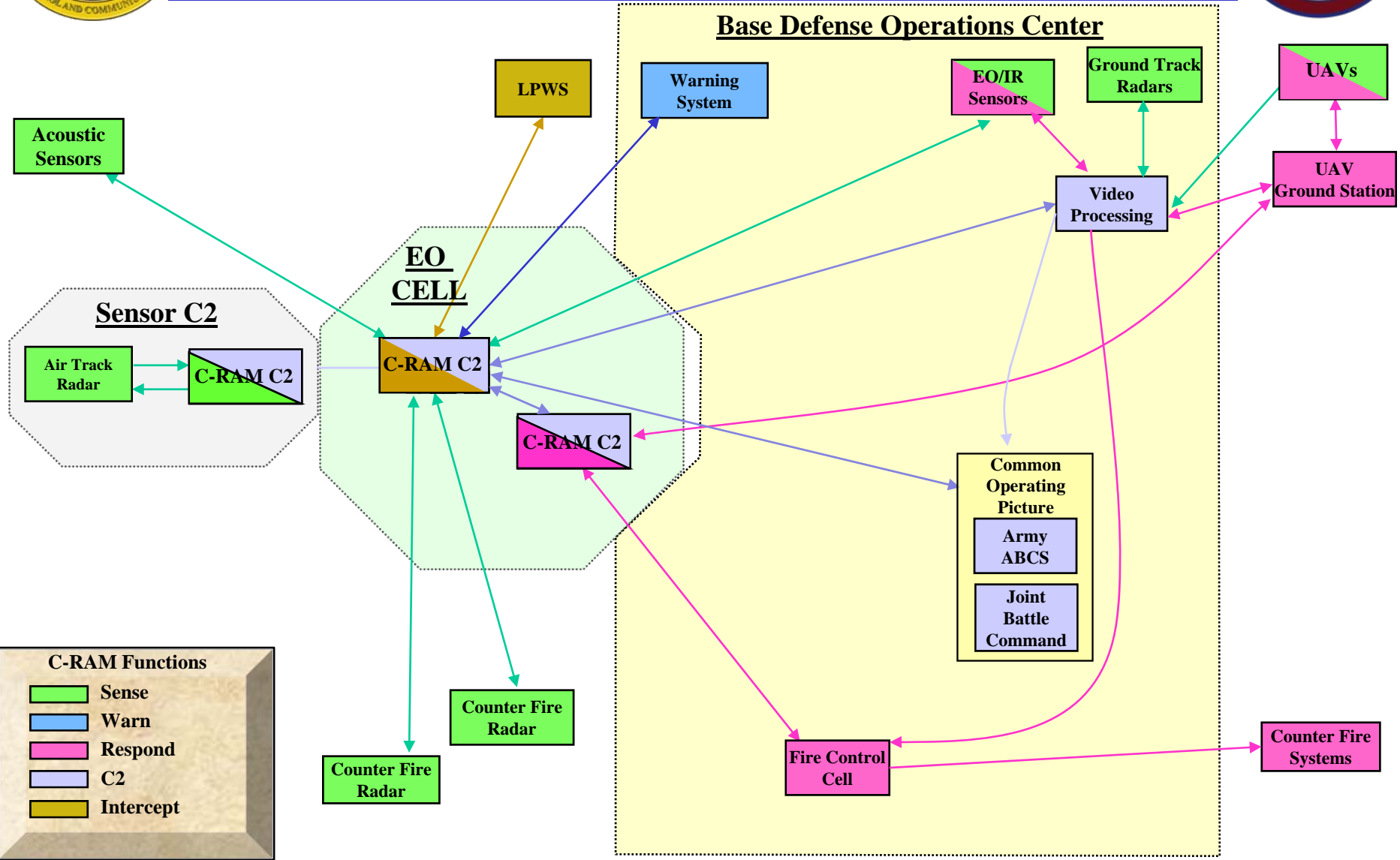
C-RAM Functional Areas



- **The RAM problem is a difficult one and requires a holistic approach in its solution. C-RAM is built on and around the seven Functional Areas that bound the problem:**
 - **Shape** – knowing the threat forces, their capabilities, and patterns so that we can make the best proactive use of our resources.
 - **Sense** – knowing, in a timely manner, that an attack is underway or spotting a potential attack before it happens through the use of persistent surveillance.
 - **Warn** – providing a timely and localized notification so troops can take protective cover.
 - **Intercept** – destroying the rounds in flight.
 - **Respond** – providing the necessary and timely information required so our troops can make the best decisions on how react to the enemy action and with what resources.
 - **Protect** – hardening structures or assets to provide physical protection where possible and practicable.
 - **Command & Control** – providing the integration of all components into a robust, flexible, tailorable, and scaleable architecture – this is what actually provides the capability

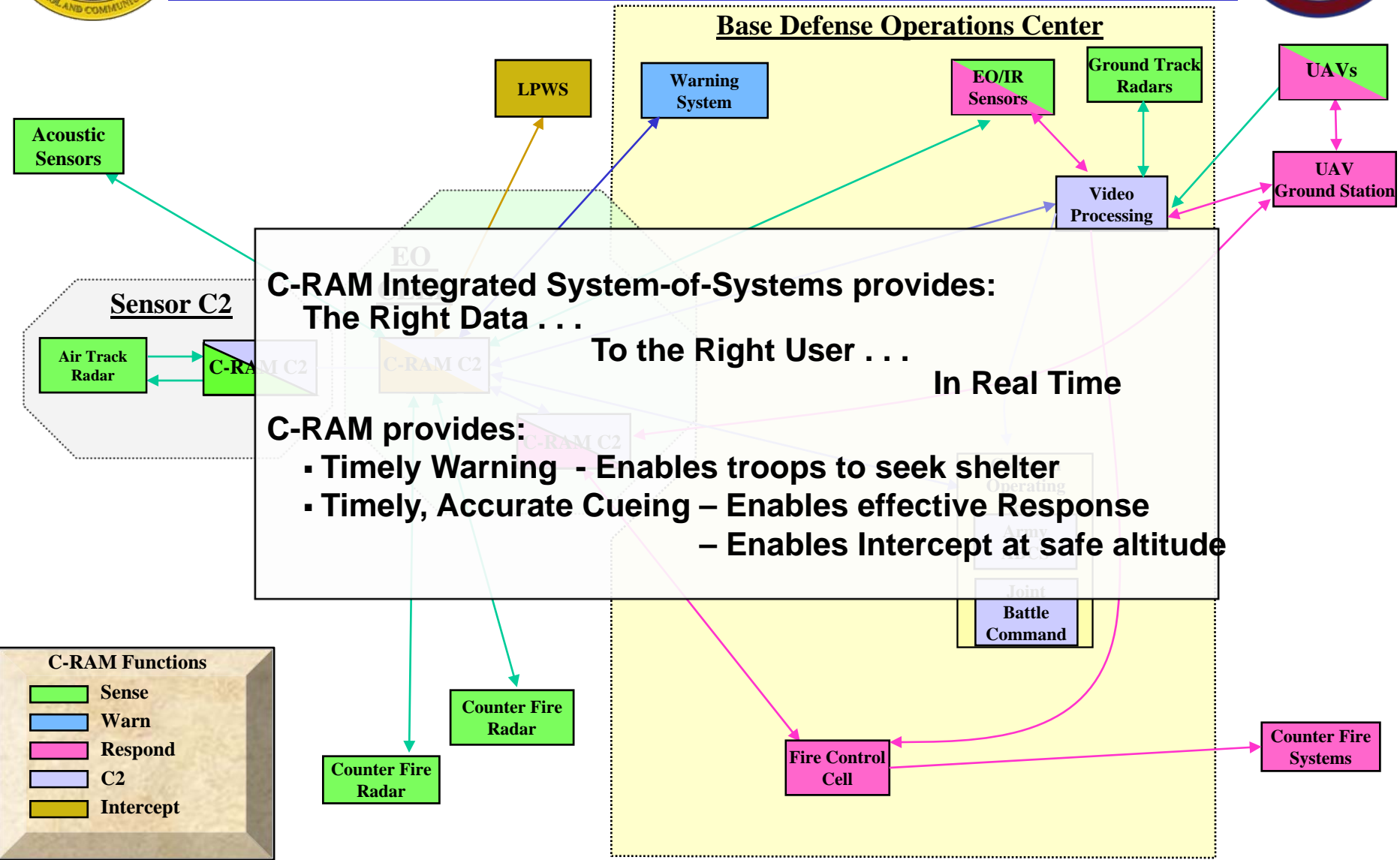


C-RAM Architecture



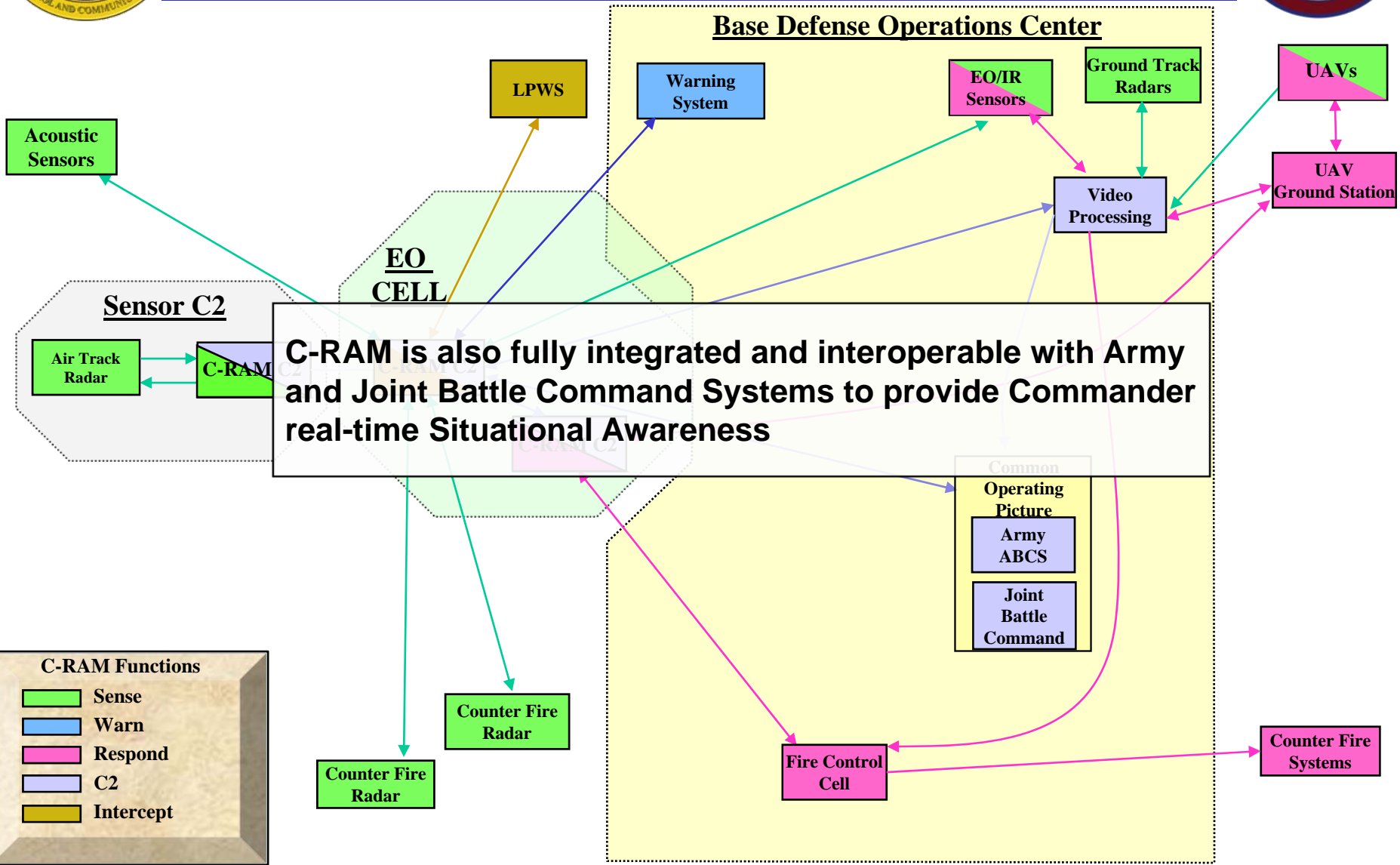


C-RAM Architecture



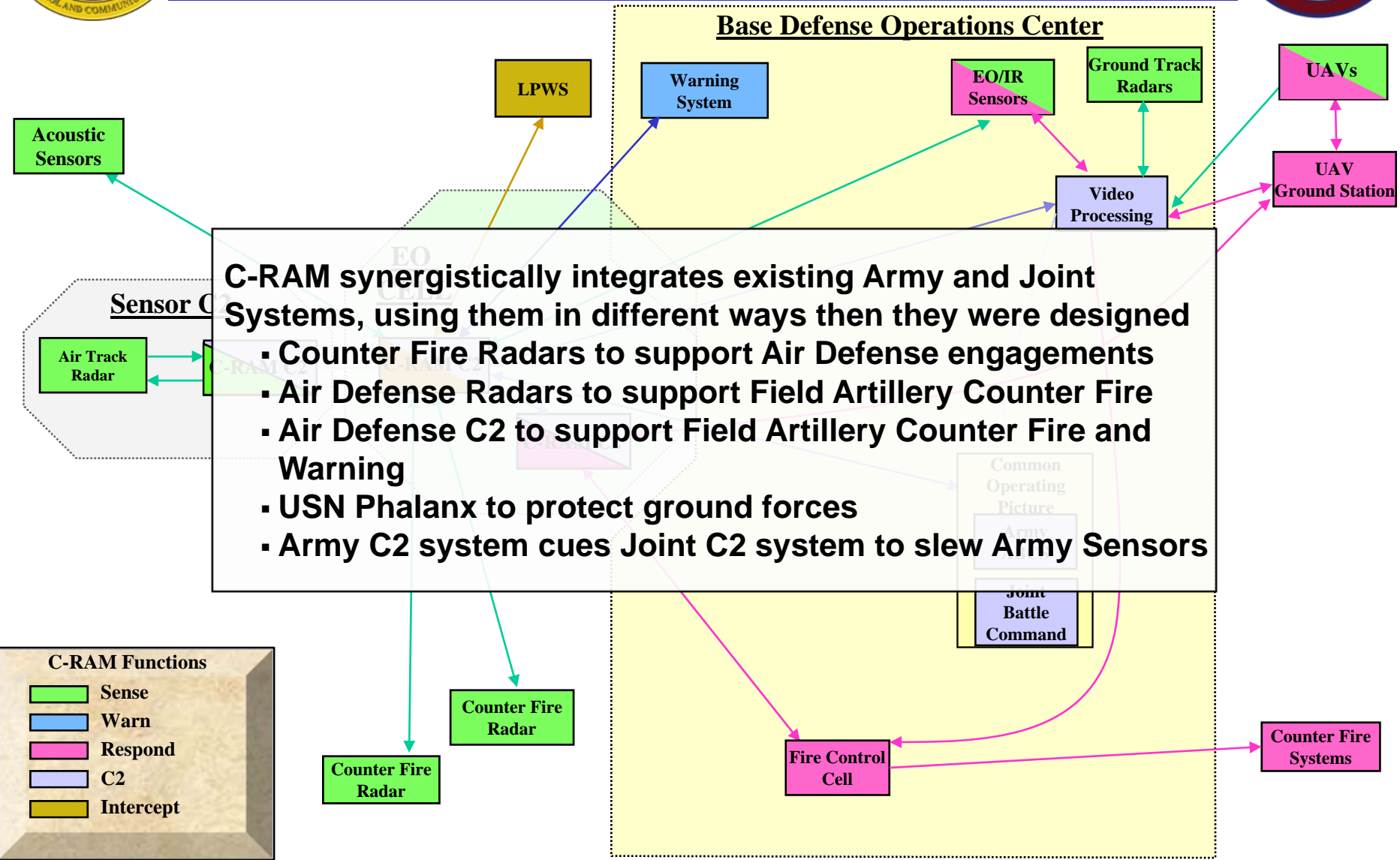


C-RAM Architecture





C-RAM Architecture





Netting of Sensors and Integration of Adjacent Locations



- **C-RAM has netted not only IDF and ABT Sensors but sensors at various locations to provide redundant and complementary coverage**
 - **C-RAM C2 correlates ABT and RAM Sensor Data from a cluster of FOBs**
 - **Data is shared/exchanged and complementary coverage is provided between them**
- **War-fighter benefits of sharing Sensor Data between FOBs**
 - **WARN: C2 Correlation of RAM tracks from Sensor At FOB X with tracks from Sensor At FOB Y**
 - **Increases WARN performance both in initiation of more valid WARNs and improves accuracy of the POI**
 - **C2 correlation of RAM tracks with ABT tracks reduces False WARNs**
 - **INTERCEPT: Improved track quality from correlation of multiple sensors**
 - **RESPONSE: Improved accuracy of the POO increases effectiveness of RESPONSE**



C-RAM Performance



- **C-RAM Sense, Warn, and Respond (SWR) performance has been extremely successful, providing timely WARNING for more that 1500 rocket or mortar attacks against C-RAM Forward Operating Bases (FOBs), with a minimum of False Warnings**
- **LPWS systems have achieved more than 110 successful Intercepts of rocket or mortar rounds**
- **Built in safeguards have prevented and continue to prevent fratricide and collateral damage**
- **C-RAM has also supported successful Response resulting in capture/destruction of IDF crews and munitions**
- **C-RAM SWR performance as well as INTERCEPT performance, has been enhanced by the netting of sensors**
- **Operational Readiness of C-RAM system currently exceed initial requirements despite operating 24/7 in extreme environments**



Integrated Base Defense System-of-Systems (IBDSoS)



- The C-RAM Office was also selected in late 2005 by the Army to field an Integrated Base Defense capability in response to other requirements and to enhance Response.
- Just like the initial C-RAM capability, IBDSoS builds on the integration of existing DoD systems. C-RAM and IBDSoS components:
 - SENSE – real time detection of IDF launches, IED emplacement teams, and perimeter threats using IDF and GSR radars, and EO/IR sensors
 - WARN – provides real time Warning to troops in hazard area of IDF launches and perimeter threats
 - RESPONSE – provides Point or Origin and locations of IED emplacement teams and perimeter threats to Battle Captains to enable timely lethal/non-lethal Response
- Both C-RAM and IBDSoS have been thoroughly tested, certified, and approved.
- Components of both C-RAM and IBDSoS have been integrated and fielded to the Training Base:
 - Systems have been operational at NTC and JRTC for 18 and 11 months respectively where they support OPFOR Play (RAM, IED, & infiltration) during unit rotations
 - Systems have fielded to Marine Air Ground Task Force Training Command (MAGTFTC) at 29 Palms and Joint Multinational Readiness Center (JRMCC) in Hohenfels
 - C-RAM and IBDSoS are integrated into TRADOC training at Ft. Bliss and Ft. Sill.

PD C-RAM Materiel Developer Responsibility Broadened Into Force Protection with Fielding of IBDSoS



Base Defense



- **The Integrated Unit, Base and Installation Protection (IUBIP) CBA/FSA process identified multiple threats to Army units/bases**
 - Indirect Fire Attack , Warning and Intercept
 - Infiltration and Assault on Unit Location
 - Human emplaced ground IEDs
 - Vehicle Based IEDs
 - Air attack and UAV observation
 - IDF Warning and Intercept
 - Sniper
 - CBRNE
 - Information / Electronic Warfare



Summary



- **The Army, Navy and Air Force have been identifying threats as part of the IUBIP CBS/FSA process**
- **The integrated C-RAM and IBDSoS systems that have been deployed in theater already address most of the identified threats**
- **The IBDSoS C2 is an Air Force Program, so as the Air Force addresses their requirement for Base Defense, there is great probability for Joint Interoperability and shared costs**