A New Era in Air and Missile Defense:

IBCS and the Dawn of Integrated Fires and Effects

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The threat environment is evolving and advancing at an unprecedented rate. Today's air and missile defense operators and leaders are required to make rapid engagement decisions in a highly complex and congested airspace that includes enemy aircraft, cruise and ballistic missiles, Unmanned Aerial Systems (UASs), coalition forces and civilian assets.

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The U.S. Army, in partnership with Northrop Grumman, is at the forefront of a paradigm shift in all-domain, joint, Integrated Air and Missile Defense (IAMD) operations: the IAMD Battle Command System, or IBCS, centerpiece of the Army's modernization strategy for Air and Missile Defense (AMD) to address the changing battlefield. The revolutionary IBCS brings with it a new era in AMD, new capabilities to the warfighter and an unmatched, decisive advantage to our nation in the evolving battlefield.

IBCS: Getting to Today

The journey to deliver to the Army a capability that integrates air defense radars, launchers and interceptors has been a long and difficult one. The concept of Army Integrated Air and Missile Defense, or AIAMD, was developed nearly 20 years ago as familiar air threats – jet fighters, bombers and attack helicopters - gave way to new and rapidly-evolving threats, from maneuverable ballistic and cruise missiles to small, difficult-to-detect unmanned aircraft and, recently, hypersonic threats.

To take on these new threats, the Army had to find a better way to get the most out of both its legacy and, importantly, its future air defense capabilities. The solution: open-architecture integration of Army and sister-service sensors, launchers and interceptors into a single, joint command and control (C2) system. The idea was to have the capability to connect both existing and new air defense systems into a single integrated network – an Integrated Fire Control Network – that passes sensor data to a common warfighter-machine interface. There, tactical decisions are made, optimal launchers and interceptors selected, and air defense engagements are prosecuted, defeating threats and defending warfighters and critical assets. Thus, the Integrated Air and Missile Defense Battle Command System, or IBCS, was born.

IBCS Engagement Operations Center (EOC)

It hasn't been an easy process. Put very simply, developing large, complex systems that deliver a revolutionary capability is hard work. The program has had its share of issues and challenges, but IBCS today is firmly on its feet and, what's more, is maturing at a rapid pace.

What was once just AIAMD PowerPoint charts, with lightning bolts representing data links from a variety of land and air sensors and shooters connected to the Integrated Fire Control Network, now is coming to life as hardware in the hands of soldiers. A string of highly-successful developmental flight tests has demonstrated that, but the journey continues as declaration of IBCS initial operating capability is a little more than two short years away.

An Inflection Point for AMD and Joint Operations

As the steady success of the IBCS program development phase continues and we get closer to production and deployment, we are facing a true inflection point in two key areas: First, we are entering a new era in air and missile defense; second, a new dawn is breaking in fires and effects integration as the joint force marches toward multi-domain operations.

First, let us look at the new era in air and missile defense. There is recognition that, as today's Patriot battalion transitions to become tomorrow's IBCS-equipped battalion, there will be a fundamental change in the way the Army employs air defense forces and conducts operations.

Dynamic Defense Design: With IBCS, not only will the long-standing problem of today's stove-piped, inflexible air defense command and control systems be eliminated, but – for the first time – commanders will be able to tailor how they deploy forces. What does that actually mean? Commanders will be able to organize, design and employ their air defense forces in a manner that maximizes every existing sensor and shooter capability in their inventory. At last, commanders will be able to integrate Patriot and Sentinel Radars into a fire control network and optimally position these assets and launchers to achieve maximum mission effectiveness. In fact, the IBCS planning module enables leadership to quickly evaluate courses of action with respect to changing battle conditions and plan flexible defense designs

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based on commander priorities and rules of engagement. What used to take weeks, even months, will soon take mere hours.

Every-Sensor, Best-Effector Operations: And, more capability is on the horizon. Northrop Grumman has invested to integrate its AN/TPS-80 G/ATOR radar with IBCS and recent flight testing shows the Army will be able to tie in other service sensors, such the Marine Corps AN/TPS-59 radars and sensors aboard Air Force F-35 aircraft, and connect them with Patriot launchers. Commanders will be able to integrate the Joint Tactical Ground Station (JTAGS) and Terminal High Altitude Air Defense System (THAAD) into the system, as well as sensors now in development, such as the Army's Lower Tier Air and Missile Defense Sensor (LTAMDS). On a global scale, the capability to integrate international sensors and effectors has also been demonstrated through collaborative prototype development performed by Northrop Grumman with MBDA and their CAMM missile, as well as with Saab and their GIRAFFE radar. This portends a new era in air and missile defense capability and mission effectiveness and, given the rapid pace of air threat evolution, IBCS fielding cannot come too soon.

Single Integrated Air Picture. For professional air defenders and other informed observers, optimizing all available assets on the battlefield is a very big deal. With its networked sensors, IBCS enables earlier detection, promotes rapid and positive identification throughout the detection, discrimination, tracking and engagement sequence, and provides commanders significantly increased decision time and space.

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With clarity comes confidence in engagement decisions, and with confidence comes trust from friendly airspace users that they will not be engaged and become victims of fratricide. Fused, integrated and correlated air track data becomes information and knowledge that air defense operators must have to prosecute engagements against modern air threats. With trust established, identification and engagement authorization can be confidently pushed to lower-echelon commanders where timely decisions are imperative in a complex and dynamic air threat environment. This will become even more important when the Army moves beyond the Patriot missile as its primary interceptor to the Indirect Fires Protection Capability (IFPC) launcher and interceptor, and as well to the Objective Maneuver Short-Range Air Defense (OM-SHORAD) capabilities, which include Directed Energy (DE).

Successful execution of the Army's base IBCS program is imperative. It is the foundation for everything that IBCS may become, but it is time to start thinking about what IBCS may be in the future. **And this gets us to the next major inflection point — connecting the battlespace through joint, all-domain operations.**

Last summer, the Joint Staff embarked on an effort to develop an operational concept that brings together all the sensors and both kinetic and non-kinetic effector capabilities that exist within the armed services in the land, air, sea, space and cyber (including electronic warfare) warfighting domains. Multi-Domain Operations Command and Control, as it was initially billed, became Joint All Domain Command and Control, or JADC2. The central idea of JADC2 is to converge the capabilities in each of the warfighting domains into a construct that enables the targeting and placement of integrated, joint all-domain fires on an adversary's standoff warfighting capabilities such as an Integrated Fires Command or an Integrated Air Defense System.

At the heart of JADC2 is the provisioning of secure, resilient and open command and control architectures that integrate sensors and effectors at multiple command echelons down to the tactical level. Further, JADC2 conceptual thinking recognizes the importance of computing and processing capacity and data storage that is searchable, as well as artificial intelligence and machine learning as essential required attributes.

Three major developments have brought us to a convergence point that has the potential to advance effector integration by an order of magnitude and will drive great advancements in

the way military operations will be conducted in the future: First, the rapid advancement of technology, especially in computing power and software development; second, the promise of artificial intelligence and machine learning; and, third, the proliferation of land, air, sea and space-based sensors and the metadata that they provide.

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IBCS as a JADC2 Enabler: A review of IBCS and the software and hardware developed to integrate air defense sensors and shooters points to real potential that IBCS can be a platform for, or at least make a major contribution to, the JADC2 concept for the Army and the joint force. Inherent to IBCS is its open architecture approach to integrating legacy and evolving capabilities. IBCS' processing and communications architecture – the enterprise bus – offers an intriguing integration opportunity for the JADC2 solution. And, IBCS' extensible and scalable Integrated Fire Control Network can support other domains and may be combinable with other established networks that contribute to JADC2.

At a minimum, IBCS can be an application that rides on other networks and is adapted for other missions. IBCS could, for example, be used as a means for command and control of offensive fires capabilities such as the Army's existing indirect fires systems and future hypersonic weapons. If JADC2 is about secure, resilient command and control architectures, sensor integration, computing and processing, then IBCS has the potential to be the platform that enables the convergence of fires capabilities to achieve desired effects, and helps usher the joint force into a new dawn of effects integration.

It's obvious the Army's Integrated Air and Missile Defense Battle Command System and the Joint Staff's Joint All Domain Command and Control Concept, although developed – and still developing – independently, have significant and interesting dependencies and similarities that should be understood and considered. On the one hand, IBCS will certainly bring about a new era in air and missile defense – that is clear. On the other, the possibility that IBCS can contribute to JADC2 is, at minimum, thought-provoking. How IBCS can help lead or contribute to a new dawn in fires and effects integration for the joint force is an important question to address. Undoubtedly, this will be a fertile topic for continued discussion as IBCS continues to mature and is fielded.

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[1]JROCM 075-19, dated 16 July 2019, subject: Joint All Domain Command and Control Campaign Plan

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