Integrated Air and Missile Defense (IAMD) Battle Command System (IBCS) for countering sophisticated modern threats, approved for Foreign Military Sale to Poland

Militaries around the world are increasingly facing formidable strategic and threat environment in terms of complexity, lethality, range, sophistication and number of threats ranging from inter-continental ballistic missiles testing, and proliferation of cruise missile and UAV technology. There is also growing threat of sophisticated cyber and electronic warfare systems that can hack or jam Air and Missile defense Networks.To counter these threats, the militaries around the world are developing global, layered, networked integrated Air and Missile defence systems.

Currently, each anti-aircraft weapon or missile defense system comes with its own launchers, its own command-and-control, and its own radar. However each system is best against a different kind of threat air or missile defense or even a subclass of them. Therefore military employ many systems as a layered defense. However, multiple screens can lead to many errors by humans like hitting a friendly target or taking multiple shots against one target.

To prevent these tragedies, US Army is developing Integrated Air and Missile Defense (AIAMD) system of systems (ASoS) that integrates all Air and Missile Defense (AMD) sensors, weapons, and their respective command and control (C2) into a networked air and missile defense (AMD) system. The Command

and Control (C2) of IAMD is known as the IAMD Battle Command System (IBCS). IBCS is designed to create “a single integrated air picture” fusing data from all available sensors into a coherent and consistent whole. Ultimately, IBCS will replace seven separate command-and-control systems currently in service. IBCS allows “any sensor, best shooter” operations to optimize limited resources and facilitate flexible defense designs.

The State Department has made a determination approving a possible Foreign Military Sale to Poland for an Integrated Air and Missile Defense (IAMD) Battle Command System (IBCS)-enabled Patriot Configuration-3+ with Modernized Sensors and Components for an estimated cost of $10.5 billion.

Poland will use the IBCS-enabled Patriot missile system to improve its missile defense capability, defend its territorial integrity, and deter regional threats. The proposed sale will increase the defensive capabilities of the Polish Military to guard against hostile aggression and shield the NATO allies who often train and operate within Poland’s borders. Poland will have no difficulty absorbing this system into its armed forces.

This proposed sale will support the foreign policy and national security objectives of the United States by helping to improve the security of a NATO ally which has been, and continues to be an important force for political stability and economic progress in Europe. This sale is consistent with U.S. initiatives to provide key allies in the region with modern systems that will enhance interoperability with U.S. forces and increase security.

Emerging threats to Air Defence System

Fifth generation stealth fighters, cruise and ballistic missile and unmanned air vehicle technology is becoming widely proliferated to become more accessible to emerging nations.

Sukhoi Pak FA is being developed by Sukhoi for the Russian Air force. China has become second nation to have two stealth fighter designs, J-20 and J-31. Stealth fighters drastically reduce the range at which air defence forces can engage a threat, the number and type of defensive systems, or tiers with shot opportunities.

More than 70 countries have some kind of cruise missiles and about 60 countries import them. They have range of 30 to 1500 Km and armed with Conventional, WMD and Anti-Armor Submunitions. Russia has demonstrated its long-range cruise missile capabilities in Syria, where it was able to hit targets at a distance 1,500 kilometers (932 miles) from ships located in the Caspian Sea.

There are 150 operational programs of UAVs in 40 countries today. They perform missions ranging from RSTA, Decoy/Drone, and Electronic Warfare to Lethal Attack missions and have Ranges up to 150 Kms. There are 353 Countries with Some Type of Tactical Ballistic Missiles having payload of 190 to 1000 Kg with Warheads ranging from Conventional, WMD and Smart Sub munitions. CMs and unmanned aircraft also present elusive targets and are difficult to detect, identify, and engage.

By 2030, the threats facing the United States around the world will have twice, if not three times, the lethality and range of today’s threats, said Maj Gen VeraLinn “Dash” Jamieson, USAF and Lt Col Maurizio “Mo” Calabrese, USAF. Anti-access/area denial (A2/AD) weaponry capabilities could include modern weapons such as hypersonic cruise missiles, fifth generation fighters, digital adaptive electronic warfare waveforms, air-to-air missiles with 150 nmi ranges, perhaps

long-range (300 nmi plus) and ultra-long-range (500 nmi) surface-to-air missiles (SAMs).

Integrated Air and Missile Defense program

In the complex air domain, today's air and missile defenders are forced to deal with uncertain information, short timelines and high consequences for wrong decisions. IBCS enables significantly enhanced aircraft and missile tracking improving the ability of combatant commanders and air defenders to make critical decisions within seconds. It links the radar, the launcher, and the human decision makers – and in more flexible ways that ever before."The ultimate long range goal is to be able to engage any target with any weapon with data that comes from any sensor" said Northrop Grumman vice president Dan Verwiel.

The IAMD program will allow transformation to a network-centric system of systems. Each sensor and weapon platform will have a "Plug and Fight" interface module, which supplies distributed battle management functionality to enable network-centric operations. The integration of all components shall allow improved engagement of air breathing targets, cruise missiles, unmanned aerial vehicles, and the tactical ballistic missiles threat.

IAMD is implementing the vision for 2020 Joint Integrated Air and missile Defense (IAMD), which is one where all capabilities-defensive, passive, offensive, kinetic, non-kinetic (e.g. cyber warfare, directed energy, and electronic Attack) – are melded into a comprehensive Joint and combined force capable of preventing an adversary from effectively employing any of its offensive air and missile weapons.

IAMD Battle Command System (IBCS)

While in conflict soldiers and their commanders are watching the battlefield on monitors inside command centers, checking for incoming mortars, UAVs, artillery, or large missiles and trying to decide if they are enemy or friendly. After that the command is send to appropriate weapon to engage the threat. Currently, each anti-aircraft weapon or missile defence system comes with its own launchers, its own command and control, and its own radar.

However, when these systems have to work together in defeating a threat results in humans to switch between multiple views which may lead to multiple shots or collateral damage. “That’s a capability that on a very short timeline, must understand what is the situation in the environment around our forces, decide how best to react, and then react to keep them safe,” Northrop Grumman’s Program Director Chuck Johnson. “What’s different across many of our situations is the timeline that’s required. It’s all a stressful environment but timelines, as they get shorter, the stressful environments increase. So a global missile defense situation might have tens of minutes of decision making time where a very short range short timeline situation to negate a rocket, artillery, or mortar round, is measured in seconds not minutes.”

The IBCS ensures that everyone in control of each system, be it Patriot, C-RAM, or something else, can see the same information at the same time and make these critical decisions. IBCS is designed to create “a single integrated air picture” fusing data from all the available sensors into a coherent and consistent whole. The Northrop Grumman IBCS solution is based on a non-proprietary, open architecture approach for integrating sensors, weapons, and battle management command, control, communications and intelligence systems (C4ISR).

IBCS will replace the current proprietary standards of

different companies with an enterprise-focused modular open systems architecture developed with Northrop Grumman. By integrating not just the basic routing, relay and server components of the network, but also standardizing the sensors, radars and launchers, the services expect to share a single, ubiquitous view of the battlespace—whether from land or sea—and allow an "any sensor, best shooter" approach to weapon to achieve mission objectives in a true open architecture environment, according to Northrop Grumman.

Northrop Grumman has developed IBCS for the U.S. Army, that integrates air and missile defense systems to eliminate stovepipes and allow warfighters to use any sensor or weapons to achieve mission objectives against aerial vehicles and balloons (air defence), as well as the defence against ballistic missiles and cruise missiles (missile defence).

IBCS will integrate seven separate command-and-control systems currently in service including Patriot, Surface-Launched Advanced Medium Range Air-to-Air Missile (SLAMRAAM), Joint Land Attack Cruise Missile Defense Elevated Netted Sensor (JLENS), Improved Sentinel radar, Terminal High Altitude Area Defense (THAAD) and Medium Extended Air Defense System (MEADS). The IBCS functionality will also be incorporated into Air Defense Airspace Management Cells, Air Defense Artillery Brigade Headquarters, and Army Air and Missile Defense Command Headquarters.

The common IBCS provides the functional capabilities to control and manage the IAMD sensors and weapons via the Integrated Fire Control Network capability for fire control connectivity and enabling distributed operations. It also enables commanders to tailor organizations, sensors and weapons to meet the demands of diverse missions, environments and rules of engagement, not achievable today. The architecture also satisfies the requirements of protection of networks from cyber and electronic warfare. The information from multiple sensors also provide protection against

jamming, electronic deception, and stealth.

There is also requirement to protect the networks from Jamming and Cyber atacks. Army Cyber Command and Army Space & Missile Defense Command have “recently ramped up” their ongoing partnership to secure air and missile defense networks, said ARCYBER’s deputy commander for operations, Brig. Gen. Joseph McGee. Those networks have “unique requirements,” McGee emphasized. “It is hard for me to think of another field in which the reliability and the assurance of the network and the speed of the decision-making is equally [critical as in] air defense.”

IBCS should allow Army missile defense to keep pace with the threat at a price we can afford,said Barry Pike, the Army’s deputy program executive officer for missiles and space. Under the old model, if you needed to replace an obsolescent radar (for example), you needed to upgrade – or replace – the weapon and command system that went with that radar as well. Under IBCS, which allows components to plug and play, you just need to replace the obsolescent piece, without having to touch anything else– a major cost savings.

Live firings and demonstrations

During recent ‘Formidable Shield 2017’ that ran from 24 September to 18 October, was designed to improve allied interoperability in an IAMD environment, using NATO command-and-control reporting structures and datalink architecture. More than 14 ships, 10 aircraft, and approximately 3,300 personnel from Belgium, Canada, Denmark, France, Germany, Italy, the Netherlands, Spain, the United Kingdom, and the United States are participating in the exercise, which is being conducted on the UK Ministry of Defence (MoD) Hebrides Range on the Western Isles of Scotland.

The IAMD live firing event was based on a collective self-defence scenario. The MRBM engagement saw Donald Cook – equipped with then Aegis Ballistic Missile Defense (BMD) system – successfully detect and track the Terrier Oriole target vehicle and then destroy the threat in space using an SM-3 Block 1B interceptor. The Terrier Oriole had been launched from the MoD Hebrides range site on South Uist.

Simultaneous with the engagement of the MRBM target, the Spanish frigate SPS Alvaro de Bazan fired a RIM-162 Evolved SeaSparrow Missile (ESSM) against an incoming anti-ship cruise missile, while the Royal Netherlands Navy frigate HNLMS Tromp fired ESSMs against a pair of incoming anti-ship cruise missiles.

IBCS has carried out three live fire tests and demonstrations successfully. It has demonstrated the ability to use any sensor to enable a shooter "without eyes on the target" to intercept at greater range. It has integrated Aegis data and other joint sensor data to improve combat identification, decision time, and defense effectiveness. In its most recent flight test, the Integrated Air and Missile Defense (IAMD) Battle Command System (IBCS) successfully used sensors and interceptors from different air defense systems, selecting from different missile types to defeat multiple threats arriving at the same time.

Earlier U.S. Army soldiers have successfully flight tested the Northrop Grumman Corporation -developed IAMD Battle Command System (IBCS) to identify, track, engage and defeat ballistic and cruise missile targets. "The program is still in the development phase; we're coming to the end of that and we're coming to a production decision this summer that will lead to additional fielding in 2018."

In April 2016, the U.S. Army successfully conducted a dual engagement flight test using IBCS, validating the system's ability to manage multiple threats simultaneously. The system

is scheduled to reach initial operational capability in 2019, however, in August 2016 the system's production was put on hold because of software issues.

United States' Joint Integrated Air and Missile Defense: Vision 2020

"United States' Joint Integrated Air and Missile Defense: Vision 2020" document outlines the Chairman's guidance to the joint force and, by extension, to all the stakeholders that contribute to the air and missile defense of the U.S. homeland and its regional forces, partners, and allies.

The vision document warns, "The future IAMD environment will be characterized by a full spectrum of air and missile threats—ballistic missiles, air-breathing threats (cruise missiles, aircraft, UAS [unmanned aerial systems]), long-range rockets, artillery, and mortars—all utilizing a range of advanced capabilities—stealth, electronic attack, maneuvering reentry vehicles, decoys, and advanced terminal seekers with precision targeting."

IAMD in 2020 must be balanced, versatile, responsive, decisive, and affordable

The vision document says that, the approach of IAMD in 2020 will be balanced, taking into account a full range of opportunities including diplomacy, a robust approach to passive defence both left and right of enemy launch, electronic warfare, active defense, and increased cooperation with our friends and allies.

The document makes it clear that the first responsibility of joint IAMD is to deter adversaries by developing and fielding

credible and effective defensive capabilities failing which is to prevent adversary's air and missile threats by both active and passive defenses and offensive actions.

The vision points out, "the link between offensive and defensive operations for IAMD is critical," and "all means, including penetrating assets" should be employed to "defeat large threat inventories. Frankly, the failure of IAMD "risks suffering potentially devastating attacks" that could jeopardize an entire campaign.

Should deterrence and prevention fail, joint IAMD melds active and passive defenses to mitigate and survive the assault. "Still, it is unreasonable to believe that offensive operations can wholly negate any sophisticated threat; therefore, the joint force must employ robust passive measures, such as CCD, dispersion, and hardening as well as layered, complementary active defenses to survive air and missile attacks."

Joint IAMD will require the horizontal integration of these capabilities, and the vertical integration of policy, strategy, concepts, tactics and training.

"The solutions to current and future capability gaps must be aligned with fiscal realities," US weapon systems costs are becoming prohibitively high. "We must find ways to avoid scenarios where adversaries launch large number of relatively cheap rockets, ballistic and cruise missiles, or unmanned air vehicle systems and our only response option is to intercept them with highly complex and expensive weapons."

The core of the Chairman's intent for IAMD is encapsulated in six key imperatives designed to guide the joint force in meeting these challenges in a logical and fiscally responsible manner.

Six Imperatives of Joint Integrated Air and Missile Defense: Vision 2020

The first is to “incorporate, fuse, exploit, and leverage every bit of information available regardless of source or classification, and distribute it as needed to U.S. Forces and selected partners.” Tapping into and cross –utilizing all-source information wrings maximum utility from every dollar spent on intelligence, surveillance and reconnaissance and can lessen requirements for new, single use collection systems. The joint force must seek out and eliminate technical deficiencies and organizational barriers to information-sharing and enable the free flow of ISR data between national systems and the warfighters who need it.

The second imperative is to “make interdependent Joint and Combined force employment the baseline.” From the earliest stages of planning, exercising, and employment, IAMD must leverage the comparative advantages of joint force components and partner nations.

The third imperative is to “target development, modernization, fielding, and science and technology efforts to meet specific gaps in IAMD capabilities, all the while stressing affordability and interoperability.” Chairman asks for “special focus” on “closing high-leverage technology gaps such as an adversary’s emerging seeker or missile development, and the development of U.S. non-kinetic capabilities.” Breakthroughs in these areas can have a dramatic effect in reducing the need to rely on expensive kinetic solutions.

Imperative number four requires the joint force to “focus Passive Defense efforts on addressing potential capability and capacity shortfalls in air and missile defense.”

The fifth imperative is to “establish and pursue policies to leverage partner contributions.” Partners should be encouraged to invest in their own air and missile defense capabilities

that are interoperable with ours. “Developing an integrated defensive network of interoperable IAMD systems can leverage cost sharing and help spread the burden among the willing partners.”

This sixth and final imperative, which directs the joint force to “create an awareness of the IAMD mission and the benefits of its proper utilization across the Department of Defense to include the development of the enabling framework of concepts, doctrine, acquisition, and war plans that support full integration of IAMD into combat operations.”

Commanders must understand and embrace every weapon and tool available to them. Educate personnel at every level how IAMD is supposed to work for the joint force and to train their people to effectively execute. How to employ joint elements together, how to employ in joint engagement zone, what combinations create what capability, and which are ineffective when employed on a stand-alone basis.

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