Fighting in the New Frontiers: Multi Domain Operations, Convergence, and Offense-Defense Integration

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Painting the Battlefield

The ever-evolving battlefield is complex in nature. The rate at which military technology is advancing is opening this battlespace to new domains; the traditional spaces of land, sea, and air have now had space and cyberspace join their ranks. This has resulted in the persistent need for the careful integration of the United States' Joint Force into a singular concept that builds careful coordination of command & control to ensure the warfighter has access to the latest intelligence and an array of capabilities that span services. This concept is Joint All-Domain Operations (JADO), an expansion on the Army's operationalized Multi Domain Operations (MDO) warfighting concept.

Introducing Multi-Domain Operations and Convergence

As the emphasis of our nation's warfighting priorities has been redirected to defeating near-peer adversaries, the military has developed and has begun to implement the MDO concept. This concept integrates capabilities and actions across all domains of warfare: air, land, sea, space and cyber. In order to do so, the complete view of the battlefield must be married to operations across all domains so that all sensors are combined to ensure that the best shooter is employed. As each military component needs to be able to create favorable space in each domain, multiple projects are underway within the Department of Defense with the intention of allowing these respective components to get inside the enemy's decision cycle and achieve the nation's objectives.

In open conflict, the ability to operate freely in all domains requires control of the airspace which has become extremely crowded and lethal. This requires the Joint Force to be able to dis-integrate enemy anti-access and area denial (A2/AD) zones and penetrate enemy defenses to destroy long range weapons systems. The Army needs to protect the force from an ever-increasing array of threats from the air in order to maneuver freely in the land domain. There is no force on Earth that can defeat the U.S. military once they enter the region, assemble, and maneuver to fight. As the saying goes "You go to war with the army you have, not the army you might want or wish to have at a later time." So, we must deliver the all-domain capable mili

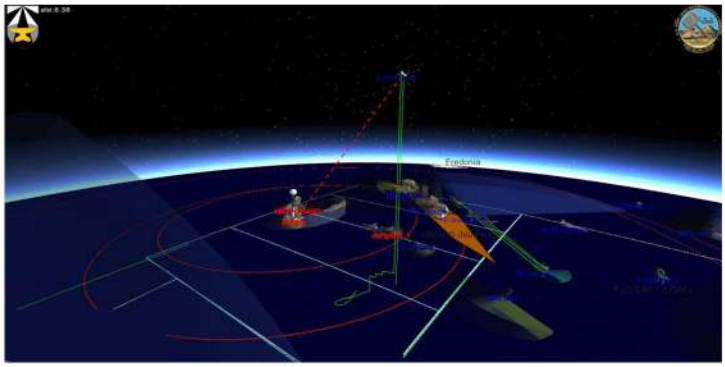
In the dis-integrate phase, ODI of fires works to further neutralize the enemy A2/AD network and defeat long-range systems. IAMD provides cover for operational maneuver at the deep maneuver, close area, and tactical & operational support areas. Mobile air defense provides a bubble of aerial dominance that is non permissive to adversary aircraft and allows for joint air support in theater. Coordination between the maneuver force, IAMD assets, and aerial support is all down over a joint all-domain network. Offensive fires begin targeting enemy medium range systems to aid operational maneuver, with targeting data communicated over the same joint all-domain network.

Dis-integration of systems will create a brief moment of overmatch and dominance, allowing for force projectors to extend their proximal zone of dominance through gaps in the adversary's front. This is the exploit phase. Short range air defense (SHORAD), man-portable, motorized, or mechanized systems that accompany infantry and armor, will continue to support maneuver forces in the deep and close maneuver areas. Offensive fires will eliminate tactical A2/AD networks and support the maneuver force by dislodging enemy defensive units and targeting exposed enemy command systems in order to create favorable force ratios for the maneuver force to further exploit.

With proper logistics and resources to feed these processes, the zones of dominance will continue to grow and extend forward along the front as enemy resources are expended and joint dominance increases. As adversary long and medium range ground-based systems and strike aircraft are destroyed, the zone of proximal dominance increases as a source becomes less contested along the front. Coordination of logistics to sustain combat operations and maintain the character of dominance, as well as ODI in support of maneuver is enabled by a joint all-domain network.

Network Convergence

Synchronization of information and command and control across the Joint Force is necessary for "shooters" to be able to penetrate, dis-integrate, and exploit the enemy on the battlefield. Having a distributed and resilient network will give the Joint Force an exponentially faster dynamic to responding to incoming threats and countering adversaries. The Defense is working to create a system that best connects and manages joint force operations during conflict to enable MDO. This system is called Joint All-Domain Command and Control (JADC2).



ABMS

The Air Force's Advanced Battle Management System (ABMS) is an alternative to the E-8C Joint Surveillance Target Attack Radar System (JSTARS), an aircraft system that performs ground surveillance, battle management, and command and control, offering valuable information regarding situational awareness for the combatant commanders. ABMS is intended to provide the best information directed towards cross-service defense operations while being composed of a "network of intelligence, surveillance, and reconnaissance sensors and will utilize cloud-based data sharing to provide warfighters with battlespace awareness for the air, land, sea, space, and cyber domains."[6]

Brigadier General David Kumashiro, Director of Joint Force Integration at USAF HQ, said that ABMS will be "the technical engine" driving the Air Force's approach to its Multi-Domain Command and Control (MDC2). The Air Force hopes ABMS will be the backbone of JADC2. The budget proposed by the Air Force can be broken down into seven categories:

1) Digital architectures, standards, and concept development:
2) Sensor Integration
3) Multi-domain data management
4) Multi-domain secure processing
5) Multi-domain connectivity
6) Multi-domain applications
7) Effects integration, which encompasses "open smart munitions," attritable aircraft, and "real-time updates to mission data files to improve electronic warfare system performance"[7]

The ABMS technology would allow for a comprehensive plan allowing for the moving of data at machine speed across the globe, from subs to satellites, aircraft to ground troops, and ships to shore. It would therefore fuse a wide quantity of data from hundreds of sensors in order to provide situational awareness for combatant commanders across the globe, functioning as a "decentralized system that draws on all domains" according to former Air Force Chief of Staff General David Goldfein.[8] This comes after Air Force officials have decided to abandon the idea of adhering to the 2018 National Defense Strategy and instead focus on the ABMS as a future backbone for the JADC2. It is thus concluded that aircraft is not the sole way to acquire command and control capability across multiple domains, hence the joint initiative ideas that resulted from this shift.

TITAN/IBCS

The Tactical Intelligence Targeting Access Node (TITAN) is an Army prototype system for a next-generation scalable and expeditionary intelligence ground station. The task of TITAN will be two-fold. It will provide multi-discipline intelligence support to targeting, and situational awareness and understanding for mission command.[9] Second, TITAN is designed to leverage space and high altitude, aerial, and terrestrial layer sensors to provide targetable data to fires networks. The Army wants to tie "deep-sensing" reconnaissance to long range precision fires in order to erode enemy A2/AD capabilities.[10]

According to Brigadier General Rob Collins, Program Executive Officer for Intelligence, Electronic Warfare and Sensors (PEO IEW&S), the Army has roughly 100 tactical ground stations, 13 operational ground stations and a few other dissemination vehicles to inform battlefield commanders with some of them reserved for certain echelons.[11] The goal of TITAN is to provide a consolidated, modular ground-system tailorable to all echelons in order to replace the varied ground stations at present.

Developed by Northrop Grumman for the U.S. Army, the Integrated Air and Missile Defense Battle Command System (IBCS) is a C2 capability that integrates air and missile defense systems to eliminate stovepipes and allow warfighters to use any sensor or weapons to achieve mission objectives.[12] Using IBCS, soldiers can perform surveillance, identification, weapon management, and engagement functions and collaboratively plan and execute joint engagements of air and missile threats.[13] The system is capable of incorporating current and future air and missile defense systems, sensors, weapons and battle management command, control, communications, and intelligence systems into a fully integrated network.

Integration provided by IBCS allows the department to invest in new capabilities in a much more fiscally responsive way by investing in sensors or weapons that

can fill capability gaps without having to buy complete weapon systems. IBCS enables common mission command across Air Defense Artillery, other U.S. Army forces, and other IAMD forces.[14] In addition to providing the means for integrating U.S. IAMD assets, IBCS also establishes the means for connecting complementary and coalition systems for joint and cooperative multinational missile defense.

CEC

Cooperative Engagement Capability (CEC) is a sensor netting system for the U.S. Navy that enables high quality situational awareness and integrated fire control capability, significantly improving the battlespace of air and missile defense capabilities of the U.S. Navy ships, U.S. Navy aircraft, and U.S. Marine Corps Composite Tracking Network (CTN.) The geographically dispersed sensors enable a Navy Integrated Fire Control-Counter Air (NIFC-CA) capability, which provides intelligence, surveillance, and reconnaissance (ISR) ability and allows various sensors, airborne or afloat, to detect and begin the kill process for incoming air and missile threats.

CEC provides the Navy with a single, integrated air picture. Once linked into JADC2, the Navy can use joint sensors to populate their air picture as well as provide ship and airborne sensor data to other services.

Networks and Kill-chain

Possession of the "network of networks" is key to the ability to rapidly and seamlessly integrate offensive and defensive fires. From deep strike to the interception of ballistic and hypersonic missiles, an open architecture of communication across the available sensors and shooters allows for the greatest persistence in target acquisition and tracking, and then flexibility in how to engage targets. Kill chains characterized by a robust architecture give greater order in contested environments characterized by swarming aerial threats and electromagnetic and cyber warfare.

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Providing persistent sensors in the air, at sea, on the ground, and in space, that allow for beyond-line-of-sight targeting can realize the full potential of integrated underlayers and retaliation. JADC2 gives the joint force the ability to tailor comprehensive force packages of multiple systems to leverage the advantages each service possesses. The key to making it all work will be low network latency, especially with regards to missile defense and kinetic interceptors. JADC2 provides persistent, flexible sensing to build a robust kill-chain apparatus, providing nimble deterrence by denial but also powerful deterrence by retaliation through offense-defense integration and leveraging forthcoming long-range precision fire platforms.

Operational Environment

In the operational environment, the following are the tenets in which MDO attempts to make the battlefield serve the advantage of friendlies while closing the window of opportunity for the enemy: compete, penetrate, dis-integrate, exploit, re-compete.[17] Competing, first expands the competitive space, allowing the full spectrum of threats to be observed unilaterally. Penetrating follows, which engages with the enemy's long-range systems and neutralizes the first line of defense. Dis-integration follows which aims to defeat the short-range systems and any A2/AD systems. This allows exploitations to follow, with freedom of maneuver now available to ground forces, this decisive point allows actions-on to follow the initial phases of the operation. Re-competing restarts the process, with the now secured terrain and other objectives in control and the next operation ready to follow. The process in its nature is malleable towards any threat. It can address non-conventional and irregular warfare adversaries while also focusing, when done with the most modern of systems the U.S. military can offer, to defeat large conventional conflict adversaries.

ODI enabled by JADC2 works to open windows of opportunity in time and space to allow for the exploitation by maneuver forces. Convergence of sensors with kinetic and non-kinetic, cyber and electro-magnetic, air and missile defense platforms directly contribute to competition through setting up formidable A2/AD zones, but also sets the condition for successful penetration of enemy defenses by neutralizing or degrading the effectiveness of enemy precision fires. This allows for the maneuver force to more safely position themselves for operations. Once enemy long-range systems have been neutralized, kinetic and non-kinetic fires, aided by JADC2 and leveraging cross-domain sensors, can begin to dis-integrate enemy A2/AD systems and create space for the maneu

in the atmosphere, as well as a high shot doctrine to achieve intercept. Richard Davis, Director of Army Issues National Security and International Affairs Division, testified to the House that the Army's initial number of 70% success was unsubstantiated. However, Charles A. Zakret, a scholar in residence at the Center for Science and International Affairs of the Kennedy School of Government and member of CFR, testified:

"Patriot performed in The Gulf War at least as well and probably much better than might have been expected beforehand, given the unanticipated nature of the threat. It was a credible, effective performance that warrants credit to the U.S. Army, the IDF, Raytheon and the other contractors who built the system."

He pointed out that without Patriot, damage and ground death tolls would have been higher and the success seen on its first operational deployment, which it was not entirely ready for, showed the Army should prioritize upgrades to a promising system. Zakret's characterization of the Patriots success in the Gulf War contributed to the Patriot being discussed, and now fielded, as part of regional theater ballistic and cruise missile defense.

In a future large-scale combat operations (LSCO) against either 2+2 adversary outlined in the 2018 National Defense Strategy, the cruise and ballistic missile threat will be far more advanced than the Gulf War. In the Gulf War, Patriot missile batteries suffered from poor communication infrastructure, poor target acquisition via radar, and poor interceptors. The tethered nature of radars, relays, and launchers meant Patriot could not have dispersed operation, making it less effective for theater defense and diminished to a point defense. Today the Patriot Advanced Capability-3 Missile Segment Enhancement (PAC-3 MSE) interceptor cannot reach its full potential range due to limitations of current legacy radars and the shot doctrine is still two interceptors per target at minimum.

With modern radars combined with a JADC2 architecture, Patriot batteries will not face the same problems in future conflict. The availability of all sensors as part of the Army's IBCS network to provide 360-degree tracking will give the Patriot system accurate targeting and could lower shot doctrine. Improvements in sensing will also allow the PAC-3 MSE interceptor to utilize its full potential range. These two characteristics will allow Patriot systems to operate in a more dispersed environment, leading to better resiliency in future conflict as well as a larger defended area. Patriot will be able to provide a real theater level missile defense capability.

Operation Anaconda

On March 2, 2002, after two months of plan and prep, coalition troops led by Central Intelligence Agency (CIA) paramilitary officers went into Afghanistan's Shahi-Kot Valley to neutralize what was understood to be a small and surprised Taliban and al-Qaeda force. Unbeknownst, they stumbled upon an enemy force 5-10 times larger than initial measures armed with heavy weapons sighted on pre-designated target locations and helicopter landing zones. Under heavy fire, close air-support (CAS) assets became the decisive element towards winning the battle. However, the lack of planning thereof for the integration of this capability ultimately led to friendly casualties and a fight that could have been won quicker and with less human toll. MDO theory in the planning process would have come a long way in achieving this.

Every service understands the need for effective information coordination. However, each has developed its own system to integrate data. But sensor data integration occurs only after each service's specific tools have collected and collated it.[21] Therefore, without proper integration, data and information falls into stovepipes as a result of individuals systems, with even more consequences from individual planning. This was the very case with the planning phase of Anaconda. Conflicting intelligence reports between different task forces assigned to the operations resulted in Combined Joint Task Force (CJTF) Mountain axing the planned integrated air operations along with ISR support and pre-planned airstrikes.[22] Unfortunately, the lack of depth at the time put into doctrinal instruction of joint operations relegated airpower to a support role as opposed to integrated into the primary planning infrastructure. Improved planning and use of various sensor layers for ISR support could have given a better assessment of the battlefield in determining the enemy firepower estimates. This initial lack of joint planning resulted in boots on the ground also lacking this access to air assets during the fight, at least in a time effective manner. Combined Air Operations Center (CAOC), unfortunately, was not included in the planning process

either. CAOC is what gives command and control over air and space-based systems, provides a unified picture of the battlefield, and serves as a link between the strategic, operational, and tactical levels of war.[23] This lack of planning at the strategic level ultimately proved costly. Ultimately, Anaconda was a showcase of the gaps MDO can fill in bringing airpower into the fold.

Integrated planning is an essential function of the MDO precipitated outcomes as is the case of systems convergence. The concept underlines understanding how to effectively employ all assets to ensure cross coordination before the warfighters are even sent in. This ensures efficiency and utilizing more with less. This is one of the crucial tenets of MDO: ensuring joint-force ops compete militarily before the armed conflict begins, penetrating and then disintegrating an enemy's anti-access and aerial denial systems or amassed combat power beforehand, and finally exploiting the resulting freedom of maneuver.[24] This implementation would have allowed the strategic and operational gaps to be covered, giving eyes to components the warfighter lacked. CAS rapidly improved and ultimately became the key to winning the battle when it was finally utilized.[25] However, as mentioned before, ISR utility and air assets should have been understood to be the component instituted to lead in the first phase. Command and control efficiency through systems convergence would have been a key instrument in ensuring the progress on this front was actionable and therefore easy for the boots on the ground to conduct follow-on actions in a timely manner.

Operation Iraqi Freedom

The lessons learned from the 1990s and the beginning of the 21st century allowed for continued success of joint-operations and improved command and control during the Iraq War. Operation Iraqi Freedom (OIF) encompassed these lessons and improved upon them to meet the conditions of the environment, through battlefield-inspired osmosis. Due to the need for decisive action, in part because Saddam was attempting to destroy everything left behind, the convergence of precision airstrikes and ground forces were crucial in achieving the mission to take ground and advance in a faster time period. By integrating coordination between precision air strikes and ground forces, U.S. Central Command (USCENTCOM) was able to slim down the U.S. ground force element to a single heavy division,

Air and missile defense were not a major factor in Operation Iraqi Freedom due to the short nature of the initial ground invasion and weakness of the Iraqi military only a decade after the devastating Gulf War. In the first three weeks of OIF, Patriot did intercept nine Iraqi short-range ballistic missiles.[28] The Iraqis did also launch cruise missiles, but to no success. However, the Departme

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