Table Stakes of the Advanced Battle Management System

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Imagine a system that instantaneously gives its user the majority of airborne battlefield data needed to make time-critical, potentially life-saving decisions. Now imagine that same system not only producing information but presenting a solution, shaving critical minutes from an observe, orient, decide, and act (OODA) loop.[1] This solution would allow the user to react before the enemy does, expeditiously placing weapons, sensors, and effects in the right place at the right time. This utopia is what the United States Air Force (USAF) imagines when it pitches the Advanced Battle Management System (ABMS), the service's answer, and impetus behind the Department of Defense's (DOD) Joint All-Domain Command and Control (JADC2) concept.

Many questions linger on what conceptually and physically ABMS entails and what it will provide to the war fighter. Is it a system or a system of systems? Is it autonomous, man-on-the-loop, or man-in-the-loop? What information will be shared? Will it control the pace of the battle, replacing C2 teams onboard the E-8 Joint Surveillance and Target Attack Radar System (JSTARS) or Combined Air and Space Operations Center, or will it be just a series of sensors that integrate into existing weapon systems?

This article cannot answer all these questions. Still, it will attempt to outline the fundamental table stakes that should guide architects and industry in the development of this future concept. While ABMS has evolved with the heightened influence of JADC2, this article will limit itself to its role in aerial combat. Integration beyond will be left for future scholars. Additionally, it will not discuss the technical means in which it could be designed but only the desired product to be delivered to the war fighter. ABMS must integrate the foundational table stakes of:

1. accessibility
2. synchronization
3. tailorability
4. built-in and upgradable artificial intelligence (AI)
5. decentralization and survivability
6. enabled communication

7. easily compartmentalized but accessible
8. centralized control and decentralized execution
9. employment of specialists

Through the implementation of these concepts, a tool will be created that will revolutionize the speed and capacity of decision-making and increase lethality and efficiency beyond what has ever been available to military commanders in the history of modern warfare.

Table Stakes

First and foremost, ABMS needs to make all relevant sensors, weapons, positioning, and battlespace deconfliction data *accessible*. Essentially, the ABMS is a more robust and user-friendly Link-16 network designed from the ground up to integrate seamlessly between platforms. The system-specific operator or AI could refine raw sensor data, which could then be broadcasted across the network to be actioned upon by other users. Ultimately, this would speed the kill chain by fulfilling an identification matrix faster or through the employment of weapons from different platforms other than providing sensor information. Weapon states, employment data, and engagement zones distributed to other users would allow for real-time accountability of available weapons and the timeline of engagements. Fighters sharing the tracking of airborne or surface adversaries, along with their quantity of missiles, would allow for timely distribution of forces and warning to commanders when risk is exceeded. The benefits of knowing in real-time the positions of all friendly and known enemy forces in every domain do not need to be explained, and ABMS can allow commanders to progress closer to that goal. Finally, airspace deconfliction measures such as kill boxes or restricted operating zones should be broadcasted, preventing fratricide and allowing freedom of maneuver and integration for assigned assets throughout different domains. Since air forces will not operate independently of other components, immediate deconfliction measures from artillery, unmanned aerial systems, and other assets sharing airspace could be transmitted. The sharing would increase awareness of the evolving battlespace and changing areas of responsibility.

Synchronization of data streams. ABMS must integrate data from "all domains" to streamline and heighten situational awareness in the battlespace. The ability to synchronize intelligence, data, and weapon or sensor effects on specific targets is a critical table stake. For example, when a potential target is identified, every entity collecting data, running an identification matrix, or providing an effect should have the ability to effortlessly place that data into a single file or log specific to the target. Cyber intelligence collections that identify centers of gravity, satellite or unmanned aerial systems imagery, airborne passive detection systems, or ongoing electronic attacks are among this information. All must be consolidated and ranked based on system accuracy to produce a single accurate model of a target's location, condition, received effects, or other data that can be seamlessly synchronized for immediate lethal or nonlethal effects, or further collection.

The information, if provided as stated in the previous table stakes, would be of massive quantities in any large-scale operation, far more than any individual or team could digest in a meaningful amount of time. That ability is why information must be easily *tailorable*. This table stake would allow the user to effortlessly see only what they care about at the moment and not get bogged down with non-pertinent data. For example, in the dynamic task of tanker management, where aerial tankers provide fuel to other military aircraft, ABMS could allow a user to filter out only needed data such as an airborne tanker's available gas and a list of scheduled or added receivers updated by the air tasking order, tactical command and control (C2), or the tanker itself. Tailorability would also allow for higher priority items based on the commander's intent to be highlighted based on the focus of the day and mission set.

With artificial intelligence advancing at a dizzying rate, ABMS needs to capitalize on this potential third-offset capability.[2] ABMS must have *built-in and upgradable AI*. Adapting AI to conduct man-in-the-loop, man-on-the-loop, or fully autonomous battle management decisions is critical in speeding up the OODA loop and holding to the rules of engagement prescribed by its programmer. In the previously mentioned tanker management mission set, AI, once configured, could proactively work unplanned refueling and source available fuel within a theater based on receivers' needs and location. AI integrated into ABMS could directly speed up the kill chain by analyzing connected weapons systems to develop a solution of the best weapon system available to interdict a target. In a dynamic targeting scenario, AI could maintain a real-time inventory of airborne munitions not assigned targets. When a dynamic target is inputted into the system, ABMS could provide an operator with the best and alternative munitions available based on desired effects and collateral damage. With the weapon owner's concurrence, all targeting data could be instantly forwarded and all networked users notified that this specific aircraft is servicing the target. While these examples solve current aerial combat challenges, the upgradable portion of this table stake would adapt ABMS to integrate with AI being developed independently of this concept. Looking to the future, ABMS AI could be the system that fuses all sources of data, then forwards it to autonomous weapons that automatically neutralize a target based on the programmed commander's intent and collateral damage. This future AI utilizing ABMS would minimize human input and be the foundational language that future US military AI is designed.

The initial pretense for the USAF's decision to divest the E-8 JSTARS fleet and pivot to the ABMS concept was a perceived lack of survivability in contested environments and a desire to shift to a more modern decentralized concept. *Decentralization and survivability* are critical to any future battle management system, and ABMS must hold to this. An easy comparison is the cellular phone, built upon a framework of antennas, internet protocols, fiber-optic cables, and satellites. One can travel virtually anywhere in the world and still be connected. Importantly, if a signal is lost from one cellular phone tower, the device seamlessly connects to a new one. This decentralization requires survivability through the employment of protocols and other methods to prevent jamming or other forms of electronic attack. Add to this the requirement that all data sources are vetted through an active information assurance program that assesses for data corruption, and a robust system would be created. This protection is admittedly easier said than done. In designing and utilizing the system, developers and operators must always be mindful of the fact that if ABMS becomes compromised, so could the USAF's future war-making capability. However, if the USAF is voracious in its defense, utilizing the same vigor in which it protects its nuclear arsenal or other strategic assets, ABMS would be secure. To meet this table stake, ABMS must be made of devices able to connect and are resilient against the attack of individual nodes, keeping lines of communication open between every war fighter and commander.

Enable communication. From tactical chatrooms, direct messaging, and digital packets of data, ABMS must facilitate communication. Features like user/mission defined chatrooms and precanned missions, dynamic targets, close air support, and joint tactical air strike requests (JTAR) must be incorporated into the system. When a joint terminal attack controller requests air support, the DD Form 1972 Air Strike Request must be integrated. The request should be seamlessly sent through higher echelons and eventually forwarded to the aircraft that will service it. ABMS can eliminate the "telephone game," providing information directly from the organization requesting action. Finally, central updates to essential documents, like the air tasking order, or real-time mission impactful information need to have a way to be distributed. ABMS should be the method to so, broadcasting and updating pertinent communications to all players seamlessly.

While the United States must be prepared to fight a conflict independently, it is foolish to think that America would enter a major conflict without a coalition of the willing. American forces fight and train with allies and coalition partners daily, but often security classifications hinder complete integration. ABMS must be *easily compartmentalized but accessible* at varying levels of classification. Existing systems and policies often wholly cut out partners from accessibility, including portions that have been previously deemed releasable. Separate ABMS systems should not exist, but American users should have the ability to filter out data that must be withheld. Partner nations like the United Kingdom have already expressed their interest in this idea,[3] and like the F-35 Joint Strike Fighter, ABMS must be designed with partners in mind. Our allies and coalition partners around the globe are critical to our national defense, and any future C2 systems must embrace them.

With its creation, the inevitable outcome with any C2 system is that a higher headquarters would have the ability and desire to influence decisions at the lowest possible level. While this is tolerable within a low-intensity operation, in a near-peer conflict, this mentality is impracticable. ABMS must enable *centralized control and decentralized execution.* The overarching design of ABMS must allow the war fighter to gather necessary data and carry out the mission based on the tactical situation, in accordance with the commander's intent. It cannot merely be a tool for commanders separated from the battle to direct action in a centralized execution model. This tool would only slow the actual war fighter's OODA loop, potentially giving an enemy an advantage or opportunity to exploit. USAF doctrine,[4] established through decades of successful air combat, must not be changed simply because a system comes online that promises all data to the commander. Tactical commanders must be empowered and have the ability to use the information provided to them to make critical decisions independently.

Nevertheless, tactical commanders must not be alone. ABMS must *employ specialists* trained to filter data and are empowered to make tactical decisions on behalf of this commander. These specialists should be tasked to maintain network integrity and act upon information produced within the system. This table stake does not imply information hoarding or limiting access to the war fighter. It means utilizing trained personnel to enable operations and assist the computer and commander where needed. Some within the DOD argue that ABMS data should immediately be sent directly to the user to influence their OODA loop. However, as many commanders know, the first battlefield report is often misleading or simply wrong. ABMS needs that filter and designated decision-maker and should not be designed to cut out tactical C2 operators nor intelligence analysis. A misguided expectation is that with ABMS, C2 decisions can be consistently delegated to the fifth-generation fighter or bomber pilot in their cockpit. While this pilot is more than capable of making time-critical tactical decisions within the specific mission, add a dynamic scenario featuring a multitude of mission sets, vast quantities of information, and the physical stressors within the cockpit that decision-making capacity simply breaks down. Tactical C2 teams have the innate ability to execute multiple mission sets, process dizzying amounts of information, and be the experts in interpreting the commander's intent within the confines of tactical or theater-wide operations. By integrating tactical C2 and the theater air control systems within ABMS, the Air Force will have a system that creates a force multiplier in which it envisions.

Conclusion

The USAF and the DOD must not settle for a system that delivers anything less than these table stakes. Only the best providers can meet them, but this model of the ABMS is obtainable. ABMS cannot be relegated or considered a "new" Joint Tactical Information Distribution System (Link-16); it can be so much more. It can be the baseline in which future generations of technology are built, and doctrine is evolved. Future autonomous wingmen, AI imagery analysis, and space-based sensors can all be designed to integrate and "feed" ABMS. The US can no longer have programs built for independent purposes, utilizing aftermarket technology to bridge communications. They must be built around this common next-generation system. Vast amounts of data will need to be transmitted, and current weapon systems will need to be modernized or replaced to support information flow. With the rise of near-peer threats and their evolving C2 enterprises, the USAF must evolve faster. No longer can the USAF rely on quantity but instead utilize the quality of weapons systems and sensors in the right place at the right time, faster than our adversaries. ABMS must be audacious and seize innovative opportunities and revolutionary changes wherever possible, but structured around the table stakes of (1) accessibility, (2) synchronization of data streams, (3) tailorability, (4) built-in and upgradeable AI, (5) decentralization and survivability, (6) enabled communication, (7) easily compartmentalized but accessible, (8) centralized control and decentralized execution, and (9) employment of specialists. In doing so, a tool will be created that will revolutionize the speed and capacity of decision-making and increase lethality and efficiency beyond what has ever been available to military commanders in the history of modern warfare. ✪

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Notes

1. Paul Tremblay, *Shaping and Adapting: Unlocking the Power of Colonel John Boyd's OODA Loop* (Quantico, VA: United States Marine Corps Command and Staff College, 2015).
2. Deputy Secretary of Defense Bob Work, *The Third U.S. Offset Strategy and its Implications for Partners and Allies*, speech, Washington, DC, 28 January 2015.
3. Development, Concepts and Doctrine Centre, *Joint Concept Note 2/17 Future of Command and Control* (Wiltshire, UK: UK Ministry of Defence, 2017).
4. Curtis E. LeMay Center for Doctrine Development and Education, "Centralized Control and Decentralized Execution," *Air University*, 27 February 2015, https://www.doctrine.af.mil/.