Decision Superiority

ABMS and the US Air Force Digital C2 Revolution

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Current US military platforms, many of which date back decades, are insufficient to combat developing adversary artificial intelligence and machine-learning technological innovations. The US Air Force's Air Battle Management System answers the challenge, delivering multidomain data capabilities to digitally connect the Joint Force across all domains.

Today's adversaries are developing the capability to use artificial intelligence and machine learning as force multipliers, rendering ineffective long-standing US military capabilities.[1] Achieving air superiority rests first upon achieving decision superiority. A fully-realized Advanced Battle Management System (ABMS), the US Air Force's component of the Joint all-domain command and control (JADC2) concept, will deliver multidomain secure processing and data management, connectivity, and applications to synchronize sensors, shooters, and networks for a digitally connected Joint Force in every domain.

Introduction

It may be surprising to learn that in the twenty-first century, the country with the most expensive and most prolific military on the planet still relies on PowerPoint slides and telephone calls to conduct real-time analyses of potential threats to the homeland. But the United States finds itself in this situation. If a potential threat from a Russian bomber appears on early-warning radar scopes, it could take more than 12 minutes for personnel from various desks at North American Aerospace Defense Command (NORAD) to coordinate information, build a slide presentation with only the most pertinent data, and present it to the officer in charge to determine if a threat truly exists.[2]

Lacking the tools to collaborate in a common environment, personnel cannot fuse the necessary data to recommend a response to the national command authority until it is finally presented to the colonel in charge of the operations floor.[3]

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1. A version of this article first appeared in *Defense & Sécurité Internationale*, HS-82 (Février-Mars 2022).
2. Amy Hudson, "Revamping Homeland Defense," *Air Force Magazine*, December 2, 2021, https://www.airforcemag.com/.
3. Brian W. Everstine, "Moving from Situational Awareness to C2," *Air Force Magazine*, October 1, 2020, https://www.airforcemag.com/.

Achieving air superiority has been the cornerstone of US military tactics since the end of the Cold War. But in today's world where adversaries are developing the capability to use artificial intelligence and machine learning as force multipliers, it no longer matters if the US military has the strongest force or the most accurate and powerful weapons. The ability to out-think (or in cyber terms, out-process) the adversary becomes the new goal; a nation's military cannot achieve air superiority without first achieving decision superiority.

Advanced Battle Management System

The US Air Force has been working for several years on ABMS, a program that will fix these issues and allow commanders to receive data fused from multiple sources rapidly. The Pentagon charged the Air Force to develop the capabilities the Joint Force needs to operate outside traditionally stove-piped domains in an effort to gain and maintain decision advantage across the competition continuum.[4] In March 2020, Major General Michael Fantini, the commander of the Air Force's Warfighting Integration Capability that was established to focus the service's innovation efforts, described decision advantage as "the collection, interpretation, and use of the information required to deter or win in tomorrow's conflicts." He stressed that success would "default to the side that is most connected across all domains: air, land, sea, space, and cyberspace."[5]

The ABMS is not just one thing or one platform to design. It has alternately been described as a network of networks and a system of systems; it is a new "internet of military things" that the Department of the Air Force's first-ever chief architect calls "an architecture to rule them all."[6]

The goal of ABMS is to replace the single paths of information coming to a central hub, such as in the NORAD example, with an environment where each system and operator works off the same shared data. A fully-realized ABMS will allow the delivery of multidomain secure processing and data management, connectivity, and applications to synchronize sensors, shooters, and networks, "connecting the right sensor to the right shooter" for a Joint Force that will be digitally connected in every domain for instantaneous awareness.[7] The concept was born from a recurring problem in the service—replacing decades-old aircraft.

4. Chairman of the Joint Chiefs of Staff (CJCS), *Competition Continuum*, Joint Doctrine Note 1-19 (Washington, DC: CJCS, June 3, 2019).

5. Mike Fantini and Jake Sotiriadis, "The New Imperative: Connecting the Joint Force with a Digital Advantage," Defense News, March 23, 2020, https://www.defensenews.com/.

6. Fantini and Sotiriadis, "The New Imperative."

7. John Tirpak, "Brown: USAF Has Been 'Asleep at the Wheel' Too Long When It Comes to EMS," *Air Force Magazine*, January 27, 2021, https://www.airforcemag.com/.

The New JSTARS

The E-8C joint surveillance and target attack radar system (JSTARS) aircraft was designed during the 1980s and first fielded in 1991, just as the Cold War it was originally designed to support was coming to an end. The platform provides airborne ground surveillance, battle management, and command and control capabilities, and the US Air Force is still flying 16 of the aircraft 30 years later. Hence, at Robins Air Force Base, Georgia, the units deployed continuously to the Middle East for 18 years, the second-longest deployment in US Air Force history.

In 2014, the Pentagon funded the research for a JSTARS replacement, and the defense industry had begun designing and testing new platforms as of 2015. But Air Force leadership realized that monolithic air and space operations centers, fed by aging JSTARS and E-3 airborne warning and control system (AWACS) platforms, were collectively not optimized for the speed, complexity, and lethality of future conflict. These "decades-old platforms" could not reliably leverage twenty-first-century technology, and "the supporting structures to enable future C2 either [did] not exist or require[d] maturation" to be fully effective.[8]

Further, the low-density/high-demand E-8C JSTARS and E-3 AWACS aircraft were known single points of failure. They were prime targets unable to operate for long in a peer competitor's battlespace, as sophisticated anti-access/area-denial capabilities, such as electronic warfare, cyber weapons, long-range missiles, and advanced air defense systems, were being developed.[9]

At the same time, the US military began to rethink its approach to Joint warfare. In 2016, the secretary of defense directed a new combat concept called "Air-Land Battle 2.0," an update to Cold War doctrine that would focus more on air, land, sea, space, and cyberspace operations.[10] This approach soon became known as multidomain battle in the US Army and multidomain C2 in the Air Force.

Senior US Air Force generals began to think about equipping both legacy and new aircraft, manned and unmanned, with emerging technology, communications equipment, and sensors to conduct the ground surveillance mission previously assigned to the single JSTARS platform.[11] For this system to be effective, it needed to process a huge amount of data, including information from US Allies and partners. Thus in 2018, funding for a replacement JSTARS was diverted entirely to the Air Force's new multidomain C2 program that would support a DoD-wide effort known as JADC2.

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8. John R. Hoehn, *Joint All-Domain Command and Control (JADC2),* In Focus (Washington, DC: Congressional Research Service (CRS), updated January 21, 2022), https://sgp.fas.org/.

9. Nishawn S. Smagh and John R. Hoehn, *Defense Capabilities: Joint All-Domain Command and Control*, In Focus (Washington, DC: CRS, April 6, 2020), https://crsreports.congress.gov/.

10. Sydney J. Freedburg Jr., "DepSecDef Offers Dough for Army Multi-Domain Battle," Breaking Defense, October 4, 2016, https://breakingdefense.com/.

11. Nathan Strout, "Congress Dealt ABMS a Blow but Experts See Progress That Could Help at Budget Time," C4ISRNET, June 15, 2021, https://www.c4isrnet.com/.

The Advent of JADC2

In September 2020, the assistant secretary of the Air Force (Acquisitions, Technology, and Logistics) noted, "It is a shame that people come into our service connected to almost everything in their personal lives, and they come work in a military where they're connected to almost nothing,"[12] This observation highlights how the military has lagged behind the civil sector when incorporating digital enhancements. Huge DoD contracts produced equipment designed to be sustained for decades with little regard to upgrades or interconnectivity with systems in the other services or even within their own. For example, the Air Force's prized fifth-generation aircraft platforms, the F-22 and F-35, were built with different communication networks that are incompatible and thus require a third platform (e.g., the ABMS Airborne Edge Node) to share data between the two.[13]

Department leadership realized technology is changing so rapidly that success in future combat will come to organizations with integrated, networked forces that can share the most information. Accordingly, in 2021 the Department of Defense crafted a strategy that allows commanders to rapidly understand the battlespace, direct forces faster than the enemy, and deliver effects to and through any domain necessary.[14] This concept was given the moniker Joint All Domain Command and Control.

The concept of JADC2 is as a DoD umbrella: The Joint Staff sets the policies, doctrine, requirements, and common standards for the data. At the same time, the services develop the applicable technology, which the Department of the Air Force is doing through ABMS. The Army and the Navy have JADC2 programs called Project Convergence and Project Overmatch, respectively, and the services are in the early stages of coordinating their efforts. In 2021, the Joint Chiefs of Staff chief information officer observed that the new JADC2 approach would "bring order to our efforts in the command and control arena to sense, make sense and act all at the speed of relevance."[15]

Despite the challenges, Secretary of Defense Lloyd Austin declared his intent to make JADC2 one of his top priorities while at the same time recognizing that bringing Allies and partners into this new realm was paramount to deter competitors.[16] Hence, data interoperability and data replication and distribution are crucial attributes of JADC2. Further, integrity and security of this data will be necessary to build trust among the services, Allies, and partners.

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12. William Roper, quoted in Yasmin Tadjdeh, "Advanced Battle Management System Faces Headwinds," *National Defense* (September 2020): 42, http://digital.nationaldefensemagazine.org/.

13. Brian W. Everstine, "Air Force's New Plan for ABMS: Smaller Budget, Clearer Schedule," *Air Force Magazine*, June 25, 2021, https://www.airforcemag.com/.

14. Jackson Barnett, "Secretary of Defense Austin Approves JADC2 Strategy," FEDSCOOP, June 4, 2021, https://www.fedscoop.com/secretary-of-defense-austin-approves-jadc2-strategy/.

15. Carol Collins, "DoD's JADC2 Strategy Leverages AI Technology, Common Data Fabric to Develop Digital Infrastructure," GOVCONWIRE, August 20, 2021, https://www.govconwire.com/.

16. Greg Hadley, "Pentagon Announces JADC2 Implementation Plan, Unclassified Strategy," *Air Force Magazine*, March 21, 2022, https://www.airforcemag.com/.

JADC2 Challenges

Joint all-domain command and control may be a hard concept to grasp as the terminology is not entirely grounded in hardware or software solutions but rather in " 'ethereal terms' " like "redundancy, resilient architecture, and information at the 'speed of relevance.'"[17] Establishing JADC2 is about looking at the realm of the possible, building for now while keeping an eye on emerging technologies and their easy integration into the capabilities of tomorrow.[18] But first, it must overcome three major hurdles.

First, the centralized C2 architecture is currently not resilient enough in the case of a high-intensity conflict wherein C2 nodes would be the first targets. Simply trading the JSTARS and AWACS aircraft with these nodes makes them the most attractive and vulnerable chinks in the US armor. Distributed network operations will thus be a key center of gravity for JADC2.

Second, for the system to process fast enough to "sense, make sense and act" with data from every domain, the US military must heavily rely on the unproven and not-yet-fully trusted concepts of artificial intelligence and machine learning. It is easier to build the user interface and inputs of a system; the industrial base has been doing this for decades. But now the military needs a system that automatically collects that data and feeds artificial intelligence to make the best decision.[19] Moreover, the commanders must trust the recommended data and decisions (a rather large paradigm shift for those born before the digital revolution).

Third, the individual services' size and range of inventory are so extensive (e.g., the Army, renowned for its ground forces, also has boats, airborne electronic warfare, and intelligence, surveillance, and reconnaissance assets) that each has become accustomed to operating virtually independently in the other domains. Retrofitting equipment on all these platforms to communicate with the other services may be cost prohibitive. Contrast this with smaller Allied armies that have no alternative but to work jointly. The French military, for example, has created technical solutions, such as Scorpion and Connect@ero, to communicate natively between services.[20]

While the Joint Staff established the overall concept of JADC2, Air Force Futures wrote the service supporting concept. The Department of the Air Force's ABMS cross-functional team leads a capability development campaign through which war fighters can discover the latest ABMS tools and concepts. Moreover, test flag exercises (including Orange, Emerald, and Black Flags) are executed every trimester to test the survivability

17. Ryan Dean and Nancy Temple, *CDA Institute: NORAD Modernization Forum, Third Report, JADC2/JADO* (Ottawa, ON: Conference of Defence Associations, September 9, 2020), 4, https://cdainstitute.ca/.

18. Dean and Temple, *NORAD Modernization*.

19. "Western Air Defense Sector Helps Shape ABMS," North American Aerospace Defense Command, September 21, 2020, https://www.norad.mil/.

20. Philippe Gros, "The Tactical Cloud: A Key Element of Future Combat Air System," Note, no. 19 (Paris: Fondation pour la Recherche Stratégique, October 2, 2019), https://www.frstrategie.org/en/.

and lethality of new capability releases. These exercises underscore the relevance of new weapons and tactics in a multidomain environment.

The end state of an operational ABMS is a command-and-control construct composed of processes and systems that compress decision-making cycles to converge effects across domains and enable integrated operations across the planet. Speed is the key. But even as units across the Air Force are dedicating efforts to bring ABMS to fruition, some challenges remain.

China produces vast amounts of data; this is, in fact, one of their instruments of power. To compete, ABMS will have to be agile, fast, and unpredictable by relying on a network-centric rather than platform-centric architecture. How will existing, legacy systems such as JSTARS process these terabytes of information? As technology improves, sensors, equipment, and operators can become oversaturated with data, causing latency issues. 80 percent of US Air Force aircraft are fourth generation or older; retrofitting them with modern command and control systems may cost too much. The challenge lies in enabling old platforms to communicate with fifth- and sixth-generation aircraft. One cannot play iTunes music files on a record player or try to link a Commodore 64 to the internet.

Enabling Allies and Partners

When the United States goes to war in the future, it will rely on its Allies and partners. The ability to count on these nations' militaries is a force multiplier and a decisive advantage the United States has over its competitors, but over-classification and other restrictive policies are tremendous obstacles to sharing data. The US military is determined, however, to leverage technology to increase accessibility and data sharing among Allies and partners, fusing that network of networks in the form of universal workstations in coalition operations centers.[21] The goal is to let software or artificial intelligence, using set rules, appropriately share information with the coalition partners who need it.

In order to transform strategic intent into reality, Ally and partner industries must work side-by-side to allow components (such as black boxes) to speak to each other or allow aircraft systems to decrypt and use data generated by other aircraft. A bigger challenge is ensuring that ABMS will be fully compatible with the federated mission networking being developed by NATO to streamline and standardize communications among the 30 member nations.[22]

France and the United States have always been "day-one" players; our air forces are like-minded and can do things that only a few can. The ability to connect our sensors for

21. James N. Mattis, *Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military's Competitive Edge* (Washington, DC: Department of Defense, January 2018), https://dod.defense.gov/.

22. "Federated Mission Networking," North Atlantic Treaty Organization, Allied Command Transformation (website), n.d., accessed May 12, 2022, https://www.act.nato.int/

the next fight needs to happen today so that our next-generation fighters and systems can operate smoothly in a new digital architecture.

Recent exercises, such as the May 2021 tri-nation Atlantic Trident in Mont-de-Marsan, have shown that even though the Rafale and F-35 can work together, they still cannot fully collaborate due to technological and classification issues. The ongoing collaboration between our air forces associated with the Rafale block F4 suggests better integration and a close future between the French assets and the F-35, envisioned as the quarterback of a future ABMS: the player who can enhance their teammates with the best view of what is going on in the field.

Additional Obstacles

Despite these and other encouraging signs, many external challenges remain with this program. Moreover, the Department of the Air Force also must overcome numerous internal hurdles to deliver ABMS on time. Beyond the difficulty of sharing information with foreign partners, the US Air Force has not solved the problem of communicating with the other services, each with its own indigenous communications systems. The Air Force is torn between making existing equipment and policies work or starting from zero and building a system from the ground up, delaying implementation by decades. The resulting dilemma can only be resolved by achieving a balance between the two options.

Implementation will come with a price. How will the US military convince its civilian leadership controlling military funding that this new ABMS program is important (on top of all the other "important" things)? Congress did not tell the Department of Defense to pursue JADC2 and kept the purse strings closed tight. The House Report on the FY2021 Defense Appropriations Act critiqued the Air Force's ABMS request, citing weaknesses in the program that included "the absence of firm requirements, acquisition strategy, or cost estimate, as well as the unclear definition of responsibilities of the Chief Architect of the Air Force and other offices involved in executing the ABMS program."[23]

In 2021, the USAF transitioned ABMS leadership to a new, Pentagon-based cross-functional team and shifted program responsibilities to the Department of the Air Force's Rapid Capabilities office. Messaging Department structural changes and priority shifts to Congress is critical to keeping the program funded.

Internal to the service itself, how can the Air Force balance ABMS with all the other must-do requirements such as paying for the next strategic nuclear bomber (B-21), additional F-35s, the Sentinel intercontinental ballistic missile, and a sixth-generation aircraft? Thus far, ABMS has the highest level of support. Despite all the programs competing for the same funding (including hypersonic and drone swarming), nuclear modernization

23. HR 166-453, *Department of Defense Appropriations Bill, 2021, Report of the Committee on Appropriations together with Minority Views [to accompany H.R. 7617*, 116th Cong. (July 16, 2020), 294, https://www.congress.gov/.

and ABMS are two of the chief of staff's top priorities.[24] Furthermore, Secretary of the Air Force Frank Kendall named ABMS one of his top seven programs needing renewed oversight to "improve the Air Force's ability to function as an institution."[25]

When General Charles Q. Brown Jr. became the 21st chief of staff of the US Air Force, his marching orders were to "Accelerate Change or Lose."[26] While the service battles with Congress over retiring old systems it no longer needs, it is simultaneously working to further Joint collaboration on ABMS. "To win the contested, high-end fight . . . we need to accelerate how we field critical technologies today. We cannot afford to slow our momentum on ABMS. Our warfighters and commanders must fight at internet speeds to win."[27]

Conclusion

This digital revolution will be a game changer for the United States and its Allies and partners. As early tests have demonstrated, ABMS will provide the decision superiority necessary to win tomorrow's high-speed engagements by giving our commanders a clear, robust, and instantaneous common operating picture. "What we showed . . . was the first time that combatant commands were in the same data cloud architectures and made decisions about posturing forces . . . results were seen in seconds instead of days."[28] The Department of the Air Force may finally be able to discard those PowerPoint slides at NORAD after all. ✈

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24. *Department of the Air Force Posture Statement Fiscal Year 2022, Presentation to the Committees and Subcommittees of the United States Senate and the House of Representatives*, 117th Cong. (June 17, 2021) (Statement of Acting Secretary of the Air Force John P. Roth, Chief of Staff of the Air Force General Charles Q. Brown, and Chief of Space Operations, General John W. Raymond), 2–3.

25. "Kendall's Top Seven Priorities to Cope with Peer Adversaries Include Two New Aircraft," *Air Force Magazine*, December 9, 2021, https://www.airforcemag.com/.

26. Charles Q. Brown Jr., *Accelerate Change or Lose* (Washington DC: US Air Force, August 2020).

27. Stephen Kuper, "US Air Force Demonstrates ABMA Joint Force Capability," Defense Connect, September 7, 2020, https://www.defenceconnect.com.au/.

28. Everstine, "Situational Awareness."