



Marines with Marine Corps Forces Cyberspace Command observe computer operations on 5 February 2020 in the Cyber Operations Center at Fort Meade, Maryland. (Photo by Staff Sgt. Jacob Osborne, U.S. Marine Corps)

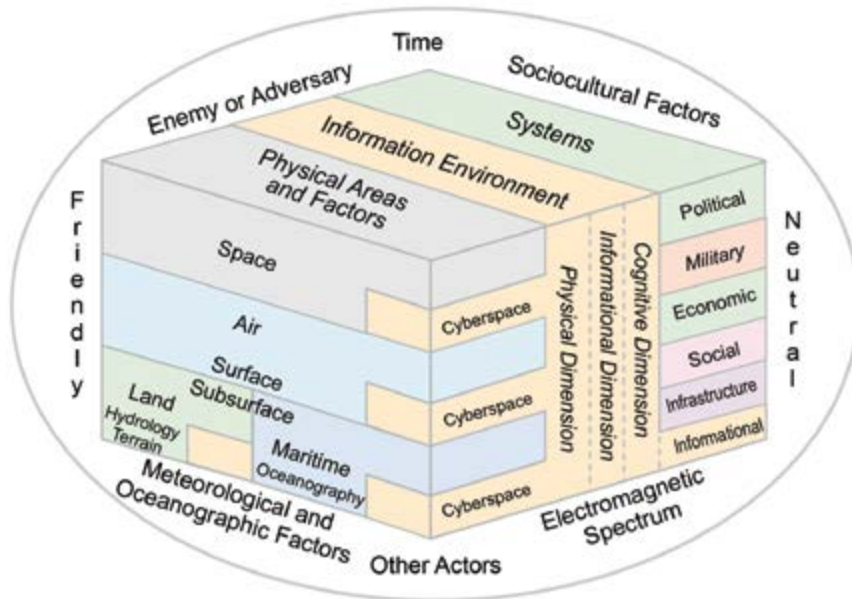
Conceptualizing Information Advantage Using Boyd's OODA Loop



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Some of the more recent conflicts in the twenty-first century, such as Crimea in 2014, the second Nagorno-Karabakh war in 2020, and the unfolding Russo-Ukrainian War in 2022, have all demonstrated the importance of information on the



(Figure from Joint Publication 5-0, *Joint Planning* [2020])

Figure 1. Holistic View of the Operational Environment

battlefield.¹ While understanding information is crucial across all levels of war and throughout the conflict continuum, it is a challenge to conceptualize at the

(OE). Moreover, the draft ADP 3-13 details how information advantage is achieved through five lines of effort. While the Army’s new model of the OE is

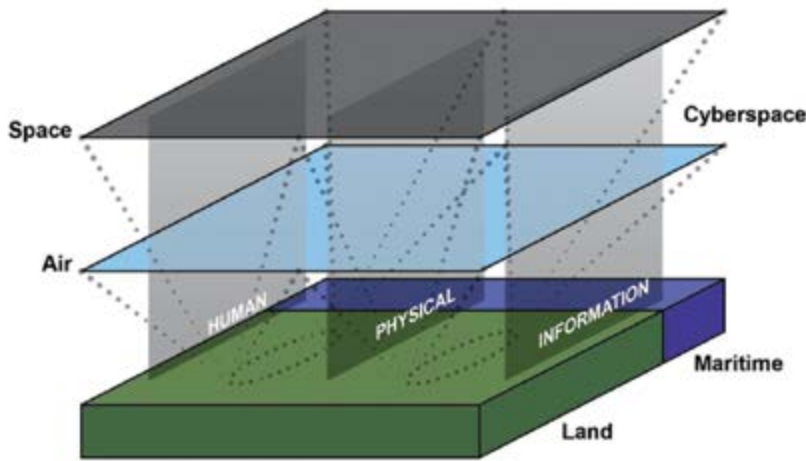
operational and tactical levels. With the move to multi-domain operations (MDO), supported by forthcoming doctrinal publications—Field Manual (FM) 3-0, *Operations*, and Army Doctrine Publication (ADP) 3-13, *Information*—the Army is beginning to grapple with how to achieve information advantage to defeat enemy forces and achieve objectives.

To successfully meet the requirements demanded of MDO, namely decision dominance, information will need to become a central aspect of the planning process across all warfighting functions. To ensure this, the draft FM 3-0 presents a holistic approach to visualizing the operational environment

Table. Comparison of Joint/Service Definitions of Information Advantage/Information Warfare (IA/IW)

Service	General IA/IW Concept
Joint	Information advantage is a state wherein an actor possesses the initiative in terms of situational understanding, behavior, and decision-making with respect to another.
Air Force	Information warfare is the employment of military capabilities in and through the information environment to deliberately affect adversary human and system behavior and preserve friendly freedom of action during cooperation, competition, and conflict.
Army	Information advantage—A condition when a force holds the initiative in terms of the use, protection, denial, or manipulation of information to achieve situational understanding, improve decision making, and affect relevant actor behavior through the coordinated employment of relevant military capabilities.
Marine Corps	Information advantage is an exploitable condition resulting from one actor’s ability to generate, preserve, deny, and project information more effectively than another.
Navy	Information warfare is the integrated employment of Navy’s information-based capabilities to degrade, deny, deceive, or destroy an enemy’s information environment or to enhance the effectiveness of friendly operations.

(Table by author)



(Field Manual 3-0, *Operations* [forthcoming])

Figure 2. Emerging Army Concept of the Operational Environment

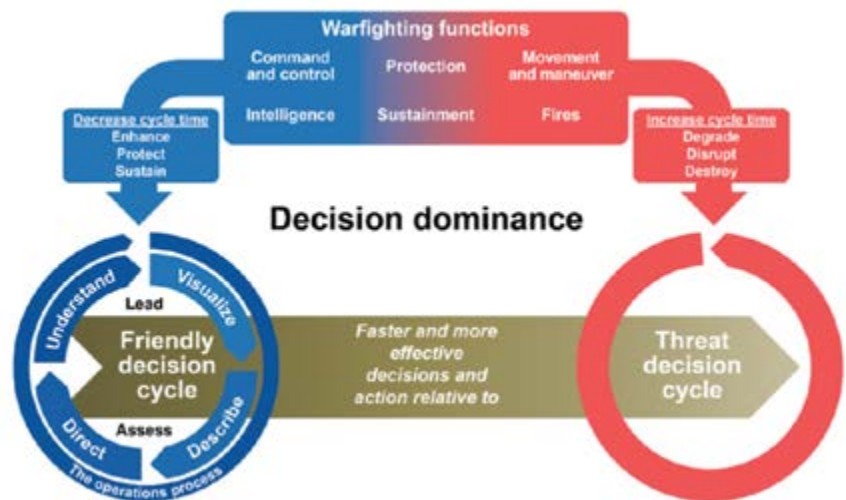
from the joint perspective is currently receiving an update with an upcoming release of Joint Publication 3-04, *Information*, in part spurred due to the addition of information as a joint function in 2017. This update does not change the core concept of how the joint force understands the information environment; however, there are minor changes.³ In contrast, the Army’s emerging concept of the OE is much more helpful in integrating information. As seen in figure 2, the Army model is truly holistic. Instead of a separate information environment, the Army sees physical, human,

an improvement from the joint force perspective, there needs to be a better way to conceptualize the role information plays in each warfighting function. Updating the Army’s framework allows for information to be integrated across warfighting functions while allowing agile and informed decision-making at all levels in accordance with the principles of mission command. This updated framework unleashes the full potential of information in the planning process and ultimately mission execution.

and informational dimensions as present in each warfighting domain. In other words, there is no need to have a separate information environment because information is present and persistent throughout each domain. While the idea that the information environment is completely integrated with the OE is expressed in the joint model, the deliberate removal of an explicitly named “information environment”

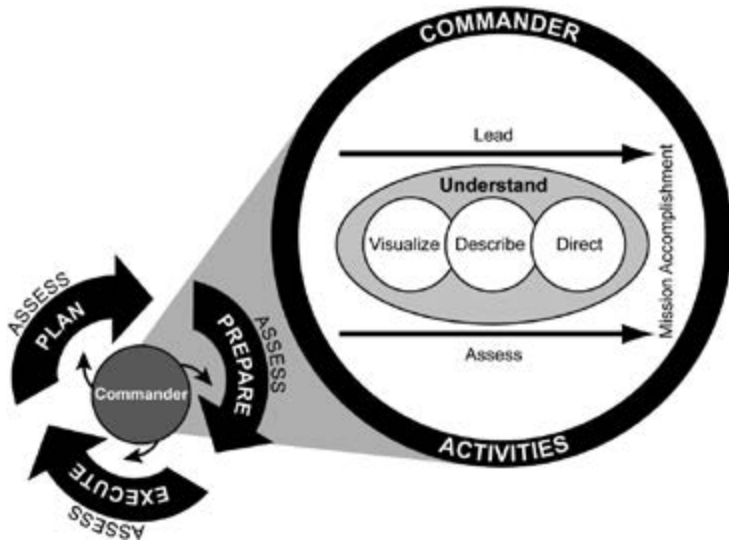
Understanding Information in the OE

The current joint view of the operational environment is best presented in Joint Publication 5-0, *Joint Planning*, figure 1 (on page 110). One important distinction is that in this model describes the information environment (IE) as a distinct portion of the OE. Additionally, the joint model breaks the information environment down into three dimensions (physical, informational, and cognitive) and encompasses the cyberspace domain.² Information



(Army Doctrine Publication 3-13, *Information* [forthcoming])

Figure 3. Decision Dominance and the Competition of Decision-Making Cycles



(Figure from Army Doctrine Publication 5-0, *The Operations Process* [2019])

Figure 4. The Operations Process

by the Army helps to provide clarity and prevents stovepiped information capabilities. Ultimately during MDO, it is through these dimensions that the military can achieve relative advantage over the enemy, including information advantage.

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Approaches to Information Advantage

Regardless of the approach to the OE or the IE, one thing is clear: information is a part of the planning process and is critical to effective decision-making. This can be seen in the definitions that all the services use to describe the role of information at the operational and tactical levels. However, just like the subtle differences of the joint and Army views of the OE, there are some clear distinctions between the joint force and the services into what constitutes

information advantage.⁴ The table (on page 110) shows the various approaches of the services and joint force in understanding information advantage.⁵

Despite the differences, at the heart of all these definitions is the idea that information is critical to the decision-making process. However, also important is that the definitions talk about decision-making in the context of competition with another actor. The ability to facilitate friendly decision-making while simultaneously disrupting the adversary's decision-making is the heart of information advantage. This idea of competition

is clearly laid out in the graphic representation of the Army's concept of decision dominance as presented in the draft FM 3-0 and seen in figure 3 (on page 111).

As depicted, the Army approach uses the operations process, specifically the commander's role in the operations process (understand, visualize, describe, direct, lead, and assess, or UVDDLA), to describe this decision-making cycle. As ADP 5-0, *The Operations Process*, outlines, the operations process is the framework for command and control, with a central role of a commander being to "drive the conceptual and detailed planning necessary to understand their OE; visualize and describe the operation's end state and operational approach; make and articulate decisions; and direct, lead, and assess operations"; this can be seen in figure 4.⁶ Importantly, ADP 5-0 notes that a "goal of the operations process is to make timely and effective decisions and to act faster than the enemy."⁷ However, using UVDDLA in the operations process as the framework for information advantage is flawed for several reasons. First, and most importantly, while the heart of the operations process is about making decisions, the process itself gives no additional insights into how decision-making occurs. Therefore, the linkages to the warfighting functions, seen in figure 3 as either enhancing or degrading decision cycles, are not readily apparent. The warfighting functions are shown to have a role but left with no indication into how to fulfill that



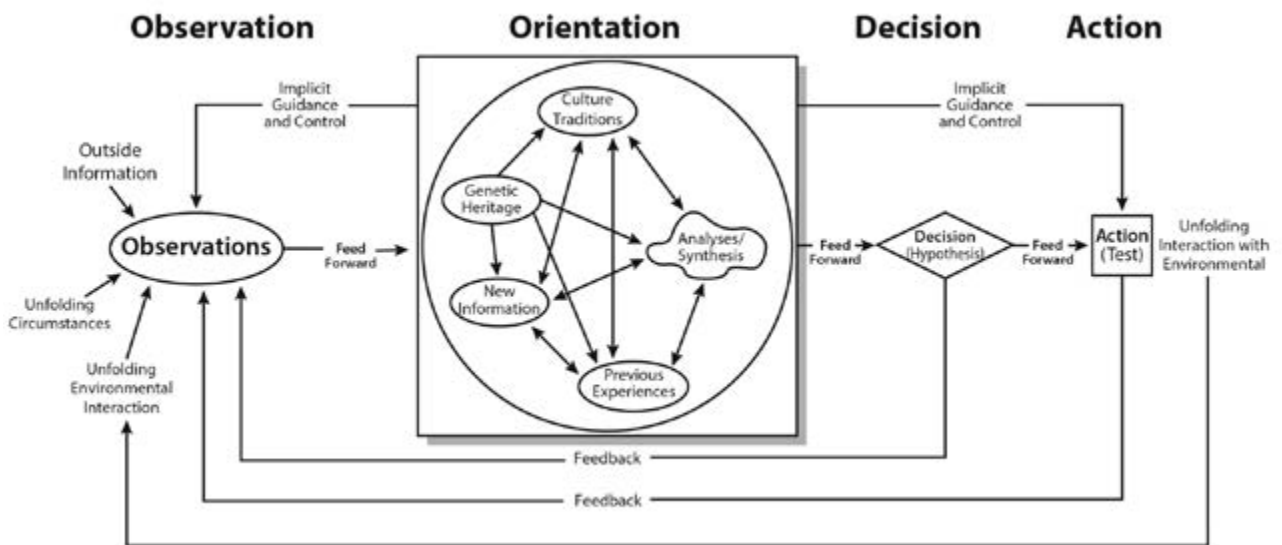
(Figure from AFC Pamphlet 71-20-9, Army Futures Concept for Command and Control 2028: Pursuing Decision Dominance [2021])

Figure 5. Sense, Understand, Decide, Act, Assess Framework

role. Finally, unlike other decision-making frameworks, the operations process is tied directly to the Army’s method of command and control. This lack of generalizability means that it does not have the flexibility to be mirrored and applied to understand the adversary’s decision-making process. It should be noted that in early iterations for the definition of decision dominance, the operations process was not what was used to describe the decision-making process. In his *Chief of Staff Paper #1*, Gen. James McConville notes that “decision dominance is a desired state in which commanders sense, understand, decide, act, and assess [SUDAA] faster and more effectively than their adversaries.”⁸ This SUDAA process is graphically depicted in the Army Futures

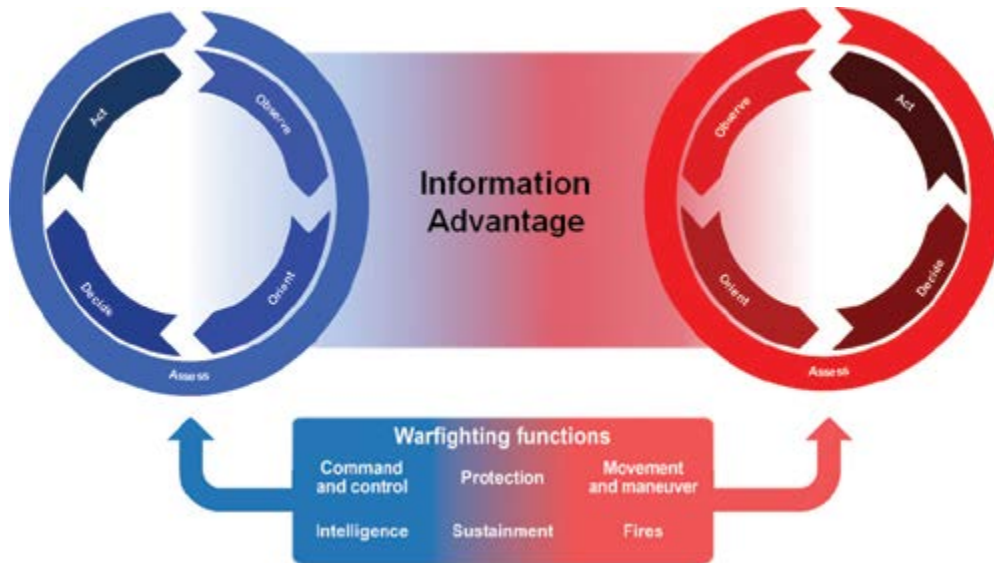
Command pamphlet on decision dominance and seen in figure 5. Using this definition has several advantages over using the operations process. First, the role of information into making more effective decisions is easily applied to the “sense and understand” portions of this process. Second, while the process itself used by commanders during command and control, the SUDAA process is less strictly tied to solely the commander.

Despite these improvements over the operations process, the idea of SUDAA is still unrefined. However, it clearly has inspiration from another decision-making framework that is more developed and can also be applied across warfighting functions and all organizational levels, the



(Figure from John A. Boyd, *A Discourse on Winning and Losing*)

Figure 6. Expanded Version of Boyd's OODA Loop



(Figure by author)

Figure 7. Updated FM 3-0 Framework with OODA Loop

orient-observe-decide-act (OODA) loop created by retired Col. John Boyd.⁹

Using the OODA Loop to Achieve Information Advantage

Boyd’s OODA loop is often simplified; however, the full version, seen in figure 6 (on page 113), highlights the complexity in decision-making. This complexity is concentrated on the orientation step, which Boyd referred to as the “big O.” The importance of the orientation step is summarized by Grant Hammond from the Air War College:

It is the amalgamation of genetic heritage, cultural traditions, previous experience, education, and new information and the analysis and synthesis that follows. These are a complex set of filters that condition action and reaction to various stimuli. In processing all this information a menu of responses is developed. These responses are then sorted, analyzed, and synthesized for a Decision on a preferred procedure.¹⁰

Also notice that the orientation step is guiding and controlling how people observe and act within their environment. The orientation as outlined nests perfectly with the Army’s understanding of the human dimension. As outlined in the draft ADP 3-13, “The human dimension encompasses individual reasoning, emotion,

and behavior as well as the broader social contexts of group interaction including culture, group identity, and societal power dynamics.”¹¹

By integrating the OODA loop framework into the existing idea of information advantage, the focus of information’s role in the decision-making process is clearer. This updated framework can be seen in figure 7. While the OODA loop has ongoing feedback between each step, information plays an outsized role in the observe and orient steps. Therefore, by focusing on these steps in particular, the Army is better able to conceptualize how to integrate the various warfighting functions into the planning process to achieve information advantage.

This framework allows for each warfighting function to see their role more clearly in enhancing or degrading decision cycles. For example, cyber electromagnetic activities can be used to degrade the observation portion of the adversary (e.g., electromagnetic attack to jam enemy radars) as well as the orientation step (e.g., cyber effects to manipulate data). As the above example shows, sometimes these roles are very clearly defined. No one in the intelligence warfighting function will be surprised by their impact in supporting the observe and orient steps of the friendly OODA loop. However, other warfighting functions have more subtle impacts in the information dimension. Take for example, sustainment’s impact on the adversary’s decision-making when the Army updates

its Army pre-positioned stocks (APS). It complicates the enemy's observation by making Army supply and movement more rapid. Similarly, the use of an APS can impact and enemy's orientation, as it requires them to now factor APS capabilities into their decision-making. These seemingly minor disruptions to the adversary's decision-making cycle might be enough to gain an advantage for a short period of time. Ultimately, incorporating the OODA framework means that during planning, each warfighting function should consider how they influence the observation and orientation steps.

Conclusions

To fully realize the requirements of MDO, the Army needs to understand how to achieve information advantage. This understanding begins with a solid framework. The update of FM 3-0 and the upcoming release of ADP 3-13 are the correct first steps. However, for any information advantage framework to be adopted, it needs to be clearly linked to the OE and the warfighting functions. Without this linkage, planning for information advantage

will remain stovepiped to those communities who are used to dealing with information, as opposed to across the entire force as demanded. While the Army's approach to the OE is an improvement over the current model used by the joint force, the draft ADP 3-13 falls short in offering a framework that clearly integrates information and the various warfighting functions. The Army needs an updated framework incorporating the decision-making theories of John Boyd and his OODA loop. Warfighting functions work to enhance friendly decision cycles or degrade adversary decision cycles. By framing the core goal of information advantage as an enabler to more effective decision-making, military members can conceptualize their impact in the information dimension regardless of warfighting function. This impact, and most of information advantage activities, are focused on the observe and orient steps of the OODA loop. This clear focus, nesting within a decision-making framework and linked to the imperatives of MDO, enables each warfighting function to effectively plan for information advantage in the complex operational environment. ■

Notes

1. Marie Baezner and Patrice Robin, *Hotspot Analysis: Cyber and Information Warfare in the Ukrainian Conflict* (Zurich: Center for Security Studies, 2018), accessed 12 July 2022, https://css.ethz.ch/content/dam/ethz/special-interest/gess/cis/center-for-security-studies/pdfs/20181003_MB_HS_RUS-UKR%20V2_rev.pdf;
- John Antal, "Top Attack: Lessons Learned from the Second Nagorno-Karabakh War," 1 April 2021, in *The Convergence*, U.S. Army Training and Doctrine Command, podcast, accessed 12 July 2022, <https://madsicblog.tradoc.army.mil/317-top-attack-lessons-learned-from-the-second-nagorno-karabakh-war/>;
- "Information Warfare in the Russia-Ukraine Conflict," 29 March 2022, University of North Carolina, podcast, accessed 12 July 2022, <https://law.unc.edu/news/2022/03/information-warfare-in-the-russia-ukraine-conflict/>.
2. Joint Publication (JP) 3-13, *Information Operations* (Washington, DC: U.S. Government Printing Office, 27 November 2012), I-2, accessed 12 July 2022, https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_13.pdf.
3. JP 3-04, *Information* (Washington, DC: U.S. Government Publishing Office [GPO], forthcoming). There is a minor change in verbiage from JP 3-13. The dimensions of physical, informational, cognitive are now referred to as the physical, informational, and human aspects of the information environment.
4. The Air Force uses the joint definition of information advantage, so its more widely known definition of information warfare is provided. Similarly, the Navy uses information warfare as its umbrella term for the ideas discussed.
5. Defined in the "Joint Concept for Information Advantage" available on SIPR, cited in Deputy Chief of Staff for Strategy, Integration, and Requirements (AF/A5/7), "United States Air Force

- Operating Concept for Information Warfare" (Washington, DC: U.S. Air Force, 16 March 2022), 4; Air Force Doctrine Publication 3-99, *The Department of the Air Force Role in Joint All-Domain Operations* (Washington, DC: U.S. GPO, 19 November 2021), accessed 13 July 2022, https://www.doctrine.af.mil/Portals/61/documents/AFDP_3-99/AFDP%203-99%20DAF%20role%20in%20ADO.pdf;
- Field Manual (FM) 3-13, *Information Operations* (Washington, DC: U.S. GPO, December 2016), accessed 12 July 2022, https://armypubs.army.mil/epubs/DR_pubs/DR_a/pdf/web/FM%203-13%20FINAL%20WEB.pdf;
- Marine Corps Doctrinal Publication 8, *Information* (Washington, DC: U.S. GPO, June 2022), 1.
6. Army Doctrine Publication 5-0, *The Operations Process* (Washington, DC: GPO, July 2019), 1-4, accessed 13 July 2022, https://armypubs.army.mil/epubs/DR_pubs/DR_a/ARN18126-AD-P_5-0-000-WEB-3.pdf.
7. Ibid.
8. James C. McConville, *Army Multi-Domain Transformation: Ready to Win in Competition and Conflict: Chief of Staff Paper #1* (Washington, DC: Headquarters, Department of the Army, 16 March 2021), 8, accessed 13 July 2022, <https://api.army.mil/e2c/downloads/2021/03/23/eeac3d01/20210319-csa-paper-1-signed-print-version.pdf>.
9. John Boyd, *A Discourse on Winning and Losing* (Maxwell, VA: Air University Press, 2018), 384. Of note, Boyd originally planned to use "sense" instead of "observe" but thought "SODA" Loop would have less credibility.
10. Ibid., 384-85.
11. FM 3-13, *Information Operations*, 2-8. The cited quote will remain the same in the forthcoming ADP 3-13, *Information*.