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A NEW BATTLE COMMAND ARCHITECTURE FOR MULTI-DOMAIN OPERATIONS

Countering Peer Adversary Power Projection

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Countering Peer Adversary Power Projection

The 2018 National Defense Strategy shifts strategic focus to preparing for high-end conflict against peer adversaries – specifically Russia and China – where the Joint Force will face acute time, distance, and anti-access and area-denial (A2/AD) operational challenges. Halting Russian or Chinese aggression and degrading emplaced A2/AD networks will require the United States and its allies to rapidly plan and execute operations using capabilities from all domains, Services, and allies in a synchronized, cooperative, and efficient manner.

Realizing simultaneous cross-domain operations will require a new approach to battle management and the supporting command and control (C2) architecture required to rapidly find, fix, and finish large sets of adversary mobile targets. Today, such synchronization at speed is difficult if not impossible. Military decision makers are dependent on legacy C2 systems impeded by multiple barriers, including those between domains, classification levels, the Services themselves, and our allies.

Such barriers exist for both sense-making and decision-making processes. For sense making, the Department of Defense (DoD) and Intelligence Community (IC) are unable to easily combine disparate data sets to improve situational awareness or to provide better information to strategic, operational, and tactical decision makers. For decision making, effectors are divided by Service or domain with limited ability to understand the full range of capabilities available to achieve desired effects. One particularly compelling example of this challenge is meeting the rapid time lines required for finding, fixing, and engaging the relocatable systems on which competitors increasingly rely as a means to project power and create robust A2/AD defensive networks.

Joint Force Not Joint Enough

Employing sensors and effectors in domain- and Service-agnostic ways could dramatically shorten the time it takes to engage multiple relocatable targets. Solving the time problem enables the Joint Force to attack and maneuver faster than Red can operate. This acceleration is one of the central animating ideas behind joint all domain command and control (JADC2). Yet, despite multiple years of focused energy and attention on this problem, DoD has made far too little progress developing and fielding the capabilities needed to make JADC2 a reality. But JADC2 is more than just new equipment. Moving toward true "multi-domain operations" will of necessity drive development of a new approach to C2, as the existing approach is still a "system of deconfliction" rather than a "system of integration."

Developing and operating robust and truly integrated C2 systems will require overcoming a number of significant obstacles. These include:

Lack of common force design. One of the most significant challenges is that the current Service-based model for development and acquisition is not conducive to developing or fielding

Joint C2 capabilities. No mechanism currently exists within DoD for creating and implementing the Joint capabilities needed by the Combatant Commands, as each Service designs to a different high-end problem unique to its domain. In the absence of a common force design, each Service focuses largely on its own specific needs as it develops various elements of a path forward for JADC2.

Platform-centric acquisition. DoD's acquisition system is optimized to develop and field exquisite platforms, and industry is incentivized to pursue large procurement contracts with lengthy life cycle operations and maintenance tails. Developing the communications networks and enabling connectivity between platforms and the C2 capabilities needed to effectively leverage those platforms is not always seen as lucrative from an industry perspective. Moreover, it can be difficult for advocates in Congress to back ethereal "connections" and "data" over more tangible and energizing platforms.

Service-based authorities and operations. Simply put, the individual Service components are averse to loosening control over their own capabilities. Handing control of assets from one domain to a commander from another is alien to their way of operating. Existing organizational structures in the various Combatant Commands reinforce this Service-based approach to operations.

Insufficient focus on C2 and technological myopia. There is a common belief that JADC2 is about bringing all the data together, labeling it, and applying artificial intelligence (AI) via an agile software approach. This approach will neither work nor provide the needed capability; it is unlikely there will be enough bandwidth in contested or denied environments to move all the data to every system and platform involved in high-end operations. Moreover, most data is not relevant to most users. Many users and systems would be simply overwhelmed by the vast quantity of data. There must be some framework to determine who gets what information. While enhancing interoperability and connectivity across systems is a critical enabler for JADC2, it is not a complete solution to the C2 challenges themselves. C2 is not just about situational awareness, it is about how and by whom decisions are made. Developing new technologies and fielding new capabilities will not be enough to enable JADC2; changes in concepts of operation, authorities, and organizational constructs will also be needed.

Experimentation, Concept Development, and Technology Enablers

New concepts and approaches to enable JADC2 must focus on operating in new ways that bring the Joint Force's suite of capabilities together from across all domains in a coherent and effective manner. They must describe how the Joint Force can organize more effectively to perform the necessary C2. They must describe the roles of theater, operational, and tactical-level commanders and decision makers in performing their duties. And they must describe what capabilities and enablers will come from the Services, national authorities, the IC, and partner nations. Obviously, new concepts will need to be developed and improved through experiments designed to help determine which Joint C2 tactics, techniques, and procedures are most effective for employing specific capabilities during rapid and dynamically adaptive operations.

Experimentation cannot proceed unless there are both new concepts and technology to experiment with. MITRE believes that before DoD can make real progress on turning JADC2 into an operational

reality, it must decide on some guiding core tenets, which can then be used as a basis for experimentation and prototyping.

Organization around function. A commander who wants to destroy a target should be able to rapidly consider all available capabilities in order to determine which would be most effective. For example, the commander must know whether Army long-range fires or Navy sea-launched Tomahawk cruise missiles are the right tool for a specific target set. To achieve this type of optimization, operational-level C2 might be organized around a dynamic set of critical warfighting missions, such as ground surveillance, fires, offensive space control, etc., rather than around domain-specific component commanders or Service-oriented operations. More importantly, to operate at speed, those operational-level C2 elements need to have the authority to task any and all assets relevant to performing their associated function as determined by the Joint Force Commander – irrespective of the Service or domain from which that capability is drawn from.

Operational "task brokering." One approach to enabling these "mission function" -based operational decision makers is "task brokering." To respond to real-time opportunities and exploit new information, operational-level C2 elements might allocate tactical capabilities via a dynamic marketplace. A complete set of "mission function" units or capabilities would act as "sellers," offering the system the effects they are able to produce at any given time. The full set of tasks to be assigned by that operational-level C2 element would then "buy" these capabilities, optimizing for variables such as time, opportunity cost, probability of success, survivability, etc.

Task performance assessments. JADC2 will increase the complexity of decision making, challenging leaders to possess the breadth and depth of knowledge needed to understand when and where capabilities can be most effectively employed. One way to help address these challenges, and to enable the brokering described above, is to dynamically develop estimates of unit, capability, or platform performance against potential tasks. This would help to isolate the need at the operational level of decision making, these estimates would help isolate the need for first-hand understanding of how well a particular asset might perform a given task from the decision-making process.

Determining mission performance estimates might be done by the tactical systems themselves or by their command elements. In cases where the tactical layer cannot provide an assessment for a large number of tasks, say for an Army ground unit too busy with combat to be answering task performance queries, a specialized system sitting between the tactical and operational levels could be used to provide rough estimates.

By automating the process of continually estimating and updating expected mission performance, estimates from a wide range of systems and capabilities can be combined and presented in a way that allows decision makers to make informed choices. In this way, Army or Air Force officers could intelligently create plans relying on Navy systems and capabilities and vice versa.

Using these performance estimates may also allow for systems at different security levels to be coupled together. The details of the classified system performing the mission do not need to be made available to incorporate the classified system into the plan. The performance estimate could be expressed at a lower security level than the information used to generate it. Alternatively, estimates could be completely decoupled from the systems with which they are associated.

Interoperability enabled by "loose couplers." Instantiating JADC2 relies on rapidly and dynamically communicating between numerous dissimilar capabilities and platforms. Today, however, many of the relevant systems cannot be connected across Services and security levels or with partner and allied systems. MITRE proposes "loose couplers" as an information design approach to enable widespread interoperability in a lightweight way. These loose couplers would be derived by determining the needs for task brokering and performance assessments described above.

As opposed to universal or complete interoperability, loose coupling involves exchanging a minimal amount of structured, high-impact information across a diverse set of users. Such an approach is ideal for distributed networks in which there are a variety of heterogeneous participants, each of which can benefit in some way from the core data in the coupling messages. What this approach gives up in data richness it makes up for in flexibility and efficiency; it has the potential to connect the widest number of possible systems.

Under this approach, data from different domains, Services, or security levels can be fused together in combinations relevant for operational C2, minimizing the burden on data transport systems. Moreover, loose coupling allows non-kinetic capabilities to be represented by the same set of performance messages, improving their integration into conventional operations.

Artificial intelligence for operational decision making. Adopting an approach using performance estimation and task brokering may enable the use of AI for operational decision making. If modeling and simulation can be used to rapidly run conflict scenarios over and over again, it may be possible to generate data to train ML algorithms capable of more efficient and effective resource task pairing. Those ML algorithms need large data sets of decisions and their outcomes for model training and testing purposes. The performance estimates described above could be used as an input to a ML or AI system. The outcome of the scenario could be used as the feedback mechanism to drive training of the ML network. MITRE is currently experimenting with the concept of task brokering, and there is convincing evidence that introducing AI into this process will lead to significantly enhanced effectiveness.

Context-based displays for situational understanding. As the complexity of the decision space for operational level C2 increases, and as the role of the machine in enabling better decisions grows, the need for intuitive decision-making displays and interfaces grows as well. New displays will be needed to allow an operator to rapidly analyze different options and courses of action (COAs), select and modify a COA, and track execution of the COA so they can intervene as needed. The operator must be able to compare machine-developed plans to a set of lower efficiency alternatives considered and not selected by the machine. They will also need to be able to modify those plans for themselves, seeing how individual choices might affect the rest of the plan and the chances for success of the mission, set of missions, or even the overall campaign.

Operators will also need the ability to dive deep into the automated decision-making process when needed, helping build trust and confidence when they are forced to operate without those deep dives. These new displays should have the ability to be preconfigured based on the role of the operator, but they must also have the built in flexibility to be reconfigured to meet the desires of the individual.

These core tenets, technical and organizational, must be addressed to enable progress toward making JADC2 a reality. MITRE is working to make advances in all of them. Other areas, such as incorporating larger strategic objectives into theater-level and operational decision making, coordination of multi-domain effects at the tactical level, and better control of the electromagnetic spectrum also need to be addressed.

Path Forward

Developing, fielding, and operating effective JADC2 will require robust experimentation and concept development at a variety of levels across both users and developers. Such experimentation should help identify the changes in authorities and organizational structures needed to execute JADC2. And experiments must include perspectives from industry, Combatant Commands, Service Components, warfighter schools, and doctrine developers.

But user experimentation with the limited C2 technology and systems available today will not by itself drive change. Making real progress will require DoD to adopt an initial set of core tenets for experimentation and prototyping. The department must then use those core tenets to unify activities across the national security enterprise.

Finally, an initial focus on specific mission challenges will help accelerate progress. Finding and engaging high-value, relocatable ground systems within the rapid time lines needed for success is a critical challenge in many operational scenarios and fertile ground for making progress to develop and field JADC2.

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