PREPARING FOR CONTESTED WAR:

IMPROVING COMMAND AND CONTROL OF DYNAMIC TARGETING

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Abstract

In a contested war, the joint force will need to identify, nominate, and strike a greater number of targets in a shorter amount of time than currently required. These conditions will stress the current command and control of a dynamic targeting process characterized by lengthy target development timelines that allow for high-confidence, centralized decision making. The traditional Air Force solution to this problem is to increase the targeting manpower and scope of responsibility at the AOC. However, the AOC will not likely achieve the desired level of "full-spectrum awareness" against a massed enemy at the speed required to support centralized decision making. Additionally, centralized decision making tends to increase decision time but also decreases risk. This essay proposes an alternate course of action that relies less on increased manpower and improved information technologies such as big data analytics, and more on decentralizing authorities to multiple, distributed entities. To shorten the dynamic targeting kill chain in a contested war, the Air Force should accept risk and adopt a flexible command and control concept that decentralizes target engagement authority by placing target identification, nomination, and strike tasking functions as close to the source of intelligence as possible.

Introduction

The Joint Force is unprepared for dynamic targeting operations in a future, contested war with a peer or near-peer adversary. Operations in contested environments are not new, but "U.S. joint forces have not been called upon to face [that environment] in recent decades."[2] In Iraq and Afghanistan, joint forces developed a command and control (C2) process designed to facilitate dynamic targeting of adversaries within uncontested domains.[3] However, two conditions of a future war, anti-access and area-denial (A2/AD) and a greater number of targets, will complicate the current C2 of dynamic targeting process. Adversary use of anti-access and area-denial (A2/AD) technology and strategy will require joint force standoff resulting in longer strike timelines. Additionally, the joint force will face more mobile, survivable, and numerous target sets in a war with a peer or near-peer competitor state than it does in current irregular wars.[4] Adversary systems will directly threaten joint force power projection and theater operations centers, and as a result, analysts will need to process a higher volume of information in order to identify and discriminate targets in a shorter amount of time than the current permissive environment allows. These conditions will stress the current C2 of a dynamic targeting process characterized by lengthy target development timelines that allow for high-confidence, centralized decision making. In order to mitigate this stress, the joint force should adopt a flexible C2 process that pushes target engagement authority (TEA) to the lowest level possible across distributed nodes within the enterprise.

This paper will begin with a brief description of A2/AD and the conditions likely to characterize a future war. Next, I will describe the current C2 of dynamic targeting processes and assess the impact of centralization on the speed of the kill chain. I will then examine the implications of the current state of dynamic targeting to joint operations in a future, contested war. Finally, I will demonstrate how adapting the C2 of dynamic targeting by pushing TEA to multiple distributed nodes below the joint task force (JTF) or joint force air component commander (JFACC) level can increase the speed of decisions required to shorten the kill chain.

Conditions of a Future War

In a war with a peer or near-peer adversary, the joint force will face improved A2/AD technologies and strategy as well as an increased number of targets in the battlespace. Anti-access is defined as "those actions and capabilities, usually long-range, designed to prevent an opposing force from entering an operational area."[5] Area-denial "refers to those actions and capabilities…designed not to keep an opposing force out, but to limit its freedom of action within the operational area."[6] The Joint Operational Access Concept (JOAC), released by the Department of Defense (DoD) in 2012, defines the joint force objective in an A2/AD conflict as "operational access in the face of armed opposition."[7] However, it will be increasingly difficult for ISR assets to locate threats in this environment before they can be used to deny joint force access. The proliferation of advanced surface to air missiles will make ISR platforms less survivable resulting in increased sensor standoff ranges and a demand for stealth sensors and sensor-shooters.[8] However, area-denial strategies will limit the time stealth platforms can maintain access, impeding the ability to maintain target tracks and necessitating a rapid dynamic targeting kill chain. Standoff weapons will be preferred in situations of limited joint force access in scope and time. However, the use of these weapons will further lengthen the kill chain due to time of flight constraints. These conditions will stress the C2 of dynamic targeting because the joint force will have less time to identify and locate imminent threats and will be forced to use less responsive standoff strike assets when the use of stealth is untenable. These problems will be compounded by the fact that the joint force will have an increased number of targets to identify and strike in a shorter amount of time than currently required.

The future threat environment will be characterized by "fully integrated and layered advanced anti-access/area-denial systems."[9] The joint force will thus require near simultaneous strikes on multiple targets in order to gain access. Competitor state acquisition of an increasing number of ballistic missiles, hypersonic weapons, and surface to air missiles further indicates an intention to employ such a strategy.[10] Additionally, many of these systems are highly mobile.[11] Advanced mobile threats will present a greater challenge to the joint force than do mobile high value individual (HVI) targets in an irregular war because more targets will need to be struck over a shorter period of time, and they will pose a direct threat to the joint force making them more time sensitive. Finally, an examination of the military expenditures of competitor states reveals that, in addition to high-end defenses, they are investing in conventional mass.[12] This will further slow the current dynamic targeting process because ISR and strike assets will need to identify, discriminate, and prioritize a greater number of targets than they are currently required. This condition will increase the volume of information processing tasks required over a given period of time for.

In sum, area-denial strategies will limit time of access for both stealth and non-stealth platforms resulting in a shortened kill chain requirement. However, standoff assets employed to mitigate anti-access strategies will result in longer strike timelines. Additionally, adversary systems that directly threaten joint force power projection will be more time-sensitive than irregular warfare HVIs. Furthermore, mobile, survivable, and more numerous target sets will require a C2 of dynamic targeting process capable of processing more information faster to identify and prioritize those threats. With this in mind, it is useful to examine the current C2 of dynamic targeting process in order to understand how the joint force might perform under such conditions.

Command and Control of Dynamic Targeting

Prior to describing the current C2 of dynamic targeting structure, it is necessary to define dynamic targeting; C2 will be defined in the following paragraph. Dynamic targeting "typically requires more immediate responsiveness than…deliberate targeting," and can either be planned targets or targets of opportunity.[13] This type of targeting consists of functions conducted by current operations forces either at a headquarters element, a tactical element, or some combination of the two. Those functions are described in Joint Publication (JP) 3-60, *Joint Targeting* as the find, fix, track, target, engage, and assess (F2T2EA) process.[14] A sub-category of dynamic targets are time sensitive targets (TST) which can be planned or unplanned but that required dynamic execution. Dynamic targeting differs from deliberate targeting in that "decisions on whether and how to engage must be made quickly."[15] Thus, decision speed is an important component to success.

ISR developments over the past decade have improved the effectiveness of targeting HVI in irregular warfare conflicts. However, current tactics have been developed to suit an uncontested environment.[16,17] C2 of dynamic targeting in the current environment is managed by a battlespace owner responsible for integrating ISR and strike in its area of operation.[18] Command and control "encompasses the exercise of authority, responsibility, and direction by a commander over assigned and attached forces to accomplish the mission."[19] The function of "direction" has the most significant influence on how C2 is applied in joint air operations. JP 3-30, *Command and Control of Joint Air Operations* advises a centralized control and decentralized execution model wherein the JFACC provides centralized direction to plan and coordinate operations and subordinate elements execute operations.[20] However, JP 3-30, emphasizes that the latitude of subordinate discretion in execution can be more or less restricted by centralized direction based on the nature of the mission.[21] Currently, direction of dynamic targeting operations is centrally controlled and direction over execution is also centrally controlled, in that target strike approval must come from higher headquarters. Over the past decade, centralized C2 of dynamic target execution has occurred in battlespaces organized at various levels from the battalion to the JTF level, but in each case "target engagement authority" (TEA) has given the commanders of those organizations the authority to authorize a dynamic target strike to subordinate elements.[22] However, joint doctrine does not explicitly define TEA or stipulate the functions contained within that authority.[23]

In current practice, TEA is held at the JTF or JFACC level and is used to describe the control that those commands have over particular functions within the F2T2EA process that contribute to a commander's decision to engage a dynamic target.[24] Because there is no doctrinal definition, I will define TEA for dynamic targeting as the authority to execute the specified functions of F2T2EA. JP 3-60 identifies the key decision-support functions within F2T2EA that must be accomplished by the TEA.[25] Currently, those functions are controlled at the JTF or component level and include combat identification (CID), positive identification (PID), target validation, strike asset deconfliction and assignment, collateral damage estimation (CDE), and execution order and approval. However, in a contested war in which the joint force does not have initial access, battlespace owners will need to manage dynamic targeting at a distance.

The traditional Air Force solution to this problem would be to place TEA with the JFACC and manage C2 of dynamic targeting within the Air Operations Center (AOC) as it does now. A future war will present greater number of targets that will need to be found and finished in a shorter period of time, and AOC analysts will have a corresponding increase in the number of compressed information processing tasks.[26] However, if dynamic targeting is left only to the AOC, the capacity for and timeliness of dynamic targeting tasks will be limited by the number of analysts it has assigned perform those tasks. This problem could be addressed by adding additional dynamic targeting personnel to the AOC or by adding capacity through decentralizing dynamic targeting to additional nodes within the enterprise. However, in a resource constrained environment, adding personnel to the AOC may not be possible. Regardless of name of the node or center performing the dynamic targeting function, the key to timely positive identification of threats will be an effective multi-source correlation and fusion capability to confirm the location and disposition of possible targets. Improvements to these capabilities within the AOC could speed the kill chain, but current conditions have stilted such developments.

Improvements in the speed of data correlation and fusion have not been required because of an HVI targeting process centered on lengthy target development.[27] In Iraq and Afghanistan, persistent ISR resulted in a targeting process that enabled commanders to receive a high degree of intelligence confidence in target identification. [28] Today, intelligence tasking and reporting cycles take anywhere from days to weeks.[29] Furthermore, the current permissive threat environment allows for continuity of intelligence collection in support of HVI target development at the battlespace owner headquarters. However, because TEA is held at the higher headquarters and the C2 of dynamic targeting process requires up-channeled reporting, subordinate entities are not practiced in lateral intelligence and data sharing, particularly across joint lines.[30] Additionally, because battlespace owners are capable of correlating and fusing their own intelligence, AOC and Distributed Common Ground System (DCGS) analysts are not often asked to provide time-sensitive correlation or fusion support to tactical units. The DCGS, "or

GSQ-272 SENTINEL, weapon system is the Air Force's primary ISR Processing, Exploitation and Dissemination (PED) system."[31] DCGS is an enterprise which consists of Distributed Ground Stations (DGS) and Distributed Mission Sites (DMS) responsible for executing multi-intelligence source PED.[32] As a result of long target development times within the current environment, analysts within the DCGS enterprise have limited experience supporting rapid correlation, fusion, and data sharing in support of dynamic targeting. The Langley Target Development Cell (TDC) within DGS-1 is one exception.

The TDC consists of targeteers from the 363rd ISR Wing, the Air Combat Command (ACC) wing responsible for Air Force analysis and targeting, integrated into the DGS-1 operations floor at Langley AFB, conducting air component target development in support of the joint task force (JTF) responsible for Operation INHERENT RESOLVE (OIR). This non-doctrinal approach was created due to both a lack of Air Forces Central Command (AFCENT) target development capacity and an approach to target development on the part of the JTF wherein target nominations are accepted from any entity regardless of status as JTF service component.[33] The principle advantage of the TDC is that it resides within the DGS, at the source of exploited intelligence. This allows for targeteer input into the real-time collection activities of the DGS which shortens the time for ISR re-tasking and target identification. This model has potential application to support targeting in a future war. The TDC's physical access to the preponderance of intelligence at the exploitation source makes it ideally suited to conduct target development. Additionally, proximity between targeteers, collectors, and analysts allows for real-time refinement of requirements and quick re-tasking of sensors to identify time-sensitive targets.

In sum, C2 of dynamic targeting is primarily conducted by component or JTF battlespace owners that retain control over the F2T2EA functions stipulated within target engagement authority. With the exception of the TDC, intelligence personnel within those headquarters are solely responsible for fusing ISR to achieve target identification. Additionally, the ISR process is characterized by a lengthy target development methodology that has slowed the kill chain.[34] As a result of this protracted process, analysts in the AOC and DGS are inexperienced in time-sensitive fusion. Additionally, senior leaders have been socialized to expect a greater degree of confidence in target identification.[35] This state of affairs has led to an increased centralization of command and control decisions related to dynamic targeting.[36,37] C2 of dynamic targeting has advanced to become extremely well suited for irregular warfare. However, the battlespace conditions of a future, contested war will present the joint force with a need for increased speed of decision, challenging the C2 model it has refined over the past decade.

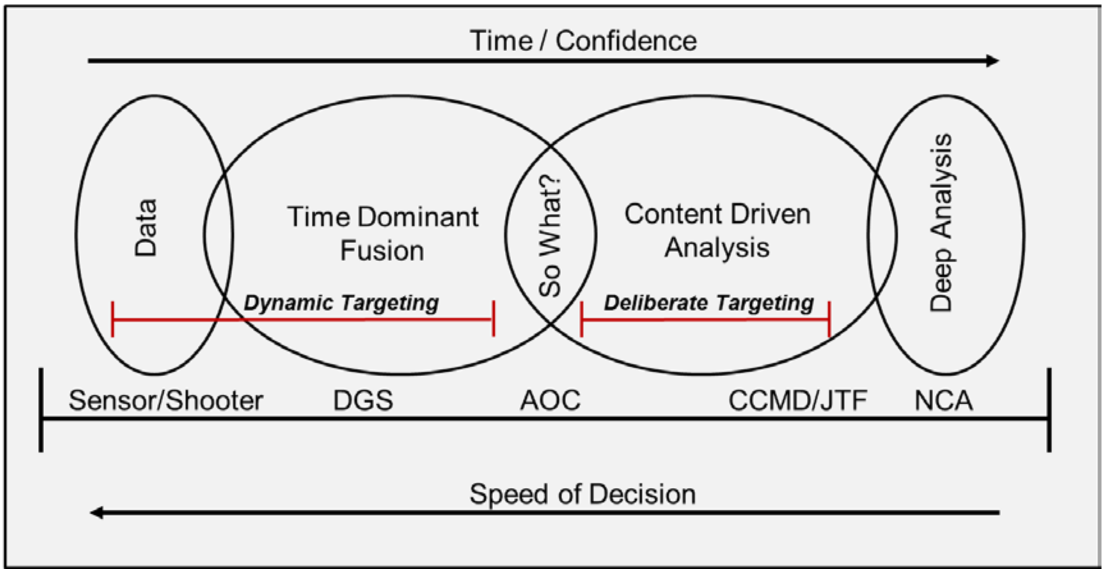
Implications for a Contested War

AirSea Battle, which was renamed Joint Concept for Access and Maneuver in the Global Commons (JAM-GC) in 2015, describes the "first and most important" phase in a contested war as a "blinding campaign," or an information battle in which kinetic and non-kinetic activities are undertaken to gain information dominance and deny the same to the adversary.[38,39] According to Air Force/A2 guidance, victory in the information battle is achieved when ISR can provide decision advantage through "full-spectrum awareness."[40] Competitor states' acquisition of air defense and cyber capabilities reflect an understanding that these are the first steps the United States would take. However, as described above, those states are also investing to increase conventional mass.[41] As Roberts and Payne note, "technology will not always be able to solve issues of scale in combat."[42,43] A future conflict will create an information processing gap because it will require the joint force to dynamically target massed forces which are highly mobile and more survivable than current irregular warfare threats.[44]

The Intelligence Community's (IC) solution to the problem of information processing scale is "full-spectrum awareness" through the exploitation of big data. The IC is moving towards implementation of the IC IT Enterprise (IC-ITE) that will theoretically provide a "data lake" or central repository of all collected intelligence.[45,46] In order to operationalize this data, an activity based intelligence (ABI) methodology of analysis and computational systems will correlate data "before" human exploitation and reveal patterns of life to help analysts "differentiate abnormal from normal activities."[47] However, the implementation of an ABI methodology alone will not solve the problems of information processing scale because big data analytics cannot account for "the human element of instinct, risk-taking, accident, and error."[48] While this may seem obvious, the implication is that if conditions change due to unforeseen factors, the results will prove erroneous if existing algorithms were based on correlation factors that have changed. This effect is likely in war because an ABI structure based on known adversary correlation factors during peace time will become invalid as the enemy changes its behavior in unexpected ways once war begins. In other words, ABI can give us exquisite insight into what we think we need to know from big data, but it cannot provide insight into what we don't yet realize we need to know.[49] When conditions change, ABI must be adapted to provide relevant correlation based on those changes.[50] As described above, analysts supporting dynamic targeting in a future war will be required to correlate and fuse more data to achieve target identification within a shorted kill chain. This will create a need to accurately process more information faster. An understanding of the limitations of big data to solve information processing scale issues is necessary for those who believe the problems of dynamic targeting in the future can be solved by full-spectrum awareness alone.

Nonetheless, while full-spectrum awareness, if attainable, would close information gaps and lead to more accurate decisions, decision-making time increases the further that data is passed up-echelon from its source.[51] To achieve target acquisition in a future conflict, tactical elements from across the joint force will require intelligence from a wide range of sensors enterprise. Unfortunately, current Air Force literature encourages the intelligence flow in the opposite direction: upward to the JFACC, the theater commander, and the policy maker.[52] As noted in the previous section, access to more data at a higher level tends to centralize decision making. In a time sensitive dynamic targeting situation, this can lead to activity paralysis in the lower echelons as subordinate commanders wait for decisions from higher headquarters.[53] In a permissive threat environment, content driven analysis, an intelligence term describing in-depth, longer-term, multi-source analysis, is possible and desirable because time is not a decisive factor in dynamic targeting.[54] However, in the time constrained environment of a future conflict, decisions will need to be made closer to the source of target detection. Thus, a time dominant fusion approach defined by rapid correlation of multiple data sources to quickly characterize an entity so that it can be further investigated by an ISR or strike asset, is more appropriate. Figure 1 below shows the relationship between time, analysis and decision-making under these constraints.[55]

Figure 1: Time, Confidence, & Entity Decision



The further left one moves on this spectrum, the faster target identification and strike can occur. However, that identification will be based on less thorough analysis leading to a lower degree of confidence in target identification. Lower confidence in the characterization of a target can also lead to an increased risk to forces due to an incomplete understanding of the environment and a risk to mission due to the potential for misapplication of limited resources. Risk mitigation is more achievable in a permissive threat environment, and at times when limiting civilian casualties is important to the outcome of irregular wars, rules of engagement (ROE) that restrict collateral damage drive a greater degree of centralization for dynamic target approval. However, those ROE may become less restrictive in a future conflict if the direct interests of the United States are threatened.[56] The figure above represents the ideal model wherein dynamic targeting occurs further to the left and deliberate targeting occurs further to the right. In a future conflict, the joint force will need to apply the right balance between speed of decision, level of decision confidence, and acceptable level of risk. In doing so, Air Force leaders will need to consider how rigid adherence to a centralized control structure might inhibit flexibility in achieving the right balance.

In sum, a future contested war will be characterized by highly mobile and survivable targets that are massed to produce a greater number of targetable entities in the battlespace. While survivable ISR will be necessary, even if access is achieved, the ISR enterprise is currently unprepared to use a more complex data set to discriminate between more targets faster than it does now.[57,58] Additionally, dynamic targeting operations at the tactical level will be slower if up-echelon commanders continue to hold TEA and centralize C2 of dynamic targeting. To protect against these eventualities, the Air Force should decentralize target engagement authority for dynamic targeting to subordinate entities that can more quickly achieve target identification, nomination, and strike. JP 3-60 states that "the JFC should normally define those situations, if any, where immediate destruction of the imminent TST threat outweighs the potential for duplication of effort."[59] A future war as described above will be one of those situations. The following section recommends a course of action designed to address that challenge.

Recommendation - A Flexible C2 Approach to Joint Targeting

Although current ISR employment has led to increased intelligence confidence and big data analytics may improve correlation, in a future contested war, no individual commander at any level should expect to attain full-spectrum awareness.[60,61] In order to account for increased mass and mobility, the Air Force should adopt a flexible command and control model for dynamic targeting. In 2010, the Air Force chief of staff directed the Air Force Research Institute to review the effectiveness of current C2 doctrine in future scenarios. The authors of the report suggested that in certain future situations, the joint force will need to adapt C2 structures. They concluded that whenever possible, "decentralizing C2 to the lowest appropriate level capable of integrating assets is the best way to increase a commander's ability to act swiftly."[62] In a future war, the joint force will require a balance between centralized control of TEA and decentralized control of those functions of TEA required to achieve the necessary speed of dynamic target identification and strike. Accordingly, the Air Force should design a flexible C2 of dynamic targeting structure that, while utilizing a centralized approach to deliberate targeting, recognizes the need to decentralize dynamic targeting to distributed entities.

This structure would make the AOC and unit-level entities responsible for deliberate targeting and decentralize TEA for dynamic targets to subordinate, distributed and geographically focused nodes such DGS sites, E-3 Sentry, or a carrier strike group. Here, it is useful to examine the particular functions of TEA as outlined in JP 3-60 that should be delegated when decentralizing TEA for dynamic targeting. This list is not exhaustive, and a more comprehensive review of each authority should be accomplished prior to implementing a decentralized C2 process. This approach resembles "strike coordination and reconnaissance" (SCAR) as described in JP 3-03, *Joint Interdiction*.[63] SCAR is an ideal approach when strike platforms have access and commanders require decentralized targeting due to adversary mobility. The approach outlined in this paper represents a hybrid structure that allows for greater decentralization of dynamic targeting in areas where those platforms do not have access or standoff is required.

To execute decentralized TEA for dynamic targeting, a distributed ISR/C2 node with a co-located targeting capability such as the DGS TDC or a carrier strike group should be given positive identification (PID), combat identification (CID), target validation, and collateral damage estimation (CDE) authority. PID is an output of the fix step and is a target "identification derived from observation and analysis of target characteristics."[64] CID is the characterization of "detected objects in the operational environment," and is based on supported commander's guidance and rules of engagement as to what constitutes a threat.[65] In order to assess PID and CID, the distributed node would require sensor tasking authority over ISR assets contributing to that judgment. Once PID is established, the node would also have the authority to validate the target. Target validation ensures “that all vetted targets meet the objectives and criteria outlined in the commander’s guidance,” and that the target is compliant with the law of war, ROE, and is not otherwise restricted.[66] Finally, during the target step the node would utilize co-located targeteers to conduct weaponeering and CDE in accordance with guidance established by higher headquarters. It should be noted that throughout the process, the JTF or higher headquarters should still promulgate guidance stipulating the criteria required to achieve PID and CID, validate a target, and estimate collateral damage. However, decentralized TEA for dynamic targeting would give the subordinate node authority to determine when those criteria are met.

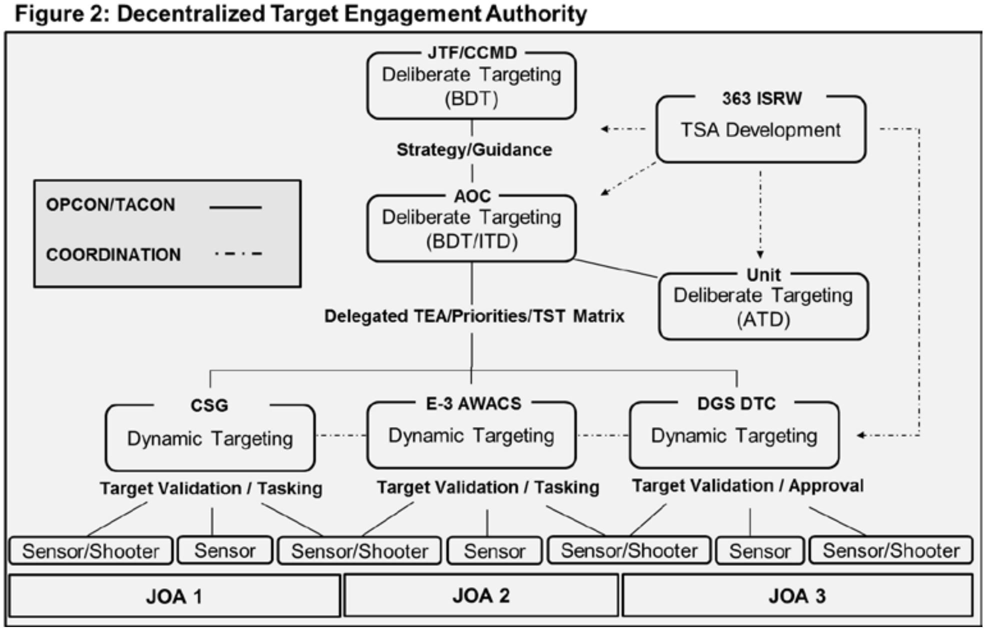
Once the above criteria are met, decentralized TEA would allow the distributed node to approve target execution. However, prior to this decision, the node would need to deconflict assets and determine which platform should perform the strike. A carrier strike group would be capable of this but a DGS, as currently structured, lacks the battle management capability necessary for strike asset deconfliction and assignment. As such, it would need to laterally pass approved targets to a carrier strike group, an E-3 Sentry, or a control and reporting center (CRC) which would task an engaging platform. The above approach would increase the number of tasks required, and significant tactics and training development would be necessary prior to implementation. However, as described in the preceding sections, the AOC will simply not be able to handle the increased volume of dynamic targets within a future battlespace without an increase in personnel. The Langley TDC provides a good initial departure point for a discussion of what this new ISR/C2/Targeting node might look like in the Air Force.

The Langley TDC is an excellent model for application of dynamic targeting in a complex war, but several elements should be modified. First, as control is decentralized, target engagement authority for dynamic targeting would need to be delegated from the JTF or component to the DGS TDC. Special instructions (SPINS), ROE, and a standard time sensitive target (TST) matrix from the AOC could provide all the guidance, direction, and prioritization required for a subordinate node to accomplish the above specified TEA functions. That guidance would also need to include corresponding ISR sensor control authority over a specified geographic area. With TEA, the "Analyst Airmen" in the DGS TDC would become the "ISR Decision Makers." Traditionalists might hesitate to grant intelligence personnel the authority to determine PID and validate a target. In fact this concept cuts against JP 3-60 doctrine, which states that "operations personnel" will validate targets according to commander's guidance.[67] If this becomes a dogmatic sticking point, the individual with specified TEA could be placed within DGS TDC to provide command authority. Ideally, however, to preserve resources, ensure simplicity, and enhance speed of decision, that authority should be delegated to the DGS. Additionally, the name of the TDC should be changed to "Dynamic Targeting Cell" (DTC) to reflect the function of dynamic targeting execution. While decentralization is not without risk of disunity of command and desynchronization of effects, Air Force leaders should assess how those factors increase the risk to mission accomplishment when weighed against the need for speed and decisive action. By assigning multiple DGS DTCs, carrier strike groups, and other C2 nodes with TEA to separate geographic regions, the joint force can increase its ability to respond to adversary mass and maneuver with information processing mass.

While dynamic targeting will be critical in the first phase of a future conflict, the AOC will still be required to conduct deliberate targeting and prioritization of all targets to produce the

TST matrix. Consistent command guidance and priorities will need to be passed to all decentralized control and execution nodes in order to ensure unity of command. The C2 structure will need to remain flexible, and the AOC will still need to arbitrate between the dynamic targeting executors for limited assets such as tankers. While the complexity of this coordination between multiple, distributed dynamic targeting centers may seem excessive, the AOC would not be responsible for dynamic target execution and could reassign those Combat Operations Division and ISR Division personnel to other roles. Figure 2 below displays a possible model wherein the AOC passes guidance and delegates TEA to subordinate elements.

Figure 2: Decentralized Target Engagement Authority



Finally, the Air Force ISR and Targeting enterprise should exercise variations of this flexible C2 model in training environments that realistically simulate scenarios and assumptions in current OPLANS. One way to do this is to force AOCs to fully participate in Red Flag with their regionally aligned DGS. Red Flag scenarios should be based on conditions and assumptions contained within current OPLANS. Additionally, the AOC and DGS should not deploy to Nellis AFB for the entirety of Red Flag. They should, for at least the first or last week, conduct the exercise from their home stations using the same systems and processes they would use in a future war. This will allow for exercise and development of flexible C2 structures that can be refined before going to war.

Conclusion

In order to remain survivable once a future war begins, the joint force will need to focus decision advantage at the tactical level. Unfortunately, current processes encourage the intelligence flow towards higher headquarters elements, leading to a greater degree of centralized decision making. Current ISR contributions to targeting are characterized by highly persistent and survivable platforms operating under a centralized C2 of dynamic targeting structure that requires an extensive target development timeline. As a result, senior commanders have come to expect a high degree of intelligence confidence in target identification which slows down the kill chain. A future contested war will be characterized by a massed, mobile, and survivable enemy leading to more targets in the battlespace and a need to increase the scale of information processing. The combination of threats that directly threaten the joint force, limited time of access due to area denial, and an increased use of standoff will shorten the kill chain time requirement. The current C2 of dynamic targeting construct is not adequate to achieve the speed of tactical decision required for this operational context. The Air Force should explore flexible C2 models that allow for the maximum amount of effective decentralization. Deliberate targeting should be separated from dynamic targeting which should be decentralized to distributed nodes that are given TEA over discrete geographic areas. Additionally, the DGS DTC model should be further developed and exercised in future Red Flags and similar venues. Air Force ISR leaders should advocate for a greater degree of decentralization in ISR and targeting operations. A flexible C2 of joint targeting structure will be required to enable a decentralized dynamic targeting enterprise capable of success in a future war.

[1] I wish to thank my advisor, Lt Col Philip Warlick, Majors Ryan Mittelstet and Kyle Porter, and my wife Lindsay for their thoughtful comments and suggestions. All errors found herein are my own.

[2] United States Department of Defense, *Joint Operational Access Concept* (Washington, D.C., 2012), 38.

[3] Ibid, 2.

[4] Ibid, 47.

[5] Ibid, i.

[6] Ibid.

[7] Ibid, 17.

[8] Maj Gen VeraLinn "Dash" Jamieson, USAF and Lt Col Maurizio "Mo" Calabrese, USAF, *An ISR Perspective on Fusion Warfare*, The Mitchell Forum 1 (October 2015), 1.

[9] United States Department of Defense, *Joint Operational Access Concept* (Washington, D.C., 2012), 10.

[10] Ibid.

[11] Robert P. Haffa and Anand Datla, "Joint Intelligence, Surveillance, and Reconnaissance in Contested Airspace," *Air and Space Power Journal*, May-June, 29-47 (2014), 43.

[12] Peter Roberts and Andrew Payne, "Intelligence, Surveillance and Reconnaissance in 2035 and Beyond," *Royal United Services Institute for Defence and Security Studies*, Occasional Paper (Whitehall, London 2016), 2.

[13] United States Department of Defense, Joint Publication 3-60: *Joint Targeting*, (Washington, D.C., 2013), II-2.

[14] United States Department of Defense, Joint Publication 3-60: *Joint Targeting*, (Washington, D.C., 2013), II-8.

[15] Ibid, II-21.

[16] Air Force Lessons Learned (AFLL), *The United States Air Force Targeting Enterprise at the Operational Level*, 26 October 2015, 22-23.

[17] Commanders in Iraq and Afghanistan have benefited from a wealth of intelligence from ISR platforms that come "as close to [providing] 'ground truth' as any time in modern warfare." Paul A. Welch, Major, USAF, "Global ISR: A process-Oriented Approach to Achieving Decision Superiority," (master's thesis, Air University, 2005), 6.

[18] Information derived from the author's experience in an MQ-1B squadron in support of OIF and OEF from 2010-2012 and assignment to the 692d ISRG from 2015-2016.

[19] United States Department of Defense, Joint Publication 1: *Doctrine for the Armed Forces of the United States*, (Washington, D.C., 2013), I-18.

[20] United States Department of Defense, Joint Publication 3-30: *Command and Control of Joint Air Operations*, (Washington, D.C., 2013), I-3.

[21] Ibid.

[22] Chance A. Smith, Captain, USAF (Chief, Target Development, Langley TDC), interview by the author, 12 March 2017.

[23] See, United States Department of Defense, Joint Publication 3-60: *Joint Targeting*, (Washington, D.C., 2013).

[24] Chance A. Smith, Captain, USAF (Chief, Target Development, Langley TDC), interview by the author, 12 March 2017.

[25] United States Department of Defense, Joint Publication 3-60: *Joint Targeting*, (Washington, D.C., 2013), II-20-II-30.

[26] Peter Roberts and Andrew Payne, "Intelligence, Surveillance and Reconnaissance in 2035 and Beyond," *Royal United Services Institute for Defence and Security Studies*, Occasional Paper (Whitehall, London 2016), 2.

[27] Robert P. Haffa and Anand Datla, "Joint Intelligence, Surveillance, and Reconnaissance in Contested Airspace," *Air and Space Power Journal*, May-June, 29-47 (2014), 31.

[28] Paul A. Welch, Major, USAF, "Global ISR: A process-Oriented Approach to Achieving Decision Superiority," (master's thesis, Air University, 2005), 6.

[29] Mark M. Lowenthal and Robert M. Clark, *The Five Disciplines of Intelligence Collection*, (Thousand Oaks, CA: CQ Press, 2016), 103-108, 136-137.

[30] Robert P. Haffa and Anand Datla, "Joint Intelligence, Surveillance, and Reconnaissance in Contested Airspace," *Air and Space Power Journal*, May-June, 29-47 (2014), 34.

[31] US Department of the Air Force, Air Force Intelligence Surveillance and Reconnaissance Agency, "Instruction 14-153 Vol 3: Air Force Distributed Common Ground System Operations Procedures," (San Antonio, TX, 2013), 5.
[32] Ibid, 10.
[33] Chance A. Smith, Captain, USAF (Chief, Target Development, Langley TDC), interview by the author, 30 November 2016.
[34] Michael Grunwald Jr., Major, USAF, "Transforming Air Force ISR for the Long War and Beyond," Wright Flyer Paper No. 36 (Maxwell AFB, AL: Air University Press, 2009), 2.
[35] George I. Seffers, "Military and Industry Seek Cyber Solutions," *Signal*, 66.10 (Jun 2012), 63-64.
[36] While each target may not be individually sensitive, the necessarily low tolerance for civilian casualties in COIN operations has yielded a requirement for intelligence persistence and penetration that will not be possible in a contested environment. Erik Lin-Greenberg, Krysten Young, and Brian Ray, "Improving Intelligence Analysis for the A2/AD Environment," Deputy Chief of Staff, Intelligence, Surveillance, and Reconnaissance (AF/A2DA), 5-6.
[37] Jeffery Hukill et al., *Air Force Command and Control: the Need for Increased Adaptability*, (Maxwell AFB, AL: Air Force Research Institute, 2012), 10.
[38] Robert P. Haffa and Anand Datla, "Joint Intelligence, Surveillance, and Reconnaissance in Contested Airspace," *Air and Space Power Journal*, May-June, 29-47 (2014), 37.
[39] See Appendix A.
[40] Department of the Air Force, "Air Force ISR 2023: Delivering Decision Advantage," (D.C.: Deputy Chief of Staff, Intelligence, Surveillance, and Reconnaissance, [2016]), 6.
[41] Peter Roberts and Andrew Payne, "Intelligence, Surveillance and Reconnaissance in 2035 and Beyond," *Royal United Services Institute for Defence and Security Studies*, Occasional Paper (Whitehall, London 2016), 2.
[42] Ibid.
[43] To an extent, Air Force reinvestment in the development of TSAs reflects an understanding that the service must prepare for conflict with an adversary utilizing mass and complex, interrelated systems. However, TSAs and subsequent deliberate target development typically focus on located targets. Chance A. Smith, Captain, USAF (Chief, Target Development, Langley TDC), interview by the author, 30 November 2016.
[44] Robert P. Haffa and Anand Datla, "Joint Intelligence, Surveillance, and Reconnaissance in Contested Airspace," *Air and Space Power Journal*, May-June, 29-47 (2014), 43.
[45] Daniel L. Murphy, "Activity Based Intelligence (ABI) / Big Data" (seminar lecture, Air Command and Staff College, Maxwell AFB, AL, 16 November 2016).
[46] Department of the Air Force, "Data Science and the USAF ISR Enterprise," white paper (D.C.: Deputy Chief of Staff, Intelligence, Surveillance, and Reconnaissance, 2016), 2.
[47] Chandler P. Atwood, "Activity-Based Intelligence: Revolutionizing Military Intelligence Analysis," *Joint Forces Quarterly* 77, 24-33 (2nd Qtr, 2015), 25-28.
[48] Viktor Mayer-Schonberger and Kenneth Cukier, *Big Data: A Revolution That Will Trasform How we Live, Work, and Think*, (New York, NY: Houghton Publishing Company, 2014), 180.
[49] Ibid, 196.
[50] In their book *Big Data*, Schonberger and Cukier propose a new professional cadre to adapt to the need for this flexibility. These "Algorithmists" would be experts in computer science, mathematics, and statistics and could constantly update code based on analyst input as to the important correlation and causal factors. Ibid.
[51] Department of the Air Force, "Air Force ISR 2023: Delivering Decision Advantage," (D.C.: Deputy Chief of Staff, Intelligence, Surveillance, and Reconnaissance, [2016]), 6.
[52] Ibid.
[53] Leo J. Blanken, Hy Rothstein, and Jason J. Lepore, ed., *Assessing War: The Challenge of Measuring Success and Failure*, (D.C.: Georgetown University Press, 2015), 322.
[54] Robert P. Haffa and Anand Datla, "Joint Intelligence, Surveillance, and Reconnaissance in Contested Airspace," *Air and Space Power Journal*, May-June, 29-47 (2014), 31.
[55] Jason M. Brown, Colonel, USAF, Figure adapted from a drawing made during lecture, "USAF DCGS," (seminar lecture, Air Command and Staff College, Maxwell AFB, AL, 19 October 2016).
[56] Jeffery Hukill et al., *Air Force Command and Control: the Need for Increased Adaptability*, (Maxwell AFB, AL: Air Force Research Institute, 2012), 10.
[57] Department of the Air Force, "USAF Strategic Master Plan," (Washington, D.C., 2015), 4.
[58] Octavian Manea, "The A2/AD Predicament Challenges NATO's Paradigm of Reassurance through Readiness," *Small Wars Journal*, (9 June 2016), 6.
[59] United States Department of Defense, Joint Publication 3-60: *Joint Targeting*, (Washington, D.C., 2013), II-32.

[60] Jeffery Hukill et al., *Air Force Command and Control: the Need for Increased Adaptability*, (Maxwell AFB, AL: Air Force Research Institute, 2012), 10.
[61] For a recommendation on how to implement big data analytics in the DCGS see Appendix B.
[62] Jeffery Hukill et al., *Air Force Command and Control: the Need for Increased Adaptability*, (Maxwell AFB, AL: Air Force Research Institute, 2012), 7.
[63] United States Department of Defense, Joint Publication 3-03: *Joint Interdiction*, (Washington, D.C., 2016), II-11.
[64] United States Department of Defense, Joint Publication 3-60: *Joint Targeting*, (Washington, D.C., 2013), II-21.
[65] Ibid.
[66] United States Department of Defense, Joint Publication 3-60: *Joint Targeting*, (Washington, D.C., 2013), II-29.

[67] United States Department of Defense, Joint Publication 3-60: *Joint Targeting*, (Washington, D.C., 2013), II-29.

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Appendix A

Numerous authors have described the difficulties that a future war might present to ISR. While planners must understand the implications of current literature, joint targeteers must account for the increasing mass and mobility of future targets and the complexity of the target environment. Much of the A2/AD literature focuses on the need to counter anti-access measures through improved joint warfighting strategies such as AirSea Battle and overcome the effects of integrated air defenses (IADS) denial through improved platform survivability and range.[1] While these considerations are important, much effort is already directed toward developing persistent and penetrating ISR.[2] Indeed, the third offset strategy seeks to counter the conventional military parity of countries like Russia and China by investing in what the Air Force Strategic Master Plan calls "game changing technologies."[3] As one author notes, the "3rd offset strategy represents an acknowledgement that the assumption of unhindered global operational access and movement (a product of the 2nd offset strategy) may be reaching the end of its cycle."[4] However, despite this realization, aspects of future Air Force strategy appear unchanged. The Air Force Future Operating Concept claims that "the nature of warfare will not change over the next two decades."[5] While this may be true in terms of war as a battle of wills, as Clausewitz described, the third offset may reflect a certain mirror imaging approach to how the West envisions the application of military force to affect the coercion of those wills.[6]

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[1] Erik Lin-Greenberg, Krysten Young, and Brian Ray, *Improving Intelligence Analysis for the A2/AD Environment*, Deputy Chief of Staff, Intelligence, Surveillance, and Reconnaissance, AF/A2DA, (D.C.: Department of the Air Force, [2016]), 2.

[2] For more information on the role of airpower in the third offset strategy see: House, The Role of Maritime and Air Power in DoD's Third Offset Strategy: Statement before the Subcommittee on Seapower, 113th Cong., 2015.

[3] Department of the Air Force, "USAF Strategic Master Plan," (2015), 4.

[4] Octavian Manea, "The A2/AD Predicament Challenges NATO's Paradigm of Reassurance through Readiness," *Small Wars Journal*, (9 June 2016), 6.

[5] Department of the Air Force, "Air Force Future Operating Concept: A View of the Air Force in 2035," (2015), 5.

[6] Car von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1976), 75.

Appendix B

Recommendation - Empower Airmen to Manipulate Big Data

The future complex battlespace will require a level of automated correlation that is currently unachievable. Today, correlation analysts in a DGS or intelligence duty officers within an AOC manually scan tactical reports within chat systems and use displays such as Google Earth to visualize correlation activity.[1] While reporting displays can be automated, the process of correlation and fusion is still manually accomplished according to the speed and capacity of the analyst's mind. While ABI promises to enhance automated correlation, analysts in a future DGS

DTC need to be able to adjust algorithms to changing enemy behavior and create rules for fused intelligence resulting in target identification to be passed directly through machines to shooter platforms authorized for strike in any domain. The current lead for implementing big data methods in the Air Force has stated that two factors within the IC make operationalization of big data different from that of the commercial sector – legal considerations and adaptability.[2] Because algorithms that interpret big data cannot account for unpredictable behavior, the Air Force will need the capability to dynamically adjust algorithms as the enemy changes behavior in a future war. A February, 2016 Air Force/A2 white paper on data science recognized that while manipulating big data will be essential, it is unrealistic to train intelligence airmen to become data scientists. The solution offered is to "smartly contract for, develop internally, and/or leverage IC Data Scientists" to provide an operational data science capability.[3] It also recommends placing this capability at "strategic AF ISR locations."[4] A future war will require a level of decentralization not currently practiced. Therefore, in order for a DGS DTC to be effective, the Air Force should also internally develop a data science capability within the DCGS.[5] To begin, as ABI capabilities are fielded within the DCGS open architecture, the Air Force should establish a pilot program wherein a team consisting of an analyst, a data scientist, and a computer programmer are placed within a DGS and given authority to continuously adapt algorithms which can respond to both a changing enemy as well as a flexible joint C2 structure. Career field mangers should seek to adapt DCGS UTCs and plan for the accession of airmen with the required skills now so that this pilot team can be in place as soon as DCGS open architecture is able to access the data lake through IC-ITE. Additionally, security managers and weapons systems communication officers should seek ways to limit security and systems barriers between the DGS, AOC, and as many other joint platforms as possible. Doing so will give analysts and targeteers within the DGS DTC the capability to flexibly adapt ABI to a changing battlespace.

[1] Information derived from the author's experience in the 692d ISR Group, Joint Base Pearl Harbor-Hickam from 2014-2015.

[2] Daniel L. Murphy is the Director of the Advanced Analytics & Technology Investments Directorate under the Concepts Development and Management Office within the Administrative Assistant to the Secretary of the Air Force Office, SAF/AA. The Intelligence Systems Support Office is operationally controlled by the Under Secretary of Defense for Intelligence. He is responsible for oversight of defining and redesigning critical defense intelligence processes and technologies required to ensure better communications, knowledge development and information sharing within the Defense Intelligence Enterprise. Daniel L. Murphy, "Activity Based Intelligence (ABI) / Big Data" (seminar lecture, Air Command and Staff College, Maxwell AFB, AL, 16 November 2016).

[3] Department of the Air Force, "Data Science and the USAF ISR Enterprise," white paper (D.C.: Deputy Chief of Staff, Intelligence, Surveillance, and Reconnaissance, 2016), 10.

[4] Ibid.

[5] Jason M. Brown, Colonel, USAF, "USAF DCGS," (seminar lecture, Air Command and Staff College, Maxwell AFB, AL, 19 October 2016).

Appendix C

A Template for Determining the Appropriate C2 Structure

The Air Force Research Institute report identifies five factors that should be considered when determining the appropriate level of C2. They are 1) the nature of an operation, 2) the available resources, 3) the capabilities of subordinate units, 4) the degree of trust and confidence, and 5) the political risk.[1] Table 1 below displays how these factors might be attributed to a JTF, AOC, and DGS during a contested war. I have filled in the cells with an initial assessment of the dynamic targeting capabilities each organization provides as they relate to the five factors. While this table does not provide a definitive answer, future planners could use a similar method when deciding how to construct the appropriate level of C2 for an operation.

Table 1: Factors for Determining Level of C2

	Nature of Operation (Enemy / Risk)	Available resources (correlation, ID dynamic targets)	Capabilities of unit (communication /battle management)	Degree of trust /confidence (in the organization)	Political Risk (of operation)
JTF/CCMD	Small Scale Contested/ High Risk	Low-Intermediate (Varies by AOR)	Variable based on nature of operation	High	Extreme-High
AOC	Intermediate Scale Contested/ High-Med Risk	Intermediate Capacity	Variable based on nature of operation	Variable	High-Medium
DGS	Large Scale Contested/ Low-Med Risk	High Capacity	Similar to AOC on an individual level but higher if multiple DGS are given separate geographic areas	Likely low for control of dynamic targeting in a major operation	Medium-Low

[1] Jeffery Hukill et al., *Air Force Command and Control: the Need for Increased Adaptability*, (Maxwell AFB, AL: Air Force Research Institute, 2012), 8-10.