Information in Joint Operations:

Insights for Commanders and Planners from Competitive Risk Modeling

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INFORMATION IN JOINT OPERATIONS:
INSIGHTS FOR COMMANDERS AND PLANNERS

Project Report for
Strategic Multilayer Assessment (SMA):
Information in Joint Operations (IIJO)

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Abstract

George Mason University (GMU) worked with Strategic Multilayer Assessment (SMA) Subject Matter Experts (SMEs) to identify risks to competition effectiveness that could be mitigated through improved integration of information into joint and unified action operations. The initial focus was aligned with evolving Command and Control of the Information Environment (C2OIE) doctrinal concepts, but later shifted from strategic level integration to integration of information into unified action activities at the operational level. It is very difficult to achieve information enabling event alignment across the Whole of Government because there is no one responsible for this alignment at any planning level (Strategic, Operational, or Execution). The U.S. military can improve alignment by incorporating non-military agencies into its traditional planning processes (mission analysis, course of action development, operations orders). This was applied to real-world planning in workshops with Operational Planning Teams where the planners learned that they could coordinate their activities with embassy country teams working through the defense attaché or senior defense official. Although planning teams are much more comfortable planning and executing joint or service military operations, the workshop teams easily adapted legacy mission analysis, Course of Action (COA) development, and orders processes to integrate information effectively into Unified Action operations. Members of country teams can align messaging, engagements, non-military information enabling activities, and perception management with military activities without specific military direction using their own agency and organization guidance, but they need the information the operational planning teams produce during mission analysis and COA development to do their own planning and execution effectively.

1. Introduction

Headquarters US Air Force (HAF) Deputy Chief of Staff, Operations, asked the Joint Staff's Strategic Multilayer Assessment (SMA) office to initiate a study to address how Joint Force Commanders, Joint Force and Service Component Commanders, and their respective staffs can best understand and integrate information and influence into operational-level planning, execution, and assessment activities across the competition continuum. Subject matter experts conducted a deep dive on the geopolitics of Chinese, Russian, and other emerging regional and non-state threats to better understand how actors view the parameters of cooperation, competition, and conflict, as well as the points at which information and deterrence activities may become escalatory. This included an examination of how the strategic communities in China, Russia, and key regional actors view U.S. motivations and decision-making. George Mason University focused in the following areas:

1. Assess the ways in which the Joint Force can most effectively integrate information and influence into its activities across the competition-conflict continuum (primary focus on competition):

    - Integrate information and influence into operational-level design and planning, execution, and assessment

2. Shape the operational environment to advance Joint Force Commander (JFC) campaign goals across the competition continuum through the application and integration of the information joint function:

    - Build understanding and trust in the purpose of and approach to joint force activities

    - Erode adversary confidence in its capabilities, strategies, and relationships

    - Diminish an enemy's ability to sense, understand, decide, and act effectively

    - Protect U.S. and partner abilities to sense, understand, decide, and act effectively

At the Air Force's request, the GMU effort addressed the following specific questions:

- What are suitable Operations in the Information Environment assessment frameworks and approaches?

- What are the characteristics of information as a form of operational maneuver and power?

- What is required to integrate information and influence into operational-level planning, execution, and assessment of effectiveness?

- What approaches to Operations in the Information Environment (OIE) operational design, detailed planning, and assessment will enable commanders to leverage and command and control the power of joint physical and informational maneuver in the OIE?

Consistent with current Department of Defense (DoD) and Joint Staff efforts, GMU examined this challenge from not only a joint ops perspective, but also by considering information-related capabilities across the Whole of Government. Today's operating environment presents the DoD with a difficult military challenge: to develop a methodology, with associated capabilities, that enables the Joint Force to collaborate and synchronize with inter-organizational partners and conduct globally integrated operations to achieve acceptable and sustainable outcomes. Furthermore, any solution to the military challenge must account for several additional factors: the complexity of the environment; interactions with adaptive adversaries; the persistence of enduring competitions; trans-regional challenges; emerging patterns of competitions below the threshold of armed combat; and the challenge of integrating military activities within the DoD and aligning those activities with inter-organizational partners. (United States Joint Staff, 2018)

The overarching issue of Globally Integrated Operations is to defend U.S. global interests against activities across the spectrum of conflict that are intended to undercut those interests. The challenge for planners is to coordinate global activities and messaging to promote U.S. objectives and disrupt adversary objectives detrimental to the U.S. and its global partners. Today's threats have global reach, act with unity of effort, integrate globally across domains, operate without borders in the information domain, and are able to exploit U.S. organizational arrangements based on geographical boundaries which differ among the Department of Defense and other U.S. government agencies (Fig. 1).
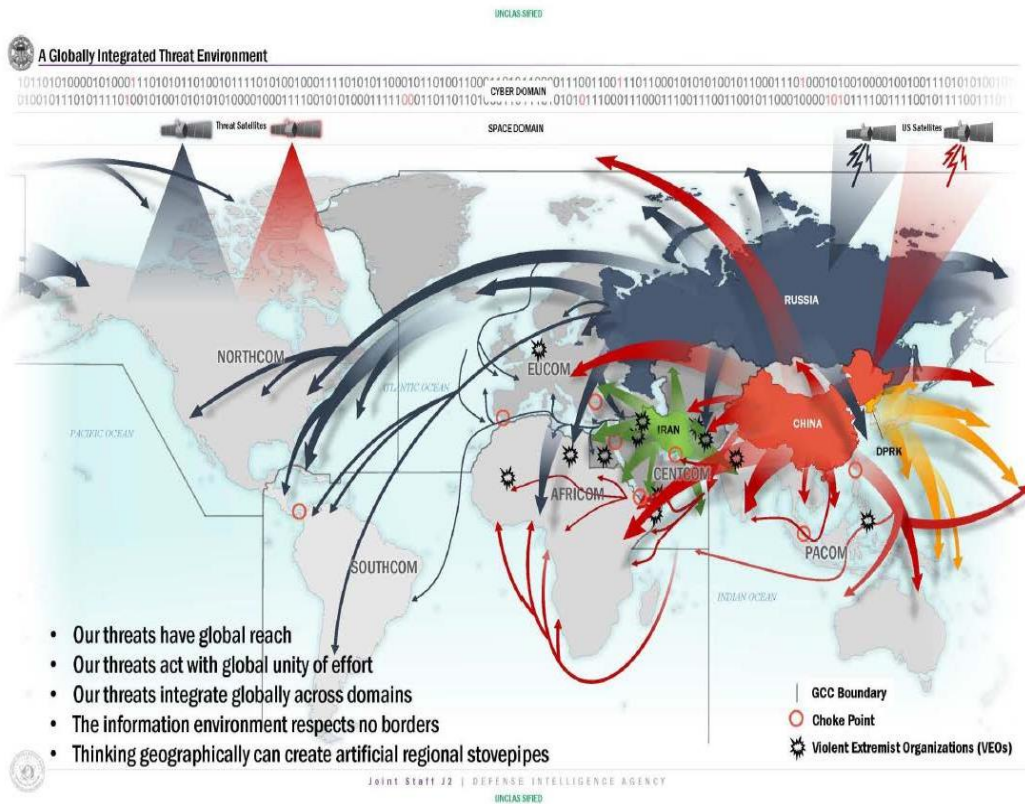

Figure 1: A Globally Integrated Threat Environment (Joint Staff J2, 2018)

The Joint Staff J7 identified seven Globally Integrated Operations capability development goals (Stephenson, 2018):

1. Identify potential crises before they develop and manage escalation favorable to the U.S.

2. Identify and counter competitor shaping activities that limit U.S. freedom of action

3. Coordinate, synchronize, and de-conflict activities and messages across COCOMs and with DoD partners (U.S. and coalition)

4. Counter competitor influence messaging when adverse to U.S. objectives

5. Assess intent of adversary activities (and messaging) and respond where appropriate

6. Assess adversary assessment of U.S. and partner global activities and messages

7. Assess risk of potential U.S. and partner mitigation options

This study was designed to support an Air Force effort in support of a departmental challenge to improve command and control capabilities the information environment. This direction is codified in a Joint Requirements Oversight Council (JROC) memorandum charging each of the services to implement actions found in the associated Operations in the Information Environment (OIE) Doctrine, Organization, Training, materiel, Leadership and Education, Personnel, Facilities, and Policy (DOTmLPF-P Change Recommendation (DCR). (Note: Materiel is not capitalized because the DCR focuses on non-materiel solutions.) (Joint Requirements Oversight Council, JROCM 068-19, 3 July 2019)

A graphical representation of the Air Force approach can be found in Figure 2. In the process of modeling these activities it became clear that the concept should be modified with the changes depicted in purple on the graphic. In particular, the analysis suggested that actors should not only include adversaries, allies, and partners, but also friends and third-party "grey" countries ("Blue-grey" and "Red-grey" depending on their leaning) that are the targets of great power competition. The modeling also made it clear that the operations and activities should not be restricted to just those performed by the military, but include whole of government, allies, and even non-governmental organizations. In many cases, the primary military contribution may be its ability to conduct planning.
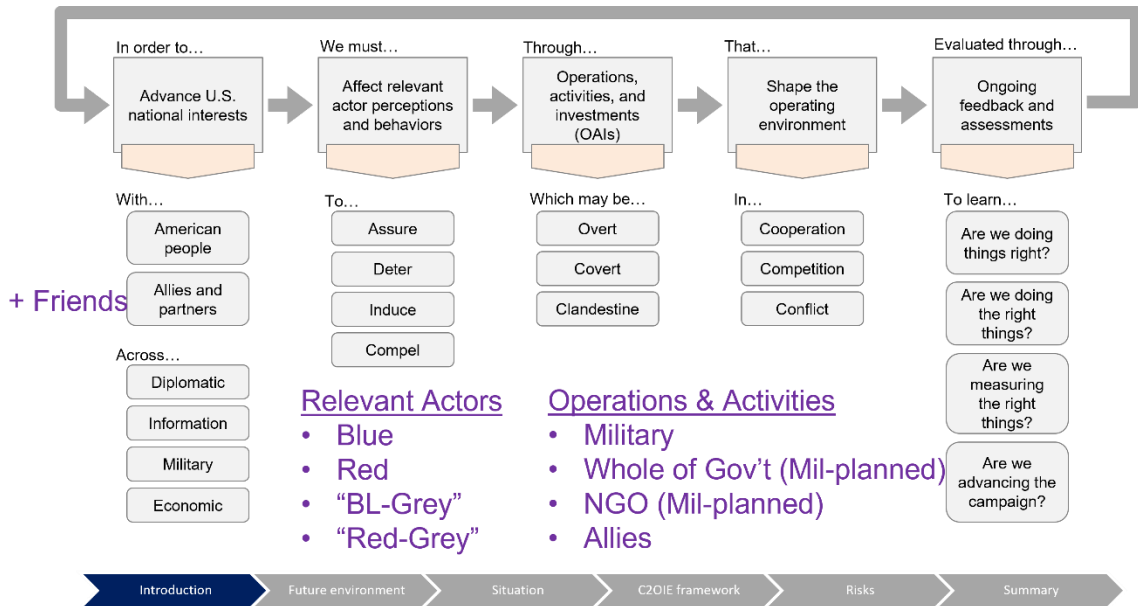
Figure 2. Operations in the Information Environment Concept Overview

The Air Force developed another graphical concept for command and control of operations in the information environment (C2OIE) that can be found at Figure 3 with modifications (in purple) that GMU added based on insights gained during the course of the SMA, because modeling again suggested that for effective integration of information into joint operations there was a need to involve a large number of government and non-government agencies. The graphic notes that the military's major strengths relative to other agencies are its capabilities and capacity for situation awareness and understanding of the environment, strategy and course of action development, and detailed planning, but non-military agencies are often better suited to execute information-related plans and assessing their effectiveness.
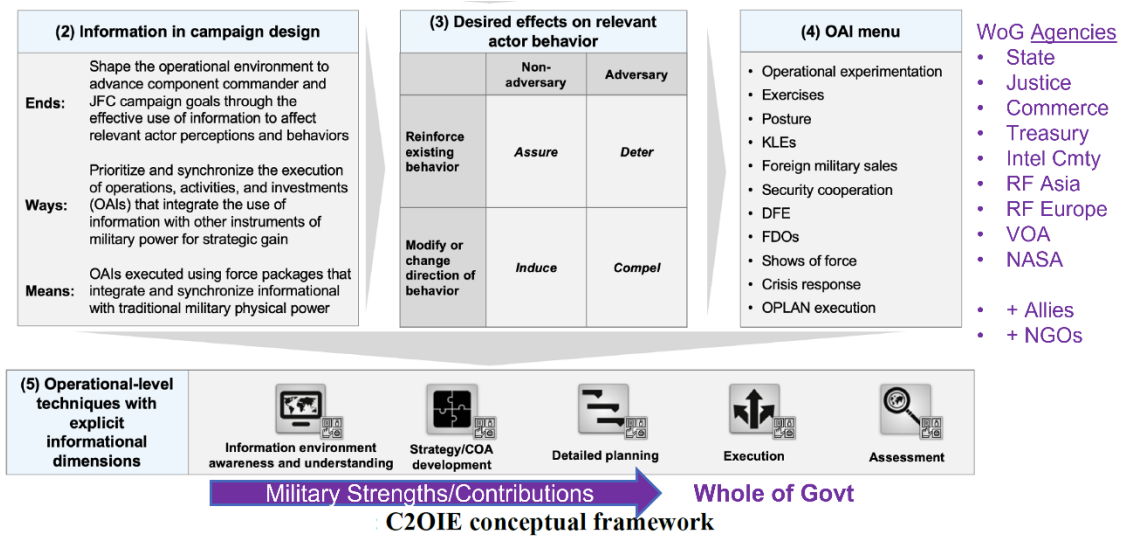

Figure 3. Whole of Government C2 of Ops in the Information Environment

Report Overview

GMU used this adapted Air Force C2OIE conceptual framework to guide its Strategic Multilayer Assessment efforts. Chapter 2 of this report provides background for the Air Force decision to shift the focus of the SMA from command and control of operations in the information environment to the integration of information in joint ops. Initially, GMU's research and modeling focused on assessing strategic risk to competition effectiveness (chapter 3) from a national level, but because the focus of the strategic multilayer assessment was the integration of information in joint operations, it became more useful to model risk to competition effectiveness at the operational level (chapter 4). Rather than perform computational experiments using the model, insights gained from constructing the model were used in workshops with operational planning teams from the Joint Global Strike Operations Center, which is responsible for planning and executing Bomber Task Force missions for USSTRATCOM focused on deterrence of adversaries and assurance of friends, and through USSTRATCOM, support to the "deter, assure, and compete" objectives of regional Combatant Commanders. This work is described in chapter 5. Observations from modeling and the workshops are found in chapter 6, and conclusions and recommendations are provided in chapter 7.

2. Background

Review of Information Concepts in Joint Doctrine

The US military views information from many different doctrinal and conceptual perspectives. For example, information is commonly considered as an instrument of national power, alongside the diplomatic, military, and economic instruments. It is also considered an operational variable for purposes of strategy development and analysis in the PMESII (political, military, economic, social, information, and infrastructure) construct. Joint Publication 3-13 (Joint Staff, 2014) describes information as an environment: "The information environment is the aggregate of individuals, organizations, and systems that collect, process, disseminate, or act on information . . . It consists of three interrelated dimensions: physical, informational, and cognitive." This section argues that although US joint doctrine defines information as an environment, its importance comes not from being an operational environment but because information serves as virtual representations of both physical and cognitive realities which can be created, stored, and exchanged in all environments (i.e., semaphore flags, newspapers, signs, markers, and so on). Virtual representations also exist in cyberspace, which, because of its dissemination speed and global reach, has made cyber operations a valuable tool for military operations (Joint Staff, 2014).

JP-1, Doctrine of the Armed Forces of the United States, refers to information as the seventh joint function of the military, alongside command and control (C2), intelligence, fires, movement and maneuver, protection, and sustainment (Joint Staff, 2017). The doctrinal challenge is that information is considered an environment, but as a joint function, information ops are a part of every environment. In 2018, the Department of Defense issued the Joint Concept for Operations in the Information Environment (Joint Staff, 2018), which explains that the information environment directly affects and transcends all operating environments. It states that the information environment comprises and aggregates numerous social, cultural, cognitive, technical, and physical attributes that act upon and affect knowledge, understanding, beliefs, world views, and, ultimately, actions of an individual, group, system, community, or organization.

People attribute meaning to information when it makes sense to them, particularly if it reduces their uncertainty about the state of the world. They do this to non-man-made information when they attribute a thunderclap to an angry god or a sound wave, or a disease to a demon or a virus. Clearly, some meanings are fanciful and some reflect reality. People are constantly generating information, intentionally or not, and other people perceive and assign meaning to it based on how they understand it. When people intentionally generate information, they create virtual representations. When the information is understood the way the communicator intended, then one has communicated effectively (Kuznar, 2021). This successful interpretation of information can influence others' behavior, which is ultimately the goal of military operations. Information maneuver employs information capabilities in multiple domains to create virtual representations that a sender uses to influence the receiver's perception of reality and therefore the receiver's behavior.

In response to a Joint Requirements Oversight Council (JROC) memorandum that asked the services and combatant commands to implement approaches to close information-related capability gaps, the Joint Staff J39 Strategic Multilayer Assessment office launched a project entitled "Integration of Information in Joint Operations" (IIJO) to address how Joint Force commanders, Joint Force and Service component commanders, and their respective staffs can best understand and integrate information and influence into operational-level planning, execution, and assessment activities across the competition continuum. One of the key questions the Air Force posed was "What are the characteristics of information as a form of operational maneuver and power?"

The US military prefers to conduct its operations based on overpowering its adversaries and achieving victory through attrition or by threatening their defeat through the employment of overwhelming force. As a result, few US military leaders are experienced or even comfortable with the use of information operations to outmaneuver an adversary as a means to victory. On the other hand, many US competitors have turned to information as a means to outmaneuver the US and therefore deny the US the benefits of its asymmetric advantages in physical power.

Adept military practitioners understand the importance of information maneuver: Information moves through every traditional military environment using both physical and electronic means and can create physical and cognitive effects on a global basis without physical movement of forces. As a result, information can be effectively employed alone, or in conjunction with other joint functions, to achieve strategic and operational objectives without the need for costly attrition operations.

Information maneuver requires that the US develop means to communicate information to its audiences of interest. It can be done in many ways to include print, social, and broadcast media, personal engagements, television and movies, and properly messaged visible activities. The US military is particularly well suited to conducting visible activities that reinforce US messaging. On the other hand, other than through personal engagements with foreign military leaders or use of cyber techniques, most messaging will be conveyed through non-military means, which will require multi-agency collaboration and coordination. History has shown that information is most powerful when conveyed over multiple means and aligned so that the messages reinforce one another.

Treating information as a form of maneuver offers a useful template for planning the integration of information into joint and unified action operations. The components of successful maneuver outlined by van Creveld —positioning, tempo, Schwerpunkt, surprise and deception, cross-domain synergy, flexibility, unity of effort, and opportunism (van Creveld, 1994)—also serve as elements of a framework to anticipate an adversary's integrated use of information to undermine US and partner interests. It would be folly for US competitors to take on US asymmetric military advantages directly. The US must realize that its competitors will seek to exploit their asymmetric information advantages as a means to compete effectively with the US and its partners. We should expect them to employ information maneuver at every opportunity. As this report will make clear, the concept of information as a form of maneuver significantly informed the development of the TIN model framework and associated workshops.

3. Strategic Risk Analysis

In the past, operational planning has focused primarily on developing concepts to defeat a potential adversary militarily. However, such an approach does not always satisfy political requirements. The research team developed an alternative approach to influence the decision calculus of key regional actors based on the Deterrence Operations Joint Ops Concept (DO-JOC). Elements of this concept were adapted to assess potential U.S. strategic risk due to global competition (Fig. 4). The activity inputs were generated based on U.S. and competitor strategic goals and objectives. The goals and objectives used to generate model inputs follow.
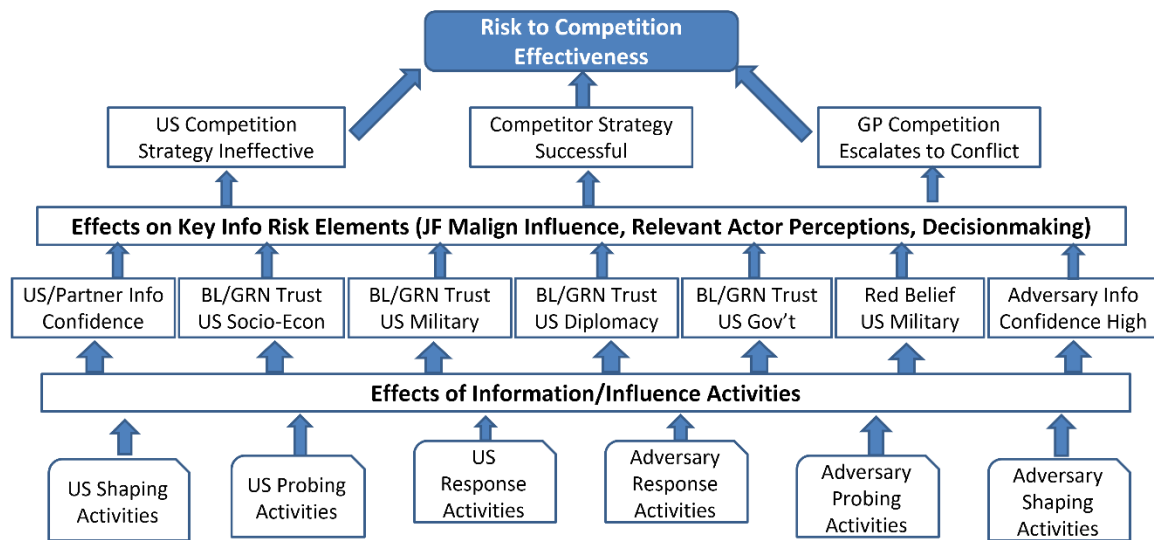

Figure 4. U.S. Global Competition Strategic Risk

China Strategic Goal: Regional hegemon with China-led international order

- Global economic and trade leader
- Promote ideology across globe
- International socio-political leader (Chinese system)
- Regional security and economic hegemony
- Counter U.S. influence in Pacific and other Chinese areas of interest

Russia Strategic Goal: Restore the Russian Empire with Russia-led international order

- Central and Eastern Europe security hegemon
- Recognized global military power with favorable nuclear balance relative to U.S.
- Expand Eurasia Economic Union
- International socio-political leader (balance of power politics)
- Counter U.S. freedom of action in Europe

U.S. Strategic Goal: Leader of free world – able to promote democracy, freedoms, equality, justice, and free markets across the globe

- Favorable U.S. balance of power in all regions – security, economic, trade
- Atlantic and Pacific security Power
- Promote democratic and capitalism ideology
- US-led international order
- Pre-eminent global military power
- Counter Chinese socialist ideology across globe
- Counter Chinese influence in Northeast Asia and Africa
- Counter Russian influence in Europe

The modeling framework drew heavily from interviews with participants in inter-agency processes focused on great power competition. It was immediately apparent that there are major differences in the way that the interagency groups conduct planning compared to military-only planning. For example, USG agencies use different terminology to describe similar activities, so recognizing the potential for communication misinterpretations is crucial to our ability to synchronize actions, particularly when dealing with an attack surface that is as broad as the information environment. (Attack surface is a borrowed term addressing the total number of points or vectors through which an attacker can try to enter an environment.) The analysis of the attack surface involves mapping it, identifying vulnerabilities and opportunities, and then applying this analysis to reduce national security risk (to the U.S.) and expand risk due to activities designed to gain advantage over the U.S. for our competitors.

Unlike military planning, competition planning is not only about setting up for the next D-Day, and because it is so different, military PLANORD and EXORD processes do not always work. In competition planning, the U.S. wants its adversaries to begin questioning their own plans. At the same time, it must recognize that competitors have their own operational plans that they will execute when presented with opportunities to compete due to situations that arise in the global environment. This uncertainty becomes challenging for military planners, because there is no line of departure to be used when moving from a PLANORD to an EXORD.

The key elements of a competition strategy include actions to (1) gain advantage, (2) defend against disadvantage, and (3) create dilemmas for the adversary. To be effective requires speed, agility, and transparency which can only be achieved through initiative and a practiced, disciplined approach.   With transparency comes exposure which is often uncomfortable for the many actors involved in such planning, but this transparency leverages an important asymmetric advantage of democracies—U.S. institutions are its source of power. Speed is complicated by a tendency for the U.S. government to react to situations, but reactive strategies create their own dilemmas because excessive speed of reaction can inadvertently escalate a situation into a crisis. The unfortunate result is a tendency to view developing situations as a sunk cost, and because it is too late to react effectively, the only remaining course of action is to cut U.S. losses.

What DoD has learned is that through disciplined initiative, not only involving the military, but the entire whole of the U.S. government, the U.S. can compete successfully by creating and exploiting opportunities rather than waiting to react to challenges. Recent experiences illustrate that the most effective campaigns involve lines of effort that create opportunities for the United States and our partners. The USG has put a framework in place to enable what it calls a focused objectives/outcomes approach to whole of government planning.

Focused Objectives/Outcomes Approach to Whole of Government Planning

The Focused Objectives Framework is focused on outcomes versus activities. In military parlance it is a strategic-level form of Mission Command. From an inter-agency perspective this approach creates a "marketplace" where every agency can bring their unique activities that contribute synergistically to achieve shared objectives and outcomes. At its foundation it requires acceptance by senior military leaders, and trust on the part of the senior leaders involved in the U.S. interagency processes. The key principle that enables this acceptance and trust is that all involved must develop a clear understanding of the risks and develop a willingness to accept these risks where necessary. With no single person in charge, the approach often requires a senior-level champion who can encourage planners from across the departments to engage collectively, often in ways that can be outside their normal comfort zone. For this reason, implementing the focused objectives approach takes time because relationship building is key to building senior leader trust in planners from agencies other than their own.

Strategic Empathy. A key element of this framework is that it is based on "strategic empathy" regarding U.S. competitors. This is not to be confused with sympathy or agreement with competitors, but an appreciation for their values interests. In particular, it requires that planners assess how competitors will perceive U.S. activities from the perspective of their interests, not those of the U.S.. An agreed-upon interest map can help underpin this part of the planning process. It is also useful to have a capability to evaluate how adversary "red team" equivalents are assessing the actions of the U.S. government. This is not typically part of military or whole of government planning. As a result, U.S. government is weak in its ability to assess how competitors will perceive U.S. activities. As the agencies gained experience with the Focused Objectives/Outcomes methodology, they learned that it is important to conduct information probing activities to assess the environment, which includes maintaining an awareness of all U.S. activities, not just those activities that are being executed in support of a deliberate planning process. This is critically important because another U.S. organization's activities could undermine the desired effects of the activities being planned.

Governing Documents. Another lesson that agency participants learned is that the Focused-Objective approach requires governing documents that do not prescribe activities but instead describe end-states leading to desired outcomes. They found that Inter-agency members acknowledge the need for planning but often find it difficult to fit their department's activity planning into a "box" that has been designed for military planning. This requires planners, particularly those from the military, to shift their thinking from achieving a victorious end-state to one focuses for long periods of time on gaining advantage for the U.S. and its partners, or creating a relative disadvantage for a competitor.

Strategic Mission Command. This new approach strives to create conditions for a coalition of the willing from across the U.S. government to play to their strengths. The concept it employs is similar to operational mission command, but performed at the strategic level with whole of government involvement. Standing orders and Terms of Reference provide agencies the authorities they need to take risk and enable self-organization, and serve as "anchor points" to guide alignment of their Operations, Activities, and Investments (OAIs) across the whole of government. Other key elements of this approach include Direct Liaison Authorized (DIRLAUTH) arrangements, published governing documents, and, as mentioned earlier, a clearly recognized senior champion. Also necessary are means to deconflict and synchronize agency activities in ways that can leverage each other's authorities and strengths. Participants in the Focused Objectives process have also found it useful to have a trusted source familiar with the campaign objectives who brings deep understanding about the target to the planning process.

Framework. The "Focused Outcomes" framework is a short form for "Event-driven, Outcome-based, Whole of Government Approach to Globally Integrated Ops Competition and Cooperation Planning, Execution and Assessment." Figure 5 provides a visual overview of the approach. To protect our national interests requires:

- A series of Whole of Department of Defense (DoD) campaigns to influence U.S. adversaries' perceptions of military competitive advantage through informed DoD OAIs (Operations, Activities, and Investments), and
- A series of Whole of Government campaigns that utilize OAIs from every agency to influence adversaries' perceptions and behaviors.
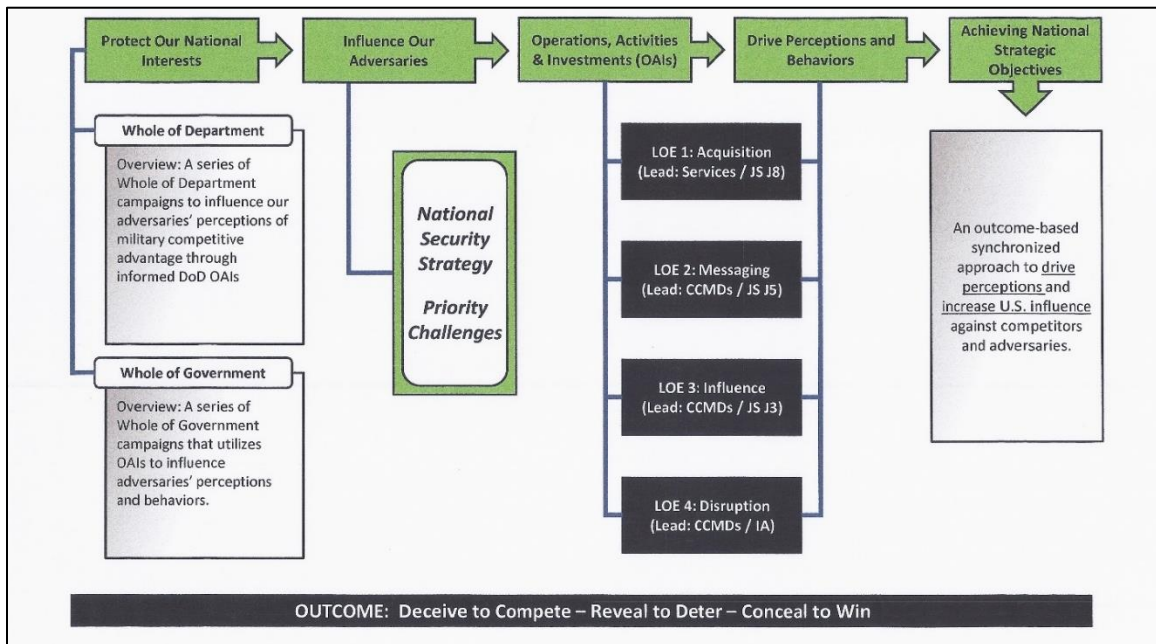

Figure 5. Outcome-Based Approach to Great Power Competition

Identified national security strategy and priority challenges establish the basis for the USG approach to influencing its adversaries. These priority challenges are addressed through four OAI (Operations, Activities, and Investments) lines of effort (LOE) to drive perceptions and behaviors:

- LOE 1: Acquisition led by Services and JS-J8,
- LOE 2: Messaging led by CCMDs and JS-J5
- LOE 3: Influence led by CCMDs and JS-J3, and
- LOE 4: Disruption led by CCMDs and Inter-Agency members

Employing an outcome-based, synchronized approach provides a means to drive perceptions and increase U.S. influence against competitors and adversaries to achieve National Security objectives. The outcomes of these efforts are focused campaigns that deceive to compete, reveal to deter, and conceal to win. Figure 6 depicts the multi-agency planning and coordination process described in the following paragraphs.

Strategic End-states. Proactive Strategies begin with Strategic End-states drawn from governing documents such as the National Security Strategy. For each strategic end-state, target audiences are identified: Leader and elites, allies and partners, enablers and supporters, and others whose views ultimately contribute to the perspectives of the leaders and elites. This step of the process is akin to target audience segmentation used in marketing and advertising.

Objectives. In parallel, planners from across the whole of government identify objectives that will contribute to achieving the strategic end-state. These objectives can be operational or strategic in nature and are outcome-based reflecting actions against the identified target audiences, and provide the framework which enables traceability from tactical-level actions to strategic objectives for planners from across the U.S. government.
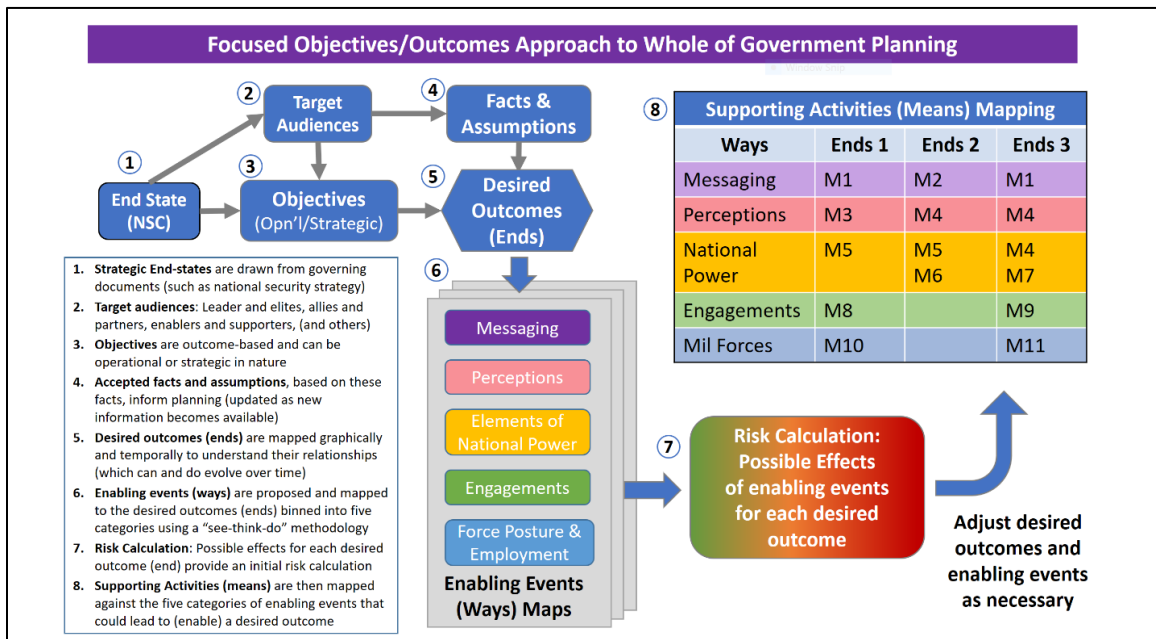

Figure 6. Focused Objectives/Outcomes Approach

Facts and Assumptions. Planners then assemble a list of accepted facts, and then based on these facts, devise assumptions to inform planning. Documenting and agreeing to these distilled facts and assumptions is foundational to the entire approach. The validity of assumptions is constantly challenged, where possible through OAIs specifically designed to test each assumption regularly until proven valid. This step is heavily dependent on Intelligence Community (IC) assessments, which can pose a challenge since these assessments requires that the IC increase its prioritization of competition planning at the expense of traditional resource planning and OPLAN development intelligence efforts.

Desired Outcomes over Time. With agreed upon facts and assumptions documented on the placemat, the Whole of Government planners map desired outcomes (ends) graphically and temporally to understand how these outcomes relate to one another, and how their relationships evolve over time. It is important to depict this graphically in a manner similar to the way complex program plans are laid out over time since the sequence of OAIs can dramatically affect their effectiveness.

See-Think-Do. The next step is where the planning transparency pays off. The proposed enabling events (ways) are then mapped to the desired outcomes (ends) using a "see-think-do" methodology. The "see" element involves delineating specific target audiences (for example, leaders, elites, and partners) the U.S. would like to influence. The "Think" element ascertains the intent of the target audience and identifies key elements that members of this audience value. The "Do" element proposes enabling events (ways) that could affect the target audience's intent or appeal to their value propositions. These ways are binned into five categories: Messaging, Perceptions, Economic, Engagements, and Force Posture/Employment.

Enabling Event Categories. Messaging enabling events consider the different ways the United States can reach a target audience, directly or indirectly, to challenge their preconceptions of the United States, challenge their own beliefs about themselves, and perhaps most importantly, lead them to question their own plans to compete with the U.S. The Perceptions bin considers what the adversary is likely to observe and then determines what different target audiences might think as a result. The Economic bin considers all available non-military instruments of power, not just the economic instrument, and serves as the basis for the senior champion to reach out to departments and agencies across the USG. Engagements are designed to harmonize efforts, from the most overt to those that are more sensitive, in order to amplify the desired effect and shape adversary perceptions. Finally, while Military force posture and employment OAIs are often the primary observable levers of influence due to the globally present nature of the joint force, it is important for the inter-agency community to understand how military OAIs can be much more effective when combined and synchronized with other elements of power that only they can provide.

Initial Risk Calculation. The inter-agency planning team assesses and lists the possible effects with respect to all possibly affected actors for each desired outcome (end). Graphically depicting these effects using red-yellow-green coding on the placemat offers an initial risk calculation if the proposed ways achieve the desired outcomes. In practice, an effect is color-coded green if it benefits the U.S. and allies, red if it benefits an adversary,

and yellow if the effect is assessed to be neutral. This visual depiction of the risk calculus for planned and unintended effects of the enabling events supports an initial assessment of each desired outcome. If the risk calculus elements for a desired outcome are predominantly red, the U.S. might not pursue that outcome or it might modify the desired outcome or ways employed to mitigate the elements of risk. Alternatively, the U.S. might elect to still pursue the outcome, but with great caution.

Supporting Activities. Supporting Activities (means), consisting of operations, activities, and investments (OAIs) are then mapped against the five categories of enabling events that could lead to (enable) a desired outcome. A single activity can support multiple enabling events across multiple categories of enabling events (Messaging, Perceptions, Economic, Engagements, and Force Posture/Employment). Although an activity in each bin is not required for every outcome, depicting this mapping of activities against enabling events on the placemat produces a visual grid map (Figure 4) which highlights where gaps might exist. In turn, the senior champion can highlight these gaps as opportunities to contribute to the campaign, and encourage all departments and agencies to offer OAIs that leverage their capabilities.

Focused Outcomes Observations and Conclusion

The Focused Outcomes Framework has already proven useful: Today regional Combatant Command (CCMD) J3s are routinely coordinating their authorities to work toward desired end-states and not limiting themselves to activities in their respective regions. Recent Information Cross-functional Team (ICTF) experiences have also clearly demonstrated the value of descriptive (vice prescriptive) governing documents issued as standing orders. They have also learned the importance of helping inter-agency members understand their roles, and the unique contributions they can make to achieve desired outcomes. In this regard, "binning" of efforts and encouraging participation from non-traditional participants has proven useful, particularly when a senior champion pushes the non-traditional agencies for their involvement.

In practice the U.S. has seen the importance of authorities to accept and manage Whole of Government risk, synchronize and de-conflict activities across agencies (DIRLAUTH), and enable self-organization. This form of Strategic Mission command is based on the use of "anchor points" such as Terms of Reference and Inter-agency Standing Operating Rules. But these documents by themselves are not enough. Effective implementation requires the development of trust and shared expectations among the Whole of Government planning participants.

The inter-agency organizations continue to emphasize the development of improved means to measure effectiveness of outcomes versus individual activities. Another benefit of the Objectives Framework approach is that it offers a means to measure the effectiveness of Whole of Government collective actions. This effectiveness feedback is necessary to promote growth across the U.S. government as a learning organization. The military will particularly benefit from this feedback, because the focused outcomes framework is consistent with the way most government agencies operate, but this approach is foreign to traditional military planners. For example, military planners do not understand the

language common to other interagency members. On the other hand, most government agencies do not understand military parlance. Learning and growing together as a cohesive inter-agency team skilled at conducting effective whole of government operations must constantly work to address these language barriers.

Conclusion: Focusing on outcomes enables all members of the inter-agency to adopt proactive approaches which play to their unique strengths and also reduce risk typically associated with traditional approaches to collective action. The focused outcomes framework enables agencies across the Whole of Government to synchronize and deconflict activities to drive perceptions and increase U.S. influence on the actions and behaviors of our competitors and adversaries. Use of Focused Objectives/Outcomes Approach framework has proven effective in increasing the success of U.S. government campaigns to protect its national interests.

4. Operational Risk Analysis

The DO-JOC posits that an actor must make cost-benefit decisions to either conduct an adverse action or exercise restraint. The central idea of the DO-JOC is to decisively influence the adversary's decision-making calculus in order to prevent hostile actions against U.S. vital interests. For purposes of competition, planners also consider assurance of friends and influencing others to behave in ways favorable to U.S. global and regional interests. It is these third parties that are often the focus of great power competition. For purposes of this study, the central idea is to influence actor behaviors in a way that promote U.S. strategic geopolitical interests.

Understanding how these factors are interrelated is critically important to determining how best to influence the decision-making calculus of adversaries. Success is not solely a function of whether adversaries perceive the costs of a given course of action (COA) as outweighing the benefits. Rather, adversaries weigh the perceived benefits and costs of a given course of action in the context of their perceived consequences of restraint or inaction. For example, deterrence can fail even when adversaries perceive the costs of acting as outweighing the benefits of acting if they believe the costs of inaction are even greater.

Joint military operations and activities traditionally contribute to the objective of deterrence by affecting the adversary's decision calculus elements in three ways: Deny benefits, impose costs, and encourage restraint. However, military capabilities can also enable other U.S. and partner instruments of power to be more effective. This is particularly important for purposes of competition which is generally not military in nature. Collectively, the Department of Defense groups these capabilities together as "Unified Action" of which "Whole of Government" operations are a subset. Direct military means include force projection, active and passive defenses, global strike (nuclear, conventional, and non-kinetic), and strategic communication, i.e., the alignment of actions with intended message. This is often confused with communication strategy. Enabling means include global situational awareness (through intelligence, surveillance, and reconnaissance), command and control (C2), forward presence, security cooperation and military integration and interoperability, and assessment, metrics, and experimentation. Additionally, military planners can be of great assistance to other parts of government by helping them analyze the mission, develop and assess courses of action, and model effects of actions. The operational challenge is to coordinate global activities and messaging to promote U.S. objectives and disrupt adversary (especially China and Russia) objectives detrimental to the U.S. and its global partners.

Recalling that the planners started with effects (behaviors) that the USG considers to be adverse or a source of potential risk to U.S. interests and working back to identify sources of influence that could lead to this effect, the planners now identify potential USG activities that would influence the decision favorably, both steady-state shaping and engagement, as well as potential response actions to regional stability disturbances. Categorical lists of potential shaping, engagement, and response activities can be used to stimulate the military

planners' imaginations particularly in their conversations with planning staffs in other agencies. Military planners now can use traditional planning tools to develop and assess courses of action (COAs).

The approach used at the operational level was to again model risk to competition effectiveness, but the major risk components were malign influence on the U.S. and its partners, third party (gray) actors trust U.S. competitors over the U.S., and great power competition escalating to conflict. The key objectives are to assure partners and friends, deter adversaries, and compete for influence over other international actors so that they behave in ways favorable to U.S. interests. The framework used is depicted in Figure 7.
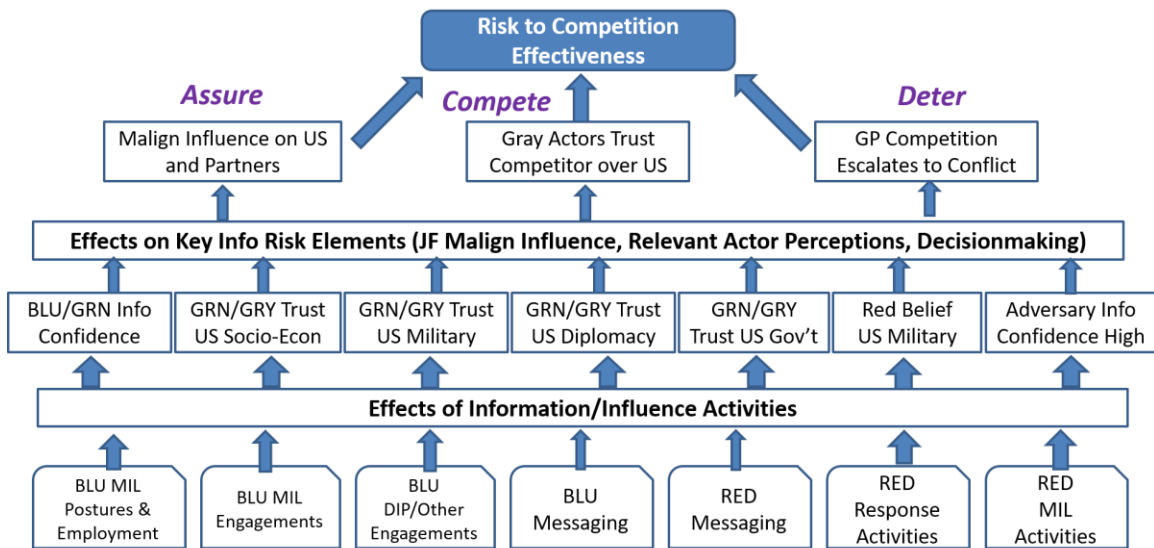

Figure 7. Enabling Events Applied to Military-led Whole
of Government Competition Operations

The model used inputs derived from the Focused Objectives framework described in the previous chapter.

Messaging enabling events consider the different ways the United States can reach a target audience, directly or indirectly, to challenge their preconceptions of the United States, challenge their own beliefs about themselves, and perhaps most importantly, lead them to question their own plans to compete with the U.S.

Perceptions consider what the adversary is likely to observe and then determines what different target audiences might think as a result.

Economic considers all available non-military instruments of power, not just the economic instrument, and serves as the basis to reach out to departments and agencies across the USG.

Engagements are designed to harmonize efforts, from the most overt to those that are more sensitive, in order to amplify the desired effect and shape adversary perceptions.

Military force posture and employment are often the primary observable levers of influence but can be much more effective when combined and synchronized with capabilities that only other elements of power can provide.

Several modeling techniques were used to relate actions to effects. With respect to effects on physical systems, engineering or physics-based models have been developed that can predict the impact of various actions on systems and assess their vulnerabilities. When it comes to the cognitive belief and reasoning domain, engineering models are much less appropriate. The purpose of affecting the physical systems is to convince the leadership of an adversary to change its behavior, that is, to make decisions that it would not otherwise make. However, when an adversary in imbedded within a culture and depends upon elements of that culture for support, the effects of physical actions may influence not only the adversary, but the individuals and organizations within the culture that can choose to support, be neutral, or oppose the adversary. Thus, the effects on the physical systems influence the beliefs and the decision making of the adversary and the cultural environment in which the adversary operates. Because of the subjective nature of belief and reasoning, probabilistic modeling techniques such as Bayesian Nets and their influence net cousins have been applied to these types of problems. Models created using these techniques can relate actions to effects through probabilistic cause and effect relationships. Such probabilistic modeling techniques can be used to analyze (but not predict) how the actions affect the decision calculus of the adversary. The real value of the models is not the result of computational experiments, but the insights the modeler develops through the process of building the risk model. These insights proved useful to actual operational planning teams (OPTs) during practical workshops conducted using real-world planning scenarios.

5. Operational Planning Team Workshops

Four workshops were conducted with members of the Joint Global Strike Operations (J-GSOC) Air Operations Strategy Division leveraging real-world planning for a series of Bomber Task Force (BTF) operations. These operations are designed to support dynamic force employment, which is a key element of globally integrated operations in the Department of Defense.

Dynamic Force Employment (DFE) provides the SECDEF, Chairman, and affected Combatant Commanders (CCDRs) the means to counter nefarious (or potentially nefarious) competitor activities more rapidly and with greater flexibility. It also creates uncertainty on the part of the competitor that it can act without fear of a U.S. response.

As a result, proper messaging of exercise DFE activities can serve as an effective deterrent against opportunistic competitor actions when the U.S. or partners are engaged in military activities in other parts of the world, which in the past, would have made a timely U.S. response to competitive activity unlikely. It can send a powerful signal of commitment with low risk of escalation and relatively low cost by rapid deploying or pre-positioning military platforms to areas of concern. The bomber force is particularly useful in this regard because it can operate from CONUS or deploy to a forward operating base and conduct operations from there.

The challenge that the operational planning teams faced was that there is no process to align their activities with messaging and other activities being conducted by other agencies in the region. The Operational Planning Teams would receive direction from their combat command which reflected guidance that had been coordinated at the strategic level. The purpose of these bomber task force operations in general were to deter adversaries, assure allies and partners, and compete with adversaries to influence the actions and behaviors of third parties. Recall the chapter 3 discussion that highlights that military activities are often the most visible, but are often dependent on other agencies to contextualize and explain the meaning of these activities.

During the workshops, the operational planning teams noted that they must already contact a number of embassies to obtain diplomatic overflight clearances as part of their planning process. The group contacted several retired defense attachés and learned that just like the OPTs they have objectives for their activities from above, but depend on the superior agency levels to perform the coordination. As chapter 3 noted, this is difficult to do at the strategic level; however, since the high-level guidance to the military and agencies is aligned, it is fairly straightforward to coordinate embassy and tactical military actions. In fact, the OPTs learned that this is fairly routine in the special ops community.

Embassy Defense Organizations

With a little research, the OPTs found that the United States Defense Attaché Office (DAO) performs representational functions on behalf of the Secretary of Defense, the Secretaries of the Military Services, the Chairman of the Joint Chiefs of Staff, and the Chiefs of the

U.S. Military Services. In partner countries, the Office of Defense Cooperation (ODC) is responsible for defense cooperation activities. The U.S. Defense Representative, normally dual-hatted with either the Defense Attaché or the Chief of the ODC represents the Combatant Commander.

Other Embassy Organizations

Embassy Economic Section: The Economic Section maintains regular contact with a variety of government institutions, American and local business organizations, think-tanks, and non-governmental organizations.

Embassy Political Section: The Political Section follows, analyzes and reports political developments in the country, and generates support for U.S. policy objectives with key leaders. Political officers also assess the results of U.S. policies and programs on relations with the host country.

Embassy Public Affairs: The mission of the Public Affairs Section is to promote understanding of U.S. political, economic and social issues — explaining to host country audiences both the current Administration's foreign policy agenda and the complexities of U.S. society and culture.

- The Public Affairs Section is overseen by the Minister-Counselor for Public Affairs who directs the Embassy's Press Office and Office of Cultural Affairs. The Minister-Counselor for Public Affairs deals directly with host nation journalists, academics, political leaders, intellectuals, and cultural figures.
- The Press Section is responsible for explaining the content of U.S. Policy, and handles all media inquiries concerning official U.S. government policy.
- Information Resource Centers (IRCs) provide authoritative, relevant, and timely background on both the content and context of U.S. policy issues

CCMD Strategy and Plans: The CCMD J5 directorate develops strategic guidance, plans military campaigns and operations, and conducts security cooperation activities with nations in the area of responsibility. The service components are responsible for theater engagement, and developing and directing the command's strategy initiatives and political-military affairs program.

A visual depiction of these relationships is presented in Figure 8. As was evident at the strategic level, while all the agencies are involved in execution of messaging and activities, the military is uniquely positioned to lead the associated planning efforts. At the strategic level it is the Joint Staff, particularly the J39, that has the tools and expertise to foster this kind of coordination and synchronization. The same is true at the operational (and execution) level with the operational planning teams.
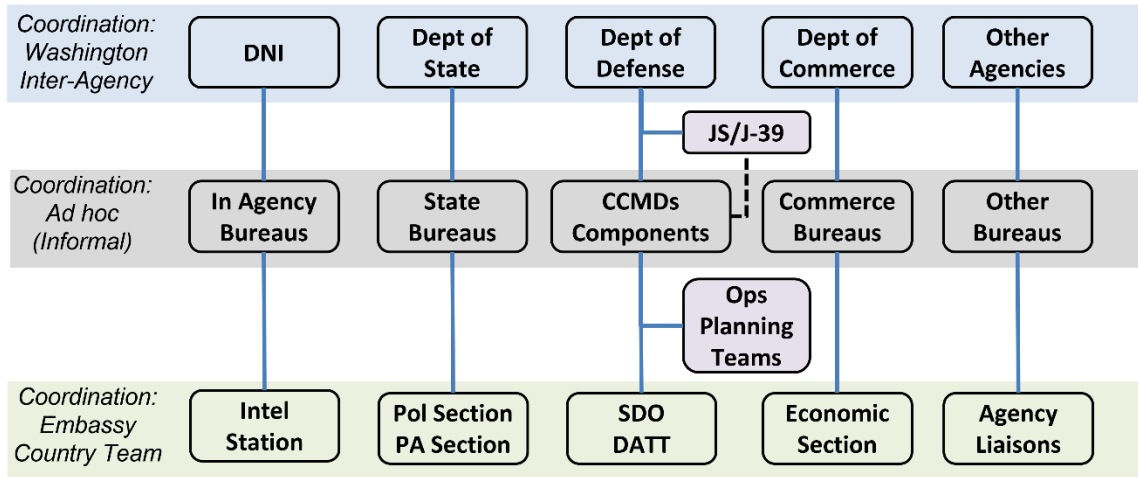
Figure 8. Military-led, Whole of Government Influence/Enabling Events Alignment

Operational planning teams are very familiar with two processes, Mission Analysis which (depicted in Fig. 9) and Course of Action development (depicted in Fig. 10). In both cases there are pure coordination requirements that apply to traditional planning but can be easily adapted for unified action (whole of government) planning.
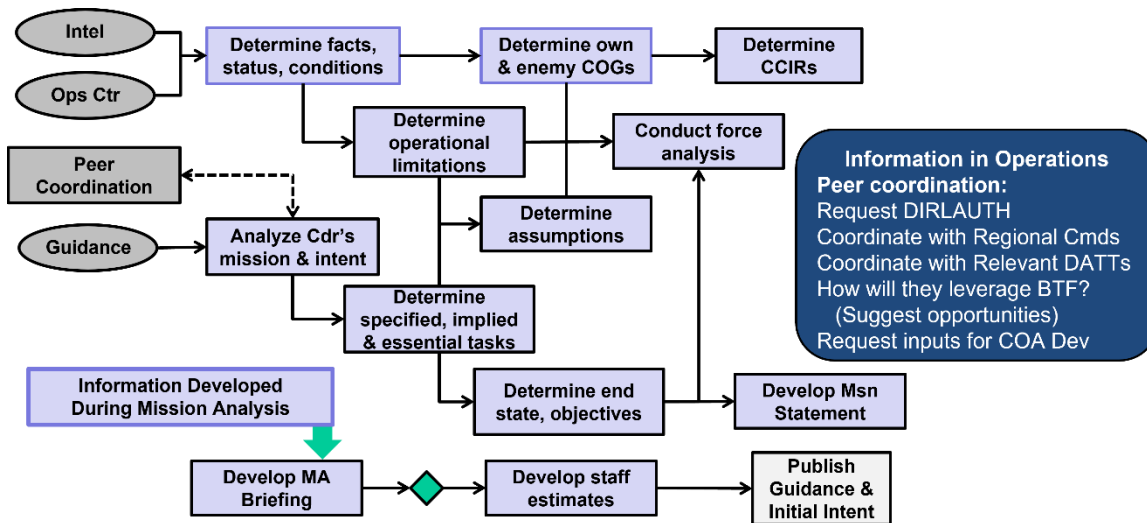

Figure 9. Information in Joint Ops Mission Analysis Workflow

Recalling the process that was conducted at the strategic level to determine allocation of resources and to conduct risk assessment it is clear that a similar arrangement can be used at the operational level. It is in fact part of the course of action development and assessment process. But in this case, instead of involving only military agencies, the embassies are now involved using all the members of the country team.
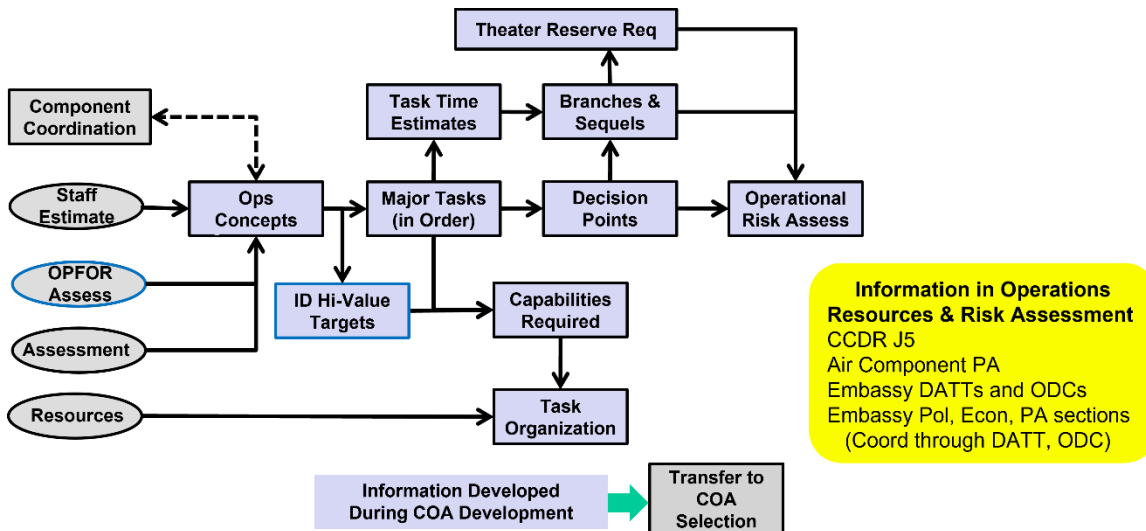
Figure 10. Information in Joint Ops Course of Action (COA) Development Workflow

The last major OPT process is the actual writing of the operations directive. It is important to recall that the operations directive does not apply only to the forces directly under the command of the responsible commander, but allows for direct support agreements with other military agencies and non-military organizations. Figure 11 depicts the contents of an integrated information operations directive.

Integrated Information Operations Directive

Supported Commander's Intent

Concept of Operations: Military Maneuver, Information Activities and Operations

Tasks to Subordinate Units (Military Employment Enabling Events)

Country Team Coordination/Support (Deter, Assure, Compete Enabling Events):

- **Relevant Embassies DATT, ODC, Defense Rep**
- **Economic Sections**
- **Political Sections**
- **Relevant Embassies Public Affairs**
- **Supported CCMD J-5**
- **Supported Components J-5**

Coordinating Instructions: CCIR, Risk Reduction Measures

Command, Control, Communications: Unified Action Synchronization & Deconfliction

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Figure 11. Information Integration Operations Directive Considerations

6. Observations

The GMU research and modeling efforts focused on providing support to operational planners involved in deterrence, assurance, and competition activities. The following observations came from both model development and the workshops conducted with operational planning teams and are aligned with study objectives outlined in the sponsor request memorandum.

Objective: Integrate information and influence into operational-level design and planning, execution, and assessment

> **Observation:** Although planning teams are much more comfortable planning and executing joint or service military operations, the workshop teams easily adapted legacy mission analysis, Course of Action (COA) development, and orders processes to integrate information effectively into Unified Action operations. Unified Action is important because the planners found that applying Whole of Government information-related capabilities was more effective than using military capabilities alone. In each of these processes, the operational planning teams were shown the effectiveness of collaborating with planners in relevant agencies across the whole of government, not only to coordinate activities, but also to benefit from their expertise. For the specific planning activities addressed in the workshops, the planners found that the Defense Attaches and/or Senior Defense Officials in the relevant embassies could work on their behalf to coordinate activities in the country teams and then allow each agency representative to perform the approval procedures that their agencies require. For operational directives, it is important to provide the other agencies with the information they need to synchronize and deconflict their activities with those of the military, and to request effectiveness assessments.

Objective: Build understanding and trust in the purpose of and approach to joint force activities

> **Observation:** The context for this objective derives from the need to shape the operational environment in order to advance JFC campaign goals. The TIN model was constructed to focus on competition effectiveness, which was decomposed into (1) assuring the U.S. domestic audience as well as U.S. partners, (2) deterring our competitors from conducting activities that might escalate to conflict, and (3) competing with our peers for the trust and confidence of third-party countries. This objective primarily targets the U.S. and its partners, but modeling suggests that it also affects the perceptions of third-party actors. Among the intermediate influence factors were trust of the United States socio-economic system, trust of the U.S. military, trust in U.S. diplomacy, and trust in the United States government. One benefit of treating this operational enterprise as a whole of government (Unified Action) endeavor is that this approach sets the stage to align information related capabilities across the United States government. In this way, when confronted with adverse messaging from competitors, people in the United States and its partner nations will hear the U.S. narrative repeatedly and consistently.

Objective: Erode adversary confidence in their capabilities, strategies, and relationships

Observation: This objective focuses on the deterrence aspect of U.S. competition effectiveness, specifically the need to convince our competitors not to conduct activities that could escalate to conflict. Among the intermediate influence factors affecting this objective are U.S. competitors' beliefs in US military's capabilities, their beliefs in the U.S. government's commitment to use its military capabilities if provoked, and U.S. adversaries' confidence, particularly based on information they have, that they would win if conflict were to ensue.

Another aspect of this objective, which was addressed in the workshops, was the U.S. use of "Reveal and Conceal" strategies to create doubt in an adversary's decision calculus regarding the ability of the U.S. to counter their capabilities, or the existence of a U.S. capability for which the adversary has no effective defense. These strategies can involve operational planning teams in a supporting role, but the majority of information-related activities of this type are planned and executed above the operational level involving service headquarters and Pentagon organizations.

Objective: Diminish an enemy's ability to sense, understand, decide, and act effectively

Observation: There are many activities that can be conducted to create ambiguity on the adversaries' part or even misdirect them to behave in ways that support U.S. operational or strategic objectives. The workshop participants discussed the importance of operational security in advance of an activity, in part to protect the military forces involved, and in part to create an element of surprise for the greatest impact on adversary perceptions, but most importantly to deny the adversary an opportunity to counter the activity or mitigate its effects.

Objective: Protect U.S. and partner abilities to sense, understand, decide, and act effectively

Observation: Leveraging whole of government and partner capabilities is particularly useful to promoting this objective. The operational planners noted the value of comparing primary and alternate sources of information to detect the existence of bad data, regardless the cause, along with means to determine which information should be ignored. Multiple agencies and partners offer a variety of information sources as well as a diversity of interpretation regarding the information's meaning. These multi-agency and multinational partners also bring a breadth of expertise that can improve understanding of situations as they develop. Better information means better decisions, which leads to more effective operations.

Objective: Identify suitable Operations in the Information Environment assessment frameworks and approaches

Observation: One of the key benefits of TIN modeling is that it provides a way to assess the effectiveness of a campaign based on the combined contributions of the contributing influence factors. The caveat to this approach is that effectiveness measures based on

computational modeling assume that the cause-effect relationships contributing to the campaign effectiveness measures are represented accurately. It may not be possible to directly evaluate the overall effect of information-related activities on the perspectives of relevant actors, but the success of the individual activities contributing to the actor perspectives can be more easily observed, and in some cases, their direct effects measured. One note: The TIN model probability profile is best understood as representing a relative change in competition effectiveness rather than a specific numerical value.

Objective: Identify characteristics of information as a form of operational maneuver and power

Observation: The US military prefers to conduct its operations based on overpowering its adversaries and achieving victory through attrition or by threatening their defeat through the employment of overwhelming force. As a result, few US military leaders are experienced or even comfortable with the use of information operations to outmaneuver an adversary. On the other hand, many US competitors have turned to information as an effective means to outmaneuver the US and therefore deny the US the benefits of its asymmetric advantages in physical power.

The military planners who participated in the IIJO workshops have developed a very good understanding of information maneuver's importance: Information moves through every traditional military environment using both physical and electronic means and can create physical and cognitive effects on a global basis without physical movement of forces. They found that treating information as a form of maneuver offers a useful template for planning the integration of information into joint and unified action operations. Although not used in this way during the workshops, the participants noted that the components of successful maneuver - positioning, tempo, Schwerpunkt ("main emphasis"), surprise and deception, cross-domain synergy, flexibility, unity of effort, and opportunism - can also serve as elements of a framework to anticipate an adversary's integrated use of information to undermine US and partner interests.

Objectives: Identify approaches to OIE operational design, detailed planning, and assessment that will enable commanders to leverage and command and control the power of joint physical and informational maneuver in the OIE

Observation: During the course of this Strategic Multi-layer Assessment (SMA) two different TIN models were constructed. The first model focused on planning strategic-level shaping, probing, and response (counter-shaping and counter probing) competition-phase activities. At the strategic level, it became clear that while US military activities are typically the most visible, even in periods of routine competition, these activities are quite often in support other agencies and are not traditional joint operations. Leveraging insights from the Joint Staff J39, the assessment team documented processes used today to align and synchronize information related activities across the Whole of Government to meet U.S. strategic objectives. For strategic-level Whole of Government competition operations, there is not a clear commander or equivalent to lead the planning and execution; therefore, in most

cases, planning is conducted in a committee fashion, with each agency head responsible for detailed planning and execution. Military leaders play an important role here because of their experience with Unified Action operational design and planning. However, in working with the Operational Planning Teams, it became clear that a different approach (and model) would be necessary to integrate information into joint operations.

Although the operational planning teams (OPTs) are only responsible for the planning and execution of the military activities, the processes that they use for traditional joint operations were easily adapted to integrate information capabilities across the whole of government into the military planning processes. The key to success is for the OPTs to understand the role of the country teams in each of the relevant countries, and to have the necessary DIRLAUTH (Direct Liaison Authorized) to coordinate planning with the J3 and J5 staffs in each of the affected combatant commands.

Detailed planning to integrate information with military activities can be conducted using traditional mission planning processes. It begins with mission analysis where the operational planning teams perform peer coordination with not only other military components but also with the defense attaches or senior defense officials in each relevant country, as well as with the J5 (and/or J3) Staffs of the combatant commands (CCMDs) associated with those countries. Coordination with other CCMDs requires appropriate DIRLAUTH. The CCMD staff and the individual country teams can provide expert insights on each of the countries that might be affected by the military activities being planned and can also offer suggestions to make the operational execution more effective. These sources of subject matter expertise are invaluable during COA development and analysis, not only to make the activities more effective in affecting the perceptions and behaviors of the targeted countries, but to prevent misperceptions from occurring with actors affected, but not targeted by the planned military activities.

Assessment of individual information-related activities is difficult but establishing relationships with the relevant country teams and CCMD staffs also provides a source of feedback to assess the effectiveness of information/influence military actions in relation to the mission objectives for each affected country.

7. Conclusions and Recommendations

Conclusions

It is very difficult to achieve information enabling event alignment across the Whole of Government because there is no one responsible for this alignment at any planning level (Strategic, Operational, or Execution).

The U.S. military can improve alignment by incorporating non-military agencies into its traditional planning processes (mission analysis, course of action development, operations orders).

All relevant (and potentially relevant) actors must be identified along with their individual objectives—not just Adversary (Red) or partners (Green), but also the third-party (Grey) actors which are often the focus of U.S. competition.

During the planning processes it is important to assess the perceptions of all actors (both targeted or not) and the likely effect of the information enabling events on their perceptions relative to the deterrence, assurance, or competition objectives that apply to each.

Department of State country experts and Embassy Country Teams can inform planning and support execution.

Defense Attaches (and other military assigned to embassies) can serve as country team entry points (with proper DIRLAUTH and CCMD coordination) to get planning inputs from political, economic, public affairs sections and other country team members.

Country team members can align messaging, engagements, non-military info enabling activities, and perception management with military activities without specific military direction using their own agency and organization guidance, but they need the information the operational planning teams produce during mission analysis and COA development to do their own planning and execution effectively.

The U.S. military focuses most of its education and training on combat operations where military force is the dominant (supported) capability but has limited experience with competition ops where non-military (Unified Action) capabilities are often predominant and the military operates as a supporting capability.

Recommendations

Update doctrine and other planning team guidance as it applies to mission analysis, course of action development, and orders processes to incorporate Whole of Government information-related capabilities into the planning and execution of Unified Action operations.

For assessment purposes, **decompose Unified Action objectives** into causal effects and influence factors that can be measured and used as Measures of Effectiveness (MOE) indicators. Procedures should call for planning teams to solicit feedback directly from the country teams through the Defense Attaché or Senior Defense Official to provide a practical assessment of operational effectiveness related to deterrence, assurance, and/or competition objectives.

Decomposing Unified Action objectives into causal effects and influence factors can also support the development of effective narratives; however, competition narratives are typically the responsibility of strategic level inter-agency processes, not operational planning teams or commanders. Operational planning teams can also apply these decomposed objectives to inform intelligence collection and analysis requirements.

Conduct wargames and other simulations with a focus on competition campaigns, and specifically focus the participants on the integration of information and influence into Joint and Unified Action operations. This is very different from traditional simulations that focus on joint operations where the military is supported. This will require development of new procedures for planning and executing Unified Action operations where the military takes the lead for planning, coordination, and synchronization of operations in support of lead agencies other than DoD. Such events will also provide participants experience with Whole of Government and other Unified Action operations as well as develop their expertise in use of the information joint function. These simulations and wargames should also encourage participants to not only "red team" the competitors to the U.S., but also assess how the competitors' red teams would assess and respond to proposed U.S. Courses of Action.

Appendix A: Timed Influence Nets

Influence Nets (IN) and their Timed Influence Nets (TIN) extension are abstractions of Probabilistic Belief Nets also called Bayesian Networks (BN) (Wagenhals et al., 2000, Wagenhals and Levis, 2001). BNs and TINs use a graph theoretic representation that shows the relationships between random variables. Influence Nets are directed acyclic Graphs where nodes in the graph represent random variables, while the edges between pairs of variables represent causal relationships. A key differences between Bayesian Networks and INs and TINs is that the latter two use CAST Logic (Wagenhals et al., 2001, Haider and Levis, 2005) a variant of Noisy-OR (Haider et al., 2006, Wagenhals and Levis, 2007), as a knowledge acquisition interface for eliciting conditional probability tables. The modeling of the causal relationships in TINs is accomplished by creating a series of cause and effect relationships between some desired effects and the set of actions that might impact their occurrence in the form of an acyclic graph. The actionable events in a TIN are drawn as root nodes (nodes without incoming edges). Generally, desired effects, or objectives the decision maker is interested in, are modeled as leaf nodes (nodes without outgoing edges). In some cases, internal nodes are also effects of interest. Typically, the root nodes are drawn as rectangles while the non-root nodes are drawn as rounded rectangles. Figure 5 shows a partially specified TIN. Nodes B and E represent the actionable events (root nodes) while node C represents the objective node (leaf node). The directed edge with an arrowhead between two nodes shows the parent node promoting the chances of a child node being true, while the roundhead edge shows the parent node inhibiting the chances of a child node being true. In Figure 5, there is a triplet associated with each link. The triplet is defined a (h, g, t). Parameter h is the influence that a parent node will have on the child node, if the parent node is TRUE. Parameter g is the influence the parent node will have on the child node if the parent node is FALSE. The third parameter, t, indicates the time delay associated with this link. For instance, event B, in Fig. 5, influences the occurrence of event A after 5 time units.
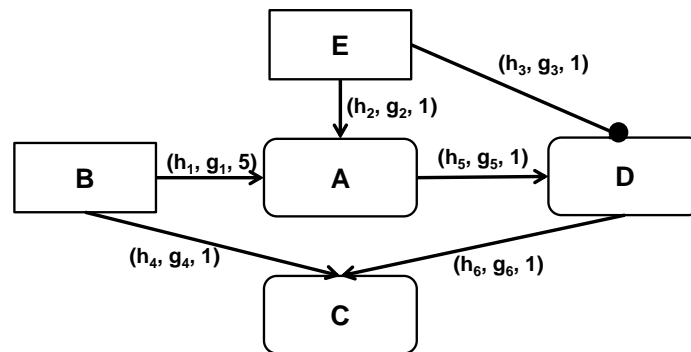

Fig 5: An Example Timed Influence Net (TIN).

The purpose of building a TIN is to evaluate and compare the performance of alternative courses of actions. The impact of a selected course of action on the desired effects is analyzed with the help of a probability profile. Consider the TIN shown in Fig. 5. Suppose the following input scenario is decided: actions B and E are taken at times 1 and 7, respectively. Because of the propagation delay associated with each arc, the influences of

these actions impact event C over a period of time. As a result, the probability of C changes at different time instants. A probability profile draws these probabilities against the corresponding time line. The probability profile of event C is shown in Fig. 6.
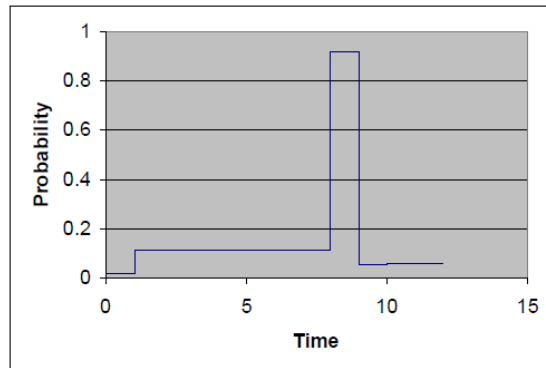

Fig 6: Probability Profile for Node C

To construct and use a TIN to support the determination of courses of action to deter competition activities by an adversary, analysts and planners can employ the following process:

1. Determine the set of desired and undesired effects expressing each as declarative statement that can be either true or false. For each effect, define one or more observable indicators that the effect has or has not occurred.

2. Build an IN that links, through cause and effect relationships, potential actions to the desired and undesired effects. Note that this may require defining additional intermediate effects and their indicators.

3. Use the IN to compare different sets of actions in terms of the probability of achieving the desired effects and not causing the undesired effects.

4. Transform the IN to a TIN by incorporating temporal information about the time the potential actions will occur and the delays associated with each of the arcs and nodes.

5. Use the TIN to experiment with different timings for the actions to identify the "best" COA based on the probability profiles that each candidate generates. Determine the time windows when observation assets may be able to observe key indicators so that assessment of progress can be made during COA execution.

6. Create a detailed execution plan to use the resources needed to carry out the COA and collect the information on the indicators.

7. Use the indicator data to assess progress toward achieving the desired effects.

8. Repeat steps 2 (or in some cases 1) through 7 as new understanding of the situation is obtained.

To analyze the TIN (Step 5), the analyst selects the nodes that represent the effects of interest and generates probability profiles for these nodes, and then compares the probability profiles for the different courses of action under consideration.

References

Haider, S. and A. H. Levis. (2007). Effective Courses of Action Determination to Achieve Desired Effects. *IEEE Trans. on Systems Man and Cybernetics – Part A, 37 (6)* , 1140-1150.

Haider, S. and A. H. Levis. (October 2008). Modeling Time-varying Uncertain Situations using Dynamic Influence Nets. *International Journal of Approximate Reasoning, Vol. 49, No. 2*, 488-502.

Haider, S., A. K. Zaidi and A. H. Levis (2008). Identification of Best Set of Actions in Influence Nets. *International Journal of Hybrid Intelligent Systems (IJHIS), vol. 5, No. 1*, 19-29.

Haider, S. and A. H. Levis, (June 2005). Dynamic Influence Nets: An Extension of Timed Influence Nets for Modeling Dynamic Uncertain Situations. *Proceedings of 10th International Command and Control Research and Technology Symposium.* Washington.

Joint Staff. (2014, February). *JP3-13 Information Operations.* Retrieved from Doctrine Publications: https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_13.pdf

Joint Staff. (2017, July 12). *JP 1 Doctrine of the Armed Forces of the United States.* Retrieved from Doctrine Publications: https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_12.pdf

Joint Staff. (2018, July 25). *Joint Concept for Operating in the Information Environment.* Retrieved from Doctrine Concepts: https://www.jcs.mil/Portals/36/Documents/Doctrine/concepts/joint_concepts_jcoie.pdf?ver=2018-08-01-142119-830

Joint Staff. (2018, June 8). *JP3-12 Cyberspace Operations.* Retrieved from Doctrine Publications: https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_12.pdf

Joint Staff J2. (2018, October 30). *Globally Integrated Operations.* Retrieved from JCS: https://www.jcs.mil/Portals/36/Documents/Doctrine/MECC2018/globally_integrated_ops.pdf?ver=2018-10-30-085737-770

Joint Staff. (2018). *Joint Concept for Integrated Campaigning.* Washington DC: Department of Defense.

Kuznar, Larry (2021, June 17). Chief Cultural Scientist, NSI. (R. Elder, Interviewer)

Peter Pachowicz, L. W. L. W. Wagenhals, J. Pham, and A. H. Levis, (April 2007). Building and Analyzing Timed Influence Net Models with Internet-enabled Pythia. *Proeedings. of SPIE, 2007 Defense and Security Symposium.* Orlando.

Stephenson, M. R. (2018, November 28). Director, Office of Irregular Warfare, Joint Staff J7. (D. H. Cabayan, Interviewer

Wagenhals, L. W., I. Shin, and A. H. Levis (June 2000). Course of Action Development and Evaluation. *Proceedings of 2000 Command and Control Research and Technology Symposium.* Monterey, CA: Naval Postgraduate School.

Wagenhals, L. W., T. J. Reid, R. J. Smillie and A. H. Levis (June 2001). Course of Action Analysis for Coalition Operations. *Proceedings of 6th International Symposium on Command and Control Research and Technology.* Annapolis, MD.

Wagenhals, L. W. and A. H. Levis. (April 2007). Course of Action Analysis in a Cultural Landscape Using Influence Nets. *Proceedings of IEEE Symposium On Computational Intelligence for Security and Defense Applications 2007.* Honolulu.

Wagenhals L. W., and A. H. Levis, (April 2001). Modeling Effects-Based Operations in Support of War Games. *Proceedings of SPIE, Vol. 4367, Enabling Technologies for Simulation Science, V, A. F. Sisti & D. A. Trevisani, Eds.*

van Creveld, M*., K. S. Brower, and S. L. Canby* (1994). *Airpower and Maneuver Warfare.* Retrieved from Air University Press: https://www.airuniversity.af.edu/Portals/10/AUPress/Books/B_0053_VANCREVELD_BROWER_CANBY_AIRPOWER_MANEUVER_WARFARE.pdf