

Effects-Based Operations: Building the Analytic Tools

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Overview

The U.S. military, under the guidance of the Secretary of Defense, is moving toward a new concept of military planning and operations that is agile and adaptable to the conflict at hand. The aim is to develop capabilities that can rapidly break an adversary's will to fight and undermine the utility of asymmetric capabilities. The new concept called effects-based operations (EBO) encompasses processes, tools, and organizations that focus on planning, executing, and assessing military activities for the effects produced rather than merely tallying the number of targets destroyed. EBO practitioners draw on the full range of instruments of national power to anticipate, track, and understand the indirect as well as direct effects of U.S. actions throughout the enemy political, military, and economic systems.

The EBO concept requires deep knowledge not only of enemy but also of friendly capabilities and structures. The current suite of analytic tools employed by the Department of Defense cannot support this approach to military operations. These tools were not designed to determine how the use of force affects adversary strategic will, to model adaptive behavior, to represent unintended consequences, or to evaluate alternative courses of action that include other instruments of national power beyond military force.

During the Cold War, the dominant principle of military planning was the ability to mass forces at key points while preventing the adversary from doing the same. Success in battle was understood to depend on the ability to dominate the enemy in an extended attrition campaign. However, the operations that the U.S. military has been called on to execute have changed in character. They are typically against opponents who have nowhere near the military might of the United States (let alone the United States with its allies), and they are not limited to the classic cross-border invasion that leads to defined battle lines, with success measured by territory defended or gained. As demonstrated by Operation *Allied Force* in Kosovo and Operation *Enduring Freedom* in Afghanistan,

considerations of military superiority at strategic or operational levels are inappropriate when compared with other factors, such as the enemy's will to fight and local considerations of military force that allow for asymmetric capabilities to be employed effectively. The new concept of effects-based operations (EBO) is an effort to leverage American military and technical might with enormous advantages in computation, information, and analysis to achieve political-military outcomes that so far have eluded the United States in the new strategic environment.

Making EBO a reality will depend on developing and using appropriate analytic frameworks of political and military problems. These frameworks and associated methodologies will enable commanders to plan more effectively for operations and then adapt those plans and operations as political and military situations unfold. Future operations that reflect the principles of EBO will require U.S. political and military leadership to understand the consequences of what may occur in the future beyond immediate military activities. Political and military decisionmakers will require a modeling framework that integrates concepts such as the explicit linking of military actions to national strategy, the continual assessment of operational outcomes and unintended consequences, the coordination of interagency efforts, and the appropriate utilization of emerging operational concepts such as network-centric warfare and rapid decisive operations.

EBO seeks to control the duration and scale of a conflict, allowing the state to achieve strategic objectives at an acceptable cost. Efforts to achieve the desired effects are pursued under the dual objectives of operational efficiency and political effectiveness. Under EBO, commanders would not commit to operations that squander precious resources, nor would they undertake actions without a likelihood of success; for example, they would not commit to a strategy of deterrence against an adversary intent on fighting regardless of the potential costs or loss. By juxtaposing the effectiveness of political outcomes with quantitative measures of military operations, assessments can incorporate qualitative values. While such analytical products cannot by their nature provide objectivity, simplicity, and/or precision, they do provide the commander with improved contextual awareness, increased ability to

select measures of effectiveness, and the chance to assess relationships between actions and political outcomes. The result is an operational paradigm that couples the use of force with purposeful political behavior and allows operators to take the most efficient or effective path to achieve the most desirable political outcome—that is, to establish the linkage between ends and means. This results in the development and use of military capabilities that serve national interests on various levels, ensuring that military and political strategy are, and remain, relevant to one another.

EBO constitutes a shift away from traditional force-on-force analysis, in which the central concerns have been the ability to mass forces and deny the adversary the ability to do the same. Due to changes in the international system over the last decade, victory in the kinds of conflicts that the United States faces is unlikely to be achieved through the massing of forces and must be pursued instead through the skillful use of force in conjunction with diplomatic, economic, legal, and other instruments of national power. As the U.S. military is asked to confront terrorism, drugs, organized crime, environmental and humanitarian crises, and armed conflict devoid of any centralized leadership on the part of the adversaries, distinctions between combat operations and political events will continue to blur, making the political effects of military activities increasingly important. EBO is a natural and logical adjustment to changes in the security environment and the diminishing barriers between military and political activities and outcomes.

A central concern is that the current suite of analytic tools cannot represent all the aspects that interest political and military leaders and allow their actions to remain mutually supportive. The current tools can generate logistical and targeting plans that make the best use of available resources, but they cannot determine the degree to which a particular targeting scheme will influence the will of an adversary or the emergence of post-conflict order. Nor can the current tools generate insight into whether a desired outcome can be achieved by using national capabilities other than military force. Nor can they evaluate the probable results using differing mixtures of force and diplomacy. A new set of tools is necessary to support and implement new strategies.

Why Effects-Based Operations?

Strategic planning has always linked military operations to a desired political outcome. Indeed, the use of violence to achieve

desired political effect is the essence of warfare as articulated by Carl von Clausewitz: “[W]ar is not merely an act of policy but a true political instrument, a continuation of political intercourse, carried on with other means. . . . The political object is the goal, war is the means of reaching it, and means can never be considered in isolation from their purpose.” Success or failure in warfare has always been judged on political outcomes and results, no matter how skilled or poor the military conduct. Coupling the conduct of military operations to the attainment of political objectives remains the primary challenge facing political and military leadership. EBO constitutes an important development in the planning and conduct of military operations, precisely because it makes a direct linkage between military operations and the desired political effects. Additionally, it is an explicit endorsement of seeking victory through the manipulation, threatening, and destruction of an adversary’s centers of gravity as opposed to engaging in costly contests of attrition in which success or failure is a matter of quantitative comparisons of gains and losses. Simply put, the United States will enter into contests of attrition only when no better option is available.

The difference between the strategic outlooks of EBO and attrition is well recognized, but what is generally less understood is that each demands distinctly different tool sets for execution. Attrition-based strategies ultimately rest upon the exhaustion of the adversary’s physical, psychological, and social will. The success or failure of attrition-based strategies depends upon choosing the appropriate measures of comparison, accurate estimates of inventories and production capabilities, and operational execution. Analytical support typically assumes a linear relationship, whereby change between similar units occurs in a constant, proportional fashion. Assessments, models, and simulations assign value and draw conclusions based on explicit axioms and estimation techniques. The result is a process that is fundamentally systematic, quantitative, and relatively objective.

Implementing Effects-Based Operations

U.S. Joint Forces Command defines *EBO* as a process for obtaining a desired strategic outcome or “effect” on the enemy, through the synergistic, multiplicative, and cumulative application of the full range of military and nonmilitary capabilities at the tactical, operational, and strategic levels.¹ Other definitions consider EBO as operations conceived and planned in a systems framework that considers the full range of direct, indirect, and cascading effects—effects that may, with different degrees of probability, be achieved by the application of military, diplomatic, psychological, and economic instruments.² While definitions of EBO seem to abound, the majority are grounded in the belief that EBO does not imply just attacking a target or achieving a simple military objective. In fact, discussions aimed at better defining EBO tend to imply the approach is concerned with activities beyond, but inclusive of, accurate targeting. These concerns are described in terms of strategic

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outcomes or goals. Strategic goals include the assurance of “beyond-first-order” effects on the agents, institutions, technologies, and motivations that constitute an adversary’s infrastructure, as well as on the global state of the sociophysical systems that comprise the adversary and international system.

The political objectives of the state provide the basis for creating an operational measure of effectiveness of an EBO. This does not replace sound military planning or decisionmaking, such as providing adequate fire support to infantry and ensuring that logistics and lines of communication are secure. Rather, EBO ensures that tactical and operational actions are explicitly part of a strategic plan developed to achieve specific political results and that unnecessary military operations are not undertaken. While asserting that successful campaigns could be economized into a single decisive blow would be unreasonable, DOD leadership may find a locus of activities by using EBO that are the most likely to succeed in operational terms, have the desired political consequences, and be performed at an acceptable cost. Ultimately, these results will serve as the best evaluator of decisionmaking.

By coupling strategic outcomes with military operations, EBO is as much about a change in emphasis and concepts as it is about force structure and operations. The roots of EBO are as old as strategy, and many military operations over the years have incorporated its tenets. Yet the EBO approach is new because it brings the justification and measures of effectiveness of military operations to the forefront of the planning process. By explicitly recognizing the relationships between military operations and political goals, a framework for understanding when, why, and how the United States will undertake military operations becomes clearer. Discussion and planning can move beyond the identification of military objectives and incorporate the logic of *why* we act into determining *how* we act. Consider the example of U.S. operations in places where clear military objectives and measures are difficult to establish, such as peacekeeping operations. These operations may be better defined by their intended strategic effects, such as ensuring that political instability does not spread to surrounding countries or demonstrating our commitment to current or future allied objectives and priorities. While the efficacy of such actions may be debatable, evaluating their success or failure based on desired political outcomes constitutes the appropriate forum for the debate. Decisions can be judged as wise or foolish only based on their original motivational contexts.

Although the strategic logic behind EBO is certainly not revolutionary, operationalizing EBO nevertheless may demand dramatic new military capabilities and forms of organization. Emphasizing the ability to achieve desired political effects within a set of constraints requires that military organizations increase their flexibility and formulate novel approaches to achieve a particular political effect. This will further require and perhaps even encourage the services to work toward the development of unprecedented interoperability and flexibility in their mission packages and organizational structures to ensure that planners can select tools, forms, and tactics consistent with the desired political ends. Specifically, the military’s tools and organization must be adaptive enough to ensure that organizational

and technological constraints are kept to a minimum, thus maximizing the options available to policymakers.

Analysis: The Lynchpin of EBO

To date, the movement toward EBO has rested upon the building of military doctrine, organization, and operational experimentation. However, the lynchpin of EBO ultimately will be the development of conceptual tools that link military operations with strategic effects. In the context of EBO, assessments require considering the second-, third-, fourth-, and n^{th} -order effects of actions and how these effects may propagate through time. By emphasizing effects beyond the first order, the evaluative criteria for determining courses of action are expanded in breadth and depth. This new requirement for evaluating military options prior to action will constitute a major part of future analyses.

Because they emphasize outcomes and seek to minimize the costs of conflict for the United States through the superior use of information and exploitation of adversary centers of gravity, EBOs are much more information-intensive than attrition-based military operations. The ability to manipulate or deter an adversary or alter the framework of existing or impending problems demands that the information, estimates, and assessments available to decision-

makers allow them to understand the environment. This is more than a matter of collecting information on the military order of battle, the operational and technical characteristics of weapon systems, and the geographic distribution of friendly and enemy forces.

Eight Information Sets

The implementation of EBO rests upon the development of eight different information sets that enable EBO by providing planners with an understanding of friendly and adversary systems. The information sets are:

- *technical*, which contains the physical characteristics of friendly and adversary military and organizational tools and describes the physical features and limitations of systems.
- *geographic*, which relates objects, such as sensors, weapon systems, people, and other actors, to positions within physical space. It is a body of knowledge about the distribution of assets and objects within the physical world.
- *infrastructure*, which combines technical and geographic information into a basic understanding of how objects and actors within the system relate to one another based on their technical capabilities. Infrastructure information is value-neutral in that it does not capture preferred ways of making connections within the system, only describing what connections exist or are possible.
- *organizational*, which overlays manmade organizations on the infrastructure data set. It addresses how human beings have formalized their relationships into hierarchies and networks for the purpose of achieving group objectives and carrying out operations. Like infrastructure information, organizational knowledge is value-neutral in that it captures explicitly defined organizational structure but does not account for organizational routines or innovation based on context or pressures.

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■ *sociopolitical*, which captures the broader range of social and political objectives of agents, organizations, institutions, and actors in the system. Unlike the organizational body of knowledge, the sociopolitical data set does not define an explicit structure but instead describes the social and political conditions from which organizations develop and serve. The sociopolitical structure is far more diverse and flexible than the organizational data set, giving life and motivation to manmade organizations.

■ *psychological*, which explains the influence of emotion, identity, morale, and other nonmaterial factors in friendly and adversary decision-making and conduct.

■ *context*, which parses the previous six data sets. It forms the body of theories and perspectives that allows analysts and decisionmakers to select appropriate technical, geographic, infrastructural, organizational, sociopolitical, and psychological models to evaluate situations. It is contextualization of these bodies of information that gives them value and allows for targets to be selected based on their value in a given set of circumstances.

■ *dynamics*, which allows analysts and decisionmakers to understand how systems change across time, and between structures and states, in response to external stimuli. Because the objectives of EBO ultimately rest upon changing the state of a threatening system from hostile to neutral or friendly, or from threatening to harmless, the development of a body of knowledge that relates action and reaction within targeted sociopolitical systems is critical. Like context, dynamics is not a focused body of knowledge. Instead, it is a set of theories, hypotheses, and assumptions that relates bodies of knowledge to one another and explains causal relationships between action and outcome.

The combination of these information sets is necessary for EBO. Use of a single set of information biases options and restricts the ability of planners and operators to engage an adversary. As the sets of information expand, not only do engagement options increase, and in some cases decrease as previously attractive courses of action become unattractive as more information becomes available, but also a deeper, more meaningful effects-based targeting and engagement plan can be developed, culminating in an understanding of how military operations will produce desired political outcomes. The U.S. military has already employed such a planning philosophy, albeit with mixed results, in the air campaign during Operation *Desert Storm* and later in Kosovo. Each of these cases reveals the potential of effects-based targeting as well as the inherent difficulties associated with its implementation.

Analytic Outputs: Quantitative vs. Qualitative

Effective military planning and operations must be supported by analytic processes that measure success, failure, and robustness. Traditionally, operational measures have emphasized quantitative factors, assigning numeric values and probabilities to actions or outcomes. However, to ensure that military operations achieve the goals of EBO, analytic support to military and strategic planners must incorporate qualitative factors into their outputs, providing insights into the history, context, and soft factors of the problem.

Quantitative measures have proven themselves useful for operational analysis and process examination. They have proven their worth when the questions and concerns of decisionmakers rest upon

answering discrete problems, such as measuring logistical capabilities or modeling the heat, blast, and fragmentation effects of a weapon. Quantitative modeling, simulation, and analysis have given rise to terms such as *probability of kill* (PK) and *circular error probable* (CEP), which are used for weaponeering and military planning. Lancaster equations have supported operational planning and strategic assessments, analyzing the potential outcomes of military conflict based on order of battle data and doctrine. These analytic approaches describe the physical requirements of military systems and the forces that might be needed to attack or defend particular targets. Analytic outputs provide planners with an understanding of the physical challenges facing forces and allow for the maximization of resources.

Well-developed quantitative methods generate outputs that are repeatable and can be independently verified. These methods and models have roots in the physical sciences and have been adapted by the social sciences. These methods require that complex problems be decomposed into manageable, discrete parts, and—ideally—that solutions to these sub-problems be combined in a fashion that solves the whole problem. However, quantitative methodologies have been hard-pressed to deal with complex situations in which outcomes are driven by context, sequence, and other soft factors, such as leadership, command and control, intelligence, morale, and training.

Qualitative models and analyses provide a much deeper and robust description of events, particularly as they relate to context and other issues that cannot be represented easily by numerical values. However, the analytic outputs are generally much more difficult to verify and are highly subjective. Qualitative analyses can provide meaningful insights into complex situations but do not lend themselves to predictive assessments beyond well-defined contexts. Rather, they serve to define and characterize the nature of a problem and identify tradeoffs between competing objectives, such as the desire to maintain political flexibility and the need to commit credible and capable military forces during a crisis. As a result, qualitative analysis does little to identify optimal or efficient solutions to problems. By focusing on the identification and articulation of multi-layered effects, these methods enable the identification of appropriate or credible solutions.

Qualitative methodologies generally produce narrative outputs, which create interpretative challenges that quantitative analytic outputs with graphic or numeric representations do not share. As a result, qualitative analyses are open to a wide array of interpretations by readers and are difficult to represent graphically. Consequently, although qualitative outputs provide a more robust framework for thinking about political, social, and military challenges by establishing a context within which forces interact and adapt, these insights are often difficult to communicate.

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Communicating and sharing insights are essential. The information required for supporting EBO also must be able to inform political and military decisionmakers of developments in their respective areas of concern and enable the two to communicate clearly. The information must help decisionmakers gain an understanding of the physical world by incorporating geography, the physical distribution of friendly and enemy forces, agents, and assets, and the technical and operational characteristics of friendly and enemy infrastructure and weapon systems. In addition, information must also capture the social, psychological, and organizational dimensions of friendly and adversary systems, explaining the motivations, intentions, perceptions, and beliefs of the actors, and what it would take to sustain or transform their sociophysical systems. Diverse information sets and analytic tools are necessary for threat assessments, operational planning, and effects-based targeting so that a context for understanding the conflict emerges and a framework for evaluating competing and complementary courses of action exists. Such a complex array of analytic tools and methods and transparency between political and military decisionmakers develop a common operational picture, enabling tactical, operational, and strategic planners to work from the same understanding and visualization of reality. EBO can succeed only if the information available to decisionmakers allows them to conceptualize complex systems and evaluate options for manipulating, transforming, or destroying them. Without the ability to provide analytic support to military and political decisionmakers, EBO will remain an interesting but ultimately unrealizable concept.

Therefore, accomplishing the objectives of EBO requires a better understanding of the nature and operations of sociophysical systems. These *complex adaptive systems*, defined as structures composed of physical assets, social institutions, and the connections between them, vary across adversaries and context. Moreover, sociophysical systems are differentially impacted by military actions. Assessing how these actions affect the structure and operations of these systems over time will likely determine the immediate success of military operations as well as the longer-term results in terms of desired strategic outcomes. The development of the underlying strategic and military assessment tools will be fundamental to making EBO a reality.

Beyond Joint: Interagency Dimensions

The broad range of information and skills necessary for effects-based analysis suggests that the military and DOD must establish an interagency analytic EBO support center. Such an interagency center is consistent with the demand for transformational capabilities that push military doctrine and organization beyond traditional jointness and interservice planning and operations. With a transformed military, the Nation's leadership can work toward the creation of a national foreign policy that seamlessly

blends military, economic, diplomatic, and humanitarian tools into a common framework in pursuit of common political objectives.

The information needed to support effects-based analysis is broad in nature and spans open, classified, current, and historical sources. The collection and management of all necessary sources of information lie beyond the resources, mission, or capabilities of any single department. Instead, DOD, State, Commerce, and Energy, the Central Intelligence Agency (CIA), and other intelligence, analytic, and operational organizations must collaborate to ensure that decisionmakers have the information they need to plan necessary operations.

This information extends beyond discrete, highly focused technical collection to the development of the context, personalities, and potential dynamism of a given crisis. As a result, the analytic process must draw upon an increasingly broad and deep set of talents and skills to relate all dimensions of a crisis to one another.

An interagency analytic effort offers the best opportunity to tap into the broadest set of skills and organizational resources, but it presents four challenges. First, discrepancies in the resources available to different govern-

ment departments have traditionally limited the level of support that CIA, State, Commerce, Energy, and other governmental agencies have been able to provide military planners. These organizations currently lack the depth in personnel to provide expert analysts to support multiple planning efforts during a crisis. Resource-poor organizations generally retain their best personnel for daily responsibilities and organizationally unique missions. Creating interagency working groups may constitute a logical and necessary step to bring together diverse skills and resources, yet the working groups must be structured so that participating in them is considered rewarding for both the individuals and organization they represent.

A second challenge is that interagency analytic centers will need to be in place before a crisis erupts. This changes analytic emphasis and interagency coordination from traditional crisis management operations to precrisis policy and operational support. The shifting of emphasis and time surrounding interagency cooperation is what will enable deep understanding of the context and dynamics of crisis events.

A third challenge is interagency leadership. Even when properly resourced and organized before a crisis, governmental organizations have distinct cultures and subcultures. Because the missions of DOD, CIA, State, Commerce, Energy, and others differ in important but legitimate ways, establishing common priorities and unity of effort will likely remain an immutable challenge to the Nation's leadership. While the creation and refinement of processes designed to mitigate bureaucratic and institutional preferences will help, interagency coordination and consensus building will fundamentally remain within the domain of skilled leadership and beyond the scope of any tool or processes to solve.

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A final hurdle will be synchronizing interagency analytic support to EBOs with each organization's operational elements. The linking of analytic production to military, diplomatic, and intelligence operations ensures that policymakers are continuously aware of why operations are undertaken and that operations and analysis are coordinated. This fluidity allows for the continuous updating of situational awareness through battle damage assessment, dynamic intelligence collection tasking, and diplomatic negotiations. Without linking analytic production and requirements to operations, the ability of one to support the other will deteriorate over time.

Because EBO ultimately rests upon the coordination of diplomatic, economic, and military operations toward a common political objective, it will present two unique problems for DOD. First, DOD must be reorganized to conduct military operations for political effect, not just military effectiveness. Second, it is more critical that DOD be capable of coordinating its operations with all relevant governmental agencies to ensure that military operations are synchronized with other forms of national power and that decisionmakers have a common framework within which to consider economic, diplomatic, and military problems. The need for interagency cooperation and coordination adds a layer of complexity to current concerns about DOD transformation. Coupling DOD activities with those of other departments would broaden the concern over transformation to include the proper distribution of resources across all governmental departments that participate in national security.

Incorporation of the “New” Social Sciences

The ability to provide necessary analytic support rests upon gathering relevant data and generating insights into the propagation of effects across interconnected systems and time. Most analytic models currently employed by the national security community are ill equipped for evaluating the propagation of effects. Implicit in the definition of EBO is the existence of analytical competencies and perspectives that allow for interconnected strategic, operational, and tactical assessments of complex sociophysical systems.

Capabilities necessary to support EBO will encompass traditional operations research (OR) techniques and also extend across—as well as integrate—other academic disciplines and intellectual traditions. Current analytical approaches used by the military OR community are limited in that they rarely incorporate any of the social sciences in a rigorous fashion. Specific disciplines composing the social sciences have a deep and storied intellectual tradition that will better enable the formulation and assessment of *second-order and greater* outcomes associated with an action against an infrastructure, system, or adversary. The incorporation of these perspectives and theories into a computational model provides a novel and

significant means of evaluating EBO. Anticipating desired or undesired effects within the complex sociophysical systems constitutes a necessary step in the maturation of EBO. Integrating social science techniques is essential.

It is worth noting that traditional OR tools—mathematical programming, queuing theory, and Monte Carlo simulation—model, analyze, and simulate the technical characteristics of systems or categorize system performance in terms of concepts such as efficiency and effectiveness. The shortcomings of traditional OR tools result from their methodological focus. These techniques were not formulated to represent explicitly all of the attributes associated with EBO, specifically the behavioral representations of the adversary and allies that are grounded in social and behavioral science theories. As a result, highly precise tools and models exist for the purposes of weaponeering and targeting, but little more than assumption-driven estimates help decisionmakers relate the effects of military action to strategic outcomes. Traditional models are useful for evaluating combat power and

warfighting potential, but they are not designed to model the political consequences of military operations, such as whether U.S. actions will result in the termination or escalation of a military conflict. Current assessments generally reflect the logical consequences of initial assumptions, which limit their flexibility and credibility.

The purpose of incorporating social science is to improve analytical approaches and enable the realization of EBO. The convergence of advances in the computational sciences and social science inquiries allows for the examination of challenging problems, while also affording the analyst the ability to consider how the behavior of individuals or institutions affects other individuals or institutions. Such interdependencies are associated with phenomena called social dilemmas, wherein the pursuit of individual or institutional interests produces an outcome detrimental to all. In social life, examples include environmental pollution and information hoarding, which leads to the degradation of natural resources and organizational performance. Military operations against another nation-state or subnational actors harbored by a nation-state can be viewed as a security dilemma, a type of social dilemma.

The explicit consideration of such consequences lies at the heart of the effects-based analytical approach, where the objectives are rendering sociophysical systems and their dynamics as well as important behavioral and psychological aspects of individuals who reside within the system or society of interest. Equally important for EBO is an analytic framework that allows for the integration of multiple, competing, highly complex sociophysical models with the effects-based concepts of operation in a credible fashion. Frameworks must allow large numbers of possible assumptions and outcomes to be visualized and assessed, which calls for the use of computational experimentation and computer-assisted reasoning. Substantial advances in this area of analysis are also the

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Effects-Based Operations and Kosovo

The U.S. air and missile campaign in Kosovo is an example of the potential for, and the difficulties of, undertaking effects-based operations (EBO). The air campaign against Serbia was carefully crafted to achieve the political effect of forcing a Serbian military withdrawal from Kosovo. Great care went into the selection of targets that would compel Slobodan Milosevic to pull his forces out of Kosovo, including the modeling of social networks and other nontraditional techniques that would persuade those close to Milosevic to influence him in ways consistent with U.S. objectives.

Political decisionmakers were actively involved in the selection of targets in Kosovo, and constantly interacted with military operators to ensure that operations were consistent with desired objectives. The relationship between political and military leaders, and the methods used to select and engage targets, were consistent with the requirements for EBO. However, the results of the campaign indicate cultural, analytic, and operational difficulties with bringing EBO to maturity.

EBO stressed civil-military relations, as civil authorities became involved in traditional military decisions at the operational planning level. Analytic support to decisionmakers was disjointed, and many key questions about targets and their relationships with social, as opposed to physical, infrastructures were difficult to answer. Finally, because of the changes in targeting criteria, the effects of weather, chance, and uncertainty had increasingly profound impacts on operational conduct and success. Targeting became increasingly sensitive to time, mobility, and context, creating an escalating demand for the ability to observe and act in near real-time.

The difference between the intended versus the actual outcome of the Kosovo campaign revealed both strengths and weaknesses in the EBO framework. Many of the U.S. objectives were met: Serbia withdrew its forces, Milosevic now faces trial as a war criminal, and Kosovo has autonomy. However, the timing and paths taken to reach these outcomes were unpredictable. In hindsight, the air campaign did little to persuade Milosevic to withdraw his forces. Instead, the Kosovo Liberation Army ground offensive, supported by the United States, proved to be the decisive factor. The air campaign in Serbia failed to persuade Milosevic to change his policy toward Kosovo; it did not weaken his political support. Instead, the difficulties associated with the postwar recovery efforts caused Milosevic's political support to weaken, and eventually led to the collapse of his regime. The inability to recover economically from the bombing campaign, in combination with the loss of political support, allowed for opposition groups to organize and effectively resist the regime, bringing about its eventual collapse following the disputed elections. These significant events occurred long after the air campaign ceased.

The campaign in Kosovo should be considered an early effort to implement the tenets of EBO. However, while the United States achieved its objectives, the events should be examined with critical and careful attention to the role of analysis and analytic products in shaping the assumptions and decisions of political and military leaders. Because EBO is sensitive to paths taken, as well as final objectives, how one achieves objectives will be as important as what one achieves.

product of advances in computational models and the social and decision sciences.³

Building an EBO Analytic Community

Beyond the further development of these frameworks and methodologies, it is necessary to consider how to include computational social science in military OR and analytic communities. This integration will likely be challenged by various concepts central to the practice of military OR and analysis. These concepts include:

- *optimization*: the process of determining the most efficient or cost-effective design or functional solution to a particular problem
- *reductionism*: the attempt to represent a complex system by a simple system or as a collection of self-contained, independent subsystems
- *prediction*: the ability to determine or reason the future state of a system
- *nondeductive reasoning*: the ability to employ models for heuristic or experimental purposes rather than as tools for predictive assessment based on inferences from general principles.

The integration of computational social science into OR will require addressing how these concepts and their associated assumptions impact the practice of military OR. The modification of cultural and intellectual norms will require training and new staff competencies. The ability to integrate these new perspectives into frameworks

and methods inclusive of social sciences will be necessary if EBO is to be effectively supported.

The inclusion of alternative intellectual traditions and broadening of the military OR community and tool sets highlight the need for interagency analytic support, bringing together people, skills, and perspectives beyond those that reside within DOD. It also signifies a changing relationship between analysts and decisionmakers. As analytic support shifts from providing predictive assessments toward describing political outcomes in probabilistic terms, decisionmakers must learn how to deal with new analytic processes and products. Consequently, the breadth of the challenges of EBO spans the full spectrum of military and civilian leadership, operators, and analysts.

Additional Effects-Based Challenges

In addition to the challenges of integrating social science perspectives, theories, and techniques with traditional OR tools, three other distinct challenges remain to make EBO a reality. First, the data and information that drive the analytic models must be readily available or rapidly and reliably acquired. Analytic tools must be built from the ground up to capitalize on preexisting or readily developed avenues of access. Open-source databases and other publicly

available sources of information will become increasingly valuable, as unfettered access to clandestine sources may prove unreliable. This is not to suggest that classified materials are not useful or should not be exploited. The exploitation of clandestine methods may be an important source of operational success. However, analytic methods and models cannot be driven exclusively by clandestine sources. The inevitable ebb and flow of intelligence access cannot become a structural impediment to performing EBO. Clandestine collection of information should continue, but it cannot have an exclusive role in providing decisionmakers with an appropriate framework for understanding a conflict and identifying desired effects.

The second challenge posed by EBO is the potential for operations to take on a life of their own. Without an independent measure of effectiveness, EBO might devolve into a series of actions where the ends justify the means. This can only be prevented by establishing the political objectives of the operation early and building in regular feedback mechanisms that relate the ongoing operations to their initial intentions. The senior political and military leadership must remain ruthlessly self-critical to ensure that revisionism does not allow failing operations to continue on self-perpetuating grounds. This is especially true in cases in which the desired effect may change, such as the shift from shoring up a failing regime to protecting our national credibility. Once operations are conducted without any guiding measures of success or failure, or those measures are ignored, military operations may become a black hole consuming precious resources and developing their own inertia regardless of their contributions to national security.

The third challenge is one of time. EBO requires a deep understanding of the political context of a conflict to give military and political decisionmakers the chance to contemplate the consequences of their actions. The end of the Cold War marked a turning point in the structure of the international system and the nature of the security environment. The fact that the United States was able to focus its resources and energy on the Soviet Union for more than 40 years allowed for deep understandings of context and consequences. In the current international system, the United States is unlikely to have the luxury of long periods of time to study an adversary. The lack of development of a deep reserve of skills and experience highly focused on a specific threat could become a major obstacle. Indeed, the lack of deep expertise on Islamic culture, Arabic languages, and Afghanistan within the security community prior to September 11, 2001, reveals the importance of lead-time and analytic investments when living in a fluid security environment. This means that although EBO demands that political context be included in planning military operations, the opportunity to develop the necessary expertise within DOD and at the interagency level may be increasingly rare and must be overcome through innovative analytic and training techniques, as well as organizational commitments to developing people and skills long before consensus on the nature

and severity of the threat is reached. The utility of such expenditures may not be immediately clear but will become obvious as unforeseen crises unfold.

Conclusions

The EBO concept has the potential to transform military planning and operations by establishing linkages between actions and intended effects. The lynchpin of this capability will not be the development of weapon systems but the ability to analyze political and military situations so that force can be used in the most effective fashion to achieve desired effects. The use of computational models that can integrate traditional OR approaches to military operations with the social sciences represents an untapped but important capability in the development of the analytic tool suite that will support EBO. All analytic endeavors have inherent limitations, but by adding rigor to the analysis of non-physical, second-order and greater effects, and other soft factors, new analytic methods and tools can assist decisionmakers and military planners with developing strategies for preventing and dealing with crises and developing plans and policies that are highly adaptive based on their consideration of a wide range of factors, conditions, and developments. While the analytic tools and models that will support military operations and strategic planning may not take center stage in the discussion about EBO, the development and implementation of analytic capabilities constitute the first step in making EBO a reality.

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Notes

¹United States Joint Forces Command, Joint Forces Command Glossary, <http://www.jfcom.mil/about/glossary.htm#E>.

²Paul K. Davis, *Effects-Based Operations: A Grand Challenge for the Analytical Community* (Santa Monica, CA: RAND, 2001).

³This point is further discussed in Desmond Saunders-Newton's plenary paper, Computational Social Science, Operations Research, and Effects-Based Operations: The Challenge of Inferring Effects from Dynamic Socio-Physical Systems, Military Operations Research Society (Workshop on Analyzing Effects-Based Operations, January 29, 2002).

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