An Alternative Approach for Operational Assessment

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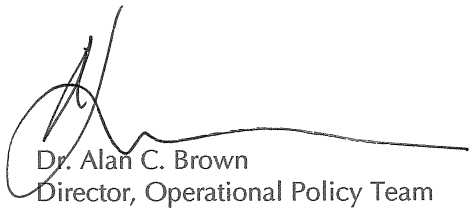

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Executive summary

No plan survives contact with the enemy.

This aphorism is well known and accepted, at least at the operational level of war. Senior military leaders, as well as academics, attribute that outcome to the fact that modern military operations are complex adaptive systems—that is, they involve diverse, multifaceted elements that interact with and adjust to changes in the environment. This paper explores the ramifications of that perspective for operational assessment processes and proposes a new concept.

The need for alternative assessment approaches has been motivated by the perception that senior leadership finds the current schemes unsatisfying and unhelpful. In part, the problems with the current methodology derive from faulty assumptions, ambiguous metrics, and incomplete understanding of a commander's expectations about assessment. In this paper, we propose something different—something that might pique the interest of senior decision makers as an approach they may find helpful. We go beyond simple tweaks—for example, merely shifting the balance between quantitative and qualitative metrics or clarifying means for aggregating metrics more rigorously—to take a systemic view of assessments. Furthermore, we disregard the constraints of doctrinal molds, because some of those limitations may be caused by faulty or inconsistent assumptions, which thwart the success of assessment efforts.

We suggest that assessment processes should be developed with the mindset that military activity evolves over time in response to the operational environment, rather than unfolding sequentially with machinelike order and procedural precision. The analogy of evolution has important implications for assessment processes. In particular, there should not be a focus on a certain, predetermined end state. The attitude should not be one of reaching a specific end state, but of getting to an acceptable one. For such a point of view, assessment

is about understanding the conditions for success and determining how to establish those conditions. Instead of heading in a set direction, the intent is to foster steady progress toward more favorable circumstances.

There are many examples that justify evolution as a reasonable and creative paradigm for thinking about the assessment process. While the establishment of a specific end state is predicated on clear and comprehensive guidance from higher authority, often the translation of political objectives into viable and coherent military objectives has proven difficult. Mission creep and the demands of dealing with adaptable adversaries also lead to changes in force employment, timelines, and tactics, with a resulting change in pertinent metrics at the operational level. Uncertainties about the operational environment, the increasing prevalence of non-traditional scenarios, and the potential of asymmetric operations highlight the fact that warfare is inherently non-linear and unpredictable.

Given those features, the evolutionary paradigm affords the opportunity to improve assessment processes and mitigate the frustrations of vague guidance, ambiguous metrics, and the proverbial fog of war. Moreover, it focuses the attention of operational commanders on setting the conditions for progress by becoming more attuned to the overall environment. Within the context of the evolutionary paradigm, progress involves accruing more information about the environment, having more options to deal with uncertain circumstances, and being able to compete better with adversaries for resources. Gauging progress involves choosing indicators or characteristics that typically mark improvement in processes or ones that are logical and self-consistent concepts for improving processes.

We contend that the evolutionary paradigm can better accommodate and facilitate an assessment process that is more useful and more accepted by senior military decision-makers: It leans to the tactical side, where near-term progress is more obvious and fruitful policy courses of action can be internalized for subsequent action. More important, it responds more directly to the key question of what to do next. At this stage, the analysis is still somewhat conceptual, but there are promising tools that might bring more rigor to the process.

Premise for analysis

The word “assessment” is used in many ways. One definition from joint doctrine is that assessment is the analysis of the security, effectiveness, and potential of an existing or planned activity—a definition that links assessment with analysis. Another definition is that assessment is the determination of the progress toward accomplishing a task, creating an effect, or achieving an objective—a definition that highlights trends and a time element. Standard dictionaries tie the word to the concept of estimation, involving interpretation of multiple factors. In general, we think of assessment as a top-level process that measures and tracks (in some way) the overall effectiveness (in some way) of an activity.

Military assessment can occur at many levels, ranging from battle damage assessment—which itself ranges from sensing physical evidence to projecting the residual mission effectiveness of the targeted system—to campaign planning to strategic policy-making. At all levels, a commander uses assessment as an aid to his decision-making. In particular, assessment is a key component of command and control at the operational level of war. Within the familiar cycle of the OODA loop (Observe, Orient, Decide, and Act) [1], assessment is associated with the “Orient” step: filtering the data gained in the “Observe” step.

Furthermore, formal doctrine [2] describes assessment as consisting of two parts: determining the extent to which operations are on plan, and trying to determine the extent to which operations are having the desired effect on the enemy. Besides the focus on issues of effectiveness, doctrine emphasizes that assessment helps determine the progress towards accomplishing a task. There also are frequent allusions in the doctrinal documents to the potential of an activity—that is, what might happen next. For example, the U.S. Marine Air-Ground Task Force's Staff Training Program emphasizes that assessment focuses on the future [3]; past and current status and actions are of little value unless they can serve as a basis for future decisions and actions.

A careful reading of doctrine indicates that assessment is more than a snapshot of where we are. It is an interpretation of how all the pieces are interconnected. At the operational level of war, that interpretation is a complicated process. Actions can be coupled, and a military commander needs to consider as well the implications of diplomatic, political, economic, financial, social, ethno-religious, and other contextual aspects of the situation. In addition, consequences are not entirely under the commander's control, because the threat and the environment react in response. Some analyses refer to this phenomenon as second- and third-order effects; sometimes, if the effects are counterproductive, they are known as unintended consequences.

Many analyses have argued that assessment is crucial at the operational level of war. Yet it seems underplayed in most discussions of staff structure and processes. Few senior leaders seem to find value in operational assessment. A key reason for their dissatisfaction is that current approaches toward assessment do not seem to help the commander. Schroden contends that assessments fail because they rarely live up to the expectations of the commanders, who, as a result, have stopped paying any attention to assessments [4]. Commanders also find little value in and sometimes are confused by staff discussions of assessments, which often revolve around details of the *process* and its implementation, not the utility of the *information* provided. As a result, assessment cells typically go undermanned and undertrained—an ad hoc addendum to the warfighting effort. Minimal effort expended engenders a self-fulfilling prophecy that the cells provide little value.

Part of the problem with the current implementation of the assessment process may be a lack of understanding of what is appropriate and feasible for assessment to achieve at the operational level of war. To address that lack, it may be necessary to go beyond simple tweaks to the current system—for example, merely by shifting the balance between quantitative and qualitative metrics or clarifying means for aggregating metrics more rigorously. Furthermore, the constraints of doctrinal molds can thwart the success of assessment efforts, especially if the concepts are based on faulty or inconsistent assumptions. An alternative approach might pique the interest of senior decision-makers as an one that they may find more helpful.

To scope the discussion, we focus on operational level of war. Joint Publication 1-02 defines the operational level of war as the link between strategy and tactics: the level at which campaigns and major operations are planned, conducted, and sustained to accomplish strategic objectives within theaters or areas of operations [5]. Thus, the operational level of war is the command level where individual elements of the operation are orchestrated into campaigns to achieve strategic objectives. Activities at this level link tactics and strategy by establishing operational objectives needed to accomplish the strategic objectives, sequencing events to achieve the operational objectives, initiating actions, and applying resources to bring about and sustain these events. These activities imply a broader dimension of time and space than do tactics; they ensure the logistic and administrative support of tactical forces, and they provide the means by which tactical successes are exploited to achieve strategic objectives.

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What's wrong with current approaches?

Methodologies for assessment processes at the operational level have fallen on hard times of late. Most prominently, as Commander, Joint Forces Command, General Mattis forbade the use of terms related to effects-based operations, operational net assessment, and systems of systems analysis [6]. Undoubtedly, his decision was well founded: the concepts have indeed been misused and abused. Furthermore, as General Mattis pointed out, the concepts are cumbersome, pseudo-analytic techniques based on faulty assumptions (at least within the context of military operations).

First, activities such as building databases for nodal analysis have become unwieldy. Data requirements are intensive, and analyses are unlikely to provide a commander the timely support he needs. Most monitoring projects err on the side of comprehensiveness, producing lengthy lists of indicators and variables that can make it difficult for policymakers to identify priority issue areas. Too many metrics are as unhelpful as none.

Second, measures of effectiveness can be ambiguous and difficult to determine. Often the effects of military actions are not readily measurable with the resources available. There have been extensive discussions that examine trade-offs between qualitative and quantitative metrics. For example, Downes-Martin touts the value of military judgment based on a combination of objective and subjective data [7]. He expounds on the pitfalls of “junk arithmetic,” which often ineffectively attempts to reduce thorny issues to red-amber-green thermographs.

Even if there are factors that one can observe about the operational environment and the actions of an adversary, one cannot reliably correlate the actions to the root causes, especially when taking into consideration the broader diplomatic, informational, and economic context that is pertinent at the strategic and operational levels of war.

Assumptions that all of the opposition's observed actions are in response to U.S. military actions are incorrect and potentially counterproductive.

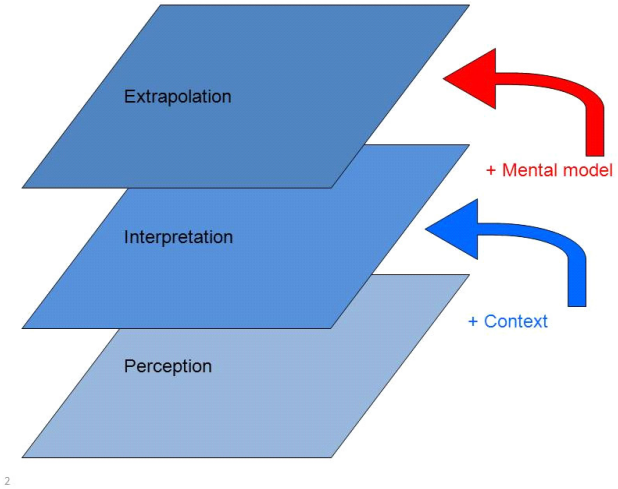
Third, assessment processes would be useful if they increased a commander's situational awareness, which informs the commander's decision-making process. But there is a fundamental misunderstanding of the concept of situational awareness. The literature provides many definitions of the term, but one that seems most pertinent and useful is that situational awareness is "the perception of the elements in the environment within a volume of space and time, the comprehensive of their meaning, and the projection of their status in the near future" [8]. Situational awareness is more than the simple perception of data. It involves understanding how all the elements interact within the overall context, and it involves forecasting what each element is going to do next.

The first part of the concept is perception. This is the aspect of situational awareness that usually comes to mind: seeing the discrete facts and data points. Perception provides a snapshot of the current state of affairs. Perception is the attempt to answer the question, "What are the current facts?" It might be displayed as a geographic laydown of forces or other types of maps, as tables of inventory, or as other lists of pertinent data. Perception is a necessary component of situational awareness, but it is neither complete nor sufficient. A necessary additional aspect of situational awareness is interpretation, which includes the integration of multiple pieces of information and a determination of their relevance. Interpretation yields an organized picture of the current situation by determining the significance of objects and events and answers the question, "What is really going on?" It demands abilities to cluster pieces of data as part of the processing of information, and it requires an appreciation of the underlying context to answer the query, "So what?" regarding any particular snippet of data. Interpretation combines new data with previous information to produce a composite picture of the situation as it evolves as a dynamic process.

The highest level of situational awareness involves more than connecting the latest information with history; it involves projection

or extrapolation to the future to answer the question, “What is likely to happen next?” To perform that extrapolation, one needs mental models that provide a mechanism for generating future states of the system, and how the conflict system is being influenced by a changing environment. The models provide means of integrating information and context. They also form part of the structure for focusing the available, limited attention toward the crucial issues. Figure 1 summarizes the levels of situational awareness and presages the means to achieve the higher levels.

Figure 1. The three levels of situational awareness



The ultimate reason for dissatisfaction with the current approaches for assessment is that they rarely take the ultimate step: assessment is supposed to look to the future. Assessment can present the commander with a reasonable first draft of a consolidated view that includes inputs from all staff directorates. An assessment cell essentially can tell the commander, without being presumptuous, “If I were you, I would focus on these key implications from today's briefing for choosing what to do next.” The commander would then ask further probing questions to determine if he should agree. Of course, the

commander can have a deeper understanding of the operation, more relevant experience, and better information sources than the assessment team, but he also has less time to ponder all the possible ramifications of the information. In effect, the assessment could provide a jumping-off point from which the commander could more readily fashion his own perspective on the current situation and the way ahead.

Historical examples

Real-world events can illuminate the issues further and help define requisite features of an effective assessment process. From the history, in several cases, lessons learned assert that clear guidance and form endstates are necessary to conduct adequate planning. However, the events indicate that such requirements likely will not be fulfilled. Mission creep often is another characteristic of some types of modern military operations. Furthermore, in many cases, the operational environment changes as the adversaries and other parties react to ongoing activities. Finally, an adversary conducting asymmetric operations can confound classic approaches to planning.

Lack of clear and comprehensive guidance

Operation Desert Thunder was the effort to provide military presence and capability during negotiations in late 1997 and early 1998 between the United Nations and Iraq over the issue of weapons of mass destruction. Desert Thunder elucidated new challenges for military forces. To military planners, the "way it should work" had been very clear:

- The nation's political leadership establishes broad political objectives for an operation.
- The objectives are translated to a military mission and corresponding military objectives.
- Planners develop courses of action to achieve the objectives.
- After choosing one course of action, mission planning takes place, involving target selection, force assignment, and endstate definition.

Desert Thunder did not work that way, however [9]. The political objective was coupled with the reason for and constraints of using air

strikes. The coupling introduced enormous uncertainty for the strike planners. The uncertainty demanded significant flexibility for the operational forces. The events of Desert Thunder suggested that planning for uncertainty would become the typical expectation for future military operations.

Ultimately, the series of operations in the Central Command theater in the 1990s led to Operation Iraqi Freedom—another operation that signaled continuing changes in the nature of the use of military forces. For Operation Iraqi Freedom, the combatant commanders did not activate the Time-Phased Force Deployment Database and military forces did not execute it. Forces moved via a process that included continual requests for forces and deployment orders. Some forces were pushed forward by the Services rather than pulled at the request of the theater commanders. Complications related to support requirements for the forces resulted from uncertainties about the status of negotiations for basing, coalition actions, etc. Those factors muddied planning options and timelines at the operational level [10].

Most recently, Operation Odyssey Dawn provided another example where translating political objectives into viable and coherent military objectives (without a clearly defined end state) proved difficult [11]. Guidance was confusing as to whether regime change was the intended option or whether operations were to be focused exclusively on protecting human life. United Nations Security Council Resolutions 1970 and 1973 authorized different military responses: protecting civilian populations, establishing an arms embargo, and enforcing a no-fly zone. Force requirements, operations, intelligence focus, and measures of success were different for each scenario. Furthermore, the U.S. wanted to transfer leadership responsibilities as quickly as possible, and the timing of transition was not determined by completion of operations.

Post-event reconstruction points out the negative repercussions of poor guidance. However, political complications are expected to be part and parcel of many operations. Thus, a changing operational environment and uncertain end states are anticipated to be a customary feature of modern military operations. A broad review of recent

military operations identified the common characteristic of an ends-means disconnect: a mismatch between available military tools and publicly-stated goals [12]. That attribute can cause problems with achieving a particular goal, but it also can cause the decision process to deviate significantly from the standard military decision process.

Mission creep

A second aspect of the difficulties of focusing on fixed end states is elucidated by several examples during recent military operations of what has been known as mission creep. Operation Restore Hope, in the early 1990s, was an operation to establish a secure environment in southern Somalia so that humanitarian relief organizations could provide famine relief services. However, what started as a mission to feed starving civilians ended in a failed attack on a Somali warlord [13]. The change in operational focus mirrored new, broad objectives of nation building, which were embodied in United Nations security resolutions. Those resolutions authorized an expanded United Nations security presence to disarm combatants, provide assistance for rebuilding the country, and eventually to conduct air and ground military operations against disruptive factions.

The operation was an instance of an operation other than traditional warfare—operations that have become more typical since the end of the Cold War. For such non-traditional missions, tensions stem from a misconception that there are distinct military and civilian (including political, economic, and humanitarian) missions [14]. The civilian aspects of the aims often are difficult to identify and prone to rapidly shift and change, leaving the military commander the task of catching up with policy or even guessing at the political objectives.

In the particular case of Somalia, contradictory and uncoordinated strategy and policy resulted in poor operational planning and execution. Reconstruction and analysis [13] proclaimed that, "UN resolutions are not an acceptable replacement for clear policy aims and a sufficient operational plan. Without such a clear policy there can be no concrete operational objectives or measurable end states." Based on recent history, however, it does not seem reasonable to expect such prerequisites.

Operation Provide Comfort in 1991 provides another example. The operation began as an effort to deliver supplies to Kurdish refugees. Later, military forces helped restore basic municipal utilities so that the refugees could return to the cities. Such actions were not part of the original tasking and they were not planned for as part of movement into Iraq. As the operation continued, however, were deemed necessary for achieving mission objectives [14].

Changes in the operational environment

Changes in the focus of campaign plans complicate a fixation on prescribed end states. For example, the counter-piracy campaign near east Africa has been undergoing a shift. The policy of deploying vessels to protect vulnerable ships and be a deterrent to pirates has expanded—with the authorization of the United Nations Security Council—to attacking onshore infrastructure. As another example, scenarios associated with the movement of drugs from South America to the United States have changed significantly over the years, as have the options to stem or deter that movement. In the past, small aircraft landed in south Florida to offload drugs. Later, the primary threat tactic was to air drop drug packages to go-fast boats for the final leg to mainland U.S. Today, the more likely scenarios involve the movement of drugs from South America to Central America and Mexico with transportation over land into the U.S., as well as the use of self-propelled semi-submersible and fully-submersible vessels.

The effectiveness of applied forces and tactics to counter the movement of drugs has changed the operational environment as well as threat characteristics and tactics. As a result, paradigms for applying forces have adjusted in response and metrics related to the new paradigms have changed in concert. Perhaps, at the strategic level, the (arguably unrealistic) end state remains the elimination of drugs in the U.S. However, the operational end state and any associated metrics, which might describe it, keep changing. That is not to say that astute leadership did not foresee the changes in the operational environment, but it is important to appreciate that the metrics and assessment processes need to change in concert.

Changes in the operational environment can affect other non-traditional scenarios, such as humanitarian assistance/disaster relief and defense support to civilian authorities. Operation Unified Relief in response to the 2010 earthquake on Haiti is a case in point. Military support spearheaded relief and restoration efforts. However, the ultimate end state for the military was to turn over the entire mission to civilian authorities and then redeploy. The determination of that point in time was that the status of the population and infrastructure was "better"—a rather vague and subjective benchmark. Furthermore, much of turnover issues were beyond the direct control of the military. They were driven by the capabilities and status of the other international and non-government agencies, which would maintain the effort. Indeed, relief and restoration activities continued after redeployment of the Navy and other military forces.

Of course, uncertainty about outcomes can turn out fortuitous as well. An historical example from World War II is Operation Corkscrew [15]. In 1943, the Allies launched an operation to seize Pantelleria, a Mediterranean island about halfway between Tunisia and Sicily, which was still under the control of Axis forces. The island was viewed as a stepping stone from Africa back onto the European continent. The expectation was that airpower would enable amphibious assault, so the operation commenced with an intense bombing campaign—significantly more intense than ever before. To some extent, the operation was viewed as an experiment about air power. One can make the case through that every operation is an experiment; one does not know beforehand exactly how it is going to turn out. As it happened, airpower was sufficient to defeat defending forces and an opposed amphibious assault was not necessary. Given that result, the implication is that different target sets, objectives, and metrics would have been more appropriate for driving the battlefield environment.

Asymmetric adversaries

Finally, complications can arise in the uncertain environments associated with complex operations-especially when adversaries have the wherewithal to choose from a menu of asymmetric options. The infamous Millennium Challenge 2002 exercise is a case in point [16].

Despite the Blue Team having thorough databases and methodologies for systematically understanding the intentions and capabilities of the enemy, the Red Team commander took advantage of the fog of war and conducted unpredictable operations with devastating effects. Much post-event analysis decried the restart of the exercise that undid the damage. Undoubtedly, important training and lessons learned were gained from "Phase 2" of the exercise event—which ignored the outcome of the unexpected threat successes—but the initial episode highlighted how warfare was inherently unpredictable and non-linear. If the exercise had stayed on the new course, there would have been an urgent need to revise the way forward and reevaluate the nature of favorable operational outcomes.

There are several common themes across the historical examples. First, the end state often is different from that originally proposed. Second, there is not a certain, pre-ordained path that the scenario follows. Third, these factors complicate the interpretation of intelligence data and other information and confuse the determination of what actions the commander should take.

Dealing with the question, "What to do next?"

Essays on military operations—many of them citing the examples listed above—frequently use the term "complex adaptive system." However, the discussions stick to old concepts rather than following through with the ramifications of the term. Proposals to revise assessment merely re-engineer ideas such as ends, ways, and means. Such changes have proven unlikely to lead to improvements that will help a commander's decision-making process.

Modern military operations are acknowledged as being complex, and the themes associated with such complexity are pervasive. The recent articles by Generals Mattis and van Riper, however, capture most of the relevant insights about modern warfighting environments [17, 18]:

- Operational environments are dynamic, because the enemy is smart and adaptive.
- Chaos makes war a complex adaptive system, rather than an equilibrium-based system. Thus it is not scientifically possible to predict the outcome of an action. As a result, the force must act in the face of uncertainty.
- The overall system is open and is weakly coupled, not a tightly interconnected structure. For such nonlinear systems, cause and effect are not straightforward. Outcomes can cascade throughout the system in unpredictable ways.

These insights highlight the faulty assumptions upon which current operational assessment approaches are effectively based—namely, that movement is linear and that he environment can be controlled. The comments are consistent with a familiar phrase that highlights the complexity of military operations: No plan survives contact with

the enemy.[1] The aphorism does not challenge the value of planning, but, rather, warns against close-minded preoccupation with a predetermined and fixed plan.

And yet, despite their caveats about the need for flexibility and innovation in rapidly changing operational environments, the authors essentially advocate a return to doctrinal principles: mission orders; ways, means, and ends; etc. Indeed, these are solid, enduring concepts, but merely a return to classic approaches overlooks the issues raised about the features of modern military operations. Hence, we explore further the implications of complex environments.

Complex adaptive systems involve diverse, multifaceted elements that interact with and adjust to changes in the environment. The elements interact in apparently random or chaotic ways although patterns emerge, which help characterize the overall system. An element does not have to be perfect in order for it to thrive in the environment; it just needs to be good enough and adapt itself to maintain a good fit with the environment. Having greater variety enhances the strength of the system to preserve the advantage.

Complex environments often lead to a class of problems called wicked. "Wicked problems" are conceptually different from simpler, "tame" problems and require alternative methods and paradigms to tackle them. Key criteria that identify types of wicked problems include [20]:

- The roots of the problem are multifaceted, intertwined, and tangled. Modern warfare at the operational level rarely is as clean-cut as routing the enemy from its geographic position or inflicting sufficient casualties to render the enemy impotent or dysfunctional. Other geopolitical factors are integrated closely with the military combat operations.
- The problem involves many stakeholders with different values and priorities. Other agencies and partners are involved in the conduct and outcome of the military operations.

1. Kein Operationsplan reicht mit einiger Sicherheit über das erste Zusammentreffen mit der feindlichen Hauptmacht hinaus [19].

- The problem changes with attempts to address it, especially in the case of resilient, adaptive opponents. Operational environments are dynamic, and the enemy is smart and can make adjustments.

Promising approaches for dealing with wicked problems include [20]:

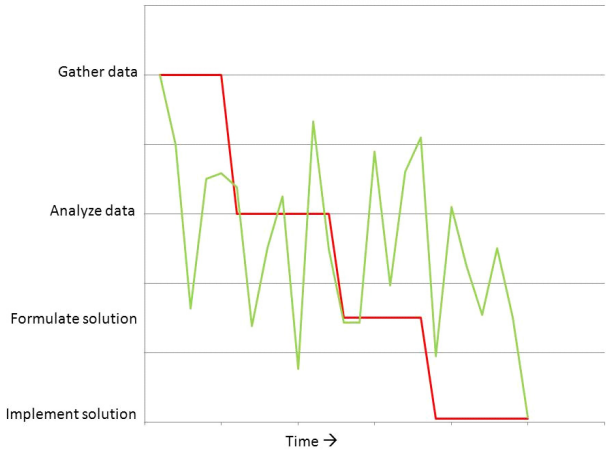
- A focus on action—even if unsure of the outcome—because of the tenuous connection between cause and effect. This offensive mindset is consistent with military philosophy, although hopefully some sort of analysis can help identify the more promising actions.
- A feed-forward orientation to address uncertain and unclear futures. Feedback applies only to refining fundamentally sound strategies, such as those that might be associated with tame problems.
- Simultaneously understanding the problem and formulating a solution. Progress in attacking wicked problems does not follow a traditional waterfall timeline, but a more jagged-line pattern, as depicted in figure 2, which is adapted from Conklin's Dialog Mapping [21]. The red, stepped curve outlines a methodical, text book analysis. The green line simulates the more likely case of false starts, follow-up data calls, disagreements about assumptions, etc.

The discussion in [21] points out that the notional timeline shown in figure 2 is not a depiction of irrationality or inexperience, but, rather, an indication of a creative drive to make the most headway possible, regardless of where the headway happens.

Furthermore, a significant characteristic of wicked problems is that there are no clean, explicit solutions. Answers are not “right” or “wrong,” but “good enough” or “not good enough.” Indeed, there is not necessarily an ultimate, unique answer—the search for solutions does not stop. Other research, relevant to operational-level decision-making, discusses how management teams simultaneously discover targets and aim at them, create rules and follow them, and are clearer about which directions are not right than about specifying final

results [22]. Those attributes are consistent with the paradigm of wicked problems. This is not an eccentric notion for military operations, for Clausewitz himself held that war's results are never absolutely final.[2]

Figure 2. Timeline for addressing wicked problems



Accepting that the solution timeline is typical of the complex environments and wicked problems associated with the operational level of war, what are the consequences for a military commander? Often the responses to setbacks (indicated by peaks in the timeline) suggest a whack-a-mole philosophy: reacting to the immediate issues, one at a time. Such an approach does not seem apropos at the operational level, where a longer-range, campaign-level perspective would be more appropriate. Rather, the approach should be to steer consistently toward improvement and progress. The issue then is how to maintain forward momentum if one must allow for uncertainty and expect stochasticity.

2. Der Krieg is mit seinem Resultat nie etwas Absolutes [23], discussed further in [24].

An alternative paradigm

Having clarified the circumstances surrounding the operational level of war and having articulated the shortcomings of current approaches, what are alternative ways for assessing modern military operations? We contend that the themes are consistent with a paradigm of evolution. Perhaps rather than thinking of a military action as an operation that unfolds sequentially with machinelike order and procedural precision, one should think of the action as an evolution—that is, a complex system adapting over time in response to its environment.

The formal definitions of evolution include the theme: a process of formation, growth, or development. Most frequently, evolution brings to mind Darwin and natural selection. Perhaps the inherent randomness and statistical variability of natural selection are components of the process (associated with the uncertainties inherent in Clausewitz's "fog of war"), but the meaning here is more along the lines of the Lamarckian concept, associated with passing on acquired traits, or of social evolution, involving learning—both of which embody some level of control being exerted over the developments. That is, evolution involves mixing and matching attributes that blend synergistically and minimize adverse effects.

Technically, evolution does not necessarily involve progress and improvement, only change. However, in the military context, some sort of progress is requisite for staying in the fight. Although there is no blueprint to follow, there is movement along a direction. Directionality implies that evolution is not purely random. Rather, it is a cumulative process "whereby a succession of small changes can bring about great transformations," although the ultimate structural changes are not always foreseeable [25].

Complexity theory suggests that, just as evolution does not have a predetermined destination, military plans should not prescribe detailed

end-state conditions. This may be the problem with a traditional systems-of-systems-analysis approach that defines an end state and measures progress toward it with stoplights and thermograph charts. That approach is inconsistent with the inherent features of complex systems, for which goal-setting is problematic. For complex systems, "If you have a stable system, then there is no use to specify a goal….If you do not have a stable system, then there is no point in setting a goal." [26]. That statement recapitulates the arguments for not setting fixed targets.

As an alternative to traditional approaches, we consider what characteristics of an assessment approach that is based on the evolutionary paradigm would both help the commander by supporting his decision-making process and would be feasible for a staff to undertake. First, progress shouldn't be assessed along the plan, because the plan is subject to change, and the changes are not necessarily obvious or predictable. In complex systems, actions occur at many different levels and on many different scales. Emergent properties, seemingly hidden perhaps because they pertain at different timescales or degrees of detail than the basic plan, can affect the characteristics of the overall conflict environment. That is, something that didn't seem to matter soon becomes a ground-breaking or driving feature. Building on these newly critical features can move the plan farther from the original concept and closer to a new reality [22]. A comprehensive view of the system's interconnectedness is not feasible. Bounding the problem—that is, choosing what is to be included or excluded in any analysis—involves value judgments that can constrain an objective assessment of the situation. Thus, an attempt to analyze the plan as operations proceed is fraught with difficulties and inconsistencies.

Second, as a corollary, the focus on some prescribed end state is also not feasible. As the historical examples demonstrated, there are disadvantages to fixed and particular goals: unintended consequences, alternative interpretations of data, and mission creep, to name a few. Instead, assessments should be made of characteristics that are favorable to preferred outcomes. That is, the appropriate focus should not be on the specific end state, but on the conditions for an acceptable end state. In such a way, assessment is about understanding the conditions for success and determining how to set those conditions.

Setting the conditions means going beneath the operational level and manipulating the emergent properties that can drive the characteristics of the overall conflict system.

Thus, our new evolutionary paradigm for assessment is to gauge movement toward uncertain, but improved conditions. To flesh out the approach further, we will have to define "improvement" and clarify exactly what constitutes progress toward more favorable circumstances. Then we can propose methodologies and tools to identify critical options for the operational decision-maker.

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Implications of the paradigm of evolution

We have argued that the concept of evolution can set the framework for an assessment approach that can support the operational commander's decision-making process. The fundamental feature of assessment then is to gauge movement toward improved, although uncertain conditions. So what constitutes progress toward more favorable circumstances? How does one thrive within an operational environment? We address the issue based on continuing analogies to biological and social evolution.

Biological evolution is associated with survival of the fittest. Evolution embodies an ongoing exchange of information between an organism and the environment. Organisms sustain greater survivability because they are more attuned to the environment and they are equipped to compete for sustenance better than their competitors. Because they are more attuned to the environment, they experience reduced stress. Because they compete for sustenance and resources better than competitors, they the effects of conflict are reduced and there is greater success in conflict. Thus, robust, although not necessarily optimal, characteristics help align an organism with the environment.

In addition, progress in evolution is associated with having more options. That is, advanced organisms are more complex and complicated, and consequently can do a greater variety of things (as well as doing specific things better). So, progress involves striving for greater complexity—generating more ways of dealing with the operational environment. At the same time, limiting the options available for an opponent can shift the overall environment in your favor.

Finally, progress in evolution is associated with gaining more information, thereby building a fuller, more detailed story of what is going on [27]. It is important to keep in mind the type of information required for decision-making at the operational level of war. Rather than pure data (for example, track and target locations, weapons status, and

friendly force status; that is, mostly facts related to specific warfighting requirements), the commander needs to know about broader, more contextual aspects. However, although broad, contextual information is important, it is crucial to remember that the decisions that an operational commander makes and the resources he applies are not at the strategic level.

The ultimate purpose of assessment is to assemble the salient facts and synthesize all the more narrowly focused inputs in order to update the scenario, and then validate it and document it. Information is critical to developing options properly because there is a perhaps counter-intuitive downside to complexity: the more options you have, the greater number of ways there are to make wrong choices. Being more complicated can mean being more vulnerable if failures cascade as they can in complex adaptive systems [28]. So another part of the challenge is to structure the system so that the features are self-supporting and there is redundancy to counteract and compensate for potential failures.

Scenario developments lead to options for what might happen next, and the appreciation of what might happen next begs the question of what to do about it. Situational awareness informs the choice of the preferred path to follow to achieve the desired outcomes. Ultimately, the decision is to draw a course of action from a subset of available actions. While situational awareness is a state of knowledge about a dynamic environment, the environment is too extensive and interconnected to appreciate fully. Thus, the decision maker cannot perceive everything; he must focus his attention, and that is where assessment comes into play.

Case study: Counter-piracy

It is instructive to explore the construct in action. As a case study we consider a counter-piracy campaign. To work through the example, we provide an overview of the scenario, lay out the types of decisions an operational commander might make, determine what "progress" means and how one might set the conditions for progress. That determines the types of information a commander needs and ultimately what assessment might provide. We close with a comparison of this process to a more traditional, doctrinal approach.

Piracy is an act of robbery or criminal violence at sea. Undoubtedly, piracy has existed nearly as long as there has been traffic and trade on the waters. In the modern era, efforts to counter piracy generally have been led by government navies. Most recently, the focus has been on pirate activities off the coast of Somalia. Earlier in the 21st century, the greater concern was the Strait of Malacca, where 40 percent of the world trade passes through. That threat has diminished in recent years, but pirate activity remains in nearby regions: east in the Sulu and Celebes seas and west off Bangladesh. Pirate activities at sea have ranged from criminal acts of seizing the valuables aboard a ship to holding ship, cargo, and crew for ransom.

In recent years, the U.S. Navy has engaged in counter-piracy operations under U.S. Code and, together with coalition forces, has operated under international legal frameworks that allow nations to apprehend, arrest, and prosecute pirates. For example, Combined Task Force 151 in the Central Command theater is a multinational task force with the mission to deter, disrupt and suppress piracy in order to protect global maritime security and secure freedom of navigation for the benefit of all nations.

Given that mandate, operational commanders have the opportunity to make several types of planning and operational decisions regarding

- The types of systems needed for productive actions to counter-pirate activity
- Rules of engagement for employing those systems
- Placement of forces, both geographically and sequenced over time.

Per our paradigm, those choices are made to facilitate progress in the scenario. That begs the question, "What is progress?" At least at the unclassified level, the overall concept of operations is to deter and disrupt piracy actions and to build the capacity of regional maritime forces to be able to maintain the counter-piracy effort on their own. So, progress includes shrinking the geographic area where pirates can operate effectively, and forcing pirates to employ less efficient and successful tactics. Such efforts reduce the magnitude of the threat so that fewer assets (and perhaps even less robust and dominating platforms) can persistently keep the threat in check. Furthermore, (acknowledging the adaptability of pirates) progress includes the threat becoming less aware of the activities to counter them, so the pirates cannot successfully avoid and thwart opposition. Progress also includes forcing pirates to rely on additional support (for example, mother ships and other logistical support), thereby increasing overhead costs and affecting the "business model" that induces the choice of livelihood.

Overall, changes in the operational concept of the pirates are signs of progress. Notedly, the threat is not monolithic, so broad strategies may not be applicable. A more tactical, short-term focus may be more appropriate. Suitable metrics address evidence that freedom of action by the adversary is reduced. This is consistent with the concept inherent in the evolution paradigm that less advanced organisms have fewer options and can do less. Thus, assessment can include estimates of surveillance coverage, which monitors and limits the adversary's operating areas. It can include reconstruction and trend analysis of apparent changes in the adversary's concepts of operation, as it responds to Blue activities.

Finally, it is helpful to be aware of what other elements of the scenario are doing. For example, are potential commercial shipping targets reducing their vulnerability by improving their means of security? Are alternative transit routes being used? Such events are outside the purview of the operational forces, but they change the overall environment and thereby have an effect on what the operational forces can choose to do. This aspect is consistent with the concept inherent in the evolution paradigm that accruing more information is another sign of progress because it helps an organism become more attuned to the environment.

Assessment can help the commander make the appropriate decisions on force employment, intelligence focus, and support requirements in order to set the conditions for progress and achieve tactical advantages. Traditional data collection and metrics that count the number of pirate attacks, number of successful interdictions, number of pirates prosecuted, and so on are detached from the concerns of the operational commander. They do not capture the necessary information to develop policies for operational decision-making—namely, where and when to place tactical forces and systems and what bounds to set on employing those assets. An ultimate goal may be that piracy does not exist, but realistically it is uncertain and unpredictable what such a state strictly would be. Would operational success merely engender a change in the threat focus? Would illegal fishing or toxic waste dumping reemerge as new environmental concerns? Such changes in the operational environment could be unintended consequences of countering the threat of piracy.

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Summary and recommendations

This report proposes a new way to think about operational assessment. The work was motivated by the perception that senior leadership finds current methodologies unsatisfying and unhelpful. In addition, what is appropriate and feasible for assessment to achieve at the operational level of war has not been well articulated. Some analytic approaches are unwieldy and based on faulty assumptions; metrics often are difficult to determine and ambiguous; and the practices are not focused on supporting a commander's decision-making process directly.

Developing an alternative approach requires a fuller appreciation of the implications of modern military operations being complex processes. Military operations take place in dynamic environments and the overall system is open and weakly coupled. The connection between cause and effect is tenuous at best. All in all, the forces must act in the face of uncertainty. This is not a dramatic, eye-opening statement—just one that has not been followed through on.

There has been academic research on ways to deal with such "wicked" problems. That research promotes such concepts as a focus on action even if unsure of the outcome, a feed-forward orientation, and the need to simultaneously understand the problem and solve it. Ultimately, that means avoiding the fixation on ways and means to get to specified end states. It means moving away from metrics that purport to measure pre-planned movement toward those end states. Standard measures of effectiveness are not sufficient because they are constructed within a framework of the description of and assumptions about the environment. Operational success, however, involves transforming the environment and changing its nature, and so the assumptions become no longer valid.

These insights suggest that the paradigm of evolution is well-suited to describing military activities at the operational level of war. Rather

than thinking of a military action as an operation unfolding sequentially with machinelike order and procedural precision, one should think of the action as evolutionary—that is, as a complex system adapting over time in response to its environment. Instead of looking toward some unknowable future, one should focus on characteristics of the overall conflict situation that are favorable. That is, the perspective is not toward reaching some specific end state, but the focus of a commander instead is on setting the conditions for an acceptable end state. And the purpose of assessment is to take a commander-centric approach and support that process.

So, what does that mean in practice? First, it means that assessment must provide the commander with the understanding of the changing operational environment so that he can begin to match up the resources he needs with the next steps he might take. Awareness of the context ensures that the commander can move with and not against the flow of events as he attempts to become more attuned to the environment. The commander has insight regarding what will make him more comfortable with the circumstances, and he is looking for ways to take advantage of the situation.

Thus, the commander's focus is on near-term decisions about the next feasible steps. Most importantly, it means that the so-what? question comes first. Instead of presenting a set of predetermined data elements and inferring their potential meaning regarding following a plan toward reaching a particular end state, the approach is to document what it takes to thrive in the current environment and then to set the conditions to foster further progress. Assessment provides the information needed to take the appropriate next steps.

Is the paradigm of evolution for assessment revolutionary? Indeed, there are aspects that sound non-doctrinal. In particular, the shifts away from a focus on prescribed end states and from matching the current state to the formal plan are major changes. On the other hand, the proposed approach considers much of the same information and retains many key characteristics of traditional planning and assessment, although with a different perspective. Assessment always has been part of the commander's decision-making process, but here we emphasize (1) that the question comes first, not the data

collection, and (2) the focus is more short-term, because it is necessary to wait how things are playing out before taking subsequent steps. Traditional planning always has acknowledged the need to re-evaluate in case of drastic changes in the situation, but the historical and analytical evidence shows that often the changes are subtle and one can go down the wrong road before realizing it. With the mindset of evolution, one is less likely to make that mistake.

The concept of setting the conditions (as opposed to measuring effects) is consistent with the use of measures of performance as indicators of activities that are intended to steer toward progress. Measures of performance offer an alternative approach to ambiguous and undeterminable measures of effectiveness: they are indicators or characteristics that have proven to improve processes (based on reconstruction and assessment of previous operations) or ones that are logical and self-consistent concepts for improving processes (based on further analyses).

Why might this perspective about assessment be better and more useful for an operational commander? First, we contend that it is constructive that assessments and assessment cells are not closely and directly coordinated with planning cells. The external, extra set of eyes has value in avoiding the potential problems of group think. An independent look exploits diversity and acknowledges the value of multiple points of view. The concept of evolution, supplemented by an adaptable point of view, can help avoid being misled by hidden factors, uncertain or unmeasurable indicators, and emerging unintended consequences.

In addition, the perspective is aligned with the concept of improvisation [22]. Flexibility and adaptability make it harder for an adversary to preempt or counteract our options because they are not able to track the repercussions as well as we can with assessment. Again, this is not a bizarre concept. Continual re-evaluation is consistent with the cycle of the OODA loop [1]. Acknowledging the perspective of evolution may facilitate keeping an opponent off balance and "getting inside his OODA loop."

Furthermore, we contend that the new perspective has the potential to be appealing to operational decision-makers. Assessment likely will

be more palatable and interesting to the commander at the operational level of war if it offers guidance to make the type of decisions within his purview. Realistically it needs to lean more toward the tactical side—as this approach of near-term, next-steps does—than to the strategic side.

Guidance from higher-authority often relates to the effects that military operations should have on the enemy—effects that are not readily measurable with the resources available at lower echelons. Routine translation of that strategic-level guidance often remains broad and abstract. Operational commanders have difficulty seeing how their actions have impact. However, showing near-term progress and promising changes to the operational environment are more obvious and internalized for subsequent action. The use of measures of performance also is consistent with a short-term viewpoint because the scenarios remain fairly stable and linear over short time periods. Understanding the direction of movement becomes more manageable over shorter time frames [25]. The evolution paradigm helps justify why input measures and indicators are important and helps solve the frustrations of not being able to measure output. Thus, the potential dangers of ambiguous metrics is reduced.

On the other hand, operational commanders may find the concept hard to accept because of an inherent need for cultural change. Commanders must allow for uncertainty and expect stochasticity. They must be willing to accept setbacks but view them as learning experiences. However, not every setback warrants drastic changes in the concept of operations. Following the evolutionary paradigm means that setting the conditions for progress by becoming more attuned to the overall environment is paramount. Focusing assessment on those aspects then fosters steady trending toward more favorable overall circumstances.

Admittedly, the analysis presented in this paper is conceptual and there are aspects that need to be examined further. For example, if the system is being controlled by a series of short steps, how can one keep things from going off on tangents? Furthermore, adaptive systems are known to be notoriously difficult to control and there is a tendency to overcorrect. Perhaps the near-term, tactical mindset can

mitigate such problems, and perhaps there are ways to control the local core of trajectories to minimize the likelihood of going way off track. Are there issues related to focusing on symptoms rather than causes? In a sense, that is the proposed surrogate for not being able to prove cause-and-effect. Treating symptoms will not resolve systemic problems, but perhaps such aspects are better left to non-military efforts.

Are there consequences of downplaying the long view, or undesired consequences in other dimensions, because there are too many variables to keep under consideration? For example, is a fear of developing an overly convoluted structure, perhaps one that proves to be fragile or unstable, warranted? As long as simple, "elegant" solutions are not required, this issue may not be serious. Neatly-designed solutions are not necessary, although, of course, straightforward concepts do help when explaining or justifying a course of action. Perhaps there are ways to clarify the connections between pieces, rather than merely displaying a slew of independent, uncorrelated thermographs as a way of demonstrating the coherence of the overall environment under construction. We pursue this idea a bit further in the final section of this report.

Academic research has identified some of the repercussions of the fact that military activity at the operational level of war is a complex adaptive system [28]. Lessons learned include:

- Fluctuations and extreme events often are more important than steady-state equilibrium. Furthermore, the essential features of a system are emergent—that is, unanticipated. Thus, fixating on the expected baseline can lead to failures to notice crucial information.
- Traditional search for optimal solutions is not tenable. Thus, exploratory approaches to identify "good enough" situations are most useful. Short, multistage processes and approaches that focus on near-term decisions are more likely to be productive in that investigation.
- Components of a complex adaptive system need not be described in great detail for a model to yield aggregate

behaviors of interest. Thus, there is hope that more rigorous application of theories of complex adaptive systems need not become unwieldy as some systems of system analyses have turned out.

Future analysis can apply control theory for complex adaptive systems in the context of these lessons learned. The basic concept would be to identify drivers that steer best toward improvements in the operational environment. Determining the relative strength and importance of the options available to a commander could be derived from a methodology such as the Google PageRank algorithm—a fast, robust method that was developed initially to assign a value to a web page [29]. Features of the algorithm might be generalized to identify the more critical options for a military commander to choose. Associated visualization tools, such as force-directed graphs—which spatially organize and group closely-related items closer together—are especially attractive for rendering descriptions of how the military forces adapt to changes in the operational environment. Force-directed graphs show where greater means of influence lie [30]. Such insights can highlight the properties and behaviors of the existing force structure and can provide direction to help an operational commander steer toward improvement and progress.

Setting the conditions for success involves manipulating the driving factors that are deeper down in the overall process-deeper than broad, strategic features. With the mindset of evolution, success involves becoming more attuned to the overall environment: accruing more information, having more and better options to deal with uncertain circumstances, and being able to compete for resources better. While military judgment and planning factors provide a foundation to assess how certain elements are dominant in that undertaking, more rigorous analytic tools can augment and improve those procedures. Most importantly, assessment procedures can be refocused toward addressing the keen interests of decision-makers at the operational level of war and responding more directly to the key question, “What to do next?”

References

[1] John R. Boyd. *The Essence of Winning and Losing*. Briefing, 28 Jun. 1995.

[2] Joint Publication 5-0, *Joint Operational Planning*. 26 Dec. 2006.

[3] MAGTF Staff Training Program. *Assessment. MSTP Pamphlet 6-9*. Oct. 2007.

[4] Jonathan Schroden. *"Why Operations Assessments Fail: It's Not Just the Metrics."* Naval War College Review Vol. 64, No. 4, Autumn 2011: 89-102.

[5] Joint Chiefs of Staff, Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms*. 12 Apr. 2001.

[6] Commander, U.S. Joint Forces Command. Memorandum for U.S. Joint Force Command. *Assessment of Effects Based Operations*. 14 Aug 2008.

[7] Stephen Downes-Martin. *"Operations Assessment in Afghanistan is Broken."* Naval War College Review Vol. 64, No. 4, Autumn 2011: 103-125.

[8] J. Salerno, M. Hinman, and D. Boulware. *Building a Framework for Situational Awareness*. Proceedings of the 7th International Conference on Information Fusion, Stockholm, Sweden: 2004.

[9] Christine H. Fox, Maureen A. Wigge, and Alan C. Brown. *Operation Desert Thunder Quicklook: Executive Summary (U),* Secret. CNA Report CNR 223. Dec. 1998. (Only unclassified sections cited.)

[10] Alan C. Brown. *CENTCOM Planning and Risk in OIF: Volume I Overview (U)*, Secret. CNA Research Memorandum

D0012360.A2/Final. Sep. 2005. (Only unclassified sections cited.)

[11] Joe Quartararo, Sr., Michael Rovenolt, and Randy White. *"Libya's Operation Odyssey Dawn: Command and Control."* Prism 3, No. 3, Mar. 2012: 141-156.

[12] Alison Rimsky Vernon. *Defining the Decade: Military Operations and Political Constraints in the 1990s.* CNA Research Memorandum D0010213.A3/Rev. Aug. 2004.

[13] Michael F. Beech. *"Mission Creep": A Case Study of US Involvement in Somalia.* Leavenworth, Kansas: Command and General Staff College, 1996.

[14] Adam B. Siegel. *"Mission Creep or Mission Misunderstood?"* Joint Forces Quarterly Issue 25, Summer 2000: 112-115.

[15] Herman S. Wolk. *"Pantelleria, 1943."* Air Force Magazine Vol. 85, No. 6, Jun. 2002: 64-68.

[16] Malcolm Gladwell. *Blink: The Power of Thinking Without Thinking.* New York: Little, Brown and Co., 2005.

[17] James N. Mattis. *"Commander's Guidance for Effects-based Operations."* Joint Forces Quarterly Issue 51, 4th quarter 2008: 105-108.

[18] Paul K. van Riper. *"EBO: There Was No Baby in the Bathwater."* Joint Forces Quarterly Issue 52, 1st quarter 2009: 82-85.

[19] Helmuth von Moltke. Militarische Werke. Berlin: E.S. Mittler, 1892.

[20] John C. Camillus. *"Strategy as a Wicked Problem."* Harvard Business Review, May 2008: 99-106.

[21] Jeff Conklin, *Dialog Mapping: Building Shared Understanding of Wicked Problems.* Chichester, England: John Wiley and Sons Ltd., 2006.

[22] Karl E. Weick. "I*mprovization as a Mindset for Organizational Analysis."* Organization Science Vol. 9, No. 5, Sep.-Oct. 1998: 543-555.

[23] Carl von Clausewicz. Vom Kriege. Berlin: Dummlers Verlag, 1832.

[24] Alan Beyerchen. *"Clausewitz, Nonlinearity and the Unpredictability of War."* International Security 17:3, Winter 1992: 59-90.

[25] George Modelski. "*Evolutionary Paradigm for Global Politics.*" International Studies Quarterly 40:3, Sep. 1996: 321-342.

[26] W. Edwards Deming. *Out of the Crisis.* Cambridge, MA: MIT Press, 1986.

[27] Gabriel A. Almond, Marvin Chodorow, and Roy Harvey Pierce. *Progress and Its Discontents.* Berkeley: University of California Press, 1982.

[28] Andrew Ilachinski. C*omplex Adaptive Systems, Agent-Based Models, and Some Heuristics Regarding Their Applicability to Operations Research.* CNA Information Manual DIM-2012-U-0007530-Final. Apr. 2012.

[29] Amy N. Langville and Carl D. Meyer. *Google's PageRank and Beyond: The Science of Search Engine Rankings.* Princeton, NJ: Princeton University Press, 2006.

[30] Andrew Ilachinski. *A Systems Approach to Understanding the Military Implications of Global Climate Change.* CNA Annotated Briefing D0022216.A1/Final. Apr. 2010.

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