

Exploiting Experimentation: A Managerial Challenge

S. K. Numrich

Institute for Defense Analyses

Alexandria, VA

snumrich@ida.org

K. M. Woods

Institute for Defense Analyses

Alexandria, VA

kwoods@ida.org

ABSTRACT

The demands of today's battlespace, whether the objective is achieving Multi-Domain Operations or integrating the newest technology into military systems and operations, require a degree of integration our forces have never experienced. The lines that once separated areas of operation are gradually disappearing as the aspirations of "any sensor, any shooter" are becoming a reality. The integration sought in the battlefield must also be experienced in the creation of operational concepts and training capabilities. Yet neither the live exercises, nor the simulation capabilities can present the full multi-domain environment. Live experiences are limited in time and space, and the availability of forces and equipment. Simulations, even as they have brought exciting capabilities to bear on training, lack capability in domains like cyber, electromagnetics, and human behavior—particularly as it is involved in complex decision-making. The challenge is best met by an integration of capabilities: wargaming in all its forms, simulation from engineering to mission level, and live exercises. Wargaming brings the complexity of human decision-making while simulation affords the ability to explore multiple sets of conditions flexibly, and finally, live exercises contribute a level of tactical performance not accessible in either simulations or wargames. This paper will explore the integration of capabilities in a methodology called an experimentation campaign; however, successful execution of the methodology presents a number of managerial challenges that will also be examined. The methodology is relatively easy, if complex. The real challenge is organizing, managing, and resourcing such a campaign in the absence of a joint coordinator and resource manager. The methodology, in part, is already used in acquisition—what we lack outside the more limited context of acquisition is policy and management.

ABOUT THE AUTHORS

Susan K. Numrich, PhD, CMSP, has been a research staff member at the Institute for Defense Analysis (IDA) since her 2005 retirement from the U. S. Naval Research Laboratory (NRL) where she served as a research physicist and was involved with modeling in nuclear structure, underwater acoustics, signal processing, virtual reality, and parallel processing. She managed research programs for NRL and the Office of Naval Research, served as a U.S. representative on NATO and The Technical Cooperation Program in modeling and simulation, and was technical director at the Defense Modeling and Simulation Office 2002–2005. An active member of the IITSEC community for more than 30 years, Dr. Numrich was elected an IITSEC Fellow in 2018 and received the NTSA Lifetime Achievement Award in 2023. Dr. Numrich has an abiding interest in using all forms of simulation to advance strategic thinking and rapid delivery of new capability to the warfighter.

Kevin M. Woods, PhD, joined the IDA research staff after retiring from the Army in 2004. During his career in Army Aviation, Dr. Woods served as an experimentation and concept development officer at U.S. Forces Command. He has a master's degree in national security and strategic studies from the Naval War College and a doctorate in History from the University of Leeds, UK. The author of numerous papers, he is probably best known for his in-depth studies of Saddam Hussein and terrorism, drawn from multiple volumes of captured documents. Dr. Woods maintains a keen interest in experimentation and experimentation campaigns. Kevin is currently the Deputy Director of the Joint Advanced Warfighting Division at IDA, which focuses on Joint Concept and Capability Development through Joint Analysis and Joint Experimentation.

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INTRODUCTION

The discussion in this paper will begin with a brief examination of the operational space in which we will consider the interdependencies among the services required to execute successfully across all domains in the multi-domain operational space. We will then examine some of the known difficulties in both simulations and interactive wargames and tabletop games, both of which are necessary in exploring future warfare as well as in planning with today's technologies and capabilities. Following this will be a discussion of experimentation, discovery experimentation, and experimentation campaigns. The notion of a campaign implies that solutions are drawn not from a single experiment or demonstration, but from a planned, consistent, managed, and funded succession of experiments with feedback and the potential to fail. We will see how the Department of Defense (DoD) has used experimentation to respond to the challenges of facing capable adversaries, and we will note places when there are flaws either in the concept or in the execution thereof. We will look at time as a driver of our perspectives and a challenge to our ability to achieve goals that we seek. Finally, we will look at lessons from the past that point to managerial issues in both the conceptual language in the campaign of knowledge currently underway in the Department of Defense and in the execution of large, joint endeavors. Along the way, suggestions will be made for addressing current gaps in both our thinking and the execution of our doctrine.

CHALLENGES OF MULTI-DOMAIN OPERATIONS

The term *multi-domain operations* is but one of many expressions used to describe the operational context in which conflict will take place as we face highly capable adversaries. Common to all definitions is the requirement for collaboration across the various domains. However, we contend that collaboration is not sufficient. To execute in a timely manner against the highly capable foe, close integration rather than just collaboration will be required.

Figure 1 is a graphic developed by the Army as a vision of collaboration across land, sea, and air as well as space and cyberspace (Freedberg, 2020). The lines on this graphic representation allude to a fraction of the communication and integration required to achieve the vision. To work within reasonable time, the battlespace would have to be supported by fully integrated command-and-control systems distributing a common operational picture supported by up-to-the-minute situational awareness provided by all sensors and sources. And it would have to be done in a hostile environment.

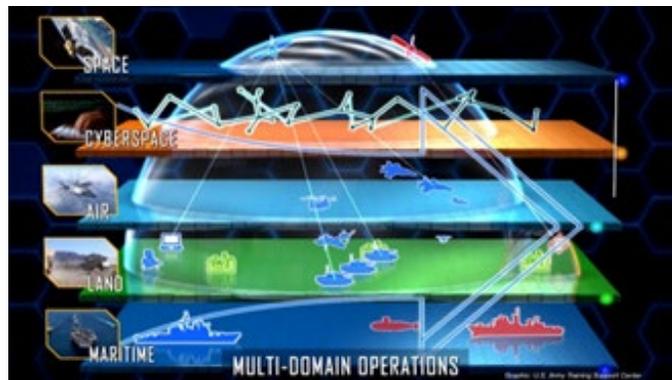


Figure 1. Graphical Vision of a Multi-Domain Battlespace

Visions, such as the one in Figure 1, are born of our imaginations and fueled by our current problems. They depict our goals, but not the pathways to achieving those goals. And it is in attempting to find those pathways that we encounter the gaps in our understanding and our ability to model our world. The first step needed to form pathways toward our goals is to break the envisioned goal into executable pieces, being careful to avoid paths that lead to suboptimization. In the military context, simulating across the entire battlespace is an extremely difficult problem, particularly when trying to incorporate the electromagnetic and cyber domains. However, military operations themselves are broken

down into missions that take place in the larger battle space, but can be described and modeled in ways that allow humans to consider and make decisions about the impact of the mission in the context of the larger battlespace.

Challenges to Simulation

Our computational tools provide excellent representations of the physical objects and their encounters at the mission level; however, they run into difficulty when having to represent the external electromagnetic environment, natural environment factors like fog and rain, communication capabilities, and the capability of the enemy to interfere with both communications and data transfer. Adding all of these features which are part of today's battlespace is a difficult problem and one that is perhaps best addressed in an appropriate balance of computational capability and human experience and ingenuity. Although both wargames and simulations are recognized as part of our toolkit, we have not used them, especially in combination with field exercises directed by a well-structured, analytic methodology. The result is a plethora of individual events from which we attempt to assemble meaningful conclusions for supporting our decision-makers.

The Department did not arrive at this juncture by design, but rather by the way the development of simulations and wargames has been managed and funded independently. The result has been a competitive rather than cooperative engagement between simulationists and wargamers. Anathema to the wargamers is the notion that a simulation should be run as a means of determining the accuracy of the results of the wargame. In the same way, simulationists tended to regard wargaming as being without the rigor behind physical modeling. The problem is far from intractable. It requires integrated management and funding guided by a rigorous analytic methodology to use physical models to support the ingenuity drawn from wargames. Wargames would have to be supported by a well-constructed data collection plan if their results are to be used as part of an analytic methodology.

In the wargame, the players can draw on both their imagination and their experience to envision the potential role of new capabilities and novel ways of employing current capabilities. Physical models can be run to explore the viability of applying the capabilities envisioned to the wargame. As these two ways of exploring the future work together, the analysts, technologists, and warfighters will begin to understand new ways of using the tools together to develop more robust conclusions.

Using field exercises as part of the analytic methodology presents a series of problems resulting from the fact that an exercise takes place at a specific location and under local weather conditions that limit the results derived from the exercise. In documenting their exercises, simulationists and wargamers can control their environments in ways not possible in live exercises; however, establishing recording requirements that include most of the factors that affect the performance of the exercise, such as weather and other conditions under which the exercise was conducted, allows the data extracted from the exercise to be integrated into an analytic methodology. Deriving a common data format and method for annotating the factors affecting the field exercise is not a difficult problem, it is merely time-consuming and requires an understanding both of what the analysts would like to have and what the participants in the exercise are capable of extracting during the course of a for live exercise. Once again, the ability to put this into play relies upon a management decision that provides both the discipline and the funding to get the work accomplished.

EXPERIMENTATION

The military has long used games, computational models, and human-driven exercises to explore operational concepts. In an effort to codify the use of experiments and define experimentation, the Office of the Under Secretary of Defense for Research and Engineering published a *Prototypes and Experiments* guidebook (2021) in which the definition of experimentation is drawn from the pocket guidebook published in Canada (The Technical Cooperation Program, 2006) and is as follows:

In its purest sense, experimentation is the application of the scientific method (the processes used since the 17th century to explore natural science) to determine cause-and-effect relationships—manipulating one or more inputs, recording the effects on an output while controlling the environment and other potential influencers, and analyzing the data to validate the relationships. (p. 3)

The *Prototypes and Experiments* guidebook further defined a term called *defense experimentation* as testing an “hypothesis, under measured conditions, to explore unknown effects of manipulating proposed warfighting concepts, technologies, or conditions” (p. 3). It is this broadened definition that will be used throughout the rest of this paper, as it allows flexibility to use not only laboratory experiments but other forms of exploration in pursuit of understanding the changing operational environment.

Experimentation Campaign

The exploration of unknown effects is often termed *discovery experimentation*. It requires some of the discipline of experimentation, but allows for considerable free play in exploring novel concepts, capabilities, and even organizational structures. As discussed in the prior section, no one form of simulation has the capability to explore the entire operational domain. No single simulation, wargame, or field exercise can generate the data needed to approach the problem space analytically. To compensate for this, and to make best use of our diverse capabilities, the methodological process called an experimentation campaign has been developed and used effectively.

In exploring the multi-domain battle, Woods and Greenwood (2018) contended that

The complex nature of military problems, and especially ones with interactions across five domains, argues for diverse forms of “discovery experimentation” to introduce novel systems, concepts, organizational structures, and technologies into settings where their use can be observed and Red Teamed.³² The results of such a comprehensive assessment will help identify MDB [multidomain battle] similarities and differences between the theaters, and will inform future doctrine, organization, training, materiel, leadership and education, personnel, facilities, and policy initiatives that must be addressed before MDB can become a deployable set of capabilities. (p.19)

Figure 2 is a graphic description of a notional experimentation campaign based on descriptions by Budge (2002)

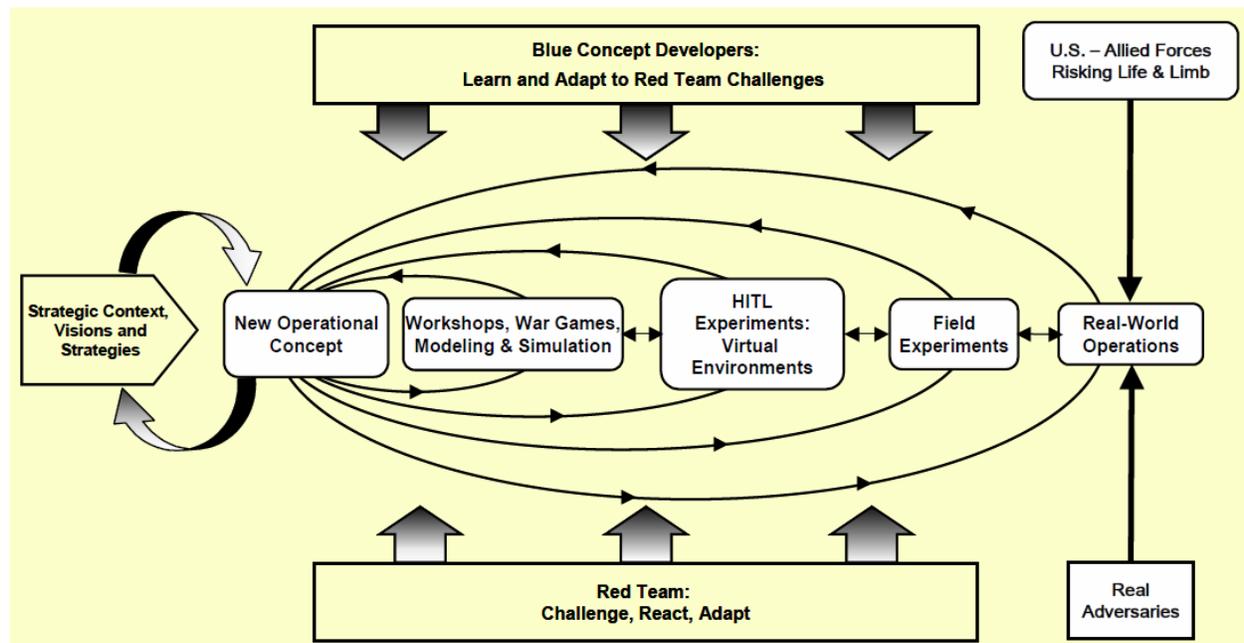


Figure 2. Components and Interactions in an Experiment Campaign (Numrich & Woods, 2017)

To be effective an experimentation campaign starts all the way to the left of Figure 2 with the concepts, visions, and strategies. Starting further into the process risks solving the wrong problem. Physical scientists, who are well known for their use of experiments, recognize that the most important part of solving a problem is to spend time and effort defining the problem itself. It is this first step that is often ignored and proves to be a stumbling block in military experimentation.

The white boxes across the midline list some of the capabilities in simulation and wargaming that can be used to explore the problem space. Typically, the initial exploration is done using human-driven processes. The discussion, together with both blue and red teaming challenges to participants, feed back into the original concept, changing and refining it as understanding of the problem increases. Once the concept is considered to be sufficiently defined it can be subjected to workshops, wargames, and modeling and simulation to the extent that the tools are available. Once again challenges are posed by red and blue teams, and what is learned at this stage is fed back to the prior stage to further refine the concept or capability. One of the most important parts of the process is to subject the new concept or capability to the warfighter if the tools are available. Human-in-the-loop experiments are ideal for this purpose. This type of feedback from the end user can alter the nature of a capability or the manner in which it is employed. Once again, blue and red teaming challenges help refine the criticisms that are fed back until the capability is sufficiently well defined to be handed over to the technical community to be developed or to doctrine developers and designers of organizational structures to be used in restructuring and training the force.

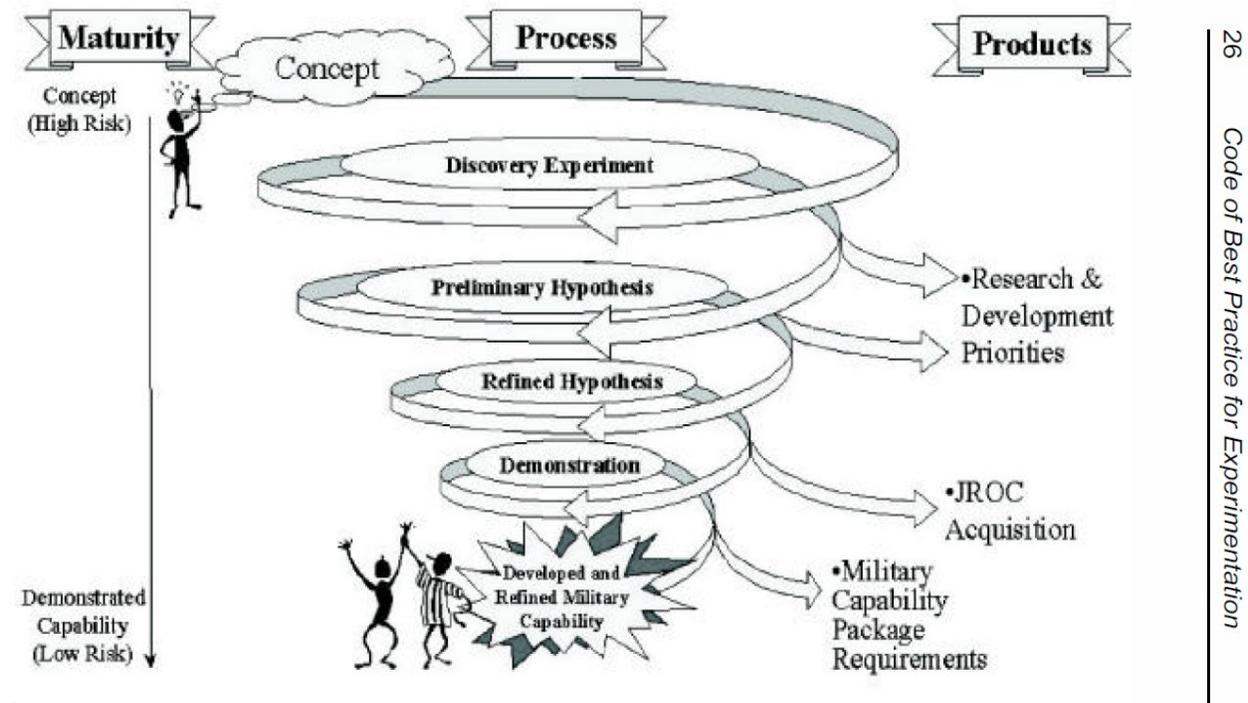


Figure 3-1. From Theory to Practice

Note: Reprinted (with permission) from *Code of Best Practices for Experimentation*, by D. SA. Alberts & R. E. Haynes, 2002. Copyright CCRP Publications.

Figure 3. A Modified Experimentation Campaign as Used in Research and Development

A modified form of an experimentation campaign is often used in the defense acquisition community, a picture of which is shown in Figure 3 (Alberts & Hayes, 2002, p. 26). The graphic is actually a waterfall display from concept to delivered military capability. The process as shown is missing two essential factors in an experimentation campaign. There is no provision for red and blue teaming to put additional pressure on each phase of the process, nor are there feedback loops that allow corrections to be made in the process of refining or even changing the initial concept. The process shown in Figure 3 lacks the rigor of a fully implemented experimentation campaign. Issues of groupthink and bias can easily arise in the absence of blue and red teaming. The feedback provided in experimentation campaign helps ameliorate the danger of solving the wrong problem.

Experimentation in DoD

Innovation requires adjustment not only in technology but in doctrine and organization. Multiple approaches have been proposed for dealing with innovation. At issue today is the nation's ability to meet the threats from technologically expert adversaries during the era of rapidly advancing technology. One of the problems that emerges is how to promote innovation that requires change in the face of budgetary restrictions. These sentiments seem to be apropos today but they were published in 1998 (Johnstone, Ferrando, & Critchlow, 1998-99) in the paper titled "Joint Experimentation: A Necessity for Future War." In a 1998 unpublished manuscript, Paul Davis suggested that there is something of a continuum of adaptations necessary to achieve a truly integrated joint functionality in the complex operational environment (Davis et al., 1998). Figure 4 depicts how that continuum of adaptations might be envisioned today.

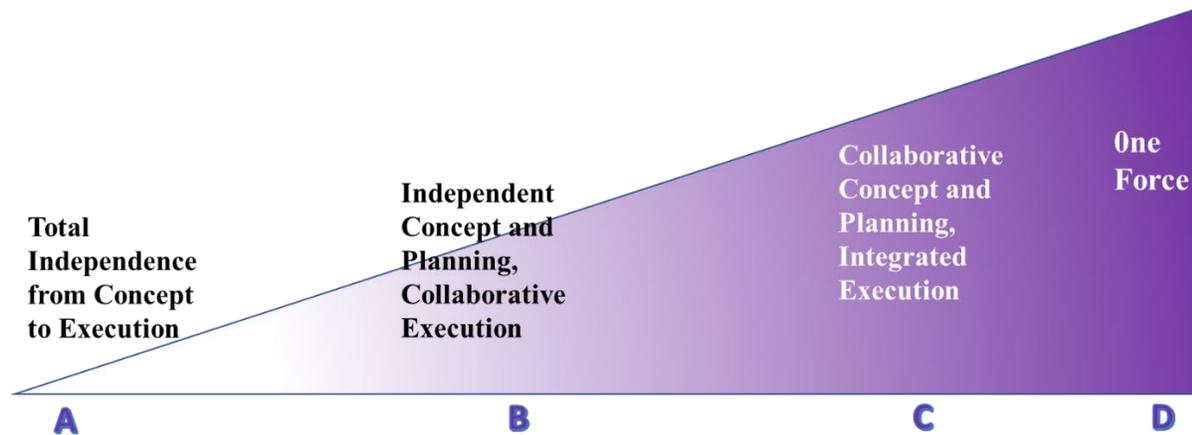


Figure 4. A Continuum of Adaptation

The start of the continuum at position A represents the state in which each service independently develops its own competencies and technologies and executes those capabilities in clearly separated lanes of operation. Position D at the opposite end of the continuum represents a situation in which there are no longer separate services but one military providing all of the operational capabilities. At position B the services each do their own assessments and technology evaluations in preparation for acquisition of new capabilities and improvement of existing capabilities; however, when involved in joint operations they collaborate to provide the most effective execution. Fully integrated execution occurs only at position C. Based on current concepts, multi-domain operations and service programs oriented toward integrated execution today's military would seem to be close to position B with the intention of moving rapidly toward position C.

Because operational concepts, including multi-domain operations, represent visions that drive the design and development of future force, the services must first answer with one voice the question of how they intend to fight wars in an integrated fashion before they answer the questions of what they need to fight with (Benefield & Grant, 2021). The authors add that if DoD is going to move but it lacks a capability development process that is both threat-informed and joint concept driven, the department must first turn attention to fixing the experimentation process which is fundamentally broken.

Note that Benefield and Grant link together the two processes of joint concept development and capability development. While the department is paying considerable attention today to developing and using experimentation, at the very start the doctrine and instructions create a divorce between concept development and capability development by assigning responsibility independently to two different organizations. DoD directive 5137.02 quite correctly assigns the responsibility for prototyping initiatives to advance innovative or novel technology development to the Under Secretary of Defense for Research and Engineering (Office of the Under Secretary of Defense for Research and Engineering, 2020). Nowhere in the directive is there a requirement for coordination with the joint staff and integration with warfighting concepts. Thus, the acquisition arm of the department with its underpinnings in research and development jumps into the experimentation process at the halfway point.

On the concept development and force structure side, the Joint Staff has issued an instruction for implementing the development and design of the joint force (Joint Staff, 2022). In this document the Joint Staff produces a description of the process and carefully assigns responsibilities to the services and other organizations involved. As part of the document the Joint Staff established the Joint Warfighting Concept (JWC) that

guides the organization, training, and equipping of the joint force and includes efforts to exercise, experiment, wargame, and analyze new ideas that, through a campaign of learning, influence future iterations of the JWC.” (p. A-6)

The process moving from concepts to concepts of operation or concepts of employment and thence to concept required capability is represented in the diagram that has many features in common with an experimentation campaign. The diagram is shown in Figure 5 and shows the progress from concept using a combination of exercises experimentation analyses and wargaming.

Figure 5 compares favorably with the beginning of an experimentation campaign with an indistinct notion of feedback represented in the cylinder labeled Campaign of Learning. If the processes put forward by the acquisition executives and the joint staff are tied end to end starting with the representation in Figure 5, the end result would be an experimentation campaign in which the beginning did not engage in discourse with the end. Looking at the two processes from this perspective gives credence to the statement that the process is broken.

Part of the learning comes from measuring the effectiveness of the process. The assessments identify and mitigate gaps in joint force capabilities thus providing essential information for developing a future force that maintains competitive and warfighting advantage against global adversaries. The information fed into these assessments arrives at the joint staff from the component services. As with many Pentagon-level processes, the degree of coordination and endless staffing reduces truly innovative ideas to the least common denominator among the service positions. As a result, many of the concepts that emerge from these processes present improvements of current operations rather than truly innovative options. Unlike the directive from the Office of the Secretary of Defense (OSD), however, the Joint Staff instruction contains provision for integrating participation of OSD proponents.

The joint exercise program, a mainstay of the experimentation program itself, is directed, coordinated, and funded through several decision bodies and forums. In the history of modeling and simulation capabilities, when funding is not co-located and controlled by the single agency responsible for managing the development, problems arise and capability development itself is jeopardized. The absence of a single agent with both managerial and funding responsibilities is a flaw in the plan, a flaw that results from having to cross service boundaries. Creating a new organization is always met with opposition; nevertheless, co-locating managerial and funding the same office is a way of circumventing the problems that arise when funding must be extracted individually from various service offices.

In 2003, the Defense Science Board established a task force on Joint Experimentation. In their Phase I report, the task force pointed out difficulties in carrying out defense experimentation (Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, 2003).

Experimentation can be an unnatural act for established organizations. Outcomes are uncertain and may be threatening to many in the enterprise. Experimentation on military operations poses additional intellectual challenges—how to account for exceedingly complex situations, adaptive adversaries, and human behavior under extreme stress. Lastly, experimentation on joint operations adds yet another layer of difficulty because of the organizational interfaces involved and the relative immaturity of processes for prioritization and resource allocation of joint capabilities.

The observations made two decades ago remain true today. The notion that failure is not an option is still current among many organizations within the military. Innovative ideas that verge on organizational change are as threatening today as they were in 2003. Organizational interfaces involved in joint operations still create problems; although,

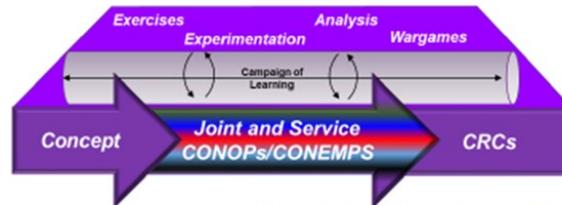


Figure 3. Concepts to CONOPS/CONEMPs to CRCs

Note: CONEMPS = concepts of employment; CONOPS = concepts of operation; CRCs = concept required capability. Reprinted from Joint Staff, from *Implementing Joint Force Development and Design*, 2002.

Figure 5. Representation of the Joint Concept and Consequent Capability Requirements

cooperation and collaboration have increased in the interim. Command-and-control systems do not easily interoperate across the services, and these, of all systems should be born joint. Military weapons and training systems alike are often packaged with vendor-unique command-and-control systems leading to a situation in which different systems within a single service do not readily interoperate. While it is to the advantage of the military to have such interoperation, it is often not to the commercial advantage of the industries that produce the capabilities. Although enforcement of contracting provisions could alleviate this problem, there is often little enthusiasm for doing this.

THE TYRANNY OF TIME

Time colors our perspectives on the operational environment. If the clouds of war are looming over us, our focus becomes winning tomorrow's battle. There is little time to conceive of or develop new capabilities, but we approach the impending confrontation with current capabilities or minimal improvement upon them. When the world around us seems calm and there is no looming struggle, we have the luxury of being capability-driven and technologists are free to develop new capabilities simply because they can do so, unconstrained or led by warfighting concepts.

The directives and instructions issued over the past two decades have focused on rapid transition of capability to support our military and live conflict. While our focus today shifts to highly capable enemies with whom we are now engaged in a competition phase of war rather than live-fire warfare, our focus is still in rapidly fielding new tools to counter our capable adversaries. The context in which we plan and execute remains tactical rather than strategic at a time when strategic vision is vital.

Today the strategic context means the rising risk of great power war, the increasing availability of long-range, precision weapons and capabilities (e.g., cyber), the partial unraveling of the post-Cold War strategic stability (attributed either to the rise of China or the internal softening of Western power together with a long list of potential causes), and, primarily on the U.S. security side, a sense that we may be out of time to prepare for the coming storm. The sense that we are out of time to secure our own national security limits our investments, like basic science, that produce results only in the long term. Policymakers have little or no interest in theoretical campaigns experimentation, long deliberate-iterative campaigns of experimentation, or even a willingness to challenge the legacy pillars of roles and missions across domains and/or services.

The above context, which emerged over the past 15 years, came on the heels of another “wet blanket” over arguments for campaigns of experimentation/learning—the global war on terrorism. More than any of the other reasons raised for the demise of experimentation at the Joint Forces Command was the inability, perceived or real, to be relevant to the current fight. The perception of relevance to the current fight still dominates the thinking on both the military and civilian side of the DoD.

With the sense of encroaching doom, the significant controlling factor behind the current concept of experimentation campaigns is time.

The notion of open-ended campaigns is anathema to a generation raised on rapid fielding, fail fast, and adaptation of commercial off-the-shelf solutions. Another more recent Defense Science Board task force on games, exercising, and modeling and simulation (GEMS) sites as a major issue our current lack of strategic gaming.

More recently efforts have focused on immediate threats (e.g., terrorism) and strategic gaming has become a rarely employed tool for analyzing today's larger and longer-term challenges. Now, the United States faces advanced great power rivals with technology capability and economic strength rivaling our own. To confront these challenges, the DoD needs to reinvigorate its strategic gaming. Tools are only as good as the participants who use them. Effective strategic gaming will require serious senior-leader participation in the gaming itself. The task force recommends taking advantage of new technological and analytical developments to re-build a strategic gaming capability to better understand geopolitical shifts, adversary goals, and rivals' potential reactions to U.S. operations and initiatives in an era of great power competition. (Office of the Secretary of Defense, 2021, p. 3)

There is a second issue with time—the speed at which new information from the “live experimentation campaign” unfolding in Ukraine is flooding through formal and informal channels. Based in large part on observations from Ukraine, the U.S. Army has canceled the procurement of the next attack/scout helicopter. The reasons for cancellation were all well-known prior to Ukraine, but the flood of information from Ukraine raised the issues to a higher level,

turning them, rightly or wrongly, into lessons learned and sufficient reason for cancellation – without time for complete analysis.

The tyranny of time, focusing perspectives toward either strategic or tactical, is moving us to look at the different campaign design or relative mix of methods. We need more wargames to understand the nature of our problem in the context/applicability of lessons learned from conflicts like Ukraine. We also need better design and data collection from field experiments and exercises to resolve the integration issues of our current status in the light of emerging adaptation needed to achieve new DOTMLPF¹ tailored to the near and mid-term problems. To generate confidence that a deliberate experiment campaign is capable of providing near and midterm insight, use limited data sets from small numbers of field events to reduce the risk of over- or-under learning, of jumping to conclusions quickly based on observations from live conflict. Direct the analysis toward critical missions, functions, and tasks. Second, use simulation to help solve the integration problems facing Joint Commanders.

The United States has to make better, timelier, more accurate decisions at scale than has ever been contemplated in the history of war to succeed against a peer threat. This is an unprecedented challenge and one for which there is no body of experience in quite the same depth as required here. Meeting this challenge demands the use of our best computational and human-driven simulations and wargames in the highly disciplined methodology imposed by the type of experimentation campaign shown in Figure 2.

RECOMMENDATIONS

We most often raced toward technological solutions, because technology is easy compared with developing sound managerial solutions; however, governing, managing, and resourcing are often the most productive paths toward solving pressing problems and reaching desired goals.

The DoD has an unprecedented talent for developing organizations that grow to the point at which they collapse under their own weight. They are characterized by processes that consume valuable resources and are incapable of responding quickly to any problem or challenge. Add to this first talent a second, the propensity to set up managerial systems in which the manager has all the responsibility but does not have control of resources. The history of simulation, particularly joint simulation, is littered with this type of management and has led to notable failures. To bring the best of simulation and wargaming capabilities together requires a manager with control of dedicated funds and the vision to see the potential of eventually handling the data from field exercises.

Concepts of what the future war will look like and how the United States will approach fighting in it are vitally important at this stage and would benefit from a strategic analysis, something that is not explicitly demanded in the current directives and instructions. The divorce between the OSD directive, which sees experimentation starting halfway into the process in Figure 2 under the joint staff instruction, needs to be remedied if we are to have an enemy-oriented, capability-driven context. This argues for different managerial structure, perhaps a new, small, agile organization dedicated solely to concept development and experimentation. In considering these and other issues Angevine wrote:

- First, the Joint Staff should not mix concept development and experimentation with other functions.
- Second, officials should ensure that there is a common vision of the future operating environment and a clear pathway from concepts and experimental results to decisions on capabilities.
- Third, the effort needs to be kept small and the costs low.
- Finally, and most importantly, concept development and experimentation should be kept joint from the start by making it the responsibility of a joint organization and by clearly defining the relationships between that organization and the services and combatant commands. (2020)

To that last comment we would add the need to include in the OSD, specifically, the Research and Engineering responsible for capability development.

To embrace the strategic and tactical, and to complement the tendency to see solely through the eyes of military or technological experience, the organization needs to be peppered with individuals who see the world through the eyes

¹ DOTMLPF is an acronym for doctrine, organization, training, materiel, leadership and education, personnel, and facilities.

of imagination. The need for such diversity was noted by both Thorp (2010) and Tetlock and Gardner (2015). The structure might be a skeleton crew drawn from the Joint Staff, both military and civilians, and OSD with a designated, highly placed leader with both responsibility and control of a single, committed budget line. Additional external expertise could be brought together contract.

Managing experimentation campaigns to have both a strategic vision and the ability to handle near- to mid-term excursions on demand, to seek and use data effectively, and to do this continuously and with rapid iterations, demands the willingness to break free of any cultural barriers in addition to resourcing adequate to the task at hand. This is a vision and like all visions it is born of the imagination and seeking a real goal. The goal is becoming more pressing with the passage of days. The time has come to think seriously about creating and waging experimentation campaigns.

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