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Red Teaming: A Means to Military Transformation

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January 2001

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IDA Paper P-3580

Log: H 00-002905

20010403 055

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE January 2001	3. REPORT TYPE AND DATES COVERED Final

4. TITLE AND SUBTITLE Red Teaming: A Means to Military Transformation	5. FUNDING NOS. DASW01-98-C-0067 AI-8-1627
6. AUTHOR(S) John F. Sandoz	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Joint Advanced Warfighting Program Institute for Defense Analyses 1801 N. Beauregard Street Alexandria, VA 22311-1772	8. PERFORMING ORGANIZATION REPORT NO. IDA Paper P-3580
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Deputy Under Secretary of Defense for Advanced Systems and Concepts Director, Defense Research and Engineering, Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics 3700 Defense Pentagon Washington, DC 20301-3700	10. SPONSORING/MONITORING AGENCY REPORT NO.
11. SUPPLEMENTARY NOTES	
12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release, unlimited distribution: February 27, 2001.	12b. DISTRIBUTION CODE 2A

13. ABSTRACT (Maximum 200 words)

In 1999 and 2000, the JAWP conducted with and for the U.S. Joint Forces Command its first joint experiment, J9901: Attack Operations Against Critical Mobile Targets. The experiment's primary focus was on exploring new joint concepts to detect and attack critical mobile targets, specifically theater ballistic missiles (TBMs) circa 2015. To expose these concepts to an adaptive enemy, a Red Team was employed to develop and execute various aspects of a future TBM force, including counters to Blue Force attack operations. The Red Team experience in J9901 also contributed to the process of learning how to design and conduct future joint experiments.

This paper makes the case that Red Teams are needed throughout concept development and experimentation, and further, that red team activities should be embedded in a disciplined process of Red-Blue interaction. At one level, red teaming could challenge our strategic context and visions of future military capabilities by inventing and exploring counter-strategies and challenging scenarios. At a second level, red teaming could focus on identifying counters to proposed new operational level concepts and capabilities; for example, the Rapid Decisive Operations concept designated by the Chairman of the Joint Chiefs of Staff as "the tool to operationalize Joint Vision 2020." A third level of red teaming activity could be in direct support of experimentation by serving as the opposing force in individual experiments. The author concludes with a discussion of the role of Red Teams in the overall transformation process that DoD is seeking to implement.

14. SUBJECT TERMS Red Teams, joint experimentation, war games, concept development, opposing force (OPFOR), theater ballistic missiles (TBMs).	15. NO. OF PAGES 40
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	0. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UL

This work was conducted under contract DASW01 98 C 0067, Task AI-8-1627, for the Director, Defense Research and Engineering, in the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics. The publication of this IDA document does not indicate endorsement by the Department of Defense, nor should the contents be construed as reflecting the official position of that Agency.

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INSTITUTE FOR DEFENSE ANALYSES
Joint Advanced Warfighting Program

IDA Paper P-3580

Red Teaming: A Means to Military Transformation

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Achieving robust new joint warfighting concepts and capabilities will require that these concepts and capabilities be subjected, as they are developed, to the counters and initiatives of potential future adversaries. Thus a systematic and vigorous Red Team program is needed, one that goes beyond merely scripting the opponent's behavior or pitting today's threat against our presumed future capabilities.

In 1999 and 2000, the Joint Advanced Warfighting Program (JAWP) at the Institute for Defense Analyses (IDA) conducted with and for the United States Joint Forces Command its first joint experiment, J9901: Attack Operations Against Critical Mobile Targets. The experiment's primary focus was on exploring new joint concepts to detect and attack critical mobile targets, specifically theater ballistic missiles (TBMs) circa 2015. To expose these concepts to an adaptive enemy, a Red Team was employed to develop and execute various aspects of a future TBM force, including counters to Blue Force attack operations. The Red Team experience in J9901 also contributed to the process of learning how to design and conduct future joint experiments.

John Sandoz, who headed the red teaming effort for J9901, draws on that experience in this paper to offer observations on possible roles for Red Teams in joint concept development, experimentation, and the larger transformation process.

The paper makes the case that Red Teams are needed throughout concept development and experimentation, and further, that the red team activities should be embedded in a disciplined process of Red-Blue interaction. At one level, red teaming could challenge our strategic context and visions of future military capabilities by inventing and exploring counter-strategies and challenging scenarios. At a second level, red teaming could focus on identifying counters to proposed new operational level concepts and capabilities; for example, the Rapid Decisive Operations concept designated by the Chairman of the Joint Chiefs of Staff as "the tool to operationalize Joint Vision 2020." A third level of red teaming activity could be in direct support of experimentation by serving as the opposing force in individual experiments.

The application of red teaming requires a deft touch. On the one hand, we don't want to stifle good ideas by subjecting them too early to the most formidable opponents possible. On the other hand, we can't wait too long to learn what adaptive enemies might have in store for our favorite ideas.

I invite your comments and feedback, which should be directed to:

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Preface

This paper was prepared for the Director, Defense Research and Engineering, in the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, under the task order Joint Advanced Warfighting Programs (JAWP). It addresses the task order objective of generating advanced joint operational concepts and joint experimentation to assist the Department of Defense in attaining the objectives of Joint Vision 2020. Members of the JAWP also contributed to the ideas and review of this report.

The JAWP was established at the Institute for Defense Analyses (IDA) by the Office of the Secretary of Defense and the Joint Staff to serve as a catalyst for stimulating innovation and breakthrough change. The JAWP Team is composed of military personnel on joint assignments from each Service as well as civilian analysts from IDA. The JAWP is located principally in Alexandria, Virginia, and includes an office in Norfolk, Virginia, that facilitates coordination with the United States Joint Forces Command.

This paper does not necessarily reflect the views of IDA or the sponsors of the JAWP. Our intent is to encourage more extensive use of red teaming as a means for stimulating the discovery and innovation needed for successful transformation.

Recent and Forthcoming Publications of the Joint Advanced Warfighting Program

Taking the Revolution in Military Affairs Downtown: New Approaches to Urban Operations, William J. Hurley, IDA Paper P-3593, forthcoming, February, 2001.

Red Teaming: A Means for Transformation, John F. Sandoz, IDA Paper P-3580, January 2001.

FY2000 End of Year Report: Volumes I, II, and III, Theodore S. Gold et al., IDA Paper P-3571, November 2000.

US Army and US Marine Corps Interoperability: A Bottom-up Series of Experiments, Rick Lynch, Tom O'Leary, Tom Clemons, and Doug Henderson, IDA Paper P-3537, November 2000.

Developing Metrics for DoD's Transformation, Joel B. Resnick, IDA Document D-2528, October 2000.

Experimentation in the Period Between the Two World Wars: Lessons for the Twenty-First Century, Williamson Murray, IDA Document D-2502, October 2000.

Lessons Learned from the First Joint Experiment (J9901), Larry D. Budge and John Fricas, IDA Document D-2496, October 2000.

Military Operations in Urban Terrain: A Survey of Journal Articles, D. Robert Worley, Alec Wahlman, and Dennis Gleeson, Jr., IDA Document D-2521, October 2000.

The Joint Experiment J9901: Attack Operations Against Critical Mobile Targets, Joint Advanced Warfighting Program, September 29, 2000. Prepared for the US Joint Forces Command.

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Introduction

The old saw suggests "live and learn" but the challenge facing military organizations today is to "learn *while* they live." This is the goal of joint experimentation, to provide a dynamic learning environment needed to improve the effectiveness of U.S. military forces in a rapidly changing security environment. Red teaming[1] opens up a new way of thinking about this security environment that is essential to joint experimentation committed to discovery and learning. Red Teams, in this context, are specially selected groups designed to anticipate and simulate the decision-making and behaviors of potential adversaries. Their purpose is to challenge the effectiveness of new operational concepts in future crises and conflicts.

- A Red Team seeks to behave in a manner consistent with the world view and cultural beliefs of a potential adversary. In the absence of reliable information about an adversary's intentions, red teaming can provide insights into how a potential adversary might respond to future U.S. military capabilities.

- A Red Team is not a scripted opponent but an adaptive adversary. By constantly adapting, a Red Team can help discover the weaknesses of operational concepts—not simply validating Blue concepts but forcing Blue to improve (or discard) them. Challenging concepts to the breaking point promotes a better understanding of future threats as well as new approaches for dealing with them.

"Wringing out" military concepts against enemy capabilities is not new. Military organizations have long tested tactics, techniques, and procedures (TTPs) against opposing forces (OPFOR). The Services currently employ aggressor units, such as the Army's OPFOR at the National Training Center, Fort Irwin, California, and the Navy's Aggressor Squadron at Naval Air Station Fallon, Nevada, to train and test operational units against thinking opponents.

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1 The term "red teaming" is commonly used to depict processes designed to bring a devil's advocate perspective by exposing flaws and gaps in our ideas, strategies, concepts, and other new proposals. This paper focuses on a form of red teaming, in which the roles of potential future adversaries are played explicitly within a disciplined, interactive, and iterative process.

The research, development, and acquisition communities also employ red teaming to pit new Blue approaches against technically feasible threats and to assess future system vulnerabilities. Other programs (some very "close hold") analyze specific potential countermeasures to weapons and weapon platforms to improve their survivability and effectiveness.

Moreover, at the strategic level, war games often use the military forces of potential adversaries to test operation plans under various strategic assumptions. The Global War Game, conducted annually at the Naval War College in Newport, Rhode Island, tests future U.S. military forces in a variety of scenarios against a variety of possible threats.

Successful red teaming, more than testing joint concepts, systems, or units, produces new ways of thinking about future military challenges and innovative ideas for dealing with those challenges. War is a phenomenon between thinking opponents. Perceptions influence actions and reactions at strategic, operational, and tactical levels. Each opponent seeks to anticipate the other's intent and to seize an advantage that will lead to fulfillment of his own strategy and objectives. Given the differences between opposing societies and cultures, war has an inherently asymmetric nature, a nature evident throughout military history. In the 20th century, Algeria, Vietnam, Afghanistan, Somalia, and Chechnya featured technologically inferior opponents who managed to win despite their weaknesses in equipment.

Red Teams provide the means to simulate possible opponents in joint experiments by creating an environment where the opposing sides adapt to their opponents' moves. In such an environment, the U.S. military can prepare for future uncertainties by gaining insights into potential adversaries and the threats these opponents can develop.

The Role of Red Teams in Defining Threats

The security environment, once shaped by Cold War competition, features a number of state and transnational organizations that can threaten regional security as well as the U.S. homeland. Thus frequent smaller-scale contingencies are more likely than major conflicts.

While none of the present military challenges is particularly new, the nature of some threats requires new thinking. Unfortunately, military history suggests that America's opponents, emphasizing their own strengths, will adapt to U.S. warfighting concepts in unexpected ways. Operations in Kosovo underline the potential of such adaptation. Serb forces used decoys to divert air strikes from actual targets. They also employed their air defense system only spo-

radically, preventing its destruction and thereby forcing NATO aircraft to operate at altitudes that degraded bombing accuracy.

In an uncertain security environment, the Department of Defense (DoD) needs to consider future threats from three perspectives: evidentiary, technically feasible, and adaptive.

- **The evidentiary threat** is studied, collected against, analyzed, and reported on extensively by the U.S. intelligence community. In the past, key military technologies tended to be solely military. This factor made the gathering and analysis of evidence relatively straightforward in examining numbers of systems the Soviets possessed and their range, payload, and other characteristics. In contrast, many key military technologies today are readily available on the commercial market, such as wide-band communications, satellite imagery, Global Positioning System receivers, and night vision devices. The reality is that the intelligence community is less likely to have the information necessary to develop the evidentiary threat. *Red teaming can help identify which commercially available technologies have high payoff to an adversary as well as help guide the intelligence collection effort.*

- **Technically feasible threats** have become more difficult to assess. Potential opponents can purchase many technologies and systems abroad. Covert developments in biological and chemical warfare, for example, are possible with relatively little cost and little chance of discovery. Commercial information technologies acquired for use in business are equally applicable for use in military command and control. *Red teaming can help identify the ways that potential adversaries can leverage available technology. The focus of technically feasible threats is on not the technology itself but the new capabilities it may enable.*

- **The adaptive threat** is likewise difficult to define since U.S. military forces may not know the unexpected ways in which its opponents could counter warfighting capabilities. *Red teaming can help identify and understand scenarios in which clever adversaries adapt to U.S. capabilities.*

In all three cases, Red Teaming should play a key role in developing and evaluating potential threats.

The so-called **validated threat** that drives most procurement programs is most often identical to the evidentiary threat. The defense community needs to recognize that evidentiary threats, technically feasible threats, and adaptive threats are all components of a validated

threat. By exploring the technologically feasible and adaptive threats, aggressive red teaming can inform and guide collection efforts to produce more complete pictures of the evidentiary threat.

Advantages and Challenges of Red Teaming

By defining future threats and refining strategic, operational, and tactical concepts, red teaming can highlight the Doctrine, Organization, Training, Materiel, Leader Development, Personnel, and Facilities (DOTMLPF) issues on which the transformation of military forces and capabilities must rest. If done at the inter-agency level, adaptive Red Teams can also inform the national policy process by examining alternative strategies and the roles that government agencies, allies, and non-governmental organizations (NGOs) can play in achieving national policy goals.

Obstacles to effective use of red teaming include prevailing culture and processes that are intolerant of surprise (as they are in most large and established institutions). Adaptive red teaming does introduce elements of uncertainty and can be disruptive to individual programs. But as part of a disciplined process of Red-Blue interaction, vigorous red teaming can inform the transformation process and lead to more robust and relevant future military capabilities.

Notwithstanding the advantages and challenges of red teaming, the cost of transforming U.S. forces over the coming decade will be high. However, it remains unclear which emerging systems will be most relevant to emerging threats. What is clear is that potential adversaries will not outspend the United States. *Indeed, their best approach may be to encourage American overspending on threats that conform to traditional military thinking.* For this reason, red teaming and adaptive joint experimentation can help prevent bad investments and, at the same time, provide a means for U.S. forces to become more agile.

Purpose of This Paper

This paper describes the Red Team experience in the first joint experiment, J9901,Attack Operations Against Critical Mobile Targets, and draws on this experience to offer a framework for the roles of Red Teams in joint concept development, experimentation, and the larger transformation process. In closing, the author presents a conclusion regarding the role of Red Teams in the overall transformation process that DoD is seeking to implement.

The Red Team Experience in Joint Experiment J9901

Joint Experiment J9901, Attack Operations Against Critical Mobile Targets, addressed theater ballistic missiles (TBMs), a problem that dates back to V-2 rockets in World War II. At present, TBMs continue to proliferate, and can carry nuclear, chemical, or biological warheads. Attack operations—locating and destroying such weapons on the ground—therefore presents a critical challenge to U.S. military forces.

Because it was the first joint experiment, the objectives included learning how to conduct effective experiments and building a base of knowledge and tools for future experiments. In addition, the experiment explored new ways to prosecute time-critical targets. The concept envisioned that sensors and sensor management and exploitation capabilities will evolve over the next 15 to 20 years to allow comprehensive coverage of enemy forces. These capabilities hold the promise of not only much greater success in locating, tracking, and attacking TBM launchers and other critical mobile targets, but in enabling the broader objectives of Joint Vision 2020.

The challenge is to flexibly maneuver different sensor platforms and sensors, and to merge their data into a coherent picture of the battlespace. The resulting tracks could provide target identification and location sufficient to permit attacks on TBM launchers with appropriate weapons when and where the targets are most vulnerable. The idea is not only to shorten the time between detection and engagement, but also to provide a synoptic, shared, engagement-quality picture of the battlespace that can enable trained teams to anticipate, detect, and attack fleeting targets.

The focus of Joint Experiment J9901 was on joint command and control. The experiment featured a human-in-the-loop system, the Joint Semi-Automated Forces (JSAF).[2] JSAF is a synthetic battlespace that integrates the air, land, sea, and space domains as well as the forces that operate in them. JSAF allowed Blue to integrate target tracks from a network of simu-

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2 Formerly the Synthetic Theater of War, an advanced Concept Technology Demonstration sponsored by the Defense Advanced Research Projects Agency. JSAF continues to be used by U.S. Joint Forces Command as a human-in-the-loop virtual environment for experimentation.

lated future sensors, maneuver those sensors, and direct networked weapons against the mobile missiles and their support systems. The objective was to learn how to find and destroy enemy missiles and their launchers on the ground, ideally before first launch. The experiment pitted Blue versus Red using JSAF simulation (Figure 1).

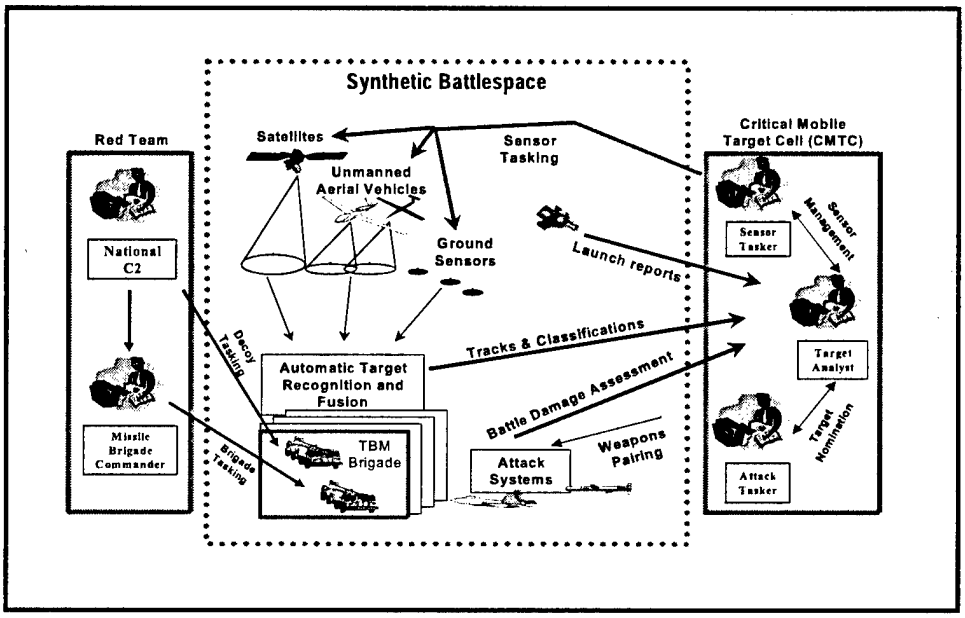

Figure 1. J9901 Experiment Architecture

Central to the concept is Blue's Critical Mobile Target Cell (CMTC) where target analysts track each target, request additional sensor coverage when required, and pass targets to attack taskers. The CMTC provides the essential link between the sensing and attack functions.[3]

Throughout the experiment, Blue's CMTC confronted a thinking opponent, the Red Team, that adapted and modified its TTPs for TBM operations in order to thwart Blue's sensing and attack functions.

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[3] For a review of lessons learned about designing and conducting joint experiments, see Larry D. Budge and John Fricas's *Lessons Learned From The First Joint Experiment (J9901)*, IDA Document D-2496, October 2000.

Red Team Organization and Functions in J9901

The Red Team consisted of three distinct components:

- **The Red Experts:** Subject matter experts who defined a context for future (circa 2015) TBM employment, the systems and technologies available, and operational objectives for Red. This group also developed technically and tactically feasible counters to Blue sensors and weapons systems.

- **The OPFOR Planning Group:** TBM tacticians who developed missile firing plans, logistic re-supply plans, and TTPs.

- **The "Red Cell" (OPFOR Operations Group):** Red operators who executed the plans and employed the TTPs in moving the TBM entities and firing missiles during the JSAF simulation.

The Red Experts consisted of subject matter experts from the technical, operations, and intelligence communities. These were individuals with significant experience in evaluating the TBM evidentiary threat who also had technical knowledge of radar sensors and missile operations. They participated in the early stages of scenario and threat development. Thus the intelligence community estimates of the evidentiary threat three to five years out were augmented by multidisciplinary discussions of (1) the technically feasible threat (circa 2015), with scientists from Lincoln Laboratories, and (2) the adaptive threat, as informed by operational experts from the Joint Theater Missile Defense Attack Operations Joint Task Force, who were skilled in field testing of missile TTPs.

The Red Experts gathered in a series of meetings to develop the following:

- Plausible scenarios for Red TBM operations, including targeting priorities against Blue forces and staging areas;

- Red systems and order-of-battle for future TBM forces;

- Expected TTPs for Red missile and air defense forces;

- Possible measures to counter Blue sensors and weapons; and

- Logistic and resupply concepts for Red TBM forces.

To help both Blue and Red Teams explore their concepts and countermeasures before simulation play, the JAWP conducted two Transparent War Games at the Institute for Defense Analyses Simulation Center in Alexandria, Virginia. Transparent War Games are iterative discussions by Red and Blue Teams undertaken to identify and explore possible variations in concepts. They begin with one team discussing its contemplated moves and counter-moves while the opposing team listens and, using group system software, brainstorms refinements to its own concepts. The teams then switch and repeat the process, which makes both Red and Blue concepts more robust.

One output from the Red Experts was a "spider diagram" (Figure 2) displaying variable aspects of TBM operations that could thwart Blue sensor and attack operations. Each "leg" of the spider displays a range of problems that Red could present to Blue. Experiment designers used these inputs from the Red Experts to decide which elements of the TBM threat the experiment would examine.

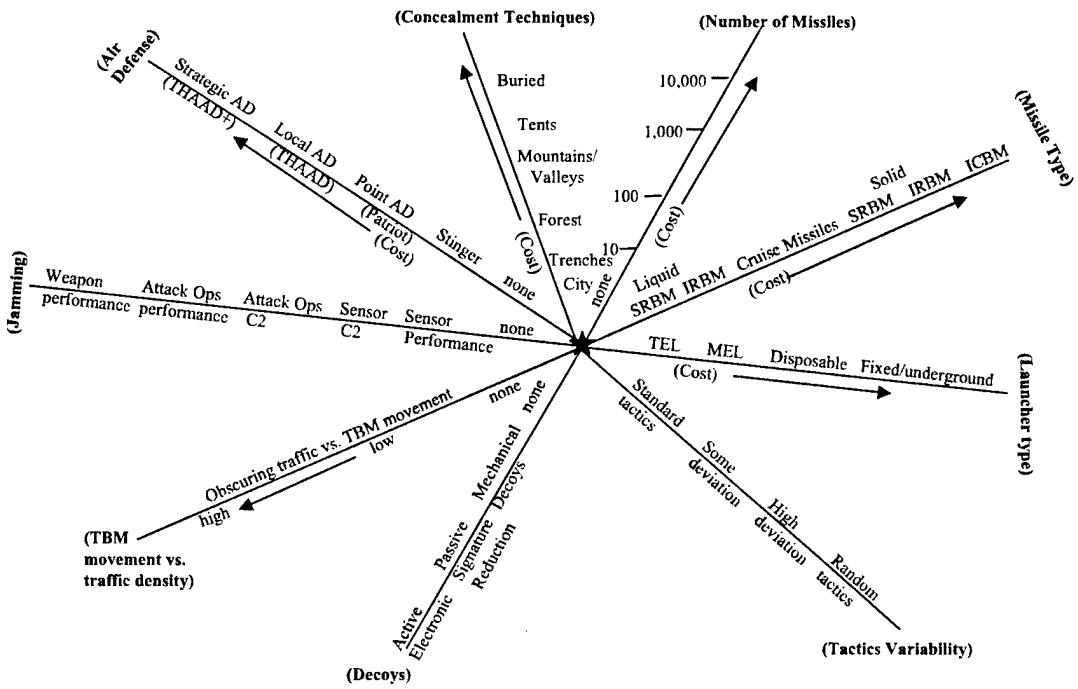

Figure 2. Spider Diagram: Red Counters for the Attack Operations Concept

Next, the OPFOR Planning Group constructed specific missile firing plans for each of its four TBM brigades and developed detailed resupply concepts to sustain its missile firing plans. The Red Cell then translated these plans into the JSAF simulation. Once play began,

the Red Cell executed these plans, but it also had the ability and freedom to modify aspects of individual vehicle movements and other TTPs.

Prior to the first experiment trial, Blue was given general information about Red's capabilities and its access to technology and other resources. Blue did not receive detailed information on variations to those capabilities, or on possible changes to Red's doctrine that could occur as a result of Red's adaptation to Blue success. The Red Cell also received general information on Blue sensor and weapons capabilities and the location of Blue aerial and sea ports of debarkation.

The Red Team did not possess complete freedom of action because of specific experiment objectives as well as time, resources, and modeling constraints, examples of which include the following:

- Capabilities of the JSAF simulation limited the density of clutter vehicles, (i.e., the ratio of non-TBM related to TBM-related vehicles using the same roads).
- Modeling the effects of Red TBM attacks against Blue ports of debarkation was deferred to future experiments.
- Aggressive air defense operations were not permitted against Blue forces because such operations would have impeded learning about the internal aspects of the Blue sensor management and targeting processes.
- During some trials, Red was constrained in its use of hidden reload sites to better support assessment of Blue capabilities to recognize TBM infrastructure.
- Red was required to maintain a certain tempo of missile firing and restricted from using urban and forested areas as launch sites.

The Red Cell conducted TBM operations in all the trials. It proved resourceful and flexible in accomplishing its missile firing plans while limiting its losses. As Blue became more efficient at tracking and attacking missile-related vehicles, the Red Cell adapted by developing deceptive practices, firing in salvos, and staging more extensively from urban environments—all of which degraded Blue sensor performance. The experiment allowed Blue to refine its concepts for sensor management and targeting in response to an adaptive adversary. In response to Red Cell actions, Blue developed new TTPs and countermeasures between and during the trials in order to thwart Red's TBM operations.

In addition, the Red Cell devised a number of measures and countermeasures that were not played in these trials but which could form the basis for future experiments on attack operations against critical mobile targets, among them:

- More aggressive attacks against Blue sensor and weapons platforms;
- Extensive use of electronic decoys that Red could activate at remote sites during missile launch cycles;
- Use of disposable transporter erector-launchers (TELs); and
- Electronic countermeasures against Blue sensor and command and controls communications to introduce uncertainty in Blue decision process.

Observations from J9901

- A Red Team needs to be involved early in both scenario development and experiment design.
- Robust red teaming requires the appropriate subject matter experts and a level of continuity.
- The Red Team's relationship to the larger organization of the experiment is a critical issue. The Red Team must be sufficiently independent to develop challenging responses to U.S. warfighting concepts. But it must also be closely linked to the experiment design to serve the overall experiment objectives and to avoid the risk of suffocating nascent concepts.
- Prior to the human-in-the-loop trials, Transparent War Games allowed both Blue and Red to explore variations to their concepts and orient themselves to the challenges of experiment play.
- Red Cell decision-making needs to be assessed in the overall context of the experiment. The players in this experiment comprised the Red Cell as well as the Blue CMTC. Dedicated assessors observed both cells as the experiment progressed to determine what effects Red's TTP changes had on Blue's thinking and vice-versa.

- The adaptiveness of red teaming in future experiments could be enhanced by a capability to change the scenario overlays used in the simulation, especially when trial variations are required.

In short, Joint Experiment J9901 demonstrated that an adaptive Red Team can push Blue concept development in two-sided, human-in-the-loop experimentation.

Beyond J9901: Design Considerations for Red Teams in Future Adaptive Experiments

Developing adaptive joint experiments should be viewed as an iterative process in which scenarios, experiment objectives, and Red and Blue capabilities and concepts must co-evolve. This section will examine some of the principal design considerations to make this possible, including scenarios development, modeling Red behavior, and controlling experiment play.

Scenario Development

Scenarios provide the context to enable and encourage Red-Blue interaction. An important ingredient in adaptive joint experimentation, scenario development starts at the strategic level with the assistance of Red Experts. Plausible strategic aims of the United States, its allies, and potential adversaries help establish the context for operational and tactical interaction.

In developing scenarios, it is important to remember that opposing sides often misunderstand each other's intentions. Blue and Red Teams should develop their respective national objectives independently, based on assumptions about strategic equities. They can thus define goals that would constitute measures of success in a given scenario.

Inputs from the intelligence community on the capabilities and intentions of possible adversaries should also include assessments of their economic capacity and access to militarily significant technologies. The more futuristic, the less precise such estimates will be, but the initial effort in developing the scenario should define a plausible adversary who has some understanding of U.S. intentions and who is also capable of applying future technologies against American forces.

Modeling Red Behavior

Modeling a robust adversary requires tradeoffs between realism and experiment resources. Constructive (computer-only) simulations do not allow a free-playing, adaptive adversary; instead, they limit Red to specific courses of action based on rules programmed into the simulation. However, constructive simulations can evaluate differing Red capabilities against specific sets of Blue capabilities—and vice versa. The greater the extent to which Red re-

sponses are "hard wired," the less useful constructive simulations are to experimentation. As existing simulations improve and new ones develop, the addition of "dials" would provide greater flexibility in Red behaviors, enhancing the simulations' utility without extensive—and costly—reprogramming. Even with such enhancements, the most serious drawback to constructive simulations will remain the absence of human-in-the-loop play—the real key to adaptation, innovation, and discovery.

In virtual (manned computer) simulations, the human-in-the-loop factor works for both Red and Blue Teams by promoting learning about the problems and assumptions that the experiment is exploring. The most valuable aspect of virtual simulations is the ability of players to modify their actions in accordance with the emerging situation. To limit the effects caused by unfamiliarity with the simulation, practice sessions and rehearsal trials are necessary to bring the teams up to comparable skill.

Controlling Experiment Play

Controlling human-in-the-loop play is perhaps the most challenging aspect of adaptive experimentation. A desire for discovery and innovation must replace expectations for validating specific operational concepts. Only this approach can create an environment in which "failure" of a concept may occur before concepts of value are discovered.

Accordingly, control of adaptive experiments should recognize and preserve the separation of certain information from Red and Blue, but particularly from Blue, where too much information about the adversary can stifle innovation. A control cell should modulate the flow of information in ways that encourage and facilitate the discovery process.

Assessment and Analysis

Assessment and analysis of adaptive experiments should consider not only the actions of players but their thought processes as well. This is particularly challenging since player decisions reflect personal backgrounds and experience. Player perceptions of information presented through the simulation also vary, depending on workstation variables such as display settings, filters, and other aspects of experiment design. Because of the wide variation in human factors, many trials are preferable, ideally with different teams. Conducting thorough post-trial interviews with the players will help identify some of the variations in the human factors.

Another important variable to be assessed is player interaction. Using the simulation to test players prior to the experiment can help in establishing the relative significance of player-influenced variables. For example, if an overreliance on the use of smart weapons causes Blue players to neglect sensor management, the control cell might limit use of smart weapons to refocus the experiment on tracking issues.

A Framework for Red Teaming in the 21st Century

Giving red teaming a strong role provides a favorable culture for discovery and innovation in DoD's transformation. Red teaming at the strategic level can contribute to a richer understanding of the security environment, helping to illuminate the kinds of missions military forces will be called upon to do in the future and how potential adversaries might oppose U.S. involvement in future conflicts. The strategic context thus provided could help guide new operational concepts and frame experiments on these concepts. Red teaming would also challenge these new concepts, exposing serious flaws and pushing the concepts to higher levels of robustness.

Certainly, the Services have recognized the value of red teaming at the tactical level in training and weapons development. The U.S. Joint Forces Command is also using Red Teams in adaptive joint experiments to test and refine operational concepts. But red teaming has value through the entire transformation process, from challenging our notions about the future strategic environment, to identifying counters to our new operational concepts, to providing the opposing forces in individual experiments. All of these are depicted in Figure 3.

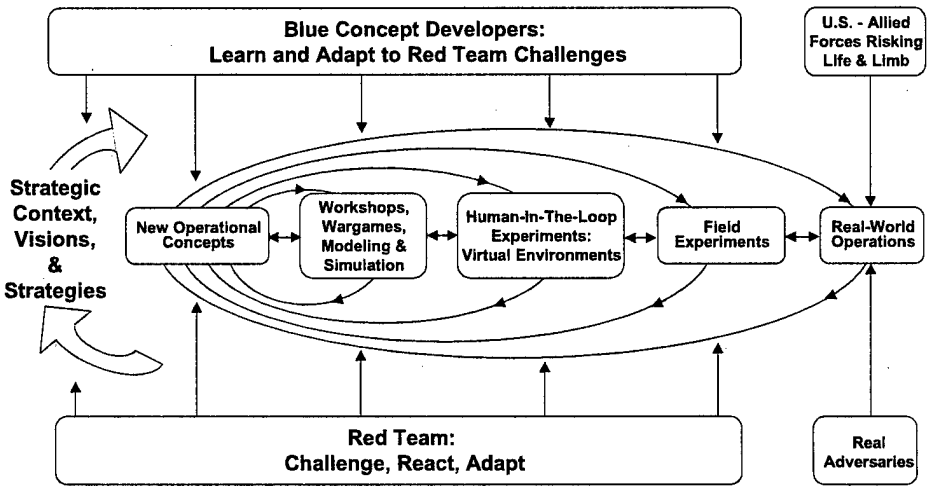

Figure 3. Red Teams Provide Surrogate Adversaries to Challenge Strategies and Concepts Throughout the Entire Process

Red teaming, in all these ways, is so important to successful transformation, and so difficult to implement, that it warrants attention by the Secretary of Defense and Chairman of the Joint Chiefs of Staff.

Capturing the technical, military, cultural, social, religious, and political values of future adversaries and how these could affect their strategies, military objectives, and doctrines remains a formidable challenge. Experienced and knowledgeable individuals exist throughout the national security community, e.g., in the operational, technical, and intelligence communities; federally funded research and development centers; industry; and academia.

However, much of the necessary expertise lies outside the "customary" national security establishment, for example, in the commercial sector with people who can provide insight into technological opportunities available to future adversaries. For these reasons, Red Teams must employ a broad range of subject matter experts, including politicians, social scientists, historians and technologists.

For the following reasons, partnerships are essential to acquiring the expertise needed for an effective Red Team:

- Participants from the DoD technical, test and evaluation, and intelligence communities can provide unique expertise to the Red Team during experiment design and execution.

- Other U.S. government agencies and NGOs will be involved in future real-world contingencies, so getting their unique perspectives is equally important.

- Allied involvement can also promote a greater shared awareness among coalition partners of the problems posed by future contingencies, and the proper response. U.S. Joint Forces Command and other commanders in chief should expand the participation of friendly armed forces in red teaming.

- The academic community, industry, the media, and Congress have important contributions to make in exploring future conflicts and how DoD could employ and support future military forces. The U.S. Joint Forces Command and the National Defense University could create an informal process that opens such a dialogue by hosting regular discussions between the Executive Branch national security community and the academic community, industry, the media, and congressional staff.

One difficulty in constituting an effective Red Team lies in maintaining continuity of effort with quality personnel. Warfighting commands, Defense Agencies, the intelligence community, and the Services all face a similar challenge, and are limited in their ability to furnish time and talent. Using a combination of a small standing Red Team, augmented (for experiments and other events) with ad hoc Red Teams drawing on a wider base of expertise, can help meet this challenge. Making the Red Team activity an integral and iterative part of concept development and experimentation, rather than an oversight or audit function, will also help.

Additionally, DoD will have to assign higher priority to red teaming, given its importance to concept development, experimentation, and transformation in general if it is to compete effectively for these scarce human resources. Furthermore, an unusually diverse team of consultant and contractor support will likely be needed to supplement the government personnel.

Conclusion: The Role for Red Teams in Transformation Should Be Expanded

A broader approach to red teaming, featuring a disciplined process of Red-Blue interaction, could inform and help guide transformation at several levels of the national security process. We can, somewhat arbitrarily, distinguish three levels where interactive red teaming could support joint concept development and experimentation.

- At one level, red teaming could challenge our strategic context and visions of future military capabilities by inventing and exploring counter-strategies and challenging scenarios. This level of red teaming might identify new missions and tasks that joint forces must be prepared to perform in the future.

- At a second level, red teaming could challenge new operational concepts in ways that future adversaries might use to thwart U.S. military forces in accomplishing their assigned missions. This activity would focus on identifying counters to proposed concepts and capabilities at the operational level; for example, the Rapid Decisive Operations concept designated by the Chairman of the Joint Chiefs of Staff as "the tool to operationalize Joint Vision 2020"[4] and supporting concepts such as Effects Based Operations, Dominant Maneuver, and Precision Engagement.

- A third level of red teaming activity could be in direct support of experimentation, including the OPFOR for specific experiments. Red teaming at this level would develop context and concepts for opposing specific Blue operational concepts. It would also develop the OPFOR concept, plan, and TTPs, and then would execute these plans in both human-in-the-loop simulations and field experiments.

In each level, the Red Team would consist of a core group of military, civilian, and contractor personnel with appropriate intelligence, operational, technical, and cultural studies back-

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4 General Henry H. Shelton, "The National Military Strategy and Joint Vision 2020," in *Army, the Magazine of the Association of the United States Army*, January 2001, p. 7.

grounds. This core could usually be augmented with additional subject matter expertise, including foreign military personnel and representatives from NGOs, for particular activities.

For the third level, when providing direct support to experimentation, the core group would be augmented with unified command representatives and the outside support needed to develop supporting scenarios for joint experiments (either simulations or field experiments). A small element, augmented by outside support and based at a field site, would establish linkages with Service OPFOR organizations to develop joint Red Team support to operational and tactical level field experiments.

A standing Red Team would also serve as a hub for networks of academicians, NGOs and others with particular regional expertise, available as resource for planning and for "reach back" during the conduct of actual contingency operations.

Because war is a phenomenon between thinking opponents, a broad approach to interactive red teaming is important to inform our thinking about future military challenges and explore ideas for dealing with them.

Acronyms

CMTC	Critical Mobile Target Cell
DoD	Department of Defense
DOTMLPF	Doctrine, Organization, Training, Materiel, Leader Development, Personnel, and Facilities
IDA	Institute for Defense Analyses
JAWP	Joint Advanced Warfighting Program
JSAF	Joint Semi-Automated Forces
NATO	North Atlantic Treaty Organization
NGO	non-governmental organization
OPFOR	opposing force
TBM	theater ballistic missile
TEL	transporter erector launcher
TTPs	tactics, techniques, and procedures
TWG	Transparent War Game
U.S.	United States
V-2	*Vergeltungswaffe* 2