MORS Wargaming Special Meeting
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Edited by Phillip Pournelle
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Wargaming Workshop Overview and Summary of Events

Workshop Chair: Phillip Pournelle, Co-chair: Yuna Wong

Editor’s note: This section was previously published in the December 2016 issue of MORS’ Phalanx magazine.

The MORS Wargaming Workshop, sponsored by the Defense Wargaming Alignment Group (DWAG), was a great success, with more than 260 attendees from six countries and keynote addresses by Deputy Secretary of Defense Bob Work and former Director of the Office of Net Assessment (ONA) Mr. Andy Marshall. The workshop was conducted October 18–20, 2016, in Alexandria, VA, on the Mark Center Campus. Initial feedback indicated the workshop’s working groups and panels advanced understanding about how wargaming should be integrated into the department’s analytic processes, introduced the fundamentals of the art of wargaming to a large number of novices, and improved the understanding of the practice of wargaming for many attendees.

The workshop was based on the Deputy Secretary’s memo on the use of wargaming to support the Defense Innovation Initiative and an assessment by the Office of the Secretary of Defense (OSD) at a practitioner’s summit in March 2016. The purpose of the workshop was twofold: identify best practices for use of wargaming to support the larger analytic process, and help generate wargaming capacity and quality. The theme was to learn by doing.

The workshop officially began with the keynote address to the plenary group by Mr. Andrew Marshall, who founded the Office of Net Assessment (ONA) in 1973 and served as its director until 2015. His remarks focused on how wargaming was employed in the past to support OSD in the development of net assessments. He stated that wargaming was particularly important in the assessment of nonquantitative factors such as competency, training, organizational psychology, and planning, which drove the choices available to our competitors. These crucial factors could not be fully addressed with standard quantitative methods alone and wargaming was an important tool to gain an accurate assessment.

Following his remarks, a series of panels were held in the plenary session. The OSD DWAG quad chairs (OSD Policy, Cost Assessment and Program Evaluation (CAPE), ONA, and Joint Staff J-8 SAGD) discussed the need for wargaming to address qualitative factors to drive innovation and increase the decision space for senior leaders. They also discussed the need for quantitative tools to support quality and accurate games. The DWAG is working to support the sharing of insights, lessons learned, best practices, and tools using the OSD wargaming repository. The DWAG is also exploring ways to increase the use of the repository by making appropriate elements more conveniently and widely available.

The Services and Sponsors Panel included staff members from the headquarters of the Army, Navy, Air Force, and Marine Corps as well as a representative from the Department of Homeland Security (DHS). Each described how they were developing their own “cycle of research,” aligning existing organizations, and developing their wargaming communities. Navy displayed a graph illustrating what appears to be the most developed service plan to move forward in the New Year’s planning and budget process.
Nine regional and functional combatant commands were represented on another panel. Most combatant commanders (CCMDs) are (re)building their wargaming capacity “out of hide,” leveraging the incentive funds overseen by the DWAG. In many cases, they currently rely on contractors to provide expertise. Fully employing wargaming will require greater emphasis on wargaming in joint professional military education (JPME), but such training is based on doctrinal definitions, which are based on the joint operational planning process. Wargaming, particularly when intended to meet the Defense Innovation Initiative, cannot be limited to current doctrine, which focuses primarily to course-of-action planning. Professional doctrine needs to be revised to be more broadly inclusive of wargaming’s many applications.

The allies’ panel included representatives from Canada, the United Kingdom, and the Kingdoms of the Netherlands and Sweden. Each expressed how the end of the Cold War and efforts in Afghanistan and Iraq diverted resources away from wargaming, but recent events in Europe have highlighted the need to rebuild their wargaming capabilities and capacity. Interestingly, the senior leadership of these countries appears to be more inclined to embrace wargaming than here in the United States. They are keen to share insights and lessons learned with us but classification issues are stymieing these efforts. OSD will consider expanding access to the repository, starting with the Five Eye partners.

The Command Red Team panel featured Steven Rotkoff, director of the University of Foreign Military and Cultural Studies (UFMCS), and Joe Cyrulik, an instructor from the Kent School. The purpose of the panel was to briefly introduce the red teaming methods taught by UFMCS, the structured analytic techniques (SATs) taught by the Kent School, and how both came about in their respective communities, and to discuss connections with wargaming. Mr. Rotkoff traced the origins of red teaming in the Army to attempts to improve military planning in the aftermath of the US invasion of Iraq. Mr. Cyrulik identified the intelligence failures of 9/11 and weapons of mass destruction in Iraq as events that propelled the greater use of SATs within the intelligence community. One topic of discussion contrasted how the Department of Defense (DoD) defines “red cell” as enemy emulation in a game and “red team” as an approach to help one’s own organization make better decisions, while the definitions are reversed within the intelligence community.

Following the panels, the workshop dispersed into three working groups, three classes, and three sample wargames. The working groups tackled specific questions; the classes introduced participants to new approaches; and the wargames provided experiential learning opportunities.

The highlight of the closing plenary was the keynote address by Deputy Secretary of Defense Bob Work. He outlined the challenges to the department characterized by the proliferation of precision strike weapons across the planet and their use and development by our competitors. He is concerned that our advantages over our competitors are eroding. He discussed how in the past the US jumped ahead using technology to offset numbers. In World War II, the Army assessed a need to raise 213 divisions to fight the Axis, but we counted on superiority in air and sea power to offset these requirements and so chose to raise only 90. After World War II, the United States first offset Soviet superiority in numbers with the deployment of a large number of nuclear weapons. After the Soviets gained nuclear parity, the second offset employed what the Russians called a Reconnaissance Strike Complex, combining near-zero-miss weapons, sensors, and a command structure to hit all echelons of a Soviet Army.
Group simultaneously. Mr. Work described how wargaming was crucial to the assessment process in each of these instances and he is convinced of the necessity to use wargaming to identify the next, or third offset. His vision for the third offset largely depends on how to best team humans and machines together, integrating the best of both into a capability greater than their sum. Normal quantitative methods alone cannot capture many of the qualitative issues surrounding the challenges and opportunities we face. Therefore, there is a need for cycles of research integrating wargaming within the larger process in the DoD.

The Deputy Secretary made clear that the wargaming initiative will go forward in the future. Financing for the DWAG incentive fund is in the Future Years Defense Program (FYDP) and would require positive action by future administrations to remove it. The key to long-term success will be for MORS and the wargaming community to capitalize on the opportunity and demonstrate value in the process for the department and the nation.

The closing plenary also heard summaries from the working groups, courses, and games. Working Group 1 was tasked with exploring the best ways wargaming might be integrated into the department’s analytic and acquisition process. Working Group Chair Paul Davis, FS, assessed the current difficulties as stemming from a schism in the view of wargaming by elements within MORS and the defense analytical community in general. The first group (systems centered) view human gaming as a subset of modeling, while the second group (human centered) view human gaming and modeling as distinct and complementary disciplines. These two perspectives affect how organizations view analysis and its effectiveness, as well as how they establish standards, expectations, and practices.

The chair assessed that the deputy’s memo indicated dissatisfaction with past practices, which have been dominated by the first group’s viewpoint and a style of model based work that has been short on creativity, innovation, adaptation, dealing with “soft factors,” and dealing with uncertainty. Thus, the deputy was calling on those of the second viewpoint (human centered) to fill a void. That shift of emphasis to human-centered gaming is quite welcome, even though intellectually, there is a merit to the first view. The wargaming community must act to meet the demand for improvements and innovation in the wargaming process. But the “how” of wargaming, its integration with other analytic activities and analytical methods, depends on the overall objectives. The design and utility of a wargame depends on the issues and functions it is intended to address; for example:

• Creating ideas, options, concepts of operations, and strategies
• Testing and tightening tentative plans, whether operations plans or program plans, seeking to make them more robust
• Sensitizing policymakers to known serious problems that, because of their abstraction, have not proved gripping enough to cause action
• Creating shared understanding of issues, the general terrain akin to a chessboard, and the general nature of options and adversaries through communication and professional socialization, as when the joint and the interagency communities learn together about a problem area.
Depending on which of these is the intent, gaming may be designed to support the needs of analysis and modeling or—precisely the contrary—gaming may be used to break out from the normal assumptions embedded in usual analysis and modeling.

Working Group 2’s results were described by Ed McGrady. The group was tasked with identifying best practices within wargames for communicating with people in and around games, and implementing innovative methods within games. They worked to identify specific technologies that could help us with game design, such as commercial products for game control, methods to record and analyze player interaction, instrumentation of players, and information visualization capabilities, such as capacitive displays, IR tracking, augmented/virtual reality, and alternative reality. They identified different game requirements and technology solutions. They worked to build games that explored game design across the spectrum of technologies. Bottom line: there are a wide range of technologies that can be very useful in games; nevertheless, technologies cannot replace the players, player interaction, or game control, but rather can better enable visualization, communication, and data extraction from the game.

Working Group 3 results were described by Stephen Downes-Martin. The group was tasked with addressing adjudication, which is crucial to enabling rigorous wargaming. The adjudication working group comprised highly experienced wargame adjudicators from across the discipline. They identified and addressed the barriers to effective adjudication, using a language processing approach to structure their discussion with maximum rigor. A detailed assessment of DoD’s wargaming process was conducted to identify where the barriers to the use of proper adjudication occur in that process, so preventing the proper level of rigor in departmental wargames. Working in two teams, the group generated a conceptual framework of the challenges facing good game adjudication, and developed several potential mitigating approaches. Recommendations growing out of this effort were refined and are contained in this report.

The workshop was book-ended by a pair of introductory classes on wargaming conducted by Drs. Peter Perla, Ed McGrady, and Jon Compton, held October 17 and 21. More than 30 people attended, with all seats taken and many others waiting on the standby list. MORS intends to offer these classes again this winter and spring. These were two of the seven classes needed to gain a certificate from MORS in wargaming and are intended to bring participants to an apprentice level of knowledge in wargame design. Additionally, on October 17, MORS offered a four-hour tutorial led by Mr. Mike Garrambone, FS, to introduce novices to basic wargaming concepts.

Steven Rotkoff taught the second course on red teaming methods. Participants used red teaming methods to explore ways to improve DoD gaming and planning. They generated 54 ideas. Their top ideas were:

- Include more cultural factors in wargames; increase “peace gaming” and not just force-on-force and kinetic wargaming
- Identify more qualitative metrics
- Increase diversity within the wargaming community
• Reduce general officer participation in wargaming design to the one general sponsoring the event to reduce dilution of effort

Participants in this second course expressed the view that red teaming advanced analytical skills and techniques should be applied to the wargames themselves (e.g., examining independent alternatives to the starting assumptions in a game).

Joe Cyrulik taught the third course on SATs, where participants learned about and applied SATs such as analysis of competing hypotheses and alternative futures analysis. Participants also discussed wargaming within the intelligence community, which views wargaming as a SAT.

The meeting’s sample wargames were designed to improve understanding of the practice of wargaming by enabling participation in their design and/or execution, providing practical experience of the techniques employed.

The first wargame, Project Cassandra, employed SATs to develop a terms of reference. SATs were used to identify uncertainties, issues and themes, actors and actions, and other factors necessary to design a wargame. These were then employed in a matrix-style game. The participants designed and participated in a cyber-themed game with domestic and global social consequences.

The second wargame, run by JHU/APL, was a computer augmented political-military (pol-mil) game set in Europe in the near future. It focused on phase zero operations during which competitors employed DIMEFIL-PMESII-based actions in their struggles with each other. Players saw the advantages and disadvantages of the wargaming approach and enjoyed the opportunity to conduct “what if” experiments, as well as to experience the challenges of building a whole-of-government plan for a campaign across a theater.

The third wargame was a series of four matrix wargames led by Major Tom Mouat of the Defense Academy of the United Kingdom. The first three games introduced the concept of matrix style games to the participants. In the fourth game, the participants created and played their own matrix style game addressing the current situation in the Baltics.

The workshop closed with a report from the synthesis group that identified what the wargaming community must do to make the most of the opportunities the department has opened:

• Get past business as usual and ensure that the design of wargames is based on best practices for the purpose of the game, not just what was used in the past

• Better educate and assist decision makers to understand when and how to use wargames

• Overcome myopia on adjudication goals and methods, which leads to intramural miscommunication and disputes

• Better integrate digital and physical approaches. Too often instrumentality is chosen on basis of point of view not on fitness for purpose.

As the Services and other organizations develop their cycles of research, they need to ensure that the senior decision makers are the focal point of the cycle.

A central theme of balance and integration emerged from the conference. Just as the quest for a third offset strives to identify the best balance between humans and machines, so must
the analysis community strive to find the best balance between quantitative and qualitative analysis surrounding the decisions humans will have to make in the uncertainty of a competition or conflict. Both quantitative and qualitative techniques must be equally rigorous, but the definition and nature of rigor is different in the two fields. There is a need for a balance among various types of quantitative and qualitative work, including human wargaming and man-in-loop simulation. Further, there is a need for MORS to reach out to other fields to improve the analysis conducted for the national security community.

More work remains to be done. The reports from the chairs of each working group are contained in this report. MORS will continue its partnership with DoD and DHS sponsors and continue its new alliance with the international wargaming community. OSD intends to conduct another practitioner’s summit to assess those insights, identify future challenges and questions, and plot a course to move forward. OSD is considering another workshop next fall with an agenda based on that assessment. In the meantime, MORS and the larger wargaming community need to take advantage of the introductory courses offered by MORS, the Naval Postgraduate School, and the Air Force Material Command. MORS offers additional education though the Wargaming Community of Practice’s monthly brown bag sessions. These and other efforts give the community the opportunity to improve its capability to execute quality wargaming in a sustained manner. As the number of analysts who understand wargaming grows, the government’s ability to be an effective customer will grow. As the number of master wargame designers in the government grows, its ability to utilize quality gaming will improve.
Summary of Suggestions

Institutionalize wargaming as a core activity within the DoD (bureaucracy)

- Continue the Deputy Secretary of Defense’s shift toward human-centric gaming as a part of the analytic process in balance with other techniques.
- Restructure the next wargaming workshop to better address the community’s needs.
- Institutionalize wargaming applied to planning effectively under uncertainty.
- Apply wargames to address critical issues informing the senior leader decision space.
- Put in place leadership who understand wargaming and protect wargames from inappropriate interference by senior leaders.
- Use wargaming to help leaders learn not what to decide but how to integrate wargame insights into their decision process.
- Employ wargaming to ensure the “right questions” are being asked.

Whole of government wargaming

- Joint Staff or OSD employ indefinite delivery/indefinite quantity (IDIQ) contracts to qualified companies to meet combatant commander (CCMD) and others wargaming needs. Enable CCMD and Services to use incentive funds and their own resources to draw upon the IDIQ contracts.
- CCMDs, Joint Staff, OSD, and others conduct a wargame series exploring options for authorities to identify acceptable sets of conditions-based authorities. By doing this in advance, the Nation Command Authority and CCMDs may improve the timeline for granting authorities, identifying new ones, and indicating the conditions in which they should be granted. Identify expertise in authorities in the wargaming community.
- Leverage J-8 SAGD expertise to conduct and develop whole-of-government wargaming capability to improve planning and synchronization with interagency process.

Provide an integrated wargaming support infrastructure

- Create a central source for adjudicators and facilitators. The wargaming repository can provide a central listing of wargame talent, in particular experts in adjudication and facilitation.

Develop a cadre of expert wargamers

- While wargaming will remain an art or craft, the number of practitioners can be expanded through a professionalization process where the formal methods for game designing transition from implicit to explicit and articulated steps with associated trainable skills.
- Remove the barriers to conference participation and travel.
- Develop education and training materials for wargamers and DoD leadership.
- Develop and document best practices.
- Develop professional interactions between gamers across all Services, industry, academia and non-DoD areas.

**Revolutionize and advance the state of the art and science of wargaming**

- Tighten wargaming to improve logical, rigorous, and systemic reasoning.
- Develop methods for assessing the “validity” of game insights by their utility for the key decisions and decision makers (not by the process for producing them).
- Employ multimethod approaches in addition to combining wargaming with other operations analysis techniques. Continue work on areas such as formal scenario development, red teaming methods, liberating structures (LS), and SATs to improve the products that can feed wargames.
- Before considering incorporating technology into games, look at the design problem and objectives to be accomplished, and then ask whether the technology can contribute to game construction, not the other way around.

**Develop a wargaming process**

- Ensure that the adjudication team for each game is engaged with game design from the beginning.
- Ensure that stakeholders and participants are properly prepared to interact with the adjudication team.
- Ensure that the adjudication team for each game is properly prepared.
- Employ iterative processes that include wargames centered on human decision making under uncertainty.
- Develop processes to identify and define excellent wargames.

**Identify and exploit connections and boundaries between wargaming, modeling, and analysis**

- Tighten war game rules where possible so they become models.
- Enrich analysis with simple models, exploratory models, multiresolution model families, and qualitative and semiqualitative modes.
- Organize to protect special features of low-resolution, exploratory modeling and analysis with and without human wargaming.
- Conduct cross-cutting analysis of existing and future wargames across the department to compare results, methodologies, similarities, and differences of processes, methods, data, and assumptions. This analysis can lead to new insights, confidence (or lack of) in results, improvement of wargaming capabilities, and identification of best practices.
- Development of a wargaming analytic agenda similar to the analytic agenda developed for campaign analysis using modeling and simulation (M&S), now called Support to Strategic Studies (SSA).
Paul Davis’s Personal Observations

Editor’s note: Dr. Paul Davis of RAND served as the chair of Working Group 1. The group was tasked with addressing how to integrate wargaming into the larger DoD analytic process. The following is a transcription of his notes from an annotated briefing. They identify some of the underlying tensions within the analytic community that must be addressed if it is to meet the challenges identified by Deputy Secretary of Defense Bob Work. Any errors in transcription are those of the editors.

I was struck throughout the workshop by a schism among attendees. One group believes, intuitively and viscerally, that human gaming—although quite powerful—is just a subset of modeling generally. The other group believes, just as intuitively and viscerally, that human gaming is very different.

The difference of perspective matters as it affects the perspective of the organizations performing or participating in the analysis; their standards, expectations, and practices; and therefore, the analysis’s effectiveness.

It seems that Deputy Secretary Work regards the second view as being the more practical. His initiative on human wargaming was the result of senior officials not being satisfied with what was coming from the “analysis community” or, more specifically, the “modeling community.” His call for a reinvigoration of wargaming was directed specifically toward the goal of innovation. Implicit in his memo calling for the reinvigoration of wargaming is a dissatisfaction with what was being delivered.

![Common Impression of Differences](image)

*Figure 1. Common impression of differences between modeling philosophies.*
I observed that those seeing human wargaming as a very different class of activity than modeling characterize differences more or less as in Figure 1. The impression is seriously erroneous, as I will discuss below. The impression is readily understandable and reflects a troubling reality about the state of practice in DoD modeling.

The impression has deep roots. Writings in the 1950s about defense modeling and systems analysis emphasized being scientific, rigorous, quantitative, and tied to mathematics. This was to be an antidote for hand-waving subjective assertions. That desire translated into an emphasis on “closed” models with no human interactions, which allowed reproducibility. Most DoD-level models have often been at theater or campaign level (e.g., IDAGAM, TACWAR, JICM, Thunder, and Storm). Many represent combat as akin to huge armies grinding each other down, as in the European theaters of World Wars I and II. Such models are quite large, requiring considerable expertise and experience to understand.

Another development was standardized scenarios and data sets with the term “data” referring to everything from facts to highly uncertain assumptions about scenario, commander decisions, and battle outcomes. Standardization allowed common baselines, which assured that policymakers would receive reports with common assumptions rather than diverse hidden assumptions chosen to favor advocates’ programs. The baselines also promoted joint thinking and assured a level playing field for joint analysis. Such reasons were prominent in DoD’s Analytic Agenda (later called Support for Strategic Analysis). Not surprisingly, however, the tendency was often to be disdainful of such other forms of modeling as the history-based formula models of Trevor Dupuy and the commercial board games of Jim Dunnigan and Mark Herman. These alternative approaches seen as somehow “lesser,” because they were allegedly less rigorous and scientific. Uncertainty analysis has been seriously inadequate.

I have demurred on these matters for many years, as in the “Base of Sand” paper in 1993 and more recent monographs available on the RAND website.

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1 Under the Analytic Agenda OSD, the Joint Staff and the Services oversaw the development of common scenarios for M&S-supported campaign analysis. OSD Policy would develop the scenarios; the Joint Staff was tasked with developing the joint concept of operations for each scenario; and OSD CAPE was tasked with running the first campaign analysis as a baseline against which all future studies would be compared. OSD Joint Data Support collected and curated the data. In time, this became the Support to Strategic Studies (SSA). CAPE no longer employs campaign analysis or develops baseline and the SSA process is in question. Criticisms of the AA/SSA have been that it is a slow and ponderous process.

2 The history I have just described has had many exceptions. To comments on a few of these:

- Paul Olsen developed the IDAHEX model at IDA in 1975. This model used human players to make force-employment decisions and emphasized maneuver. The development had considerable opposition because IDAHEX was more like a human game in some respects and, therefore, seen as inadequately “scientific” by some critics.
- In the 1980s, I led a project that developed the RAND Strategy Assessment System (RSAS), which allowed either players or computer agents to make force-employment decisions and included many “soft” effects.
- In the 1990s, General Paul Gorman emphasized that “everything” short of war was simulation and distinguished among constructive, virtual, and live simulations while seeing great value in all of them.
- Throughout the years, DoD has made at least modest investments in historical research and, in the 1980s, in work such as that of Trevor Dupuy.
Students of Modeling Should Know

- Many powerful models are simple, but detailed models provide deeper understanding and often inform the simple models.
- It’s two-way: low resolution information and modeling often informs detailed work.
- Rule books of games are simple models.
- Models can be (and often should be) interruptible or interactive.
- Models can be qualitative or “semi-quantitative”.
- Even quantitative models are often loaded with subjective guestimates.
- Uncertainties abound and standard cases are at best test cases.
- Analysis is product of research cycle that should include mix of instruments.

Against this background, it should be no surprise that in teaching, I urge a broad view of modeling as in Figure 2. Some observations that elaborate on these items:

- “Good” models are sometimes remarkably simple (think of the radar equation or various equilibrium models). In-depth understanding, however, may require much deeper work, whether to inform or even to calibrate the simple models.
- The opposite is often true, that low-resolution information and simple modeling inform much more detailed modeling (knowing the forest helps organize looking at trees).
- In a sense, human gaming is a kind of modeling. If the gaming includes adjudication, the adjudication rules constitute a model, however rough and ready.
- If models are to help us understand phenomena, they should often allow for human participation that reveals additional factors, options, or phenomena, e.g., which can later be represented analytically.
- The quantitative/qualitative split is a bugaboo. Many “soft” phenomena can be characterized with meaningful, albeit imprecise, numbers.

- Over the course of several decades, it has become possible to do excellent uncertainty analysis despite the curse of dimensionality. Such uncertainty analysis, however, is still rare.
- Even in the last decade, DoD’s analytic community has sponsored a number of activities that broke from the mold I have disparaged. These included reviews of social science for counterterrorism and intervention, the British-sponsored Peace Support and Operations Model (PSOM), and the Joint Irregular Warfare Baseline (JIWAB). A number of these are discussed in a special issue of the Journal of Defense Modeling and Simulation slated for January 2017, which I co-edited with colleague Angela O’Mahony.
• Quantitative models are not better merely by virtue of using numbers, if the variables and/or structure are highly uncertain. It is better to parameterize an uncertain soft factor than assume it away or assert some precise value.

• Uncertainties abound. Standard cases should be seen as test cases. Many such cases may be necessary.

• Overall, we should focus on analysis, and see it as the product of a cycle that includes research, modeling, human gaming, and other instruments as appropriate.

Moving Ahead

• Dep Sec Def’s shift to gaming was precisely right
• Needed next step: revolutionize DoD’s approach to analysis, M&S, and human gaming
  • Institutionalize planning effectively under uncertainty
  • Enrich analysis with simple models, exploratory models, multi-resolution model families, qualitative and semi-qualitative models...
  • Tighten war gaming to improve logical, rigorous, and systemic reasoning based in part on war gaming
  • Tighten war game rules where appropriate (they become models)
  • Organize to protect special features of low-resolution, exploratory modeling and analysis with and without human war gaming

Figure 3. Moving wargaming ahead.

With this background, my own conclusion is that Deputy Secretary Work was precisely right in reinvigorating the activity of human gaming, not because such gaming is theoretically so different from modeling, but because DoD modeling has been too dominated by a narrow approach. The analytic community should take this seriously and reform, as suggested here. This will include incorporating human gaming in the larger activity of modeling, simulation, and analysis, and also using modeling to inform the design and execution of human gaming.

References


Working Group 1: Integration Process

Chair: Paul Davis; Co-chairs: Matt Cafferey, Mike Ottenberg, and Jim Bexfield

Working Group 1 was tasked with identifying how to best integrate wargaming into the larger DoD analytic process. Numerous presentations were viewed by the working group; this report summarizes the issues the working group identified as being most salient. Most of the presentations have been posted on the OSD CAPE-managed wargaming repository. Readers are encouraged to consult them for details.

This working group report examines five main issues related to the process of integrating wargaming into the larger analytic process. First, we examine the general functions and roles of wargaming that define its effective use and the context in which it is an effective technique. Second, we examine how several organizations, particularly the Services, employ (or aspire to employ) wargaming within their larger analytic process. Third, we summarize salient insights from the myriad presentations made to the group. Fourth, we summarize specific suggestions from the group that affect the department and the wargaming community. Finally, we suggest a list of questions that should be addressed at future workshops and symposia.

**FUNCTIONS AND ROLES OF WARGAMING**

The group quickly determined that where, when, and how human-centric (vice model-centric) gaming can and should be used depends on the questions being asked and the context in which they are asked.

The working group collected a list of functions, beyond the analytic, that human gaming can perform. Wargames can be used for:

- Creating new ideas, options, concepts of operations, and strategies.
- Testing and tightening tentative plans; seeking to make them more robust by identifying fatal flaws and identifying requirements.
- Understanding adversaries, including their mindsets, objectives, strategies, and perceptions; potentially “irrational” behaviors (in our eyes); recognizing that we don’t know: alternatives!
- Understanding and conveying possible consequences of executing operational plans (e.g., ABLE Archer, Fallujah) or developing new plans.
- Understanding trends.
- Diagnosing competitions, to include brainstorming/speculating about competitions, such as tactical or system-level measures and countermeasures, arms races, and strategic competition.
- Sensitizing policymakers to known serious problems.
- Testing planning scenarios to identify variants to be covered in requirements, subtleties to be addressed, and fatal flaws.
- Communication and professional socialization for shared understanding, and sometimes rehearsal.

As discussed in the instructions to the working group, it is crucial to recognize that the role of human gaming varies fundamentally across contexts. We particularly distinguish functions of creating, testing, sensitizing, and communicating and socializing. Further, the way gaming is best used varies for
- informing policymakers in crisis (or in anticipating a crisis), and
- informing near-term, mid-term, or long-term planning.

![Different Occasions for Human Gaming](with myriad shades)

1. Problem and solution characters are not well understood (may also be wicked)
2. Problem is significantly understood but no useful models exist
3. Models exist but may miss critical considerations
4. Models exist but need tailored aspects (e.g., conops or synchronization)
5. Excellent models may or may not exist but are abstract; need human walk-throughs for sensitization, synchronization, socialization, rehearsal, ...

*Figure 4. Occasions for the use of human gaming.*

It was also recognized that there are occasions where normal analytic processes are unsuitable for particular problems. Figure 4 identifies conditions in which human gaming can be very effective and required, particularly for problems where human decision making and risk factors play a large part in the potential outcomes.
PRACTICES EMPLOYED BY ORGANIZATIONS THAT USE WARGAMING

Recognizing the range of functions and reasons for using games, the working group surveyed how different organizations have employed or designed their games and how they have employed, or intend to employ, them in a larger analytic process.

Figure 5 illustrates how ONA organizes the range of games it has employed over more than 40 years of gaming and analysis. ONA uses many games to explore future capabilities or potential developments. Other games may focus on a specific domain area to increase understanding of competitions or trends within the domain. Some games combine expertise and insights from multiple domains to explore multidomain operations and their effects on a warfight or competition. These multidomain games can further be characterized by the time frame in which the events occur, enabling variations or parametric analysis of possible capabilities. Other games look at the overall force, requiring players to manage a portfolio of forces and capabilities over time, in competition with other countries. Finally, ONA has conducted games for the purposes of improving gaming. ONA conducts intellectual capital development games to examine how changes in game designs affect the games’ performance and their suitability for other purposes.
Against this background, Paul Davis suggests a paradigm for using human gaming to connect well to modeling (see Figure 6). It uses the metaphor of learning a game such as chess. We should try to understand the game—its rules, the game board, the nature of our adversary (or adversaries) in the game, possible strategies and tactics, and so on. We can then even build models and decision aids to represent our understanding. These may have both qualitative and quantitative aspects. We can then design human games to probe the edges or examine matters not reliably understood—not “wasting” the game opportunity to address what we know with confidence. Such games may extend our knowledge (e.g., reveal new tactics and strategies) or discover errors in our previous thinking. We might then do some analysis and report tentative conclusions, but we would also reenter the cycle of thinking, theorizing, modeling, and looking for information.

Suppose we have done this. We believe that we understand the game, or at least partly understand it. How can we do better? Physical scientists could go to the laboratory and run controlled experiments. In the present context, we can, among other things, run human games, thinking about them as experiments. This, however, means that we should design the games to accomplish something useful. We needn’t bother with games that would merely tell us what we already know with confidence. Rather, we want games that will probe the edges or examine matters not understood.

Such games may extend our knowledge, discover downright errors in our previous thinking, or identify things to incorporate in our refined theory and related model. We might then do some analysis and report tentative conclusions, but we would also want to reenter the cycle of
thinking, theorizing, modeling, and looking for information. This process model is akin to the model-test-model approach in building physical systems, but with the human game—rather than laboratory or field exercise—used for testing. The cycle should continue as needed, until we arrive at “settled theory.” In truth, that time may never come for national security work because the world keeps changing, as do our competitors and adversaries.

2. Gaming as Routine Part of Campaign Analysis Methodology (CAA)

Figure 7. Center for Army Analysis analytic process.

Figure 7 illustrates how the Center for Army Analysis (CAA) integrates wargaming into its campaign analysis and larger analytic effort.
Figure 8 illustrates the broad “Naval Analytic Enterprise” process in the Chief of Naval Operations’ (CNO) Design for Maintaining Maritime Superiority. The process uses various operations analysis tools to evaluate Naval Concepts and Concepts of Operations (CONOPS): studies, as contained in the Integrated Analytic Agenda (IAA), wargaming, exercises, and experiments. Wargaming takes naval concepts, such as electromagnetic maneuver warfare, and assesses various CONOPS against a thinking and adaptive opponent. Campaign analysis helps inform wargaming by projecting potential outcomes of those CONOPS against a specified threat. Once an optimal CONOPS has been chosen, engagement-level analyses can help assess its effectiveness, (e.g., how large an area of uncertainty must be created, or how long it must persist, to protect a naval formation). Finally, platform- and system-level analyses can help determine the requirements, (e.g., a jammer must cover this large an area and that frequency range to create the needed effect).
SUMMARY OF INSIGHTS FROM PRESENTATIONS

The following is a summary of insights gleaned from the large number of presentations made to the working group.

In his working group keynote address, Paul Davis of RAND discussed how relationships among gaming, modeling, and analysis differ by context. He then elaborated on the paradigm in which one starts by modeling (both qualitatively and quantitatively) to summarize knowledge, designs human games to test and probe further, conducts games and learns from the gaming, and iterates with model enrichment. Davis illustrated this with a case study, a recent project about deterrence and stability on the Korean peninsula. The project included theorizing, modeling, design of human gaming, gaming, and drawing lessons to be reflected in the next round.

In his presentation on historical wargaming perspectives, Matt Caffrey of HQ AFMC/A8OW discussed how analysis and wargaming have had a mutually enabling relationship over time. He believes wargaming can shorten the OODA (observe, orient, decide, and act) loop, thus giving the wargames user an advantage. Wargames can help, but they can also mislead. There is a need to assess wargame confidence based on the quality of the analytical products, difficulty of the problem, and appropriateness of the design. A good design combines a desire to win with a need to follow doctrine and the game objective (which could be to train).

Davis moderated a panel that included members from US federally funded research and development centers (FFRDCs) and Allied defense analysis organizations.

Ed McGrady of CNA discussed the rigor that needs to be in a wargame for it to be successful.

Kevin Woods of IDA discussed viewing wargames as the creation of history and how applying methods used to learn from history may be beneficial: learn from failures and successes, make predictions, test hypotheses, and understand the present better. He suggested that we should look for trends across wargames, including identifying disagreements where further analysis may be needed.

Murray Dixon of DRDC Canada discussed the company’s plan to use wargaming to support the Ministry of Defense’s (MoD) strategic planning process. Wargaming helps in validating scenarios and identifying key drivers in a scenario. Dixon stated that wargaming has limited use in identifying capabilities needed in a scenario.

Colin Marston of the United Kingdom’s Defence Science and Technology Laboratory (DSTL) discussed how the UK just formed a wargaming team to support analyses throughout DSTL. He showed how wargaming directly impacted analyses and decisions in areas such as communications in a crisis, reaction of the public to government messages following terrorist incident, etc.

David Shlapak of RAND discussed how RAND used its Framework for Live Exercises (RFLEX) to game the Baltic scenario. In RFLEX, rules are guidelines, not straitjackets, and emphasis is on being reasonable, accurate, and flexible vice precise and rigid. Repeated game plays (~35) and follow-up research build confidence in results. This process identified the need for high-level modeling to explore results in more detail.
Charles Snyder of IDA discussed the use of Cassandra\(^3\) to support programmatic decisions in the realm of biological and chemical weapons scenarios. They demonstrated the use of wargames to inform the best use of forces in a domestic crisis scenario.

Jon Compton of OSD CAPE discussed the use of wargames in CAPE. CAPE used a structured multiphase design with a survey-based data capture process to inform an assessment of multiparty negotiating strategies. CAPE carefully tested the game design before game execution, leading to better results.

Dave Reynolds of the US Pacific Command (PACOM) discussed how emerging capabilities will present new challenges to Red and how Red may react. He discussed how PACOM uses wargaming to compare courses of actions (CoAs) and provide data to campaign models (e.g., Joint Integrated Contingency Model, or JICM), as well as how it uses the CAA model CWAM to support wargames.

Chris Dougherty of OSD Policy described how wargaming is used to develop defense planning scenarios and help stakeholders learn the scenario. He identified the need for more use of M&S in adjudication.

Corrine Sorden of OSD CAPE discussed the DoD Wargame Repository. OSD CAPE maintains more than 500 game reports in the repository, with roughly half reporting insights gained. The repository, which is used to generate a monthly report to the Deputy Secretary of Defense, contains lists and schedules of future wargames and an adjudication tool database. Linking wargaming results to analysis and decisions is currently a challenge.

Sharon Beermann-Curtin of OSD Strategic Capabilities Office (SCO) discussed how OSD SCO is conducting a wide range of wargames with a focus on how advanced technologies and operational concepts can achieve deterrence.

Al Sweetser of DHS discussed how DHS is using wargaming in homeland defense analysis. DHS has a nascent analysis capability with only one wargame to date. The game used 1,800 people in an earthquake scenario. He noted that there is great potential for more wargames in TSA passenger checkpoint and border security operations.

The workshop also included a panel with representatives from the different Services.

Mark Gallagher of USAF A9 discussed how wargames have a wide set of decision variables and thus are well suited for evaluating strategy. USAF A9 is assessing best ways for allies to contribute to wargaming within the alliance structure.

Steve Stoddard of CAA discussed how CAA uses OSD incentive funds to move wargamers to theater (e.g., Afghanistan). Posture options were explored in security/strategy wargames. CAA used wargame results to help make CoA decisions and refine OPLANs prior to conducting analysis in JICM.

Mike Bailey of the Marine Corps Combat Development Center discussed how MCCDC used wargames to inform prioritization of gaps (warfighting challenges) and establish analytical requirements. It then used wargames as a prelude to analysis in the areas of concepts, employments, and CONOPS.

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\(^3\) This is not the same as the Project Cassandra discussed later in this report.
Chuck Werchado of the Navy staff OPNAV N81 showed a cycle that integrates wargaming with concepts, exercises and experiments, and CONOPS into analysis. He stated that OPNAV N81 needs better access to data for adjudication, better ways of extracting actionable insights, and a way to give wargame insights the appropriate credibility to assist in decisions. He also suggested solutions to those needs.

Peter Wilson of RAND discussed his “Day After Games.” The process presents players with a future crisis/problem and takes them through education, analytical framework, issue identification, alternative CoAs, issue prioritization, decision, implementation, and evaluation. The technique is used in low-probability, high-consequence situations. An important role of the process is sensitizing participants to the need for action programs to prepare for such events.

Dominick Wright of OSD, AT&L discussed the use of modular wargaming in the department’s operational energy analysis. The process builds game space using modules. When executing a game, modules are played by a human, automated, or omitted based on the requirements.

Thomas Choinski of the Navy Undersea Warfare Center (NUWC) discussed technology assessment using wargaming. He stated that four communities need to interact to produce innovation (doctrine, warfighter, acquisition, and science and engineering); otherwise, aliasing (different signals to become indistinguishable) problems occur when one or more community is excluded.

COL Lynette Arnhart of US Central Command discussed how CENTCOM has developed a wargaming cell that uses M&S (including STORM) to aid with adjudication.

Jane Pinelis of Johns Hopkins University Applied Physics Lab (JHU/APL) and LTC Christian Teutsch of JS J8 SAGD presented “Wargaming and Analysis: An Exculpation,” which compared wargaming and quantitative analysis.

Jackie Henningsen of IDA presented “Wargaming and Analysis: The Danger of One Without the Other,” which discussed when in designing a wargame to consider salience (relevance – who cares) and gravitas (weight/importance of players).
WORKING GROUP 1 SUGGESTIONS

The following are specific suggestions compiled by the working group to improve wargaming and analysis within the department.

Suggestion 1: Wargaming Capacity

In the practitioners’ summit in March 2016, there was a consensus that there was insufficient capacity within the wargaming community. The working group echoed these concerns and came to similar conclusions. The wargaming community is struggling to keep up with the renewed demand. Specifically, there is a lack of skilled adjudicators and skilled facilitators. Wargames are often hampered by a lack of available players.

Unfortunately, the temporary funding available from the wargaming incentive funds or other efforts are of limited value as there is no contractual vehicle in place to hire temporary help. Further, even if the funds were available, temporary solutions will not address the long-term demand.

CCMDs (regional or functional) operate on relatively short timelines, which makes using incentives or other funds to assist in creating new wargames impractical, as their ability to put new contracts together to use the funds does not match their annual cycle.

The working group proposes two solution to address these problems. First, we suggest creating a central source for adjudicators and facilitators. The wargaming repository can provide a central listing of wargame talent, in particular experts in adjudication and facilitation. Second, the Joint Staff or OSD could employ indefinite delivery/indefinite quantity (IDIQ) contracts to qualified companies. When a combatant commander, or other organization, needs to draw upon the contract, they can use a Military Interdepartmental Purchase Request (MIPR) money to the owner of the contract (with or without incentive funds) and gain the assistance of the contractor with the appropriate skill set. Further, the repository and/or the contracts should also include the skill sets of retirees or other personnel who are familiar with wargames and are prepared to fill specific roles as players (e.g., air defense expertise for air defense planners within a game).

Suggestion 2: Combatant Commander Authorities

The working group identified a problem limiting innovation. CCMDs are generally prevented from innovations in force structure, doctrine, or systems as these are provided to CCMDs by the Services. The only areas they could realistically change is the manner in which those forces could be employed and/or their authorities to execute innovative missions. CCMDs are usually constrained by existing authorities and methods of employing forces provided by the Services (for real operations, it takes significant effort and time for CCMDs to gain additional authorities and permissions for new employment of forces above or beyond current authorities [FML/CONOPS]). CCMDs have challenges exploring the potential of changes to force employment and authorities as it is difficult to get the right DoD/interagency personnel to participate in the game(s) to enable realistic exploration of concepts outside current authorities. This is especially true if a short-notice wargame is needed.
A potential solution is to create a pool of DoD/interagency partners familiar with CCMD authorities (DWAG, OSD-P, OSD-C, OCLL, SAG-D, WAD, CAPE). Identifying the right personnel to participate in the wargame helps CCMDs understand what is within the realm of the possible. This could improve innovation and inform the CCMD as to what new authorities to request and/or to use forces in innovative ways.

CCMDs could conduct wargame series to identify acceptable sets of conditions-based authorities. By doing this in advance, the Nation Command Authority and CCMDs may improve the timeline for granting authorities, and for identifying new authorities and the conditions in which they should be granted.

Identifying wargamers with expertise in authorities would enable quick-turn games on this subject.

Suggestion 3: Whole of Government Wargames

The working group identified a problem with the limited interagency participation in wargaming. CCMDs generally require support from agencies outside DoD, particularly when examining new approaches to addressing intra-theater problems. This is hampered by the fact that most CCMD timeframes are annual or semi-annual in scope, while most interagency issues are addressed on a longer time scale. This is further exaggerated by the fact that DoD has disproportionate access to resources (personnel, money, equipment, and more rapid response timelines). The problems CCMDs usually face are inherently related to both military and interagency actions, and the military risks getting out ahead of the inter-agencies.

The working group offers the following potential solution. DoD should develop whole-of-government wargaming capability to improve planning and synchronization. JS J-8 has done some wargaming in this manner and has made some progress running games like this in support of the National Security Council (NSC).

Suggestion 4: Crossing-Cutting Analyses of Wargames

The working group believes that important insights could be gained by comparing results and methodologies across wargames with the same theme. Differences in results could result in a deeper understanding of concepts or serve as the basis for further games or analyses. Similarities in results may increase decision makers’ confidence in results. Differences in methodologies may lead to unexpected insights, or help organizations identify ways they can improve their wargame capabilities or discover better methods. Similarities in methodologies could lead to the identification of best practices. Differences in data and assumptions may lead to new insights. Similarities in data formats could make comparison of results easier.

There are several potential thematic areas to enable the comparison of multiple games:

- In same country to provide insights to decision makers,
- Using the same methodology to develop best practices,
- On the same problem type to gain insights and may enable evaluation of methods,
On a common characteristic (e.g., COCOM games) to enable sharing of approaches and practices, which could improve future activities.

The working group identified the steps an analysis would entail to gain effective insights. First, identify wargames associated with the theme(s). Second, obtain documentation on these wargames. Third, develop a reasonably detailed understanding of each wargame by conducting a reading of the documentation, then clarify and expand gained knowledge by communicating with wargame sponsors, participants, etc. A common taxonomy will be required for describing wargame assumptions, data, results, and methodologies. Finally, develop a database employing this taxonomy and compare inputs across the wargames to develop insights.

From this, a meta-analysis of the games could be conducted. Examples of questions this analysis may be able to answer include:

- Are wargames in a thematic area producing consistent results? If not, why not?
- What wargaming capabilities do organizations have and how can they best enhance it?
- What are the unanswered questions that may be best addressed by a wargame?

This kind of meta-analysis will not be easy to do correctly and will require experienced analysts and wargamers.

Suggestion 5: Wargame Analytic Agenda

The working group discussed the creation of a wargaming analytic agenda similar to what was in place for campaign analysis to support strategic assessment, but focused on supporting wargames instead of M&S. It would be a database of common scenarios, data, and initial CONOPs and assumptions for wargames. These should be pertinent to CCMDs, not just the SSA version that pertains to OSD/Joint Staff views of CCMD challenges). The database should be developed to support common models that use the data.

The working group discussed potential benefits of this wargaming analytic agenda. In theory, it could enable faster, more efficient wargame setup, minimizing pregame research. It could enable a better basis for comparison of results in different games due to consistency of input data. Finally, the use of vetted data and methodologies could potentially improve game quality.

The working group identified several factors regarding the wargaming analytic agenda. The database in the wargaming analytic agenda could include data for each scenario, the road to war, geography, force beddowns, system characteristics, adjudication data, etc. The data could be compatible with some commonly accepted tools (SWIFT, C-WAM, etc.), preferably in the

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4 Under the Analytic Agenda, OSD, the Joint Staff, and the Services oversaw the development of common scenarios for M&S-supported campaign analysis. OSD Policy would develop the scenarios, the Joint Staff was tasked with developing the joint concept of operations for each scenario, and OSD CAPE was tasked with running the first campaign analysis as a baseline for all future studies to be compared to. OSD Joint Data Support collected and curated the data. In time this became the Support to Strategic Assessment (SSA). CAPE no longer employs campaign analysis or develops baseline and the SSA process is in question. Criticisms of the AA/SSA have been that it is a slow and ponderous process.
formats these tools use. Organizations would not be required to use these tools, but having both the tool and data available would encourage their use. Standards and approving authorities would need to be defined and update procedures would need to be established. The OSD CAPE maintained repository could become the basis of this effort and contain some of this information, with special permissions and restrictions required for sensitive data. The OSD Policy “Cookbook” may be a step toward developing a wargaming analytic agenda. More importantly, organizations with long histories of conducting wargaming, such as the Naval War College’s Halsey Alfa and CAA, have successfully developed and employed their own wargaming handbooks.

ENDURING QUESTIONS

Finally, the working group identified a list of enduring questions that should be addressed at future wargaming workshops and symposia.

Enduring Questions
Potential Research or Future Workshop Topics

• When should a series of wargames be used? A set of wargames? A single wargame?
• What game designs are more conducive to generating surprise and innovation as game outputs? (e.g., constrain actor resources?)
• How can Information warfare, electronic warfare, cyber warfare, command and control be best integrated into wargame design?
• How can one judge the quality of a wargame given multiple types of games with differing/multiple objectives?
• What is the correct sequence to integrating other analytical methods with wargaming? Research => model => Game? Reverse? Question dependent? Sometimes games are used to generate data for modeling.
• What are different ways that other analytic methods can be used within wargaming? Adjudication support? Explore paths not taken?
Working Group 2: Communications and Implementation in Games

Chair: Ed McGrady; Co-chair: Paul Vebber

SUMMARY

Technology is not a driver for game narratives, gameplay, or the players’ game experiences. But it can be used to enhance players’ ability to engage with the game, to visualize what is happening in the game, or to manage the complexity of the game. Many technologies designed to allow for online or digital play can serve the dual purpose of controlling the game and allowing for data capture. However, what to do with the vast amounts of data generated in a game remains an unanswered question.

Therefore, whenever we consider incorporating technology into games we should first look at the design problem and objectives to be accomplished, and then ask whether the technology can contribute to game construction, not the other way around. When you do that, as our working group did, you find that there are some existing and emerging technologies that could have a significant impact on DoD gameplay if organizational, financial, and, most importantly, policy and security issues could be overcome. These technologies all center on making the presentation of information to the players easier, allowing for control to manage player interactions, and capturing player interactions for post-game analyses.

INTRODUCTION

How do you communicate in games? How do you implement games so that players, the control cell, and everyone else knows what is going on? What role does technology, particularly emerging digital technology, play in facilitating communication in games?

As part of the MORS wargaming workshop, Working Group 2: Communications and Implementation in Games discussed these questions. Our work encompassed the entire scope of communication in games. It included communication within the game, between players and others (the white cell, the control cell, various subject matter experts (SMEs), etc.), and with the “outside world” observing the game, but not participating within the “magic circle” (ethnographers, analysts, senior mentors, sponsor representatives, etc.). The goal was not just to understand communication in games, but also to identify specific tools that we could use to implement new ways of communicating and structuring our games.

Our group was composed of approximately 30 individuals interested in various aspects of the topic. The group was split evenly between those with a technology background and those with a focus on gaming. Many of the gamers were also familiar with technology and issues surrounding technology and its use in games.

The discussions were divided into three sections. The first section put the technologists and the gamers into separate groups. Their goal was to gain baseline understanding of both technology and wargaming capabilities and requirements. The second section brought the two groups back together in a plenary to discuss how different kinds of technology could address
wargamers’ communication and implementation needs. The goal was to understand the role technology plays in wargaming, and what emerging technologies could actually help with wargame communication, control, and presentation.

One area we steered clear of was the topic of adjudication. There was an entire working group devoted to the challenge of adjudication in wargames. What we were interested in is how adjudication results might be communicated to players, and how players might interact with an adjudication system.

Finally, we divided evenly into two groups to work through a game design, and try to understand how technology could be used in the design. Everyone unanimously agreed to focus on CENTCOM issues. One group focused on the competition between Saudi Arabia and Iran at the strategic/policy level, while the other group examined a tactical problem of operating destroyers (DDGs) in an ambiguous threat environment in the southern Red Sea and Western Pacific.

This working group report provides an overview of what was discussed, identifies some of the key issues that arose, and describes our results. But first we will describe what we mean about communications in games.

**COMMUNICATION IN GAMES**

To baseline the discussion, we spent some time structuring the problem and developing a common vocabulary for talking about communication in games, as we discuss in this section.

How do games communicate? What do they communicate? With whom do they communicate? We considered several ways in which games communicate.

Games can present information in four distinct ways:

- **Illustration.** They can graphically show the information to the players. This can be in the form of maps, first person perspective drawings, or pieces that represent different units.

- **Abstraction.** Games can use tables, charts, and other abstract representations of reality to present information as well. In wargames it’s common to see combat results tables, turn charts, or logistics/build charts presenting information on abstract processes to players.

- **Emulation.** The game can emulate a real-world concept within the space of the game. Digital games commonly use this format. Players have a display similar to what they might see in the real world, and manipulate controls to move, shoot, and conduct other actions.

- **Decoration.** This type of communication involves the addition of narrative elements to a game that have little or no relationship to what the players are being asked to do. Candyland is a typical commercial example of this: it is a race game decorated as a candy-based adventure. This type of communication is the least interesting for professional gamers as it does not relate player actions to the topic of the game.
In addition, we can consider how different elements of the game, players, controllers, designers, and observers communicate with each other, the game, and the rest of the world. One way to characterize this is:

- **Outer elements of the game** are the things you think of when you think of a game. These include:
  - Players
  - Materials
  - Scenario
  - Mechanics
  - Venue
  - Observation

- **Inner elements of the game** are those characteristics of the game that are created from the interaction of the elements, are implied by the social and political situation of the game, or occur in the minds and imagination of the players and designers. These include:
  - Dramaturgical (how players present themselves to the game and the real world)
  - Narrative/gameplay
  - Neurological
  - Social
  - Framing
  - Humanistic

These elements were used to stimulate a discussion of the game environment, communications, and how games present information to players.

In the working group we also wanted to baseline players on issues regarding the history of games and how they fit into analyses. In our briefing on the history of wargaming, COL Matt Caffery, a noted historian of wargaming, discussed how technology was incorporated into wargaming historically. From that discussion, we can see that the technology was matched with the gaming problems that were being encountered. In other words, the questions asked demanded new types of games and new ways of communicating with players.

**Why Use Games?**

The subgroup of self-identified “gamers” (or those more interested in aspects of “what makes something a game”) had a rather wide-ranging discussion that emerged from a set of introductory questions that can be summarized as “why do we use games?” The answers varied, but all centered on “what are the challenges I face?” both in the near-term “day-to-day routine” and the more conceptual:

- Developing future concepts
- Support to “net assessment” and diagnosing future areas of competition
• Implementing current concepts
• Examining interplay between aspects of current doctrine
• Developing doctrine and tactics, techniques and procedures
• Support to development of operational plans
• Support to “operational art” (developing an understanding of relationships between force, space, time, and geography)
• Support to acquisition decision makers
• Support to service “equity stakeholders” (looking at things like force structure, roles and missions, etc.)
• Support to efforts to combine “whole of government” capabilities to meet emerging strategic challenges

There are undoubtedly others, as this is not an all-inclusive list.

The common threads of this discussion included aspects of the relationship of analysis (and analysts) and wargaming (wargamers) and the need for it to be competitive but not antagonistic (or dismissive). Decision makers need the different perspectives each discipline provides, together with that of operators conducting field exercises, rehearsals, and experiments. The use of “analysis” to mean any deep thinking about a problem muddies the waters as to the differences between analytic and wargaming techniques, each of which provides decision makers with deep knowledge about a problem from a different perspective.

On the other hand, the common use of “wargame” to similarly mean “think deeply about it” complicates things as well. Just as not all “analysis” of a challenge involves disciplined application of analytic techniques, it is even more common for “wargaming something” to involve little in the way of disciplined wargaming techniques. This gives rise to the pejorative use of BOGSAT to describe these cursory efforts to which people often attach the label “wargame.” That is not to say group discussions employing disciplined facilitation techniques are not valuable. It’s just that they are rarely wargames despite being labeled that way.

This circled back into “why do we use games?” by way of “why we need GOOD games?” The definition of “GOOD” is different for each of the categories indicated above as well as in the eye of the various beholders associated with the game. What is good to the sponsor (i.e., supports a non-contentious outcome) may be achieved by means of a dubious game design, or alpha participant dominated execution. The consensus of the group was that good games are games that people trust. From the perspectives of the sponsor, participants, designer/developers, and implementers, there are always issues with the various aspects of the gaming process. Identifying, rectifying, or mitigating those issues develops trust among those involved in the gaming process and results in trustworthy insights emerging from the play of the game. This leads us to the question of how do we build that trust and what technologies are available to enhance trustworthiness. While trust is a subjective quality, the bottom line is that effective
game-related communication is the foundation this trust is built on. This provides context for the discussions of communication and implementation that follow.

**Technologies for Communication in Games**

The primary discussion in the working group centered on identifying and assessing how new and emerging technologies could be used in communication and implementation in games. In this section, we focus on the problem of communicating in games, and in the next section we discuss implementation. These two topics overlap and were discussed interchangeably during the working groups.

Practically, in games, communication occurs in four places:

- Within the game
- Between the game and the players
- Between the players
- Between the “game world” and external observers/analysts/consumers

**Communicating Within the Game**

Whether implemented by a “sneaker-net” and dozens of white-cell personnel, a complex architecture of computer software products, or a set of rules describing interacting objects and mechanics, “The Game” itself requires extensive amounts of information to be communicated to provide players with an environment for effective interaction.

In early “free kriegspiel” implementations “The Game” existed mostly in the head of the umpire, or the collective umpire team. The development of rigid kriegspiel encapsulated some of what went on in the umpire’s head into rules, charts, tables of data, and adjudication methods. It may seem odd to speak of something like a manual board game “communicating with itself” but as anybody who has played a game with an elegant synergy between its components can attest, a game whose flow is intuitive and well-structured provides a much richer environment to think about the subject matter of the game and not expend all one’s energy wrestling with a haphazardly implemented game concept.

Tools and techniques assisting in this area include rapid prototyping of game components—in particular, creating graphics for things like game boards, pieces, cards, and charts and tables. Given the difficulty of finding sufficient testers in one place, online forum software and software development tools (like GitHub.com) can be used to collect input from manual game testers as well as software testers. Tools to create virtual instantiations of manual games quickly are becoming increasingly usable. Applications like Cyberboard (http://cyberboard.brainiac.com) and VASSAL (http://www.vassalengine.org), which can be time consuming to learn or require moderate programming chops, are being supplanted by virtual gaming environments for Euro-style games such as Tabletopia (https://tabletopia.com) and Playtable (https://playtable.xyz), which take advantage of touchscreen technology and interactions with physical objects.
This led to a philosophical aside about “when is a manual game implemented on a computer no longer a manual game?” This may seem pedantic, but there is an aesthetic to gathering a group of people around a table and strategizing different schemes of maneuver. Whether a simple paper chart with a vellum overlay or a touchscreen with a host of display capabilities, an observer would see them as a “chart exercise” or “board game.” The difference becomes one of time savings in communicating an understanding of the relevant risk calculus associated with each scheme of maneuver, and the depth to which the different factors impacting risk can be drilled into.

Increasing complexity and scope of participation in a game can lead to a requirement for entities in the game below the level represented by the players to have their decision making represented by various types of white cell personnel. These can be groups of support personnel who are “half white cell/half control cell” adapting to prevent gameplay from veering off into territory not relevant to the game objectives, or be “pucksters” who “drive forces around” following doctrine as closely as possible. In either case, the communication of information to and from these cells is extremely important and often not paid attention to as closely as possible. This can be particularly acute where “pucksters” are manipulating large numbers of forces within a simulation environment and miscommunication can result in a need to “reset” the game to a time before the miscommunication disrupted things.

Facilitating communication within a large game environment using multiple tiers of support personnel requires a facility-wide communications and networking infrastructure to ensure information is flowing as intended. This can require quality assurance monitors who can identify breakdowns in communication within the game that threaten the game objectives, and can intervene to ensure the proper information gets where it needs to be in a timely fashion, or assist in troubleshooting the problem directly. This also includes information technology specialists who can identify and troubleshoot network and computer workstation problems, which require their own communication network and protocols.

Communication Between the Game and the Players

A lot of discussion centered on how to best communicate information about the game to the players, and vice versa. Typically, game information is communicated to players through materials and interaction with some kind of situational display of game objects or entities, their attributes and relationships. In both cases, there is often a control team that acts as the arbiter in decisions about what information to give the players and when. Materials could include video or audio as well as written materials and documents. The situational display may be as simple as a paper map and tokens, or a highly immersive synthetic environment. We will come back to this later.

As an aside, a discussion threaded through the working group concerning environmental communication with the players. In the construct given in the last session, this would include the venue. However, working group participants also discussed how to create an immersive ambient environment for the players. This would include sound, smells, and other sensory inputs. The consensus was that while this was interesting and worth thinking about, there was no compelling reason or capability to use these techniques at this time.
One of the first questions discussed by the group was the question of quick and easy video clip production for games. A recurring challenge in many types of games is how to “parachute the player into the game” with some sense of context and understanding of how the situation they are faced with emerged. The visceral player response to “fight the scenario” when they feel “I would never have let the situation get to this point” is difficult to overcome without the players being early participants in the game design process. An alternative is to produce videos that portray news broadcasts or video teleconferences (VTCs) with commanders that convey how the situation they are faced with emerged, getting the player to “willingly suspend disbelief” and enter the flow of the game.

In designing video for games there are several challenges:

- Commercial video production is expensive and time consuming.
- It requires actors to be hired to read the material.
- Classification or releasability issues may interfere with production and actors.
- The material covered by the videos is often central to the game scenario, which may not be finished in time to accommodate production requirements.

These and other factors can make video production for games both expensive and complex. Participants discussed online and other alternatives for production. There are online capabilities to construct animations either free or for a small fee that could be used in place of actors and film production to create news videos. Examples of such sites include moovly (www.moovly.com), goanimate (www.goanimate.com), and powtoons (www.powtoons.com). While these animations cannot replace a live news anchor, they are far cheaper and more flexible than a live actor and video production. As with most of the technologies discussed in this working group, policy and security issues would not be easily overcome.

There was a lot of discussion about how players would communicate with and visualize the game. Currently, most of the designers present (digital game designers were represented in the group as well) use paper and pencil techniques to communicate with the players. The most commonly used capability for wargames is the map with a representation of units and capabilities that the players interact with. Substituting a digital visualization capability for this communications process is a significant goal for game designers and developers. The challenge is that several interactions are accomplished using a physical map and pieces: the visualization by the players and controllers, the representation of game relationships between the pieces and terrain on the map, the nature of the units and map terrain, and the ability of players and control to manipulate the pieces on the map in real time. Substituting all these interactions is challenging for any technology.

One capability that was discussed throughout the working group was the Standard Wargaming Integration Facilitation Tool (SWIFT) system. SWIFT is a government owned software system designed to allow games to be created and manipulated in a digital environment. The system can be used to duplicate any gaming environment digitally, including maps and pieces. Players and controllers can interact with the game pieces through the SWIFT interface. SWIFT also has the advantage of being available on networks at any classification.
level. SWIFT is being used in ongoing wargames, in some cases simply to capture player moves for future playback. However SWIFT has some limitations, primarily centered around manipulating entities within the program in real time.

With SWIFT as an example of what a general-purpose digital environment can do, the group discussed emerging technologies as well. Considerable time and thought was given to the problem of visualization. Large-screen, capacitive, resistance, or infrared touchscreen displays were discussed as a way to use digital environments like SWIFT to allow players to manipulate the game environment while visualizing it at the same time. The Playtable device (playtable.xyz) and software mentioned earlier is an example of such a device.

The challenges with technologies like touchscreen displays are cost, size, and difficulty in relocating the display in support of games. Some working group members noted that they often had to do games in a variety of venues and at a range of classifications, including games overseas. Moving large displays a long distance, and using them in a highly classified environment can produce significant logistics, policy, and security challenges.

One way to overcome these limitations on touchscreen displays is through augmented or virtual reality. Augmented reality (AR) puts information, data, or graphical displays over a live view of the real world. Heads-up displays, head-mounted displays, and handheld displays such as Pokemon Go are examples of AR. Participants discussed AR products currently available and their potential uses.

Discussions focused on head-mounted or heads-up displays that would overlay digital information on real-world environments. This is currently an emerging consumer technology, with most of the available systems being either prototypes or professional and requiring considerable development work to apply. If these systems were available, then:

- Many of the policy and security issues associated with large displays would be easily overcome as these systems are small, head-mounted, and easily transported and controlled. They would still need to be approved to work in a classified environment but that would be substantially easier than moving large displays.

- The systems could mimic the current map-and-pieces construction used in conventional wargames. Motion-sensing devices such as Microsoft Kinect could be paired with AR devices so players could not only visualize the terrain and units, but also interact with them in real time.

- AR devices could enhance player information dissemination and communication in many game environments. For example, in pol-mil games, AR displays could track individual players, with nationality and other player characteristics displayed for the players whenever they look at another player. The ability to manipulate virtual environments would further enhance the systems’ flexibility, allowing players to make virtual exchanges and manage virtual control systems or other interactive virtual devices.

- AR could also enhance the ability for control to communicate with and manage large player sets in real time. Push notifications could appear instantly on targeted players’
displays. Messages, briefings, and video could be pushed to one or more players by control. These would then appear on a player’s virtual display. Since AR would be tied to the player and not a fixed location like a conventional computer, players would be able to interact with each other, the game system, and control all at the same time.

Virtual reality (VR) systems were also discussed as possible venues for in-game communications. VR systems completely immerse the player in the environment, and allow players to manipulate and interact with digital objects within the VR environment. This differs from AR in that the player is not also present in the real world while engaged in the VR environment.

With VR, players could engage in a shared environment from remote locations. VR would also allow players to move unfettered and interact within the environment, without moving very far in the real world. While VR has some appeal over AR for some games, it also limits how players interact as they are now interacting with avatars in the virtual environment and not each other in the real world. For games that place a premium on players making decisions about the environment they are in—squad combat simulations, for example—VR may be a preferred technology. However, for analytic wargames, the premium is on players’ ability to come together as an organization, plan for combat, and conduct operations as opposed to interact with the environment. Thus, VR may be too virtual for wargames that place a premium on planning, coordinating, and strategizing.

A compromise between AR and immersive VR is the use of virtual worlds (VW) technology. Rather than try to overlay information on an actual scene or provide a first-person perspective of what the player sees, VW technology provides a “tethered camera” view that lets the user “fly around” to explore the VW from multiple perspectives. VWs commonly use avatars to anchor the user’s perspective of where they and others are, but this is not required. A VW depiction can be a view of a three-dimensional scene depicting the locations of objects, entities, and environmental effects that the player is free to “fly-thru” to view from any desired perspective. For other applications, a simple top-down two-dimensional view of a game board is sufficient.

The need to engage in collaborative planning, coordination, and strategizing can be enabled using the different display perspectives VWs can provide to support wargaming. Players can shift between these different areas in the game—from a virtual operations center depicting avatars of other players performing tasks, to a three-dimensional representation of a tactical situation, to a top-down view of a two-dimensional chart display or synchronization matrix—and can even consult doctrine publications or training materials. The use of standard video game controllers to navigate the different modes of interaction takes advantage of the increasing facility service members have with these devices given that most grew up playing video console games.

From an analysis perspective, since all players’ actions within the virtual world are recorded, the precise timeline of player activities can be examined and used during hotwash or debrief to get additional perspective on why things were done, and whether, in hindsight, the player may have done things differently and at what point that became clear, based on information the
player acquired. There is also a policy/security advantage to VW platforms that can act as a “wrapper,” isolating instances of other software hosted on virtual machines within the VW platform. This allows the use or emulation of some types of software within the VW, which is itself vetted through the various required security and network access protocols, without having each program individually vetted. Whether a given application can take advantage of this capability or not depends on the specific software implementation and the architecture of the specific virtual world platform.

Depending on the application, the combination of AR, VR, and VW, each used to provide a specific capability required to achieve the game objectives or to reduce a game’s time commitment, has the potential to significantly change how we game. The downside is the temptation to use these technologies, introducing significant expense, where they are not required, either because of desires to impose centralized control over wargame implementation, or because of the false imprimatur the addition of any sort of high tech tool is deemed to provide to a game.

Other topics discussed include:

- Play by e-mail (what the moderator terms “asynchronous games”). These games allow players to submit moves via e-mail to a central moderator who then pushes adjudication back out via e-mail. Players can communicate with each other during and between moves. This format allows players to participate at a more leisurely pace, from remote locations, and over extended periods of time.

- Persistent games. These games extend over substantial but undefined long time periods and allow players to come and go from the game. Many commercial games have elements of persistence. In World of Warcraft, for example, many players participate in building the game world over an extended period of time.

- Use of online tools to move game information back and forth between players. The Naval War College is exploring online and other commercial tools such as the Unity Engine development environment for producing games that allow players to share a common visualization over network interfaces.

**Communicating Between the Players, and Control and the Players**

Communication between players was touched on briefly during the working group. While AR headsets with sound and voice would allow players to be interconnected, other, less advanced technologies were also discussed. These included radio headsets for the players, in-room phones for strategic games, and use of text messaging and other social media platforms to allow players to communicate. Ultimately how players communicate, with both each other and control, is tied closely to how the game is implemented. The next section focuses on implementation technologies, which, in some cases, can be used by the players and control for interaction.
TECHNOLOGIES FOR IMPLEMENTING GAMES

By implementation we mean two things: the methodology control uses to manage the game, and the physical instantiation of a game design and the mechanics of player interaction with game components. We did not address any particular adjudication style or model as another working group dealt with that topic specifically.

How can technology help designers better structure the flow of the game and control player actions? Working group participants focused on technology that would promise big changes in design concepts as opposed to incremental adaptations of existing technologies.

SETTING THE OBJECTIVES

The first question addressed how technology could change the way you interact with sponsors. One idea advanced, drawing on the existing DWAG efforts, would involve a database of games or game concepts that could be used to better inform sponsors about the kind of game the designer was advocating to address the problem. This would be a comprehensive database, not simply a database of past games, but one where all the various game techniques could be shown to the sponsor. In a previous working group, a format similar to that used for commercial games (boardgamegeek.com) was proposed as a possible model for informing sponsors about game types, tool capabilities, and use cases.

Another participant indicated that they used word maps to help the sponsor identify what the objectives of the game might be. This technique takes interview transcripts or other notes about the sponsor’s interests and maps out the word frequency to understand what elements are most important elements to a sponsor.

A concept that had multiple potential applications was using automated software to interview people about a game’s goal. Automated systems could both formalize setting objectives and involve more people in the overall design. In addition, automated applications could also used in game analysis, where players are interviewed as part of the post-game analyses.

GAME ENVIRONMENT

There are many kinds of games, and they are constructed to support a wide range of activities and fields. Repurposing existing games was identified as another way to incorporate new practices and technologies into DoD wargames. Participants identified computer games, particularly those with relevant data displays or models, for use in conventional wargames. For example, economic considerations often play an important secondary role in wargames. How various countries’ economies are doing in the face of conflict can determine the overall success or failure of warfighting actions. At minimum, the relevant warfighting commander will take into account economic considerations as they plan for escalation or war termination. Participants mentioned a wide range of existing economic games, both in academia and commercially available, that might be repurposed in support of DoD wargames.
An example of a game environment that participants suggested might be used in support of DoD gaming is Democracy 3, a geostrategic computer game. For some purposes, “re-skinning” more abstract strategy games (e.g. “Eurogames”) with a different context (but keeping very similar game mechanics) may be a way to use elements from several games as a means to draw players into that context.

Many current DoD games use existing structures, portals, secure networks, e-mail, etc., to facilitate gameplay. These network applications usually allow for file sharing, social media-like interaction, messaging, and other actions to occur within a secure VPN environment. These environments run on either the Nonclassified Internet Protocol Router (NIPR) or Secret Internet Protocol Router (SIPR) networks.

SWIFT is an example of an interactive system that allows for game information to be shared among players. SWIFT focuses on replicating the game environment within the SWIFT interface. It could be used for almost any game, but it focuses on games with components that players manipulate.

Conference participants discussed other systems that could be used to facilitate policy, strategic, or national security games that did not focus gameplay on pieces and a physical space. One example is Conductrr (http://www.conductrr.com), an easily modified and scalable multichannel gaming communications platform. Conductrr can include a private-messaging environment, newsroom (news ticker and dynamic video display), near-field communication (NFC) tagging, running activity feed, and scavenger hunt capability. It is a transmedia development platform, meaning that it can orchestrate across media, phone, video, computer, etc.

Another set of technologies that generated a lot of interest was the use of game engines to create digital environments for the players. For example, the US Naval War College is exploring the Unity (https://unity3d.com) game engine for supporting its games. The Unity engine provides a wide range of environments and can be used for everything from a 3D environment to simulating a traditional map and pieces exercise in Unity’s 2D mode.

In discussing game engines, the game designers in the working group pointed out that there are several practical obstacles to using digital environments in support of DoD games. The primary obstacle was cost, in particular the cost of the graphics. Even though the Unity engine, for example, is free, constructing the required graphics to a usable level of detail would be time consuming, costly, and in the end only result in graphics that applied to the particular problem being considered.

Going Mobile

Another set of applications that were discussed for game control can roughly be categorized as mobile technologies. These include the use of smartphones, including smartphones that the players already have, as well as RFID and other tagging technologies.

Some of the collaboration technologies discussed include:

- Sandboxed applications for iOS that could be developed to assist in gameplay. This could include using messaging to alert players to what was occurring in the game, to pushing
injects and other control information over the phone. Players could also use the sandboxed applications to securely communicate with other players.

- Bboogle (http://projects.oscelot.org/gf/project/bboogle) is an open source variant of the common Blackboard (http://www.blackboard.com/mobile-learning/index.aspx) education app, which lets you create a sandboxed environment where you can share documents, messages, sites, and other information (drawing on the Google environment). Participants noted that there is a SIPR version of Bboogle.

- Virtual world platforms, discussed above and developed by the Naval Undersea Warfare Center to enable virtual training and rapid prototyping, are currently being developed to support gaming as well. These platforms have been hosted on both NIPR and SIPR servers and can provide near-real-time creation and manipulation of entities by multiple users in multiple locations seamlessly. They are hosted through the Defense Information Systems Agency (DISA) and have been already been vetted for certain applications.

- One of the objectives of the Deputy’s wargaming initiative is to create a DoD CoP system for wargaming. Already some, such as the Naval War College, are building CoP sites that will allow the sharing of information.

- The Naval War College has developed a game move tool (web, SQL-based) that allows individual players to document activities, key decisions, and explanations for their decisions.

- Facilitation tools abound on the web and in applications. These tools support meetings and provide secure portals. Facilitate pro (http://www.facilitate.com/technology) was mentioned as one example of such technology; ThinkTank (http://thinktank.net) is another online application in this category. In addition to allowing online participation in the games, these tools make capturing player discussions and actions easy.

Technology has advanced to the point where it would not be hard to track player actions and communications in real time during a policy or strategic decision-making game. Participants identified several technologies that could be used:

- Mobile devices can track players using the Global Positioning System (GPS). They could also record and stream sound and video of player actions.

- RFID technology could record player movements, identify which players are proximate to each other and when, and then transmit this information over mobile applications to a central database. A wide range of tracking technologies could relieve players from having anything more than a simply RFID transponder attached to their clothing.

- RFID could be combined with Internet of Things technologies to make decisions about what to do when players are proximate to each other. For example, when an RFID tag is detected by a wearable computer/receiver that control had identified as an interaction of interest, a recording could be made of any conversations between that pair of players.
• The human factors/human performance community has invested in technology such as eye trackers, computer-assisted video analysis and the virtual prototyping capabilities that have application for wargaming as well.

Game designers had several cautions to the use of any sort of advanced technology, but tracking and mobile technology in particular:

• Many games for DoD are one-off rather than a sustained series, and the effective cost of implementing some of these technologies might not be worth it for the type of games we are required to do.

• Some of these ideas will generate a lot of data on player interactions. Who will analyze that data, and what they will do with it, is unknown.

• Security and policy issues can become a significant challenge. Getting mobile technology into classified games, including the use of wireless, will be challenging. Use of RFID or audio recording of players will require consent and possibly a human subjects research panel approval. While these hurdles can be overcome, they will represent a significant challenge to implementing new technologies.

Artificial Intelligence

The group was fortunate to have an academic expert in artificial intelligence (AI) participate in the discussions. Designers asked how AI could be used to augment play by playing the rest of the world in a conflict game.

The AI used in commercial games is designed for particular, constrained game environments. When the rules and player behavior are well known, then it is relatively straightforward to produce AI that can operate within the constraints of the game. What designers need is a more general type of AI, one that can react to dynamic situations. This AI is not as capable, or as far along, as the more limited expert system types of AI. An application for AI could be areas where the game has constrained sets of actions that have defined inputs and outputs. However what designers need is AI that can respond to negotiations, bluffing, and intimidation.

Data Collection and Analysis

All the digitally mediated techniques we discussed could also double as data collection mechanisms for post-game analysis. Gateways, sandboxes, virtual worlds, Blackboard-like portals, and other team communication tools allow for recording player interactions and decisions during the game. Likewise, proximity devices and digital audio or video capture tools allow players to be monitored and recorded during live, face-to-face games.

These techniques have several challenges as well:

• Defining the role of human subject research protocols as you begin recording or instrumenting players

• Determining how to process the rather large amounts of data generated so that they become usable
- Deciding what questions will be answered by the data flow

Social science research may benefit from many of these techniques as interactions and decision processes can be mapped. However, insights into warfare may come just as easily from player experiences and reporting as from a detailed analysis of interactions.

**Design Implications**

All of these technologies for game control and player management have advantages and disadvantages. Their advantage is that they allow designers to incorporate vastly more detail, immersion, and story information into their game. But can, or will, the players absorb this greater amount of detail? What should designers do to make the new information digestible to players with limited time and interest in participating in the game?

New game implementation environments, such as the Unity engine, will be time and attention consuming to already overtasked designers. Designers naturally ask, “Is the juice worth the squeeze?” Incorporating new technologies means that designers will have to take time from design and implementation work to manage them.

**GAME DESIGN WORKSHOP**

After discussing a wide range of technologies and potential applications, we moved into a different kind of brainstorming session: a game design workshop where we could discuss technologies, communication, and implementation in games from the perspective of building a game. We divided into two design teams; one focused on designing a high-level, strategy-policy game looking at an interstate conflict; the other focused on a specific, tactical wargame problem.

In both cases, the CENTCOM participant in the workshop convinced the participants that his area of responsibility (AOR) would be a good subject for gaming.

**Pol-Mil Game**

The subject of the pol-mil game was the competition between Saudi Arabia and Iran for dominance in the Middle East. There was much discussion and debate about what, exactly, the objectives of the game should be. Participants settled on a game that examined the competition in terms of both countries’ roles in the Middle East, and the role of the US in the region. The basic game design, which we did not get very far on, was a matrix where experts in the region took on the roles of the different countries. The goal was to understand both phase 0 and phase 1–4 conflict options between the two countries. Cyber and other nonkinetic capabilities were of particular interest. Because this game would have a heavy economic and raw materials component, some sort of computer-aided play was envisioned, with players’ moves affecting the price of oil and markets.

Several issues arose during the discussion that highlight how technology can be integrated into this form of game:

- Democracy 3 (http://positech.co.uk/democracy3) was identified as a way in which data could be displayed in the game. The game has a detailed governance model tied to
economic outcomes. Inputs and outcomes are displayed in a linked network that allows players to visualize their countries’ economic and political situations. This is an example of how video game technology, or techniques, might be incorporated into policy games.

- The use of open source machine learning tools for recording gameplay, then creating algorithms to duplicate player behaviors was discussed. The goal was to develop AI-like elements in the game to allow the game to be played repeatedly or with fewer players. For reasons discussed in the AI section, some were skeptical of this approach, however the highly structured nature of a governance game might better lend itself to digitization of player positions.

- Using audio to text tools to keep up with the conversation and document the game was brought up. Several tools, from Siri to Cortana to using a stenography machine, were identified as new or different ways to take notes during player discussions.

- Online tools to moderate and facilitate the game were also discussed. While we had already covered the tools, here the participants focused on the rate of play and participation in online communities. Will people keep working on the game? Or will the participation rate drop over time with online tools? These were significant questions for games that persisted over long intervals and gave players relative anonymity to drop out of the game.

As mentioned previously, we did not get very far in the design of this game for several reasons:

- We had difficulty agreeing on precise objectives for the game.
- Several participants were highly skilled and experienced at this sort of game, resulting in multiple points of view toward the design.
- We were not focused on the game design as much as identifying how technologies could fit into the overall architecture of the game.

However, we were able to identify how different kinds of technologies could shape the future of these types of pol-mil games:

- Digital platforms, whether sandboxes or portals or other forms of media, could allow players to participate in their own time and at their own pace.
- Digital tools could also allow for aggressive data collection, whether the game is online or face-to-face.
- Using existing interfaces from commercial games could potentially enhance players’ ability to digest and respond to a country’s worth of information.
- Finding some way to develop digital players who could take the place of the relatively large number of SMEs required for this sort of game was one of the most challenging, and potentially very rewarding, aspects of incorporating digital tools into these games.
Naval Presence Game

The other focus group spent two four-hour sessions on taking the topic of interest, exploring some game design options, and looking at issues related to implementing that design (i.e., do you make it a seminar-style game, a matrix-style game, a manual board game, or a computer-based game). Much of that decision involves the manner in which information is presented by the game to the players so as to enable properly informed decision making—how it is moved (communicated) within the game between the players, between game players and adjudicators, and then outside the game world to observer/analysts. Given recent events in the vicinity of Yemen, the topic chosen was exploring the decision space associated with maintaining a maritime presence in a hostile but ambiguous threat environment. This offered an opportunity to use the game design process as a vehicle to map information about the situation into the various parts of a game:

- **Context: Representation and Meaning.** What is the game about? Who are the players? Why would players play it? What are the decisions that players need to make? What information would they have available to inform that decision? What do they know about what other players are doing?

- **Constraints: Time and Expense.** How long does it take to learn the rules? How long does it take to formulate a strategy to win? How long does it take to play? How long does it take to assimilate what went on? How much does it cost to create? How much to play? How much to change? How long do I have to complete the project?

- **Design: Objects, Attributes, and Relationships.** What are the most important objects that must be represented in the game? What is the smallest set of attributes needed to describe them? What is the minimum set of interactions between objects that must be defined and assessed? What is the least complex representation of critical elements of information players have within the game world that maps effectively to the real world?

- **Decisions: Choices, Information, and Consequences.** What is the minimum number of choices the players are presented with that stimulate them to consider the required range of information? How many decisions at once? How quickly must they make decisions? How are the consequences of their decisions communicated to them? What amplifying information is needed to fill in for things that are abstracted in the game design, yet affect outcomes?

- **Implementation: Constructs, Mechanics, and Rules.** What components are required to describe the objects, attributes, and relationships within the game world to the players? What components are needed to provide the required information about the game world to the players? What components are required to enable the player to effectively interact with the game world and each other? How is this information communicated to players to help them understand game flow, identify when decisions should be made, what the available choices are, and assess the risk associated with the choices?
• *Play: Observation, Interpretation, and Assessment*. How is the information flowing within the game implementation, between the players, and between those observing the game captured? What metadata is required to facilitate the effective interpretation of that information? Based on what objective or subjective criteria is that information and metadata assessed? How does one determine how effective the game was at achieving its objective?

This is a still evolving framework, much of which was not explicitly considered in the game design process that was undertaken for the workshop and needs to be fleshed out by SMEs to make it an operationally useful tool. At this point, a “carton-level” scenario in the region is used to illustrate how the game system works, and is not realistic in any professional sense. This also ensures that it stays away from anything potentially classified at this point.

The discussion started with the context, “what is the game about?”

Given the observed and likely threats from adversaries in the region, what does a pattern of operations for naval forces, which can be maintained for an extended period (one to several months) look like? What do the potential risks look like and how can they be managed or mitigated? Players would play it to gain some familiarity with regional geography and some of the first-order limitations on operating naval forces (logistics, states of readiness, time/distance relationships, and possible activities of adversaries). The latter is brought home by a team of players actively playing Red to try to create holes in naval presence to exploit.

Who would play it? To begin with, the assumption was “naval professionals desiring to gain some familiarity with the problem and region.” As the design went on, there appeared to be a possibility that it could be developed into something of actual use to those operating in the region. Again, to ensure that it stayed initially at the unclassified public releasable level, the primary source of game information was Wikipedia. The specific information that would make it relevant to real-world users would have to be added by those that had it, thus making it classified.

So, given this context, and who the audience might be, how many players are there? This discussion started to get the group’s creative juices flowing as the discussion moved to why particular sides would or would not be represented in the game, and what the motivation of those players’ victory conditions might be. There were several schools of thought on this, with some thinking it should be a single US player and a single Houthi player. Others thought the game needed to be between two teams of players so the relative communications impediments could be a deterrent to too much Houthi communication (i.e., US reconnaissance/strike capability, abstractly represented, could have a chance of killing one or more Houthi players each time they exchange information).

What this discussion showed was that a similar game could be played by different numbers of people—once the possible card mechanics were described, even a single side “against the event deck” is viable for a single player or cooperative team. For the sake of moving the design discussion along, a teaming arrangement of three Houthi tribal leaders, each with a distinct set of capabilities and motivations, would be on one side, and the commanding officers (COs) of three US DDGs (potentially a fourth for the in-theater support base ship USS PONCE) would be
on the other. The tension here was the motivation that each ship CO wanted to accumulate the most time on station, so as with the Houthis. While the game was won or lost by one side or the other, the individual player on the side that contributed more to that victory is the winner. For the more professional application, some discussion of “white cell” representation of higher echelon commanders like a Carrier Strike Group (CSG) Commander, Commander, Joint Task Force—Horn of Africa (JTF-HOA), or Commander, Naval Forces Central Command (NAVCENT) might be necessary.

The motivation issue of what constituted victory and what each side’s theory of victory might be was a lengthy discussion that was more philosophical than directly game related. Part of it involved whether one could know that or not, and if one accepted they did not know it “in real life” if that meant the game was negative learning or could not be trusted. The consensus seemed to be that part of the usefulness of such a game was to play it many times, assuming different motivation and victory conditions for the adversary each time and seeing how much a difference it made. At the very least, the in-depth exploration of what those motivations and theories of victory might be is part of what makes the time spent playing such a game worthwhile. Again, to move the design along the three Houthi warlords were given the following:

- **Houthi Player 1**: Motivation is using the arms trade to make money to support his tribal militia. He can choose to try to acquire large missiles (of particular interest to player 3), or fast boats and small arms (of particular interest to player 2). Victory condition is to complete at least five arms deals per month of gameplay. These must all come in by ship, so if they are interdicted by the US Navy, they fail.

- **Houthi Player 2**: Motivation is building the capability of the local pirates so as to be seen as the extender of influence in the region and profit from it. Victory condition is to complete at least five merchant vessel interceptions per month of gameplay. It is likely these will be disrupted by the US player if a ship is in the vicinity. These operations will draw the US DDGs out of position to intercept arms smugglers or defend against missile strikes on Yemen or Saudi Arabia.

- **Houthi Player 3**: Motivation is to demonstrate battlefield leadership by conducting at least five missile raids into Yemeni government-held areas or Saudi Arabia. This player controls the mobile launchers for the missiles and decides when and against whom they are used.

The thorn in the side of all these victory conditions is the US Naval presence, which can interdict Houthi player one’s arms shipments, can intercept Houthi player 2’s attempts at piracy, and can defend against Houthi player 3’s missile attacks.

So, despite having individual victory conditions that can be accomplished on their own, they stand a much better chance of achieving their victory condition if they work together to either lure away, otherwise occupy, or directly attack the US ships in the area.

The 3 (4?) US players each command a ship that has readiness, logistics, maintenance, and various random things—equipment casualty reports (CASREPs), directions to visit certain ports
to “show the flag,” emergent combined operations with local naval forces, calls to beef up CSG defenses, etc. They get points for intercepting arms shipments, preventing pirate attacks, defending against missile attacks (including against themselves); and they lose points for failing to meet commitments when they are directed (cards in the event deck, either randomly chosen, or sequenced in a specific order by a scenario MSEL script). The timing is complicated because the crew must occasionally be let off the ship (continuous days at sea, often at general quarters (GQ), erodes readiness by a period of many days to a week or two), the ship must be refueled within certain constraints (like never go below XX% fuel), and, of course, things can break badly enough to have to go into port sometimes. Some argued that the idea of “coopetition” between the US players was not credible and that in real life they would work together without regard to any personal agenda. Others scoffed at that. So it was left as another aspect of the game that was easily used, or not used, as those using the game saw fit.

This sets the context of “what’s the game the players are competing with each other in.” The above is notional to provide an example and to “be a game” needs to be fleshed out and play-tested. A draft of a notional game scenario is attached as an appendix.

The question of what information the players would have available—classified or not—to inform their game decisions is open-ended. In real life, an inexhaustible amount of information could potentially be relevant. To make that information manageable for the game, this is reduced to a deck of event cards, one or more of which is drawn each turn to build a backstory that evolves over time and against which the players can discuss what information they would want, where they would get it, and how having or not having it would affect their decision making. This event deck could be set up in advance to present the players with specific events in a predetermined order (a quick and dirty version of a master event sequence list (MESL) that is common to many more complex command-post-exercise-type events. This framework allows a small group of players to have a similar, but faster (although more abstract) experience than what they would get in a more manpower-intensive, simulation-driven command post exercise (CPX).

Other information issues discussed were the need for either cheat sheets or computer models for things like fuel consumption; mean time between failure of significant equipment; crew stamina; weapon performance; intelligence, surveillance, and reconnaissance (ISR) capabilities, etc. An interesting discussion, not unlike the adversary motivation one about how realistic the game needs to be, is how things like the above can be represented for the game to be useful? Some argued that the “more real the data are, the more trust you have in the game.” Others argued that once a sort of threshold is met, there is not a lot gained in spending the effort to drill down any further. By the end of the discussion, however, it was the group consensus that even with fairly cursory ship- and weapon-specific data, a lot could be gained from the game about the types of situations that arise and simple relationships between the operational factors of time, force, and space in the region.

That led to some discussion about analysis of the results of the game and what information needed to be collected about gameplay. The consensus was that gameplay results needed to be framed within the context of mission analysis—in other words, you need to collect data not just about gameplay, but also on all these discussions about how you tailor different aspects of
representing the overall presence mission by making different game scenario choices (such as
who the players are, their motivations, and the depth to which capabilities are represented or
events are scripted). It became clear that for a game like this that represents more of a gaming
framework, the data collection had to start well before players actually played a single turn.
Thoughts in this area included:

- How do you keep track of what goes on for analysis?
- Video and audio capture
- A function of the purpose. Supporting a CoA-generation process, an acquisition process,
or an education objective would use different means.
- Players could write down on a move sheet or using software the rationale for why they
  are doing the things they are doing.
- Ability to search the resulting database and collect metrics
- Post-game interviews, particularly with Red, to identify the “a-ha” moments where an
  opportunity was identified or a vulnerability countered
- Trade-off between stopping the game to review a key event with taking the players out
  of the flow of the game
- Scheduling on a game “battle-rhythm”

This brought home the idea of using the sort of game design methodology described above
as a general way to frame the interactive piece of a mission analysis problem. Gameplay then
helps focus follow-on analysis in two areas—insights from the play itself together with insights
into possible changes to make to the game scenario to get at different aspects of the mission
decision space. These two things combine to provide insights into what dominant strategies for
each side might be in what sorts of circumstances and assuming different theories of victory of
each side (like fully cooperative US ship COs vs COs who know that only one of them will get the
“1 of 6” fitness report (fitrep) that means an opportunity to make Flag).

The bottom line was the reality of a nonlinear cost in both time and money the further you
turned the abstraction knob toward “actual reality.”

The board and game pieces themselves provide a surrogate operational picture to show the
players what they know about what is going on in the region. For this demonstration scenario,
this is kept very minimalist. This is one of the areas where information display and automated
sense-making capabilities can enable a much more complex array of information sources to be
understandable by the player. To start with, however, the minimalist approach promotes the
players building up to what information they think they need, rather than presenting them with
every bit of information available and expecting them to make sense of it all. The actual
construction of game components was truncated due to a lack of time. Some examples of the
direction this was going in are provided below.
The map in Figure 9 was created using Visio and the freeware version of Mapcreator3 (www.primap.com).

Figure 10 is an example of an event card. Activity cards would be somewhat different. Events could include CASREP equipment, targeting info as it becomes available (if Houthis talked …), requests for forces (underway replenishment (UNREP) ship), new forces or opportunities available (for Houthis – arms deal, ship to pirate, etc.), theater security cooperation tasks, Tribal leader effects (the Houthi players given hoops to jump through like the US), general news cycle stuff that provide opportunities or restraints, and whatever else you can think of that you want the players to have to deal with.

The concept for what “happens in a game turn” is a time step game—players draw an event card to start their portion of the turn, then they can play activity cards to try to do a task. A die roll indicates how much time elapses performing the task (in days) and whether it is successful or not. Some activity cards, such as “refuel,” require being in a certain place (port or with an
UNREP ship) vice a variable amount of time. Activity cards and event cards are used to structure sequence of events:

- Time track has 30 spaces, where each circuit is a game month.
- Event markers are placed in appropriate boxes based on cyclic activities of players, play of support cards, or ??
- Time track marker advanced a number of days as indicated on each event card.
- As each event marker is passed over, it is resolved.

The player actions during a turn include:
- When do I move forces?
- Where do I try to look for enemy forces?
- When do I “turtle” my units?
- When do I play an activity or support card?
- When do I coordinate with other players (putting myself at risk)?
- When do I just go all “LEEEEEEROY JENNNNNKINS”?
## Working Group 2 Participants

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Working Group 3: Adjudication

Chair: Timothy Wilkie; Co-chair: Stephen Downes-Martin

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Executive Summary

Working Group 3: Adjudication addressed two questions:

- What are the barriers to doing the best possible job of adjudicating wargames?
- How can we best overcome those barriers?

Why adjudication matters

Wargames explore the consequences of decisions and inform the analytic agenda of the DoD. Adjudication is the game process for selecting consequences of players’ decisions that matter and support the sponsor’s objectives. Good adjudication is therefore critical for wargames to provide value to the DoD’s larger analytic and acquisition process. Wargamers and wargaming organizations need to understand barriers to good adjudication and how to overcome them. This understanding educates and trains the pool of adjudicators, thereby increasing wargaming capacity and capability.

We used a disciplined group process

The process was based on a combination of language processing with silent clustering and adapted by the chairs for use in this working group.

Summary conclusion to Question 1: Barriers

Inappropriate albeit well-meaning interference by senior leadership who are not expert wargamers combine with a lack of established and documented adjudication art and science among the wargaming CoP, resulting in games that do not achieve their objectives with the best possible quality.

Major comment: “We have seen these barriers before. Why are they still a problem?”

The shortfall in wargaming adjudication capacity and capability is the joint responsibility of the DoD (which is institutionally hostile to wargaming conferences and funding travel to games at sister organizations) and the wargaming community (which tends to focus on quantity of games rather than quality).

Summary conclusion to Question 2: Mitigations.

- DoD responsibilities for wargame capability and capacity:
  - Support professional development of skilled adjudicators by removing the barriers to conference participation and travel.
  - Put in place leadership who understand wargaming.
  - Protect the game from inappropriate interference by senior leaders.

- Wargame community responsibilities for wargame capability and capacity:
  - Develop education and training materials for adjudicators and DoD leadership.
  - Develop and document best practices.
  - Engage with gamers from other services, industry, academia, and non-DoD areas.
• Ensure the adjudication team for each game is engaged with game design from the beginning.
• Ensure stakeholders and participants are properly prepared to interact with the adjudication team.
• Ensure the adjudication team for each game is properly prepared for the game.

**Working Group 3 Questions**

• What are the barriers to doing the best possible job of adjudicating wargames?
• How can we best overcome those barriers?

**Working Group 3 Approach**

We chose working group participants who were competent and experienced wargame adjudicators by their reputations and their biographies. We split them into two parallel teams of eight people, each lead by one of the working group chairs.\(^5\) We used a disciplined group process based on a combination of language processing with silent clustering adapted by the chairs for use in this working group. The process works best with teams of six to eight people. Fewer than six results in not enough breadth or discussion, and more than eight runs into combinatorial problems and some team members not working. For a detailed explanation of the approach and its advantages over ill-disciplined approaches, see the industry and academic literature on the subject.\(^6\) Participants were asked to report using their direct adjudication experience or using direct observations. Having only experienced adjudicators ensured that the unavoidable interpretation of experience and observation was based on competency.

For the Barriers question, each team produced a paper product of the form shown in Figure 12. This is an abstraction hierarchy of barriers, types of barrier, and areas of concern. The data in each diagram (shown in Appendix A) was captured and recorded in the embedded Excel file (see below). In addition to the barriers and mitigations, comments made by the working group members during discussion that did not make it into the abstraction hierarchy were captured and recorded in the Excel file. At the top level of the abstraction hierarchy each team produced an influence diagram that showed how barriers made other barriers worse. After the MORS

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5 We had 16 slots (two taken by the co-chairs) and had to turn away several qualified applicants. We were one short due to one of our group who chose not to come without informing us.

6 See the “Language Processing Method” manual at https://goalqpc.com/?s=Language+Processing (last accessed 11/22/2016) for information on this method. We selected these methods as their results have long been proven to be superior to those obtained from ill-disciplined methods such as brainstorming or bogsats; see for example “The Illusion of Group Productivity: A Reduction of Failures Explanation,” Barnard Nijstad, Wolfgang Stroebe, and Hein Lodesijkx, *European Journal of Social Psychology*, Vol 36, 31–48 (2006). For a general overview of how brainstorming has long been debunked see, “Groupthink: The Brainstorming Myth,” Jonah Lehrer, *The New Yorker*, January 20, 2012, online at http://www.newyorker.com/magazine/2012/01/30/groupthink (last accessed 11/22/2016) and references contained therein.
Special Meeting ended, the two teams’ influence diagrams and abstraction hierarchies were examined and an integrated influence diagram was created, as shown in Figure 2.

When answering the second question dealing with mitigations, both teams generated mitigations to the barriers they had respectively identified, and linked each mitigation to the type of barriers they addressed (i.e., one level up the abstraction hierarchy). One team (team A) clustered their mitigations into lines of effort, and also assessed how important the barriers are and how hard it would be to implement the mitigations (ranked “a,” “b,” etc., with “a” highest). The other team (team B) identified critical mitigations and generated pros and cons for their implementation.

The working group was over-ambitious in allocating only four hours to each question, and question 2 (mitigations) requires significantly more work.

After the special meeting was over, each item collected during the working group sessions was further refined by Stephen Downes-Martin to identify and combine duplicates (even though worded differently) and reword items into the present tense (most participants worded their observations in the past tense). Some submissions contained several observations, and these were split into their spate components. The working file containing the exact original wording, and the mapping to the refined product is available on request to working group members only. Every item has a reference index ID number and this ID is attached to each item in the diagrams that follow.

Figure 12. Abstraction hierarchy product: Format and legend.

An integral part of this report is the embedded Excel file that contains all barriers, types, areas of concern, and additional notes, each of which has a unique reference ID. This ID is used whenever an item is mentioned in the following part of this report.
INTEGRATED BARRIER INFLUENCE DIAGRAM

It is clear from the barrier influence diagram that there are two main drivers to what it is that interferes with doing the best possible job of adjudicating: the immature state of the art and science of adjudication (at least as documented and instantiated in the adjudication community writ large) and adverse outside influences (from senior stakeholders such as the sponsor, players, and wargame organization and their respective chains of command). These combine to put at risk the game’s ability to meet the sponsor’s objectives for the game. Responsibility for this lies on both the adjudication (or larger wargaming) community and on the DoD. It is pointless for either side to deny its culpability; doing so will simply ensure that the current situation continues, and that the capacity, capability, and innovation of wargaming fails to come up to the levels desired by senior leadership.

As one of the working group participants asked, “We have seen these barriers before. Why are they still a problem?” A possible answer to that was provided for the special case of adjudicating discovery games that deal with novel situation at the operational/strategic levels. The diagram from that paper is provided in Figure 14 for comparison purposes.
Figure 14. Adjudicating discovery wargames.7

Way Ahead

This is a complicated problem with many interacting barriers to good adjudication, and there is no short list of silver bullets that overcome all the barriers. But we have identified a structured hierarchy of barriers and an initial list of mitigations mapped onto these barriers. In addition, we have a documented structured approach to adjudicating games that deal with novel operational/strategic situations.

Summary Conclusion to Question 1: Barriers

Inappropriate albeit well-meaning interference by senior leadership who are not expert wargamers combine with a lack of established and documented adjudication art and science among the wargaming community of practice resulting in games that do not achieve their objectives with the best possible quality.

Summary Conclusion to Question 2: Mitigations.

- **DoD responsibilities for wargame capability and capacity:**
  - Support professional development of skilled adjudicators by removing the barriers to conference participation and travel.
  - Put in place leadership who understand wargaming.
  - Protect the game from inappropriate interference by senior leaders.

- **Wargame community responsibilities for wargame capability and capacity:**
  - Develop education and training materials for adjudicators and DoD leadership.
  - Develop and document best practices.
  - Engage with gamers from other services, industry, academia and non-DoD areas.
  - Ensure the adjudication team for each game is engaged with game design from the beginning.
  - Ensure stakeholders and participants are properly prepared to interact with the adjudication team.
  - Ensure the adjudication team for each game is properly prepared for the game.

Major Comment: “We have seen these barriers before. Why are they still a problem?”

The shortfall in wargaming adjudication capacity and capability is the joint responsibility of the DoD (which is institutionally hostile to wargaming conferences and funding travel to games at sister organizations) and the wargaming community (which tends to focus on quantity of games rather than quality).
**Recommendations**

- The wargaming community and senior leadership get together and address the institutional barriers thrown up by DoD to the professional development of the wargaming community.
- The wargaming community’s chains of command provide time and resources for adjudication and wargaming professional development.
- The wargaming community develop and document educational and training materials, including an adjudication bibliography.
- The wargaming community and senior leadership systematically identify which barriers and their possible mitigations are relevant to the unique circumstances of each organization that sponsors or does wargaming and applies the mitigations to the barriers.
- The wargaming community continues a rigorous and disciplined continuation of this workshop’s results, both in their own organizations and together at workshops and conferences.
- MORS sets up and maintains websites that support each working group to maintain momentum.

**APPENDIX A: BARRIER WALL CHART COMPONENTS**

![Barrier Wall Chart](image-url)
Team A

Poor adjudication design (178)

- Adjudication process missing key elements or not followed (161)
- Adjudicators do not review the key factors behind their decisions and thus do not account for those factors in the next turn (9)
- Adjudicators do not maintain consistency between moves due to uncertainty in predicting the effects of future capabilities in future conflicts (10)
- End game adjudication and post-game results are damaged by poor data capture, communication and coordination (152)
- Adjudicators generate different perceived narratives in the minds of different players (12)
- Adjudicators do not record their decisions and the reasons behind their decisions (11)

Adjudicators are not effectively trained in the adjudication process (8)
Team A

Poor in-game communication (179)

- There is a failure of communication equipment or procedures (153)
- Decisions by distributed adjudicators is degraded by technical connectivity failings that interfere with discussions between the adjudicators (14)
- Adjudicators do not confirm the players receive and understand the adjudication decisions (15)

Adjudication guidelines or results are communicated poorly (154)

- Adjudicators do not confirm the players receive and understand the adjudication decisions (15)
- The players do not have a proper understanding of the roles and responsibilities of the adjudicators and players within the adjudication process (15)

Team A

Adverse outside influence (180)

- There is improper command influence on objectives and process (155)
- Sponsor changes the objectives mid-game creating inconsistency between adjudication before and after those changes (155)
- High ranking game cell leads order the cell to make no game decision that threaten a preferred outcome and to only make decisions that support the preferred outcome even if such decisions make no tactical or operational sense (20)
- Wargame director’s chain of command changes objectives mid-game creating sufficient inconsistency between adjudication before and after those changes that the game objectives are not fully met (21)

Game is hijacked by outside agendas (156)

- Senior players use their positional authority to interfere inappropriately with adjudication (22)
- Adjudicators do not deal with ingrained tribal friction between groups or services (23)
- Adjudicators do not establish and maintain their credibility and authority in the eyes of the players (24)
Team A

Inappropriate application of adjudication tools (181)
- Inappropriate mathematics is used to support adjudication (158)
  - Adjudicators use methods, tools and approaches which are meaningless (27)
  - Adjudicators do not appropriately use “roll of the die” or other random number generator (29)
  - Adjudicators do not articulate the relationship between judgment and chance (29)
- Adjudication design and performance is poor (159)
  - Adjudicators accept without challenge player inputs that are insufficiently detailed (30)
  - Adjudicators do not maintain consistency between moves due to uncertainty in predicting the effects of future capabilities in future conflicts (10)
- The adjudication briefing to players at the end of a move does not contain all the required information (32)

Players ignore or change required inputs to the adjudication process because of overly burdensome move input sheets and planning tools (26)

Team A

Loss of game control (182)
- Adjudicators lose control of the adjudication process (181)
  - Adjudicators allow SMEs and players to interfere inappropriately with adjudication (28)
  - Adjudicators accept overly generous assessments by SME advisors of future capabilities being played (38)
  - Adjudicators do not adequately take account of bias (positive and negative) of SME advisor inputs into the adjudication decisions (34)
- Cell discussion is disproportionately dominated by a small number of players (33)
Team B

The art of adjudication is immature (185)

- There is a lack of literature on effective wargame adjudication (49)
- The adjudication process does not use the most appropriate combination of adjudication techniques (50)
- There are no metrics to measure how well a game is adjudicated (51)

Players provide insufficient or inadequate input to adjudicators (64)

Adverse influences on adjudication (186)

- Negative influences arise during game play (169)
- Adjudicators do not deal with players who game the game by cheating or manipulating the adjudicators or control (53)
- Players complain about adjudication decisions (54)

Adjudication is not safeguarded from negative influences (170)

- Players attempt to influence adjudication decisions (55)
- Non-player participants attempt to influence adjudication decisions (56)
- Players and observers attempt to drive the adjudication to a pre-conceived or self-serving outcome by injecting bias in the adjudication (57)

The adjudication process is driven by biases and organizational interests instead of objective evaluation (52)
Inadequacy of adjudication process results in game failing to meet objectives (187)

**Team B**

- Adjudication is done poorly during game play (171)
- The overall sequence of adjudication decisions do not support the game objectives (1)
- Adjudicators do not account for conditional statements when unclear how far a move will go in time (58)
- Adjudicators do not have enough time to properly adjudicate and report outcomes (59)

- Adjudicators did not properly communicate with players (172)
- The players do not have a proper understanding of the roles and responsibilities of the adjudicators and players within the adjudication process (16)
- Adjudicators do not properly tailor their feedback to each of the player cells (62)
- Adjudicators do not provide a consistent or relevant picture of the game world (63)
APPENDIX B: INTEGRATED INFLUENCE DIAGRAM

Influence Diagram

APPENDIX C: TEAM A MITIGATION

Lines of Effort

➢ Enduring procedures and effective management:
  • Create checklist of common failures.
  • Include advance backup plans in case of failure.

➢ Recruitment and orientation of senior leadership:
  • Recruit and orient stakeholders and key observers.
  • Begin work early to identify and vet potential adjudicators.
  • Communicate with game leadership to ensure they agree with adjudicator selection.
  • Conduct early and frequent engagement with game sponsors to drill down and agree on key game objectives.
Planning and development of the game:

- Pre-game identify candidate injects that will keep game on track to meet objectives.
- During wargame planning create detailed data capture plan.
- Ensure data capture personnel understand responsibilities and process.
- Validate adjudication design and conduct adjudication rehearsals.
- Pre-game complete and test adjudicator communications and written guidance.

Develop long term adjudicator capability and capacity:

- Develop pool of adjudicators: 1. Identify talent; 2. Identify skills; 3. Provide opportunities to develop adjudicators; 4. Review and refine skills; 5. Widen experience; 6. Assist adjudicators.
- Develop or identify training games for adjudicators: 1. Identify games with key skill requirements; 2. Playtest and record insights and skillsets.

Pre-game training and game testing:

- Pre-game provide adjudicators with capability descriptions and reference material relevant to the game.
- Acclimate adjudicators to game process and expectations by pre-game adjudication training sessions.

Leading the game:

- Wargame chain of command is willing and able to counter inappropriate influence on game process.
- Leadership provides sufficient time and resources to develop adjudication design.
## Priority and Difficulty

| Mitigation Actions                                                                 | a   | b   | c   | d   | e   | f   | g   | h   | i   | j   | k   | l   | m   | n   | o   | p   | q   | r   | s   | t   | u   | v   | w   | x   | y   | z   | Type_ID |
|----------------------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Create checklist of common failures                                           | ✓   | ✓   | ✓   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 147 |
| Include advance backup plans in case of failure                                | ✓   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Recruit and orient stakeholders and key observers                              |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | ✓   |
| Begin work early to identify and vet potential adjudicators                     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Communicate with game leadership to ensure they agree with adjudicator selection |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | ✓   |
| Conduct early and frequent engagement with game sponsors to drill down and agree on key game objectives |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | ✓   |
| Pre-game identify candidate injects that will keep game on track to meet objectives |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | ✓   |
| During wargame planning create detailed data capture plan                       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Ensure data capture personnel understand responsibilities and process           |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | ✓   |
| Validate adjudication design and conduct adjudication rehearsal                  |     | ✓   | ✓   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Pre-game complete and test adjudicator communications and written guidance       |     | ✓   | ✓   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Develop pool of adjudicators: 1. Identify talent; 2. Identify skills; 3. Provide opportunities to develop adjudicators; 4. Review and refine skills; 5. Widen experience; 6. Assist adjudicators |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | ✓   |
| Develop or identify training games for adjudicators: 1. Identify games with key skill requirements; 2. Playtest and record insights and skillsets |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | ✓   |
| Pre-game provide adjudicators with capability descriptions and reference material relevant to the game |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Accclimate adjudicator to game process and expectations by pre-game adjudication training sessions |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | ✓   |
| Wargame chain of command willing and able to counter inappropriate influence on game process |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | ✓   |
| Leadership provides sufficient time and resources to develop adjudication design |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
# APPENDIX D: TEAM B MITIGATIONS

## Mapping to Barriers

<table>
<thead>
<tr>
<th>Mitigation Actions</th>
<th>Type_ID</th>
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<tbody>
<tr>
<td>When developing an adjudication plan, identify and determine a communication plan for all stakeholders.</td>
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<td>Formalization of a professional wargaming organization (standards of practice, advocacy, ethics, professional development)</td>
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<td>Develop an adjudicators toolkit and train adjudicators to use it appropriately.</td>
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<td>Common adjudication repository of techniques, methods, examples</td>
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<td>Include standards of conduct ingame rules &amp; procedures for participants</td>
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<td>Establish formalized standardized training for adjudication best practices and procedures</td>
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<td>Develop game specific adjudication instruction guide to support game adjudication team training</td>
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<td>Data capture plan must explicitly incorporate adjudication rulings and associated decision making process</td>
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<td>Extensive as possible play testing and pre-game drill of adjudication cell and its supporting tools</td>
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<td>Ensure isolation of adjudication team from observers &amp; stakeholders</td>
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<td>Make lead adjudicator part of the game design team</td>
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<td>Synchronize facilitator priorities with needs of adjudication cell, and prep player teams properly to ensure player teams provide needed information and level of detail to support efficient adjudication</td>
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<td>Include trusted agents from blue and red during adjudication to account for all decisions and intent</td>
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<td>Identify player types and adjust game management to account for them</td>
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<td>Adjudication process needs to be transparent to players and no misleading information allowed</td>
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<td>Adjudication team leader monitor players and their inputs for organizational biases and intimidation of adjudicators</td>
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<td>Assemble adjudication cell with a mix of proficient quantitative assessors &amp; a suitable mix of experienced warfare operators, policy and foreign service SMEs</td>
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<td>Adjudication team leaders during game development must identify adjudication process, data collection process, data to be collected, models &amp; methods</td>
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<td>Focus organizational and personal attention and effort towards developing best practices, case studies, and learning resources specifically focused on adjudication</td>
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<td>Announce a call for papers on effective adjudication</td>
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<td>When developing an adjudication plan, identify and determine a communication plan for all stakeholders</td>
<td>Establishes common ground among community. Provides points of entry.</td>
<td>Establishes an already small community.</td>
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<tr>
<td>Formalization of a professional wargaming organization standards, practice, policy, ethics, professionalism</td>
<td>Establishes common ground among community. Provides points of entry.</td>
<td>Establishes an already small community.</td>
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<td>Common adjudication repository of techniques, methods, examples</td>
<td>Increase access to relevant literature.</td>
<td>Duplication of effort. Current repository does not solve this problem. Quality control. Access requirements.</td>
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<td>Conduct training during wargame execution for future adjudicators</td>
<td>Captive audience. Builds cadre.</td>
<td>Training could get in the way of the game. Resources.</td>
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<td>Include standards of conduct in game rules &amp; procedures for participants</td>
<td>Establishes a code of conduct. Provides outlet for players to vent.</td>
<td>Might stifle creativity. Might not solve problem.</td>
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<td>Extension of formalized standardized training for adjudication best practices and procedures</td>
<td>Broad applicability.</td>
<td>Too immature to develop generalized best practices.</td>
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<td>Create standardized practices &amp; procedures for development of adjudication plans</td>
<td>Provides starting point. Provides a proven practices guide. Helps integration into game design. Establishes and increases body of knowledge about adjudication planning. Heightens awareness of adjudication issues. Enhanced collaboration.</td>
<td>One size does not fit all.</td>
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<tr>
<td>Develop specific adjudication instruction guide to support game adjudication training team</td>
<td>Early awareness. Buy-in minimizes bias. Coupled to adjudication plan.</td>
<td>Time required. One shot.</td>
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<tr>
<td>Data capture plan must explicitly incorporate adjudication rulings and associated decision making. Extensive as possible play testing and pre-game drill of adjudication cell and its supporting tools</td>
<td>Allows for professional judgement in specific situations. Provides documentation for analysis. Reduces friction points. Identifies potential problems.</td>
<td>Having to explain every adjudication is unnecessary overhead. Add complexity. Does not use actual team resources.</td>
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<tr>
<td>Ensure isolation of adjudication team from observers &amp; stakeholders</td>
<td>Reduce adverse impact and bias with adjudication.</td>
<td>Might miss relevant information or context.</td>
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<tr>
<td>Make lead adjudicator part of the game design team</td>
<td>Adjudication plan, tools and process integrated into game development.</td>
<td>Availability of adjudication.</td>
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<table>
<thead>
<tr>
<th>Mitigation Actions</th>
<th>Pros</th>
<th>Cons</th>
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<tbody>
<tr>
<td>Synchronize facilitator priorities with needs of adjudication cell, and prep player teams properly to ensure player teams provide needed information and include trusted agents from blue and red during adjudication to account for all decisions and intent</td>
<td>Will increase likelihood of getting appropriate inputs.</td>
<td>Player buy-in. Assists adjudication in ambiguous situations. Might create bias. Game specific.</td>
</tr>
<tr>
<td>Identify player types and adjust game management to account for them</td>
<td>Adjudication can identify potential rogue players.</td>
<td>Don’t want to change the gameplay to match the player, dirty game to meet objectives.</td>
</tr>
<tr>
<td>Adjudication process needs to be transparent to players and no misleading information allowed</td>
<td>Buy-in keeps adjudication honest. Avoid black box.</td>
<td>Game objectives might require deception. Greater opportunity for argument.</td>
</tr>
<tr>
<td>Adjudication team leaders monitor players and their inputs for organizational biases and intimidation of assembled adjudication cell with a mix of proficient quantitative assessors &amp; a suite of experienced warfare operators, policy and foreign service SMEs</td>
<td>Adjudicator lead is in best position to identify adverse impacts.</td>
<td>Opportunity to introduce bias and preconception. Adjudicator lead is busy. Hard to do. Out of our control.</td>
</tr>
<tr>
<td>Adjudication team leaders during game development must identify adjudication process, data collection process, data to be collected, models &amp; methods</td>
<td>Right people with right skills.</td>
<td>Adjudication tools, plans and process integrated into game development.</td>
</tr>
<tr>
<td>Focus organizational and personal attention and effort towards developing best practices, case studies, and learning resources specifically focused on adjudication</td>
<td>Adjudication tools, plans and process integrated into game development.</td>
<td>Introduces competition between adjudicator and analyst. Getting into the role of the analyst.</td>
</tr>
<tr>
<td>Validate adjudication process prior to execution</td>
<td>Building the body of knowledge. Early preparation and awareness. Identify gaps in adjudication process.</td>
<td>Time.</td>
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</tbody>
</table>

**APPENDIX E: ADDITIONAL COMMENTS**

<table>
<thead>
<tr>
<th>ID</th>
<th>Additional Notes</th>
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</thead>
<tbody>
<tr>
<td>64</td>
<td>Players provide inadequate input to adjudicators.</td>
</tr>
<tr>
<td>67</td>
<td>Players try to push adjudicators into making decisions that support the player’s agenda or that of the player’s community.</td>
</tr>
<tr>
<td>68</td>
<td>Not enough time is allocated to develop the problem being wargamed.</td>
</tr>
<tr>
<td>69</td>
<td>Adjudicators do not properly design the adjudication process to achieve the game objectives.</td>
</tr>
<tr>
<td>70</td>
<td>Adjudication cell capacity is insufficient</td>
</tr>
<tr>
<td>72</td>
<td>Player input and adjudication support tools are not properly tailored to the wargame.</td>
</tr>
<tr>
<td>74</td>
<td>Sponsor intimidates the adjudication team in an attempt to influence the adjudication process and decisions.</td>
</tr>
<tr>
<td>75</td>
<td>Senior players with higher rank than the adjudicators intimidate the adjudication team in an attempt to influence the adjudication process and decisions.</td>
</tr>
<tr>
<td>76</td>
<td>Adjudicators have problems dealing with senior players whose rank is much higher than their own when the player disagrees with the adjudication.</td>
</tr>
<tr>
<td>77</td>
<td>Adjudicators have problems dealing with sponsors whose rank is much higher than their own but who are not wargaming experts.</td>
</tr>
<tr>
<td>78</td>
<td>Nonplaying participants become emotionally involved and start engaging in the player decision process.</td>
</tr>
<tr>
<td>79</td>
<td>Adjudicators do not deal effectively with players who argued with them over the adjudication decisions or process.</td>
</tr>
<tr>
<td>80</td>
<td>There are not enough ethnographers allocated to each game cell.</td>
</tr>
<tr>
<td>81</td>
<td>Ethnographers are not properly trained or not knowledgeable enough about the context of the wargame to properly capture the cell discussions.</td>
</tr>
<tr>
<td>83</td>
<td>Adjudicators do not understand how data capture effects the players’ decisions nor how to take this into account.</td>
</tr>
<tr>
<td>85</td>
<td>The adjudication process does not identify or take into account the biases present in the adjudication team.</td>
</tr>
<tr>
<td>86</td>
<td>There is not enough time to properly playtest the adjudication process.</td>
</tr>
<tr>
<td>87</td>
<td>Adjudicators are ordered to use a rigid adjudication process for a game that includes novel concepts and capabilities that required judgement based adjudication.</td>
</tr>
<tr>
<td>89</td>
<td>Players who are domain experts challenge adjudication decisions.</td>
</tr>
<tr>
<td>91</td>
<td>Players have not been properly briefed about game objectives and mechanics.</td>
</tr>
<tr>
<td>92</td>
<td>The Red cell has young aggressive junior officers whose decisions are more aimed at beating up on senior officers in Blue than playing to win.</td>
</tr>
<tr>
<td>93</td>
<td>The Red cell does not play to win to avoid humiliating senior officers in the Blue cell or to support a preferred service or community position.</td>
</tr>
<tr>
<td>95</td>
<td>The game flow communications plan does not properly support the discovery and transmission of new information between players and adjudicators.</td>
</tr>
<tr>
<td>96</td>
<td>Pretending that poor game technology is “fog of war” or “cyber action” instead of admitting the truth and dealing with it.</td>
</tr>
<tr>
<td>97</td>
<td>The adjudication plan does not identify in advance what aspects of possible situations and adjudication decisions should be captured.</td>
</tr>
<tr>
<td>98</td>
<td>Adjudication is not integrated with game design.</td>
</tr>
<tr>
<td>99</td>
<td>Buy-in from senior players is not obtained before game start.</td>
</tr>
<tr>
<td>100</td>
<td>Expectations of players are not effectively managed.</td>
</tr>
<tr>
<td>101</td>
<td>Players lose confidence in the honesty of the adjudication and play cynically.</td>
</tr>
<tr>
<td>103</td>
<td>Rotation frequency of military staff on adjudication teams is too fast to develop adjudication experience and competency.</td>
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<td>Page</td>
<td>Text</td>
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<td>------</td>
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<tr>
<td>105</td>
<td>The credibility of the adjudicators and the overall event is destroyed by leadership who call an event a wargame when it is not.</td>
</tr>
<tr>
<td>106</td>
<td>There is no direct subject matter expertise available for adjudicating situations for which we have little or no experience or real-word data.</td>
</tr>
<tr>
<td>107</td>
<td>Not enough time is allocated to collecting and recording adjudication decisions and their justifications for those decisions.</td>
</tr>
<tr>
<td>108</td>
<td>Players find and exploit loopholes in the game design.</td>
</tr>
<tr>
<td>109</td>
<td>Players flood the adjudication cell with RFIs.</td>
</tr>
<tr>
<td>110</td>
<td>Senior and experienced SMEs on the adjudication team use their real-world knowledge to drive adjudication to support their objectives instead of the game objectives.</td>
</tr>
<tr>
<td>111</td>
<td>People are on the adjudication team because of their subject matter expertise but do not have required wargame adjudication knowledge or skill.</td>
</tr>
<tr>
<td>112</td>
<td>Senior leadership demands fast low-quality results and loses interest and focus on developing wargaming capability and capacity.</td>
</tr>
<tr>
<td>113</td>
<td>DoD still hostile to conferences (including wargaming conferences), which is where the most effective professional learning (not training) about wargaming and adjudication occurs and is shared.</td>
</tr>
<tr>
<td>115</td>
<td>Adjudicators are not incorporated into post-game analysis.</td>
</tr>
<tr>
<td>116</td>
<td>Senior leaders rotate too frequently to become wargame SMEs but still interfere with adjudication planning and execution.</td>
</tr>
<tr>
<td>117</td>
<td>Leaders whose only expertise is the word “wargame” in their job title interfere with adjudication planning and execution.</td>
</tr>
<tr>
<td>120</td>
<td>OPTEMPO of wargame organizations does not leave enough time to provide good education and training of adjudicators.</td>
</tr>
<tr>
<td>121</td>
<td>Organizations’ ability to widen their adjudication experience and knowledge is hobbled by travel restrictions to participate in each others’ games.</td>
</tr>
<tr>
<td>122</td>
<td>The DoD wargaming community including adjudicators is highly homogenous and resistant to external ideas.</td>
</tr>
<tr>
<td>124</td>
<td>There is a lack of knowledge about adjudication tactics, techniques, and procedures (TTPs).</td>
</tr>
<tr>
<td>125</td>
<td>Adjudicators do not provide a post-game analysis and report on how well the game was adjudicated and on adjudication problems and failures.</td>
</tr>
<tr>
<td>126</td>
<td>Wargamers’ supervisors and senior decision makers have little time to become knowledgeable about wargaming and adjudication processes.</td>
</tr>
<tr>
<td>127</td>
<td>DoD wargaming community is insular and does not look outside itself, for example to the commercial gaming community or academia, for adjudication knowledge, ideas, and techniques.</td>
</tr>
<tr>
<td>129</td>
<td>Adjudicators do not drive the different narratives that develop during a game to a conclusion that supports the objectives.</td>
</tr>
<tr>
<td>130</td>
<td>The skill, expertise, and capacity of the adjudication team for successful real-time adjudication is not present.</td>
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<tr>
<td>131</td>
<td>Players make decisions that would bring the game to a nonuseful early conclusion.</td>
</tr>
<tr>
<td>132</td>
<td>The advanced skill, expertise, and experience necessary to adjudicate a game involving deception and different INTEL pictures is not present.</td>
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<tr>
<td>133</td>
<td>Adjudication plan has not properly taken into account the need to make decisions about who gets what information from ISR and other intelligence streams.</td>
</tr>
<tr>
<td>134</td>
<td>Players do not understand the difference between game positions and real-world positions.</td>
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<tr>
<td>139</td>
<td>Adjudication does not incorporate all the aspects of the situation required by the game design and its objectives (for example attrition, expenditures, logistics, etc.).</td>
</tr>
<tr>
<td>140</td>
<td>The adjudication cell includes unnecessary people for bureaucratic reasons.</td>
</tr>
<tr>
<td>142</td>
<td>The adjudication process for the game is not documented or formalized and becomes ad hoc.</td>
</tr>
<tr>
<td>143</td>
<td>Adjudicators make poorly considered decisions when engaging one-on-one with players.</td>
</tr>
<tr>
<td>144</td>
<td>Adjudicators lose track of the state of the game, where everyone is, and what is happening.</td>
</tr>
<tr>
<td>145</td>
<td>Adjudication plan does not correctly match the required adjudication team size and skills to the workload generated by the level of free play.</td>
</tr>
<tr>
<td>146</td>
<td>Adjudication plan does not correctly match the required adjudication team size and skills to the workload generated by the adjudication frequency.</td>
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Project Cassandra Report

MORS Wargaming Special Meeting, October 2016
Dr. Yuna Wong, RAND Corporation
CDR Phil Pournelle, OSD Office of Net Assessment

OVERVIEW

Project Cassandra was one of three wargame tracks conducted during the MORS Wargaming Special Meeting in October 2016. Meant to be one of the “learning by doing” sessions, Project Cassandra attempted to give participants an introduction to a number of approaches that eventually culminated in a wargame. In doing so, it touched on scenario development, liberating structures, structured analytic techniques, narrative analysis, and matrix gaming.

One defining characteristic of the Project Cassandra methodology is the extent to which the process attempts to give participants ownership of the results through their active participation. Project Cassandra is meant to be a concentrated, quick effort as well, though it can be expanded to accommodate greater research, analysis, and formal expertise.

METHODS BACKGROUND

Project Cassandra draws upon several methodological areas, some not traditionally combined with wargaming within DoD circles. These areas are: 1) scenario development, 2) red teaming methods such as liberating structures, 3) SATs from intelligence analysis, 4) narrative analysis, and 5) matrix gaming. In terms of drawing from previous efforts to combine multiple methods with wargaming, it drew on previous work by Pournelle and Wong, including previous presentations in 2015 to MORSS and the MORS Wargaming CoP on structured discussions, a previous iteration of Project Cassandra at the 2016 Connections Wargaming Conference at Maxwell AFB, and the Joint Irregular Warfare Analytic Baseline (JIWAB) study from 2010–2013.8

Scenario development used and referenced in Project Cassandra drew from previous work on the use of scenarios in corporate and in defense planning.9 There exists an extensive literature on scenario development and scenario use to draw from and to better incorporate into wargaming, both in the development of scenarios for wargaming and the use of wargaming to develop scenarios. The literature on addressing counterfactuals when thinking about the


future is also relevant and one that could also be readily folded into to improve scenario design and development within the context of wargaming.\textsuperscript{10}

Two other sets of related and overlapping methods, red teaming and SATs, are also covered within Project Cassandra. The Command Red Teaming panel in front of the workshop plenary introduced red teaming as practiced by the University of Foreign Military and Cultural Studies (UFMCS),\textsuperscript{11} and SATs as taught at the CIA Sherman Kent School.\textsuperscript{12} Red teaming and SATs were also taught as separate mini-courses by instructors from UFMCS and the Kent School in concurrent sessions during the workshop. However, the Project Cassandra session combined basic elements of both into constructing a wargame. Problem-structuring methods and judgment-based methods, largely from nontraditional British operational research and NATO operational analysis, are also adjacent sets of methods often used for complex problems, but are more involved and outside the scope of what was available in the 16 hours available to run Project Cassandra.\textsuperscript{13}

Liberating structures, one subset of group methods taught by Army red teaming, are approaches meant to create more productive group work than traditional microstructures such as presentations, status reports, managed discussion, or open discussion.\textsuperscript{14} Within the context of red teaming, the use of liberating structures and other techniques is meant to break up hierarchy, allow for wider consideration of ideas, and avoid groupthink. The focus on red teaming arose because of internal urgency within the military planning community after the perceived failure to plan for post-invasion Iraq. SATs, developed over several years within the intelligence community, received renewed focus after the twin intelligence failures of 9/11 and Iraq weapons of mass destruction. The purpose of SATs is to allow analysts to better lay out and question their own assumptions and analyses. SATs cover methods than may be applied either by individual analysts or by teams, but have a similar intent as Army red teaming methods to improve assumptions and to broaden the scope of ideas considered.


Project Cassandra also applied actant analysis, one form of structured narrative analysis previously applied to wargaming by George Mason University and Marine Corps analysts.\textsuperscript{15} Although actant analysis has been used to analyze narrative in wargaming, this was the first use of it as a method to build out wargame actors and to shift players into first person, narrative roles ahead of a wargame.

Finally, the wargaming technique used in Project Cassandra was matrix gaming. Matrix gaming has found wide application in allied and US defense circles in recent years, including by defense ministries in Australia, Canada, and the UK; and has been used by US wargaming organizations such as US Army War College and FFRDCs such as CNA and the RAND Corporation. Developed first by social worker Chris Engle, matrix gaming is a lightweight and flexible adjudication mechanism that is applicable to any number of topics.\textsuperscript{16} A separate wargame session, run by Maj Tom Mouat of the UK Defence Academy, was also run during the MORS wargaming workshop.

**Session and Results**

Project Cassandra ran for four four-hour sessions. Session 1, held on the afternoon of Tuesday, October 18, included an overview, introductions between participants, and a brief discussion of the readings on teams. Readings covered how some teams within Google outperformed others, and what made for good and bad wargaming teams within the US intelligence community. Discussion also covered the microstructures and design elements behind liberating structures, and participants used liberating structures such as 1-2-4-All, impromptu networking, and nine whys to introduce themselves and the reason they were attending the workshop.

Session 2, held on the morning of Wednesday, October 19, began with a presentation of the 2015 ONA summer study, “Reconsidering Resources.” The study questioned commonly held views that future conflict will be driven by resource scarcity, and presented a number of results showing evidence of resource abundance and dematerialization in key sectors. This offered a segue into a brief discussion on a SAT known as key assumptions check, and an introduction to the CIA tradecraft primer on SATs. The group also used another common SAT, structured brainstorming, to generate ideas on the national security implications of the ONA summer study. Breaking up into four groups, participants did three rounds of brainstorming on Post-It notes (divergent thinking) and generated 115 ideas before starting to group individual ideas into categories (convergent thinking). Voting then produced one main idea that participants wanted to take to the next stage of Project Cassandra: information vulnerability and spoofing.


Session 3 on Wednesday afternoon was scheduled to cover scenario development. Time constraints led to less discussion than planned on many of the concepts behind the organizational use of scenarios. Instead, the group went into the use of the liberating structure “critical uncertainties,” an approach that is the same as the SAT alternative futures analysis. The group first identified 12 critical uncertainties that would affect information vulnerability and spoofing in the future. The top two uncertainties that the group voted on were information access (either open or closed), and the nature of the enemy (known or unknown). Crossing these two axes produced four future scenarios. Participants then split up into four groups, each taking one future scenario, and added details and assumptions. The group chose one of the four to wargame: “Cyber Mercenaries,” where there is open access to information, but the enemy is unknown.

The group again brainstormed to generate the potential actors in this space, and converged on five: 1) the US and UK governments, 2) the future Chinese government after a transition to democracy (but still hostile to the US), 3) US banks, 4) hackers for hire (hackers who worked for a government and now seeking employment), and 5) an unknown actor (later to be discovered to be an anarchistic movement). The session ended with participants split into actor teams, and generating their actors’ narratives using actant analysis worksheets. Each team had to write out their actors’ objectives, means, helpers, blockers, sender (entity or conditions that provide the background rules and values), and receiver (entity or conditions where the rules or values are manifest). The intent was for participants themselves to generate the actors, goals, and conflicting viewpoints that they would then wargame.

Session 4 on Thursday morning was the matrix game, using the actors generated the previous day. Participants used the “pros and cons” system of matrix adjudication and played two rounds. Under this adjudication system, for their turn, each team had to specify an action that they were taking and list the reasons why they would be successful. Other teams then weighed in with reasons the team would or would not be successful in their action, and results were adjudicated by die roll, modified by the arguments for or against probable success. Teams were given different levels of resources (cyber, cash, or personnel) according to their relative advantages, and turn order was determined as teams volunteered to take their turn. The session ended with a brief game hotwash, and feedback from participants about the Cassandra process.

**PARTICIPANT FEEDBACK**

Participants were mostly new to wargaming and the other methods and approaches used in Project Cassandra. Many identified the need to gain more knowledge about wargaming as their motivation for attending the workshop. Participant therefore had little other wargaming experience against which they could compare the Project Cassandra approach; however, overall feedback was important and helpful, and point the way for many further improvements that are possible for Project Cassandra.

On the question of whether participants got what they were hoping for out of the wargame session, feedback was that Project Cassandra offered good exposure to the entire process of
building a wargame. Participants also commented that they felt the methods were good collaborative techniques, and one person indicated that they were “pleasantly surprised” by the different methods. This met one of the objectives of Project Cassandra, which was to expose participants with structured group methods and an adjudicated wargame, so that they would be less likely to satisfied when encountering unstructured discussions being passed off as wargames. Participants genuinely appeared to enjoy many of the different methods. For example, even after time was over for people to introduce themselves through the nine whys, pairs introduced to each other for the first time through the exercise would continue their discussions during breaks. When given an actant analysis worksheet to fill out, another participant exclaimed, “Fascinating!” Another commented that the packet prepared for the group was handy.

Participants were also explicitly asked to generate and present ideas on how Project Cassandra could be improved. This was intended not only to provide the co-chairs with genuine suggestions for improvements, but also to encourage the participants to begin to see themselves as users and designers of methods. Participants offered a number of important comments. One was that there needed to be clearly explicit guidance on what they were doing during the course of Project Cassandra and why, and better framing of new tasks. Some planned discussions about methods and approaches were cut during the course of the session to allow for more active participant time, but this pointed out the need (in an event intended for people to “learn by doing”) to better explain what it was that people were supposed to be learning and what it was they were supposed to be doing. Similar comments were that the connections between the process was “clunky,” with it being unclear how the pieces fit together and what it was exactly that participants had accomplished. A clear theme was the need for better transitions between individual parts of Project Cassandra. Individual pieces, such as the first brainstorming session, were also critiqued.

Another key piece of feedback was that explicit guidance was desired for when participants started designing a wargame, again because of the newness of many of the members to wargaming in general. This raised an important question because Project Cassandra is not the typical way wargames are designed (generally not by committee). One participant asked about Peter Perla’s suggested process for wargame design, and how Project Cassandra mapped against that. Other good issues raised by the group were whether the resulting game had in fact addressed the national security topic of information security and spoofing; whether the end results had strayed too far from the overall topic of resource abundance; that players in the matrix game seemed to be playing current day rather than extending mindsets into the future; and how analysis could be done to determine whether overall objectives were met.

CONCLUSIONS AND RECOMMENDATIONS

Project Cassandra is an approach intended to use multiple structured methods to guide a group through building their own terms of reference for a matrix wargame. Additional explicit explanation of the process’s organization, inputs, and outputs are warranted in any future iterations; as is some redesign to make the transitions smoother. Additional methods of transitioning thinking into a future framework should also be explored, as this is a common
problem in wargames. The time constraint of only having 16 hours for all the steps of the process makes this challenging, and a process meant to be introductory for newcomers to wargaming should surely be different than a process meant for experienced or standing teams to quickly design games.

Certain aspects of Project Cassandra appeared to work well, such as the liberating structures intended to quickly form a team where participants connected well with each other, identified shared purpose, participated equally, and were actively engaged in a collaborative effort. The use of actant analysis to create actor narrative also appeared to work well, facilitating the transition of players into the engaged, first-person, role-playing mindset necessary for quality wargaming.

The overall Project Cassandra process also raises important questions of how to better integrate other promising methods into wargame design. We recommend continued work on areas such as formal scenario development, red teaming methods, and SATs, to improve the products that can feed wargames. For example, more complete exploration of a scenario space before selecting one to wargame, and development of better CoAs beforehand, can yield better insights for a wargame when it is supported with additional creative and critical thinking upstream. Additionally, another conclusion from both Project Cassandra and the participants in the minicourse on red teaming is that these types of structured methods may also be used in the creation of a wargame itself to improve wargame design and execution.

This last point, additional formal methods in processes that include wargames, and the processes that create them, is key. To continue professionalizing wargaming, it is vital to make the transition from implicit tasks and craft to explicit processes and articulated methods. The less wargaming is considered a master craft done by a talented few, and the more it can be identified as specific tasks and steps with trainable skills associated with them, the more we can demystify wargaming and improve the practice. Wargaming currently has significant gaps in theory and articulated practice, so the more the conversation can be pushed into these areas, the better.
Synthesis Working Group

Chair: Peter Perla

INTRODUCTION

How do you write a synthesis report for a special meeting/workshop attended by some 250 professional wargamers and defense analysts, and composed of three pre- and post-workshop courses and tutorials, three working groups, two in-workshop courses, and three examples of creating and playing games? Not to mention keynote addresses by such notables as Mr. Andy Marshall, founder and long-time director of ONA, and the Honorable Robert Work, Deputy Secretary of Defense (DepSecDef). Even with a group of a dozen observers and notetakers, capturing all the high points, much less the raw nuggets of insights brought to the surface by dozens of speakers and during innumerable discussions would require a book-length treatment—were it even possible. The Synthesis Group leaves the mass of such details to be recorded by the various leaders of each of the component elements of the meeting.

Instead of summarizing all the various sessions and their output, the Synthesis Group focused on several prominent themes, which we saw weaving their way throughout the meeting.

There was much discussion of “bridging the gap between wargaming and analysis.” Working Group 1 of the workshop confronted this issue directly. In past discussions of this general topic, including at the MORS special meeting last year, when wargamers talk about the differences between wargaming and analysis, they usually cast “analysis” in traditional ORSA terms. But it became clear during the discussions this year that more common DoD usage these days treats analysis more broadly—including wargaming as another analytical tool on par with campaign analysis. Partly as a by-product of this attitude, we noted the tendency of non-wargamers to want to treat wargames in ways that are not necessarily applicable to the proper use and understanding of the wargaming tool. One symptom of this tendency was the oft-expressed desire of analysts to treat repeated gaming of the same specific scenario—or even general topic—as if the games were iterations of Monte Carlo simulation experiments. Based on their quantitative point of view, such analysts seem to think in terms of quantitative outcomes and measures from wargames, even though such a practice is of questionable validity.

Indeed, a second major theme centered on the debate about how to judge the validity or “rigor” of wargames. Once again, the analysis community (in contrast to the wargaming community) often cast rigor in terms more appropriate to mathematical models and digital simulations. Because most professional wargamers working in the defense field (as opposed to the commercial wargame industry) are also analysts, and frequently analysts in the ORSA mold, they are only too well aware that few individual wargames or even series of wargames should be judged by such analytical standards. But so too do professional wargamers understand the need for—and strive to achieve—intellectual rigor in wargames. A focal point for much of the debate about validity and rigor is the adjudication process in wargames. Indeed, this issue was
the subject of Working Group 3, a tightly focused working group comprising more than a dozen highly experienced wargame adjudicators.

A third major theme that the Synthesis Group observed from different points of view was the importance of better communications, not only between the wargaming and analysis communities, but also within the wargaming community itself. Working Group 2 explored some of the issues associated with these problems, but the broader issue of where, when, and how to communicate relevant information to key decision makers as they face difficult decisions permeated the entire meeting.

One commonly accepted idea is the notion of a “cycle of research” (or cycle of innovation) first articulated in those terms some 25 years ago. This concept involves the use of all available research tools—wargaming, quantitative and qualitative analyses, exercise and experiments, and real-world experience—to reinforce each other in a continuous feedback loop of research to inform decision makers. That final point is essential. A recurrent theme iterated by representatives of the OSD was the critical importance of communicating information and insights beyond the analytical community writ large (including wargamers) to key leaders in the department. While the existing departmental infrastructure and processes facilitate communicating traditional analytical results to those leaders, opening a window directly into the contributions of wargaming has proven to be a challenge.

Overcoming the challenge will be easier and more likely to bear fruit if the wargaming and analytical communities (if we can agree to use those terms for the purpose of distinguishing the epistemological orientation of each) can come to grips not only with their differences but also with their similarities, and use both differences and similarities to integrate insights better to inform decisions.

Based on our observations, our discussions, and the debates we had among ourselves as we prepared our quick-look outbrief at the end of the workshop, we have boiled down our synthesis of the meeting into a series of five questions and answers.

- What do we want?
- Why do we want it?
- Why don’t we have it now?
- How do we get it?
- Where do we go from here?

Others, even others at the same meeting, may choose to answer these questions differently—or even choose to focus on different questions. Nevertheless, we believe that we have captured the essential core contributions of the workshop as a whole in what follows below.

**What Do We Want and Why Do We Want It?**

There are several ways to answer this question depending on who “we” are. The current reemphasis on wargaming has largely been driven from the top down. But success in the effort
also requires that we understand the view from the wargaming trenches, and particularly how to integrate wargaming most effectively into the current dominant position held by operations research and systems analysis within the bureaucratic, organizational, and conceptual framework of DoD decision making.

The View from the Top

In his opening keynote address, former director of Net Assessment Andrew Marshall described how wargaming helped DoD pick up on the Soviet concept of a revolution in military affairs (RMA), which the Soviets derived from their own study of the US tactics for coordinating and applying precision fires. These tactics have come to be called the Second Offset (following the so-called First Offset, the development of weapons and concepts for using battlefield nuclear weapons). Marshall’s ONA commissioned historical studies of past RMAs to identify how long they give one side an advantage, and why one side does better than another at applying the new technologies. Their conclusion was that success stemmed from innovations in organization and concepts of operations. That research helped identify the success resulting from the US Navy’s interwar wargaming program and the similar success of the German army during the same period. Those successes stemmed partly from the respective wargaming programs, but depended even more strongly on integrating wargaming with practical exercises and experiments, which helped correct the assumptions and effectiveness estimates used during the games, and exposed critical discoveries such as the importance of launching pulse strikes from aircraft carriers.

Marshall related how a very active program of wargaming and analysis during the 1990s grew from initial false starts to make important contributions. The quantity of games eventually developed into higher quality games as leadership learned which organizations and individuals were to be relied on to produce and deliver high-quality gaming experiences capable of illuminating innovative operational concepts. A prime example was the way Secretary Schlesinger chose to continue the programs for manned strategic bombers. Quantitative assessments by the office of Program Analysis and Evaluation (PA&E) argued for reducing the bomber fleet because a narrow systems analysis based on comparing the cost for destroying targets demonstrated that missiles were more cost effective. Schlesinger adopted a view that there would be broader consequences for such a decision, and perceived that the bomber program had resulted in the USSR’s spending heavily on defensive systems rather than offensive ones. Such insights can easily be overlooked by a too narrow cost-effectiveness analysis.

Mr. Marshall saw the virtue of an active program of wargames. He recognized that human decision makers are attracted to the games by their very nature. Producing detailed paper analyses required months of effort to characterize a problem and outline potential courses of action, and often required months more of debate about which course of action might be best. Wargames involving the key decision makers forced them to address the issues directly and with immediacy. And such games created better opportunities to reflect the character, doctrines, and constraints of our opponents that we do not share—provided of course that
games were blessed with knowledgeable and creative red players who could help broaden the thinking of blue leaders.

From Director Marshall’s past perspectives to the present, DepSecDef Work used his closing keynote address to elaborate on Marshall’s discussion of the role of wargaming in developing the first and second offsets. More tellingly, he sees wargaming as increasingly necessary to help develop a third offset. To truly achieve that third offset, he identified four grids that the US and her allies will need to dominate:

- Sensor grid
- Command and control grid
- Battle-command grid
- Logistics grid

Establishing, or reestablishing, domination in these critical dimensions of major-power conflict is becoming increasingly difficult because our potential adversaries have achieved parity with the United States in precision battlefield munitions and their application, and “they can throw as much and as deep as we can.” Additionally, he argued “they have a theater battle network as good as we currently have.” How then can the United States and its partners achieve the advantage they will need to deter conflict and defeat their opponents if deterrence fails? Work believes that high-quality wargaming can help us understand the future environment; in particular, he stated that he is relying on wargaming to accomplish three major goals.

First, he wants wargaming to tell us how the operational environment is shifting under our feet. There is a need to describe these future dynamics as the basis for a wargaming program, including the nature of advanced capabilities and what they would do. He wants wargames that describe theater warfare in 2035. How far will precision guided munitions change? What will new equipment be like? How will TTPs evolve to employ these new weapons and equipment? How will concepts of operations change? How will organizations change? Wargames need to explore these issues and reveal our opportunities.

Second, he wants wargaming to help develop alternative operational constructs for employing current warfighting teams, as well as to help identify needed changes to current force structure. What are the bundles of capabilities we need to construct to overcome future challenges?

Finally, he wants wargaming to illuminate the decision space—programmatic as well as technical and operational—in which the political leaders must maneuver.

As have others, DepSecDef Work sees the similarity of our strategic and technical environment today to that of the interwar period; but the stakes are even higher and so too is the requirement for even more innovation in creating and using wargames. To that end, he has succeeded in providing funding sources across the future years defense program (FYDP) to pursue all the objectives he wants wargaming to achieve. It is up to the community of wargamers and analysts to leverage those resources to achieve practical results.
Summarizing the challenge Mr. Work has posed to the DoD analysis and wargaming community, based not only his keynote address but also on the discussions that took place across the entire special meeting, we characterized the main points as follows:

- We must reinvigorate the creativity of DoD wargaming to support innovation in critical senior leader decisions.
- We must better integrate wargaming with other analytical tools to better inform senior leaders about programmatic and strategic options.
- We must apply innovative wargames that cut across stovepipes to help integrate thinking and planning across the department
- We must show the leadership how to apply wargaming more broadly to help the DoD as a whole—from the senior leaders of today to those who will step into those positions in the future—to understand and be prepared to deal with the shifting environment we will continue to face.

The View from the Trenches

The DoD leadership and the advocates for wargaming within it have called on the wargaming community to take a more active role in achieving the goals described in the preceding section. But just what is this wargaming community? Who comprises it?

This community has defined itself as the creators and practitioners of “real wargames,” in turn defined as “dynamic representations of conflict or competition in a synthetic environment, in which people make decisions and respond to the consequences of those decisions.” This definition contrasts with the overly broad but more common usage of wargames (more often war games) to apply to any artificial representation of warfare, including models, exercises, campaign analyses, and computer simulations without human players. In many ways, the core of the self-described wargaming community is embodied in the principal participants in the Connections Wargaming conferences of the United States and other countries.

Several of those other countries sent representatives to the meeting, and those representatives explained how they all view wargaming. For example, Canada is using wargaming techniques to improve its own integration with allies, and to develop new doctrine in the last few years. The Netherlands representative described how her military establishment looked at wargaming from a hybrid perspective, as a means for looking at future conflict beyond a classic kinetic fight. The UK has increased its own use of wargaming in recent years. For example, the DSTL has established a centralized wargaming cell. The representative from Sweden described how the deployment of Russian short-range Iskandar missiles in the Kaliningrad region has resulted in renewed use of wargaming by the Swedish government to explore the implications for its own regional position.

Listening to the voice of this wargaming community, heard both in the Connections conferences as well as the two MORS Wargaming Special Meetings, it seems that wargamers want at least the following things from the DoD leadership and ORSA communities:
• Respect from the nonwargamer elements of the analysis community—for the diverse skills and contributions wargaming brings to the table.

• To work in equal partnership with other practitioners—not as a peripheral or subordinate contributor.

• Funding to conduct and to develop better wargames—that is, opportunities to experiment with innovative wargaming techniques beyond the limited perspectives of individual sponsoring organizations and commands.

• Development of more (and more talented) wargamers and better educated consumers—partly through an increase in PME programs (both uniformed and civilian) to teach the techniques and uses of wargaming.

• Direct channels to leadership—fewer gatekeepers from organizations with limited to no understanding of what makes wargames useful and how to interpret their output.

• Openness to innovation—calling on a diverse group of SMEs, new approaches, innovative definitions of game data, and increased understanding and use of creative analytical techniques from social sciences.

WHY DON’T WE HAVE IT NOW, AND HOW DO WE GET IT?

Achieving the desiderata of both the leadership of the DoD and the wargaming community requires overcoming organizational, professional, and philosophical obstacles. Those obstacles exist both within and outside the wargaming community.

Overcoming External Obstacles

Since at least as early as the 1960s, the wargaming community has nearly always faced an uphill struggle to influence the highest levels of DoD decision makers. The creation of the Systems Analysis Office during the Kennedy administration inaugurated a period in which economic and quantitative analysis overshadowed traditional military expertise and wargaming as the arbiters of important programmatic and policy decisions. In a vicious cycle, the less wargaming seemed to matter, the more widespread became the misunderstanding of wargaming and its relationship to other analysis techniques, and the expertise in its use consolidated into a few centers of excellence, often more focused on training and education than on direct support for decision makers.

Yet, as the limitations of the newer forms of analysis became more evident, clumsy (if we may be allowed to characterize them that way) attempts to use wargaming to “prove” the efficacy of new systems and concepts also proved to disillusion those who sought the elusive panacea for predicting the future and making the right decisions. Hence wargaming experienced the roller-coaster ride of favor and disfavor among the department’s leadership.

Today’s renewed emphasis on applying wargaming to critical departmental issues is another of the high points in that sine wave of popularity. It is also an object lesson in why that cycle exists. As the leadership directs more emphasis on wargaming, misinformed subordinates task
the wrong people (often quantitative analysts untutored in effective wargame development) and the wrong organizations (such as traditional modeling and simulation groups or already undermanned planning staffs) to “do” wargaming. The end result has seen wargaming become caught up in preexisting organizational stovepipes on one hand, and applied to issues outside its proper sphere of competence through a bandwagon dynamic on the other. If wargaming is the flavor du jour, everyone says they are doing wargames for everything—even when they are not. And the seeds of disappointment and disillusion are planted once again in the minds of those who don’t really understand the tool and how to wield it effectively.

From our cross-group perspective, the Synthesis Group assessed that meeting these challenges requires that senior leaders should receive “independent” (or perhaps better, unfiltered) insights and advice directly from wargames as well as other analytical efforts. These unfiltered insights can be amplified and put into broader context through integrated assessments based on the cycle of research and innovation. Successful application of the cycle of research also requires that the defense analysis community address the question of where wargaming should fit into the broader “analytical” toolbox and how it can best contribute to the integrated insights department leaders need to make the best decisions in the fields of policy, strategy, programatics, and operations. This strikes us as a worthy topic for a next MORS special meeting on the cycle of research.

Overcoming Internal Obstacles

If the wargaming community—or indeed, the wider analysis community—is to overcome these formidable external obstacles, it must endeavor also to surmount its own internal difficulties. There are two broad categories of these obstacles.

The first set of obstacles centers on the practitioners of wargaming, the group to whom we apply the shorthand term of “wargamers.” Never a very large community, especially in comparison to the ORSA community, it has been growing in numbers recently because of the current DepSecDef emphasis. But increasing numbers inevitably results in a dilution of talent and capability.

In a very real sense, wargaming can be considered an art or, perhaps more tellingly, a craft. Professional wargamers have entered the “guild” largely on the basis of their own inherent interest rather than any formal program of instruction. They develop their skills through practical experience and individual study—from novice, to apprentice, to journeyman, to master—much as a medieval silversmith might. But with few or no formal programs or structures, novice and apprentice wargamers frequently fail to recognize their own shortcomings of knowledge and skill. The relatively few master wargamers, once sufficient in number to develop and apply innovative high-quality wargames, have become overtasked as the emphasis on wargaming increases. Unfortunately, the number of journeyman wargamers has been determined by the earlier lower levels of emphasis rather than the current high levels. The result is a “bathtub” of experience and skill, which has in the past contributed to the dreaded sine wave of wargaming popularity.

Better and more widespread education of current and potential wargamers is thus essential. More numerous and more experienced and talented wargamers are needed, not only
to do better games targeted on important decisions but also to conduct more numerous games required as essential elements of providing both independent and integrated insights. So too is the need for greater numbers of the proverbial educated consumers of wargames. Achieving the necessary critical mass of both groups requires that the informal training regimen of the wargaming craft be supplemented by a more formal training regimen of a wargaming profession. The foundations of a DoD-sponsored line of effort for PME programs in wargaming already exist in civilian academia as well as nascent DoD efforts, such as those courses provided by the Naval Postgraduate School. MORS itself has just launched a certificate program in wargaming. Investing some of the existing wargaming incentive funding to develop a cooperative effort in either a certificate or graduate-degree program with a DC-area university might be worth pursuing.

The second set of obstacles internal to the wargaming and analysis community might be termed epistemological or philosophical. There are several strands of these internal debates, most of which are too arcane for discussion at the special meeting or here. But one critical issue has been highlighted repeatedly over the last several years. This is the issue of the rigor or validity of wargame outcomes or results. It is an especially vexing issue because too often the terms are defined in terms dictated by the ORSA elements of the broader analysis community and applied to wargames as if they were quantitative models or simulations. In simplistic terms, a simulation is usually judged on the basis of how its outputs derive from two primary elements: 1) validation: whether its assumptions and structure somehow represent the real world well enough for its purpose, and 2) verification: whether its internal workings follow the formalisms of logic and mathematics. We can term this a sort of “process validity.”

In contrast, the validity of wargames is best thought of in terms of the validity of the insights they elicit from their creators and participants. This sort of validity is in eye of the beholder or the decision maker, much like lessons of life and history. Do you believe that experience, your own and that of others, has something to tell you that is valuable to your current or future decisions? What do you base that on? Where data and numbers apply, it may make sense to pay attention. But they don’t always apply. And even when they do, it may not be helpful. But this is an individual process. In the context of DoD, the issue is more often how to persuade others—who were not themselves involved in the game—that the game has produced insights of value. Instead of validity, perhaps the better term is “trustworthiness.” We can term this a sort of “product validity.”

To make more productive the discussions and debates about rigor and validity between the wargaming and ORSA communities, wargamers need to articulate—and indeed to internalize—a theory of rigor, validity, or trustworthiness, that can be widely understood, accepted, and practiced by the professional community, both wargamers and analysts. All too often, ORSA practitioners have restricted their vision of integration to focus on how wargames can help them do better analysis or help them to publicize or socialize the results of their own analyses. To broaden this narrow vision, the ORSA and wargaming communities will find it more productive to identify where analytical tools can help, not interfere with, identifying trustworthy insights from human decisions. Then, working together, the two communities can jointly develop such tools.
Based on our observations during this meeting, we believe we are finally at the point where many understand how and when technical models and simulations can be helpful to wargaming—and when they are hurtful. We see this in how the Navy is now looking through its numerous simulation tools to identify which ones are worth adoption or adaptation for wargames, and where there are as yet unmet needs for new tool. Either way, the value and irreplaceability of human decision making was discussed at length, as well as what M&S can and cannot contribute. For example, an IDA presentation about its project Cassandra gave clear examples of how M&S enhanced a tabletop wargame by injecting science and reason to help the players understand the consequences of an attack with weapons of mass destruction (WMD). The model they used wasn’t meant to be predictive, just to give some reasonable results and simple portrayals for the combat effects of WMDs. In effect, as the presenter termed them, the results served as a “conversation catalyst.”

WHERE DO WE GO FROM HERE?

In the Synthesis Group outbrief at the meeting, we presented our assessment that achieving the goals the DepSecDef had articulated for wargaming could best be achieved by a concerted effort by the wargaming and analysis communities to:

- Apply “excellent” wargames to address critical issues informing senior-leader decision-space
- Assess the validity of game insights by their utility for the key decisions and decision makers, not by the process for producing them
- Help leaders learn not what to decide but how to integrate wargame insights into their decision process

Of course, applying excellent wargames to address critical issues informing the decision space of senior leaders requires that we define “excellent wargames.” The prime characteristics of such games are that they are

- Asking the right questions, defining the right objectives, and applying to the right decisions
- Engaging games created by master designers
- Played by the right senior leaders
- Supported by the right experts

It also demands that we suggest a process by which the right questions can be determined based on departmental objectives and upcoming decisions, both technical and operational. In the acquisition cycle, analysis is required to determine desired capabilities as well as industry’s ability to achieve the capabilities. Wargames should feed off this analysis as well as provide input data to additional analysis, given the postulated capabilities associated with specific systems. If nothing else, wargames can generate a set of questions that could be asked by the
DepSecDef about every program, and which could be answered by excellent games. On the operational side, a good example is how the Joint Staff J8 used a series of games to help the J3 sort through the issues associated with moving and destroying Syria’s chemical weapon stocks. The games were able to address a full range of contingencies by thinking through the task, the players, and the environment, including the full range of what could go wrong, so that the Joint Staff was ready to recommend a solution that ultimately worked.

It is clearly not necessary to wargame every issue, but the DepSecDef should certainly be able to ask the question, “Was this wargamed?” He could then go on to ask, “How was the wargame structured? What did we learn from the wargame that will affect the way we conduct this mission?” Again, the intent is not to add another layer to the bureaucratic process that must be followed to initiate an action, but rather to use wargaming when appropriate to think through a task to maximize its chances of success.

Throughout the various sessions, participants raised reasonable questions about what kind of decision support wargames can provide. Similar questions were raised about technical analyses. The growing consensus was that neither technique in and of itself provides enough information to make fully informed programmatic or investment decisions. These concerns reemphasize our earlier comments about the importance of getting the insights from the right wargames into the heads of the right senior leaders at the right time, and not placing so many caveats about their interpretations so as to make them unusable.

As the Synthesis Group looked across the entire workshop, we were struck by the frequency with which different organizations illustrated their efforts with a flow chart depicting a feedback loop between wargaming and quantitative analysis. The flow charts weren’t identical but the message was clear in all of them—the message of the cycle of research. Some organizations, noticeably the Army’s Concepts Analysis Agency (CAA), CNA, and the Rand Corporation, are embodying that cycle in individual analysts and teams who engage in both wargaming and ORSA-style analyses. Other organizations who do not follow this practice, perhaps most noticeably the USMC, seemed most likely to complain about how wargames don’t meet their analytical agenda. Could there be a positive causal effect of cross-pollenating the techniques within the same part of an organization? Should other analytical organizations consider the potential value of doing something similar themselves?

Another recurring theme that cut across keynotes, panels, presentations, working groups, and wargames was the idea of replicating or iterating wargames. There was broad agreement, if not true consensus, that such repeated gaming is beneficial because it allows broader and deeper exploration of issues, creates opportunities for more creative innovations, and inspires greater confidence in results that appear to be consistent across a range of players and circumstances. There remain disagreements and debates about whether and when such iterations should be done with the same or different players. It appears that different organizations are approaching this issue differently, which may provide some interesting comparisons about learning effects, longitudinal studies, or other methodological and theoretical issues.

Ultimately, however, it falls to the self-defined wargaming community to take the lead, to get its own house in order and demonstrate proverbial value-added for its contributions. It has
been too easy for individual practitioners and wargaming organizations alike to fall into too narrow a lane of business as usual. As demand for games has increased and the best practitioners have become overtasked it has been necessary—and perhaps too easy—to rely on tried-and-true techniques, which may be drifting too close to tired and boring. The powerful demonstration of the techniques of matrix gaming during the meeting illustrated a vector to get past traditional methods for addressing nontraditional problems. Matrix games provide a relatively low-cost, low-overhead, and flexible approach to discovering valuable qualitative insights for organizational challenges. But matrix games put an even higher premium on involving the right decision makers as players and the right experts as advisors and umpires.

As our interpretations of some of the discussions of the working group on adjudication methods seemed to indicate, individuals and organizations sometimes exhibit a form of myopia about both their goals and methods for adjudication. At the best of times there must be a delicate balance between adjudication of game actions to further the overall objectives of the game and taking care that the adjudication does not in fact create the dreaded effect of “negative training” when outcomes are at odds with the best analytical assessments. The resulting intramural miscommunications and disputes degrades the value of wargaming in general, not only that of specific games. That working group made progress on outlining the range of issues and positions regarding adjudication; following up with a more comprehensive guide to adjudication issues and techniques will go a long way toward opening more constructive dialogue within the community.

The issue of creating such open communication more broadly within the wargaming community itself remains surprisingly contentious. Working Group 2’s discussions highlighted the contrast between those advocates of vastly increased reliance on digital tools and those more comfortable with physical approaches, such as tabletop maps and markers. Each of these toolsets has much to offer in the right circumstances, but it appears that too often the instrumentality of a game is dictated more by the creators’ point of view and less by a clear-eyed assessment of fitness for purpose. During the play of the computer game of Phase 0 operations, one participant in the meeting espoused a position that, “If your game takes four days per turn, and thousands of die rolls, get a computer. If a short time, and few die rolls, use a boardgame.” Too often we have seen wargamers design too complex a game, or analysts create too opaque a digital simulation when a simple game would do better and expend far fewer resources.

The work presented by those participants outside the narrower wargaming community also opened some terra incognita that the community should explore more carefully. The concept of red teaming as espoused by the Army’s Training and Doctrine Command, opened many eyes to the possibility of adopting its techniques to help design more creative and more comprehensive wargames. Similarly, the use of structured analytical techniques offers several tools to help game designers build and explore credible and useful future scenarios, which depend less on the creativity and biases of individual designers and more on a thorough and comprehensive assessment of current trends and possible future discontinuities. By drawing on the expertise of all its practitioners, as well as those in these and other associated fields, the wargaming community can and should expand on the efforts begun at last year’s special meeting to codify
best practices in this and similar areas where diversity of opinion reflects diversity of applications.

Finally, and most importantly, the wargaming community must work harder to educate senior decision makers about when and how to use wargames—in concert with other tools—to support their critical decisions. At this writing, the wargaming repository managed by CAPE provides the best and most direct line of effort to accomplish this task. But that repository is still in its infancy and in many cases suffers from gatekeeper syndrome—sponsors who maintain a stranglehold on which games are added to the repository and which results are highlighted. Access to the repository is also limited by classification issues and network constraints. One approach suggested during the meeting may be worth further consideration—creation of an unclassified newsletter to alert the community of the availability of particularly important results or particularly interesting upcoming events.
Actions for MORS

The workshop was tasked with identifying how wargaming should be integrated into the larger analytic process and growing the capacity of the wargaming community to produce high-quality games. The workshop did not, and could not, meet these goals in a single event. The following are the chair’s suggestions on how to continue the efforts to meet these goals.

To build upon the success of the workshop and continue to reinvigorate the art and discipline of wargaming, MORS will have to take the following actions. It must continue to contribute with others toward the growth of a cadre of new wargamers through introductory courses. It must further the growth of the knowledge of all practitioners and the identification of best practices through a vigorous CoP that continues to partner with other elements of the wargaming community and other disciplines that contribute to the understanding of the factors involved in the innovation process. MORS will need to restructure future wargaming workshops to make them more effective.

MORS, the Naval Postgraduate School (NPS), and Air Force Material Command (AFMC) have been conducting short introductory courses to wargaming. MORS offers a series of classes and awards a certificate for those who complete it. Those who complete these short courses are considered to be at the novice level. To attain an apprentice-level knowledge of wargaming would require completion of the quarter/semester-long college credit courses that are part of the academic coursework on wargaming available from NPS and other academic institutions, both military and civilian. Based on the insights from the Synthesis Group, it is important that MORS be clear about the limitations of the certificate course it offers.

MORS has continued to operate a very vibrant wargaming CoP with monthly brownbag teleconference meetings enabling practitioners to compare notes and identify best practices. The CoP enables the continuous education of the wargaming community and enables progression of wargaming practitioners to move from novice to apprentice to journeyman. As the body of work is developed, some effort will be required to catalogue the presentations and bin what presentations are designed for what skill level of the practitioners to enable their elevation.

The workshop identified additional communities that have skills that would greatly benefit MORS members in their analytic capabilities. MORS needs to continue partnership with communities already identified and reach out to others. MORS’ partnership with the international wargaming community known as Connections was critical to the success of the workshop, drawing upon the years of knowledge from that body. Further, the workshop demonstrated the value of red teaming and SATs and the community who practice them. Future efforts should continue to include both of them.

The identification of human-focused wargaming to meet the demand for innovation within DoD directs attention to the fact that the minds of the players are the main instrument within a wargame. Therefore, the next community that needs to be brought into the dialogue is that of psychology. Psychology has many relevant areas of study and methods that are applicable to improving our understanding of the cognitive, individual decision making, interpersonal dynamics, formal theory about learning, and many other psychological aspects of wargames.
For example, educational psychology and military psychology are two subfields that would be highly pertinent to improving our understanding of what goes on in a game, what we are really achieving in the minds of the players, and how games might be better designed and understood.

We recommend that MORS leverage its previously developed relationship (through the MORS Social Science CoP) with the Society of Military Psychology, Division 19 of the American Psychological Association (APA), to begin this important dialogue. While the relationship between the US military and operations research goes back to World War II, the relationship between the US military and psychology traces from World War I. WWI gave rise to modern psychology in the US, and one in four members of the APA identified as military psychologists by the end of WWII.

Feedback from the last two wargaming workshops identified the need to restructure the next wargaming workshop. The standard MORS working group construct must be changed and adapted. The 2016 workshop added introductory courses to wargaming and SAT. It also added wargames to enable participants to learn by doing—participating in successful wargames put on by master game designers.

However, the working groups at the two workshops were inhibited by the attendance of participants who joined a working group, not to contribute, but seeking knowledge. The most successful working groups were those who limited the membership to experienced practitioners, those most able to contribute. Excluding those seeking knowledge in the working group subject areas would be counterproductive and miss the opportunity to grow expertise, specifically to expand the knowledge of practitioners and enable their progression. Therefore, working groups should continue but provide a criteria for acceptance and/or prerequisite knowledge controlled strictly by the chairs. Having identified the experts in the field for each working group, the chairs should then support a corresponding seminar for apprentice- and journeyman-level practitioners to advance their knowledge.

Working groups should be a meeting of experts in their field comparing notes, deconstructing and examining their work among peers, and identifying best practices. Those same experts should in parallel rotate to the corresponding seminar in the same field. Each expert taking their part in a seminar focused on the journeyman-level practitioners.

The wargames should continue and be focused on the novice- and apprentice-level practitioners.