Conversations with Wargamers

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Introduction and summary

What the project is about

The War Gaming Department (WGD) of the Naval War College (NWC) asked CNA to carry out the Wargaming Strategic Linkage project to explore new ideas for designing and carrying out wargames with significant play at two or more levels of the classic military trinity: strategic, operational, and tactical. The project team undertook to explore how other prominent Department of Defense (DoD) organizations and civilian contractors and consultants thought about and dealt with the issues related to this topic.

This paper documents the notes we took during several conversations with prominent wargaming practitioners as we explored the issues associated with wargaming strategic linkage. It also details the more substantive ideas and concepts we developed during those conversations. The major results and recommendations of the overall study are documented in a separate CNA research memorandum.[1]

To set the stage for the discussions, we used the following background piece to describe the project and our goals.

Wargaming strategic linkage[2]

Background

As the Navy places more emphasis on learning how to think and act at the "operational level of war," the Naval War College is reinvigorating its Global War Game (GWG) Title X wargaming program, with

1. Peter P. Perla and Michael C. Markowitz, *Wargaming Strategic Linkage*, Forthcoming (CNA D0019256.A2)

2. This section is the text of the material we sent to our interviewees.

the objective of incorporating serious operational level play in the context of a strategic game. Because the strategic, operational, and tactical levels of war are linked, the NWC wants to develop new wargaming techniques that cut across those levels efficiently and effectively. This goal is particularly important in reference to gaming at the strategic and operational levels of war. Currently, there is no consensus at the NWC about how to do multi-level wargaming that links the strategic, operational, and tactical levels of war, and there is no established methodology.

During the heyday of the GWG, the NWC used a hundred or more mostly uniformed, controllers and facilitators to manage play and maintain the linkages between levels. With increasingly reduced uniformed manning at the college, such a brute force method is no longer practical. As a result, the NWC asked CNA to work with them to explore possible approaches and adapt and develop a methodology that will allow the Naval War College to design and carry out multi-level Title X (and possibly other) wargames in an economical manner, without having to use a "cast of thousands" (in the words of the past chair of the WGD).

Our emphasis is on identifying and developing concepts and mechanisms for representing the linkage between the strategic, operational/strategic, and operational levels of war. We are researching existing wargame systems. We plan to adapt and extend what we learn from that research, coupled with our own design ideas, to recommend some approaches that the WGD can evaluate for suitability to execute wargames at the operational level and higher and that require a relatively small number of game-control personnel.

We are discussing these issues with several organizations and individuals with a history and reputation for conducting wargames at the strategic and operational levels. To start off the discussions, we submit for your consideration the questions below. We will provide a copy of our final paper in an appropriate form to all of the participating organizations.

Questions for discussion

1. What multi-level wargames have you conducted or participated in?
2. What were the goals and objectives you sought to achieve in multi-level games?
3. What interfered with your ability to achieve your goals?
4. What did you do to overcome the problems?

Conversations and contents

During our interviews, we did not strictly address each of the questions in a self-contained discussion, but we attempted to track them as we conversed. In some cases, we drew specific answers out of the conversations; in others we did not.

In the remainder of the paper we present the distilled notes of our conversations. Our procedure for documenting these conversations began with a written summary of our notes for each such conversation. We then presented the participants in the conversation with the written summary and asked for corrections and additions, to ensure that we had not misunderstood or misrepresented what the interviewees had said or meant.

We present our summaries of each conversation in chronological order of our meetings or phone conversations. After listing the groups in their order of appearance, we present each conversation in detail. The individual conversations include some of our own interpretations and analytical extensions of the ideas discussed with the interviewees. Those ideas, are of course, ours alone, and we do not claim that they represent the opinions of any of the individuals or organizations with whom we spoke. Where possible, we distinguish our own contributions by printing them in *italics*.

The collection of insights we derived from these conversations is embodied in the companion research memorandum, *Wargaming Strategic Linkage*. The current paper itself does not attempt to synthesize ideas across the various discussions or groups, except in the case of rare and narrowly constrained issues.

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People we spoke with

This paper contains ten sets of notes. In chronological order, the people we spoke with were:

- Mr. Mark Herman, vice president, and Mr. Richard Phares, senior analyst at Booz-Allen Hamilton
- Dr. Bill Lademan, the director; Mr. Bill Simpson, long-time technical expert; and others at the wargaming division of the Marine Corps Warfighting Laboratory at Quantico
- Professor Doug Campbell, center director; Colonels Evans and Hume, directors of operations & gaming, and of science & technology, respectively, and several others from the U.S. Army's Center for Strategic Leadership at the Army War College at Carlisle
- Christopher Carlson, Captain, USNR (Ret.) and currently an intelligence analyst with the Defense Intelligence Agency, who is a principal collaborator and game designer with Larry Bond for the *Harpoon* and *Command at Sea* miniatures wargame systems and the *Harpoon* computer game
- Professors Stephen Downes-Martin and Christopher Weuve, U.S. Naval War College, War Gaming Department
- Professor Erik Kjonnerod, Advisor to the President, National Defense University (NDU)
- Mr. Scott Simpkins and other wargaming experts at Johns Hopkins University Applied Physics Laboratory (JHUAPL)
- Mr. Matthew Caffrey, Colonel USAFR (Ret.) and Mr. Terry Christian, U.S. Air Force Applied Research Laboratory
- Colonel Russ "Rudder" Smith, USAF, the Director, Warfighting Applications, LeMay Center for Doctrine Development &

Education and other senior staff of the Air Force Wargaming Institute (AFWI)

- Mr. Tom Allen, director of the Simulations Center of the Institute for Defense Analyses (IDA, and Dr. Terry Heuring and Dr. Sue Numrich, members of the senior staff.

We present the results of each of these conversations and interviews in its own section below.

Booz-Allen-Hamilton

Mark Herman is a partner and vice president at Booz-Allen-Hamilton, with a practice built on wargaming and other analytical tasks. Richard Phares is a former Navy officer who worked with CNA on several projects while on active duty, and who now works for Mr. Herman. Mr. Phares also has had experience with Navy wargaming at a variety of billets, including a fleet information warfare activity. Both are active in commercial hobby wargaming; Mr. Herman, in particular, is a prolific and well-known and respected designer of hobby board wargames, many of which incorporate innovative techniques for addressing some of the same issues of multi-level play as those we are exploring.

Mr. Herman has had extensive experience as a participant in DoD wargames at many levels and for all the Services, including the Navy's Global War Game series, and the Army and Air Force Title X games. He described the way the Army and Air Force games approached gaming strategic and operational levels in similar terms; he distinguished the Navy's Global series from the others. In nearly all cases of interest, the games were classic Title X games, focused on large questions of force structure, theater allocation of forces, and Service roles and missions.

The Army and Air Force games tended to take place in two stages. In the first stage, relatively senior officers and officials took a strategic level look at the situation to be explored and created guidance for the second-stage, more operationally focused, games. The guidance stemming from the strategic games took two principal forms: strategic and operational intent, and rules of engagement (ROE). The resultant ROE became a critical control tool for managing the operational game. The operational players were constrained to follow the ROE unless they could ask for and receive relief from, or changes to them.

From Mr. Herman's perspective, the Navy Global games he experienced were more loosely controlled. They also carried out the full range of strategic, operational, and tactical tasks within the same game construct. Even in cases when preliminary events took place to provide some initial conditions and guidance, the on-site play at the strategic level, using an active cell for the National Command Authorities (NCA), produced a more complex and dynamic play experience because "real players," not just subgroups of the Control cell, assumed the leadership roles.

In all cases, with the Global War Games being the most visible example, Mr. Herman identified management of time as the principal technical difficulty of designing and running such multi-level games. *This problem stems from the fact that different levels of decision and action (strategic, operational, and tactical, for example) frequently have different decision cycles as well as distinct "time constants" for feedback loops.* At the lowest tactical levels, for example, troops in contact may have to make split-second decisions with immediate feedback on the effectiveness of their actions or the imminence of the threat. At the highest strategic levels, the NCA may normally make decisions on the basis of a daily briefing schedule; the strategic effects of broad decisions about resource allocation and theater-level objectives and operations may take weeks or months to become manifest.

The kinds of approaches Mr. Herman and Mr. Phares have seen for addressing this issue fall into a couple of main categories: those games that employ a single "clock speed" for all levels of play simultaneously, and those that shift clock speeds (and so activity types and levels) as the emphasis of play shifts from one level to another. These latter we typically call telescoping time, but Mr. Herman used a couple of interesting and evocative terms to describe slightly different approaches.

The first term he used was "Alice in Wonderland." The players are first at one level of decision making and its corresponding time scale, but then "fall down the rabbit hole" into a new level and time scale. Classic boardgames have used this technique for decades. In the 1960s naval game *Jutland*,[3] the players begin at the operational level,

3. Dunnigan, James F. *Jutland.* Boardgame. Baltimore: The Avalon Hill Game Company. (1967)

moving fleets and squadrons across a hexagonal map (with each hex representing many nautical miles) and with time measured in hours, until contact occurs. At that point, play shifts to the tactical level and the individual ships in the various squadrons in contact are placed on a "battle board," which is any large flat surface, like the floor. Time shifts to only a few minutes a move and the tactical action is resolved until the next tick of the operational clock should have occurred. Players then revert to the operational scale temporarily to resolve higher level interactions, returning to the tactical level should that action be continuing.

Mr. Herman's *Gulf Strike* game[4] uses a similar concept in space, not only in time. Strategic play (really theater level in this game) takes place on a small-scale map of the entire Indian Ocean/Persian Gulf region. Units, particularly air and naval units, may operate on this map using a time-distance scale commensurate with the level of abstraction at that level. But most of the spaces (hexagons) on the strategic map represent a group of larger-scale hexes on the "operational" map. A unit, say an aircraft, that enters a hex on the strategic map can "fall down the rabbit hole" to one of the sub-hexes on the operational map. Thus, no unit is ever physically present on more than one map at a time. And the unit's characteristics and behaviors may change depending on which map it is located.

Another term, which Mr. Herman used in connection with his own design of a hobby game called *Pacific War*,[5] was a "black hole." *Pacific War* is a game covering the entirety of World War II in the Pacific theater. As such, players must think at the strategic level, but much of the game's play centers on what we would call the operational level. Indeed, the game can be played in operational scenarios, each of which represent a specific campaign—such as the Midway operation, for example. In *Pacific War*, time scales changed in a manner more dynamic than *Jutland's* simple shift of scale. The *Pacific War* approach

4. Herman, Mark. *Gulf Strike*. Boardgame. Baltimore: Victory Games. (1983)

5. Herman, Mark. *Pacific War*. Boardgame. Baltimore: Victory Games. (1985)

allows players to designate a "target space" in which their planned operation would take place. As forces moved closer to the "black hole" of the target space, the time scale would change in a dynamic manner to represent the interplay of logistics, intelligence, and response capabilities.

Mr. Herman also talked about the use of consistent time clocks across the various levels of play. Such an approach has been used during many of the past Global War Games, as well as in large-scale exercises such as Millennium Challenge 2002.[6] There are many challenges involved in using this technique; most are the result of potential "down time" among the players at the higher levels while the players at the lower levels operate at lower clock speeds and greater levels of tactical detail. When the higher level players do not have to be actively involved in game play full-time—instead receiving periodic update briefings or urgent real-time communications only when needed—the down-time issue can be managed more easily. In such cases, the lowest level of play will dictate the game's speed, with small numbers of fixed points of synchronization occurring when the higher levels of command receive situation updates. In addition, time jumps of some magnitude can be useful for advancing play between operationally or strategically significant time periods or events without having to "run the game clock" at the lower speed to conduct detailed tactical transitions.

At the most advanced levels of synchronization across different time streams for different levels, it is often necessary to use what Mr. Herman called a "run-time manager." This term is usually applied to a computer subroutine whose task it is to monitor the various time streams in multi-level games to make sure that actions at each level

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6. For some basic information about this exercise, see "Special Briefing on Millennium Challenge 2002," presented to the press by Air Force Brig. Gen. Smith, deputy commander, JFCOM'S Joint Warfighting Center, on May 22, 2002 11:00 AM EDT. Available online at http://www.defenselink.mil/transcripts/transcript.aspx?transcriptid=3456. For a discussion of some of the more controversial issues associated with the play of the exercise, see Gladwell, Malcom. *Blink.* New York: Little, Brown and Company. (2005)

are coordinated to occur in the correct sequence across levels. For example, an air strike that takes five tactical time steps to reach its target at the tactical level may create effects at the operational level one operational time step after it launches.

Another approach that Mr. Phares highlighted is one that separates the time streams completely. This approach is characteristic of some very high level games that employ lower level "precursor" games. The low level games are played some time ahead of the higher level game and provide inputs to the higher level game that allow details to be fed into the later game without the usual time lags necessary to generate such inputs on the fly. In essence, the lower level games provide "look-up tables" of results for the use of the umpires in the higher level ones. This is a tricky proposition, of course, because the lower level games can seldom anticipate all the details and nuances of situations that might arise during the higher level game.

Finally, Mr. Herman and Mr. Phares speculated about future directions for gaming of this type. Mr. Herman emphasized his belief that technology would be exploited more completely to conduct more and more multi-level games in a virtual environment—that is, using networked computer systems to allow players from different levels of command and diverse organizations to play together from geographically dispersed locations. There is not much practical difference between player interactions when they are confined to separate rooms within a common facility as compared to operating from separate facilities.

Mr. Phares pointed out that such games can also take advantage of current computer capabilities to create both persistent gaming environments (those in which the game never stops, though some players may stop playing to rest or sleep) and "freeze-state" environments (those in which the game state is stopped at specific times so that players may step out of the game and pick it up later without any changes in state). He also pointed out that the techniques used for this sort of gaming can be applied readily to allowing games to be played in a virtual environment by connecting players with real-world command centers and systems. This notion is an extension of the concepts that

were incorporated in the Battle-Force In-Port Training (BFIT) program, begun during the late 1980s.[7]

As more and more command systems and processes become dominated by electronic means of communicating and displaying information, such virtual-reality gaming approaches more and more closely to the ideal of having decision makers use the actual systems they would employ in real-world action for playing the game—at least at the levels of command above those in which the use of physical senses to encounter physical realities still dominates.

7. For a discussion of BFIT in the context of wargames, see Perla, Peter P. "Future Directions for Wargaming," *Joint Force Quarterly*, Summer 1994, pp. 77 – 83, available on-line at http://www.dtic.mil/doctrine/jel/jfq_pubs/jfq1305.pdf.

MCWL Wargaming division

Overall conversation and insights

We met with Dr. Bill Lademan, new director of the division; Lieutenant Colonel Reed Bessenger, USMC, operations officer; Mr. Michael Schaefer, a civilian contractor from Decision Engineering Associates, LLC; and Mr. Bill Simpson, civilian wargaming officer and long-time acquaintance, who was our principal point of contact and organizer of the meeting.

Our discussion of multi-level wargaming ranged over a variety of topics. They described some of the games they have done and the techniques they used. Here are some of the high points as we recorded them.

During a game designed to explore the operations of an Army Stryker brigade, the design made use of multiple levels of play within individual game cells. They had as many as three levels of command in a single cell, and the players had ready access to walk back and forth and discuss their actions, facilitating synchronization within a cell. Furthermore, they employed an open adjudication and assessment style within a seminar game format, a recurring theme during the entire discussion, which also helped keep the different levels of play synchronized.

During an extensive wargame that took place prior to Desert Storm in 1990, they used a boardgame as the basis, complete with hex map and cardboard counters. This was a three-level game. At the tactical level, six players/umpires managed the fight using the game board. They were supported by computer aids, which helped keep track of logistics, rates of movement, losses, and other statistical information. The results of these computer models were often modified and adjusted on the basis of discussion among the players and control.

The tactical game was informed by and fed back to an operational level player group. This group was the largest set of players in the game. They, in turn, responded to and fed back to a strategic level of play. Like the tactical level, this level was represented by roughly six players. These players were, on the whole, more senior that the other players. Furthermore, they had been involved in a pre-game process that established strategic objectives and approaches for the game. They included Blue and Red experts as well as experts in "Green," allies and neutrals. During play of the game, these experts frequently roamed from cell to cell among the other players, to gather information, provide insights, and elicit feedback from them. This strategic cell also had the responsibility of responding to player questions about the previously provided guidance and ROE, as well as requests for changes.

From the Quantico perspective, particularly that of Mr. Simpson, the key interface is that between the tactical and operational levels. The tactical level players are more umpires or control than actual players. It is their job to implement operational directives in the mechanical system of the game to enable adjudication of outcomes. The fewer such tactical players the better because the critical failure point lies in a breakdown of coordination at this level. If the tactical level activities get out of whack, then the entire clockwork system of the game can become undone. The process of adjudicating tactical actions and feeding those adjudications back into the operational level players in real time (not instantaneously) is the engine that drives play at all the higher levels.

Mr. Simpson described a couple of ways to run this process. One way is with a game clock, tying every activity to specific time hacks. This approach was a common feature of Global War Games in the past. But the technique preferred by the Quantico gamers eschewed the game clock and instead focused on broader moves defined by phases and events. The phases of the game were defined ahead of time during the design process. Events within the phases flowed from player decisions and actions. As Dr. Lademan pointed out, however, rapid and realistic adjudication of game events is a *sine qua non* for this approach to work smoothly.

Mr. Simpson described their preferred technique as a hybrid process. Player teams planned in a closed-game format, not seeing the other side's intentions. But the adjudication and assessment processes were open; that is, players from both sides would discuss what they could or could not see or understand, and what the effects of the opposing actions might be. Control would be forced to make a call only when the two sides could not agree, in their professional judgment, about what was a reasonable outcome of their mutual activity.

This line of discussion led to a contrast of how they viewed the terms adjudication, assessment, and analysis.

- Adjudication is determining what happens as a result of interactions in the game; the result on the game board, if you will.
- Assessment is the general evaluation of the resulting situation; a primarily qualitative discussion of strengths and weaknesses.
- Analysis is largely focused on the "backend;" what did we learn? It also has a role in the "front end" by providing to the designers some of the basis for adjudication; analysis tends to be more quantitative than either adjudication or assessment.

Mr. Simpson graciously provided us with a copy of a set of briefing slides he presented at a MORS conference in which he describes the differences between assessment and analysis. This gave us even more insight into how to think about these issues from the MCWL perspective.

We asked them to describe the biggest challenges we face in multi-level gaming. Mr. Simpson once again took the lead, describing it in terms of the "three-map problem." This term refers to a classic issue from the earliest days of the Prussian *kriegsspiel*. The full-up classic game required three maps—one for Blue, one for Red, and one for the umpire. Only the umpire's map showed ground truth; the player maps showed only what the players could see or had reported to them. In the past, these maps were paper; today, nearly all displays of this type have gone to some electronic format.

The use of computers to keep track of what may literally become thousands of entities, or playing pieces, is a potential boon to

wargaming, especially at the tactical level. The danger comes when the third map, ground truth, slides into the background and the processes of the game do not provide for tight control by the umpire over the activities of Blue and Red. When the players see only their own maps, or more broadly speaking their own information, the umpire must be the one to ensure that ground truth dictates actual events and encounters. This can be an overwhelming task for a single umpire or small group, especially if Blue and Red are not single players but tens or dozens, as was the case in GWG 2001. Mr. Simpson used this latter game as a touchstone for this discussion.

He argued that instead of the Blue and Red tactical-level players being actual players of the game, they should better be considered arms of control. Their job at the tactical level is to create a reasonable, plausible and, especially, useful story line to feed back up the chain to drive operational- and ultimately strategic-level play. Instead of keeping the Red and Blue displays hidden from each other, Mr. Simpson argued that they should share them and work in a closely coordinated fashion to develop the story line together. In essence, he was arguing for a new sort of *free kriegsspiel*, not driven from the top down by a senior umpire, but rather one driven from the bottom up by the low-level players. Dr. Lademan called this idea the "elegance of synthesis;" the conversion of a three-map problem into a one-map solution. All the tactical players work with ground truth because all are umpires, not players. Their roles include not only implementing higher order decisions and adjudicating their outcomes, but also reporting those outcomes back up their chain of command in a way consistent with what the two sides would be able to know in the real world.

This discussion led also to the recognition of another problem that can get in the way of effective multi-level gaming. For the concepts to work well, Red and Blue must both be able to know what they should know in the real environment. Too often it is the case that game designs over-emphasize Blue systems and capabilities, creating an asymmetry in realism between the representation of the sides. Less often, there can be a failure to give Blue enough credit for capabilities of fundamental importance to achieving a game's objectives. This problem seems to stem primarily from failing to recognize the importance of matching a game's design parameters or models with the

dynamics of real action that must be represented effectively to achieve a game's objectives. The best example is a case in which Blue forces are counting on an asymmetric advantage in intelligence, surveillance, and reconnaissance (ISR) based on technical systems that provide Blue an information advantage. When the game design or game models are abstracted to too high a level, such that the systems for adjudicating and assessing game results are not sensitive to the critical asymmetries, the representation at the tactical level may preclude realistic information and decision making at the higher levels.

Mr. Simpson identified those problems as sources for some of the weakest elements of GWG 2000 and 2001. The asymmetry between Red and Blue in detail of representation and action of forces and sensors—and in the amount of game support each side received—handicapped the Red players by preventing them from knowing what they should have known in the real world under similar circumstances. Commanders on both sides must receive the information they are entitled to receive by the play at the lower levels, or the game's representation is fundamentally and fatally flawed where it counts the most—in the decision making processes. This pitfall is one of the key dangers a game's collection, analysis, and production (CAP) team must be continually alert to.

From the Quantico perspective, you can maintain a common game clock across all levels of play, even at speeds faster or slower than real time, but to make even that sort of game work, the lowest level of play must be preparing ahead of time for the events of importance foreseen as a result of the higher level plans and decisions. This requires that the "players" at the lowest level be subsumed into the umpire function and work together to create the story line that flows from and feeds back to the higher levels. This story line or storyboard must be "hacked" to a series of specific events, but those events must occur according to the running clock. To use this technique successfully requires collaborative planning tools and a means of creating and displaying the common picture that all the umpires can play off. In large games, like past Globals, the "game floor" must stay at least a couple of days ahead of the play at the next level up—the operational level.

During the last couple of GWG's, the display for that storyboard was a physical, or analog, one—a long whiteboard or paper display showing the upcoming sequence of events (*similar in concept to displays of battlefield synchronization used by the U.S. Army during contemporaneous exercises.*). (Later during our research, Professor Christopher Weuve of the NWC provided us additional information about how the GWG 2001 game director, Warren Wiggins, actually executed this. It included the following elements:

- The master whiteboard was a chronological display of all of the events of the game, past and future.
- When the players determined that they would conduct an action (e.g., launch a strike), the master whiteboard would be annotated to include the planned event, and then working backwards, the controllers would add all of the elements necessary to make the event happen.
- As events (either the big event or the supporting pre-cursor events) happened, the other side would be notified of events that were visible to them, thereby triggering counter-actions.
- There were events that were rendered irrelevant by both adversary actions and own-cell changes. Unexecuted events were left on the whiteboard, but the fact that they were unexecuted and the reason why was listed. Thus, the whiteboard became the de facto post-game chronology.

Note that, at least theoretically, this approach offers a potential solution to the problem of not emphasizing pro-Blue asymmetries. Many of the asymmetries that U.S. forces enjoy involve faster decision and execution cycles, which can be well-replicated through this sort of approach).

Such a display allows the entire group of umpires to maintain their situational awareness and determine with whom they need to cooperate to drive the game's events. To build and maintain it, those umpires must talk face-to-face—computer technology is not yet up to managing such an intricate dance automatically. Instead, the computer systems are best used for their primary strengths—to keep track of the "mechanical" information and physical interplay of systems

and units. Just as real orders flow from human commanders at one level to their human subordinates at lower levels, game commands must be acted upon by human umpires at the lowest levels. By imposing real-world command and control disciplines, such as the system of warning orders, alert orders, and execute orders, the operational and strategic decision makers give the tactical umpires the required lead time to build the story and manage the collisions of forces the orders initiate.

Of course, as Lieutenant Colonel Bessenger so correctly pointed out, the biggest obstacle to a successful game lies in a poor or non-existent statement of objectives and a design process focused on achieving those objectives. The Marine Corps Warfighting Laboratory's Wargaming Division has developed a set of procedures to facilitate the rigorous application of a logical design process that makes those necessary connections. (Although these materials were still in draft form and could not be referenced, we consulted copies of some of their materials and gleaned ideas from their approach that proved to be useful complements to the rest of our thinking.) In particular, the concept that Mr. Simpson termed "rapid assessment gaming" holds great promise as a pillar of what they at Quantico are beginning to explore as the "next generation of wargaming."

Questions and answers

To help "prepare the battlefield" for our conversations and kick off the discussion, we had sent the staff at Quantico the set of four primary questions listed earlier. We did not run the meeting rigidly according to those questions, but we can provide some summary answers to them as the result of the conversation.

1. What multi-level wargames have you conducted or participated in?

   The Wargaming Division is responsible for conducting a program of wargames in support of the Commandant of the Marine Corps (including USMC Title X games), other Marine Corps sponsors, and sponsors outside the USMC as well. They provided us with a written summary of several of the games they conducted over the past 15 years. In addition, the division also coordinates USMC

participation in other-Service Title X games. Mr. Simpson was an active participant in Naval War College Global War Games, particularly GWG 2000 and GWG 2001, where he played roles as a senior umpire for Marine and ground operations.

2. What were the goals and objectives you sought to achieve in multi-level games?

   The goals and objectives of the wargames have varied across a wide spectrum, from some educational and training objectives to broader research objectives, including gaining insights about future force mixes and new concepts of operations. These latter issues seemed to dominate the multi-level gaming; exploring the complex interplay of strategy, operational concepts and force mix, and tactical employment of forces and systems is a frequent and challenging topic for multi-level wargaming.

3. What interfered with your ability to achieve your goals?

   The direct response to this question revolved around the "three-map problem" discussed earlier. Interpreting that problem more broadly, we would characterize what we heard as being primarily an issue of synchronization—not only synchronization in a chronological sense, among the actions and decisions of the different command levels, but also synchronization of game processes and mechanics with real-world driving dynamics. A major element of this obstacle is the requirement to provide both (or all) sides in a game the information to which they are "entitled;" entitled in the sense that they would, of necessity, have such information in a real situation. (If two surface ships pass within 500 yards of each other in clear visibility, they would certainly know of their mutual presence.) A corollary to this problem is the damaging effects of poorly managed and coordinated tactical-level play for creating realistic conditions for higher level decision making.

4. What did you do to overcome the problems?

   The main thrust of the discussion of solutions focused on the value of the "hybrid" technique of closed planning and open adjudication and assessment, which appears to be the more or less standard approach for many of the USMC games done at Quantico. The

extended conversation about the techniques used in GWGs 2000 and 2001 really came down to an application of this hybrid approach in a slightly modified form during a running-clock game rather than the more usual USMC approach of an event-driven game. This approach is eminently applicable to multi-level gaming; the operational and strategic level decision makers can play a closed planning game, while the tactical-level play takes the form of an extended open adjudication session, in which the tactical players assume the roles of umpires with the task of providing the story line to feed up the chain to the operational and strategic players. Without political or bureaucratic imperatives to "play the approved models," which may well require dozens of bodies to maintain and run them, there is no obvious reason why a small team of such umpires (of the right background and temperament, to be sure) could not manage this task. Indeed, the smaller such a team can be, the more likely that all the umpires can maintain shared situational awareness of the activities they need to coordinate, and that their resultant story line is clean, plausible, and understandable to the higher level players.

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Army Center for Strategic Leadership

Under the auspices of Colonel Robert Hume, USA, the Director, Science & Technology Division of the Center for Strategic Leadership (CSL) of the US Army War College (USAWC), we spent the afternoon in briefings and discussions of wargaming with a dozen members of the USAWC's staff. In addition to Colonel Hume, we heard from Colonel Philip M. Evans, USA, Director of the Operations & Gaming Division, who largely coordinated the presentations. Professor Doug Campbell, the overall Director of CSL, also spent virtually the entire 3 hours with us. A full list of the participants is at the end of this section.

Background of CSL gaming

The point the CSL staff made repeatedly is that their focus is nearly exclusively on learning. Their use of gaming is thus strongly consistent with this focus. In addition, their gaming has to accommodate a large number of students (hundreds of students organized in seminars of about 15 to 25 students each) and must be fully integrated into the educational process, resulting in a carefully controlled and mentored gaming environment (rather than one of unrestricted free play). Their games are focused on the strategic level of thinking and look out to the far future (the 2020s +). Their fundamental design structure envisions real-time play coupled with jumps from critical period to critical period.

Unlike some gaming philosophies that emphasize modeling and representation of events and outcomes primarily in terms of believability and credibility, CSL strives for the more difficult goal of representing complex tasks as realistically as possible. Partly as a result of this philosophy, their games tend to be more flexible and adaptable to student decisions and less scripted than other approaches. Finally, because of the close integration of international students throughout

the seminars, the games are almost always played at the unclassified level.

Much of the session we had with the staff concentrated on the scope of CSL wargaming and incorporated discussion of our major issues within several broad segments. The key presentations and discussions revolved around four topics:

1. The Joint Land, Aerospace, and Sea Simulation (JLASS), a long-running series of joint educational wargames with participation of all the Service war colleges as well as the National War College, Industrial College of the Armed Forces (ICAF), and Joint Special Operations University (JSOU)
2. Role-playing simulations created by the Strategic Experiential Education Group (SEEG) and used by non-resident students in the distance learning program
3. The International Fellows Strategic Crises Negotiation Exercise (IFSCNE), which uses gaming in a unique approach to help teach key skills to the international students
4. The Strategic Decision Making Exercise, which is both the major gaming element of the program and the one with potentially the most interesting insights directly applicable to our current research effort.

JLASS

JLASS originated as CarMax (for Carlisle and Maxwell), a joint Army–Air Force game, which became integrated with other senior Service colleges and National Defense University (NDU) as it evolved into its current form. The JLASS game concerns itself primarily with campaign planning. Players from NDU's Industrial College of the Armed Forces (ICAF) typically play at the level of the National Command Authorities (NCA) and the other schools take on lower-level roles. As real-world command structures evolve, the game evolves with them; newly added elements include both Africa Command (AFRICOM) and Southern Command (SOUTHCOM).

College faculties meet six times yearly to coordinate their efforts. Most important, of course, is to identify the goals and objectives of the overall game to allow each participating agency to achieve their specific goals and objectives within the overall framework. To manage the play of the game to achieve those learning objectives, a steering group, or "council of elders," oversees play in real time.

Over the course of the academic year, the schools work together to develop the scenario and story lines. At the end of each year's game, they publish a "World Summary," which forms part of the backdrop for the next year's scenario development. (Though, as we understand it, that connection is not as strong as it would be if it were a continuing scenario from year to year.)

Students, typically at the O5 and O6 levels, actually play the game, usually in 5-hour moves at the beginning of the day. After the students complete their moves (essentially planning exercises), the council of elders spends the afternoon working through the plans, determining what should happen as a result of those plans, and preparing update briefs to report back to the players. Most of the details are worked out in concert with operational controllers who, along with active media play, represent the principal means of connecting the players with game events.

Of particular interest for our research, the controller-to-student ratio is close to one-to-one. The after-action-report (AAR) process is a critical link between the players and the controllers and other faculty, as players receive situation updates and give direction for responding to those new situations. The control and adjudication processes try to emphasize broad capabilities rather than specific platforms and systems.

Role-playing simulations

The CSL created the SEEG to empower a group to think about how to adapt new technologies to experiential education. In addition to off-the-shelf games (such as *A Force More Powerful* by BreakAway Games), SEEG quickly adopted the Fablusi game engine (http://www.fablusi.com), a role-playing simulation engine developed in

Australia. What we saw at Carlisle and other sources on the Internet indicate that the engine is more focused on true role-playing, rather than eye candy.

SEEG uses Fablusi and its other games to create multiplayer on-line gaming sites and populate them with specific "conference rooms" and "buildings" representing specific individual game worlds. Players may enter these various worlds and assume roles, with their concomitant powers and limitations.

The Distance Education program comprises more than 300 students worldwide. These students play games provided by SEEG for one to two weeks at a time as part of a two-year program. These games are considered as a laboratory supplement to the core readings of the course. Students play through a progression of games to experience and learn about the processes of campaign planning.

International fellows program

The USAWC and CSL have a numerous and active program for students from outside the United States. One unique employment of wargaming at CSL is to help those international students learn better negotiating skills, cultural awareness, and language skills, partly as an end in itself, but also as a means of preparing those students to play more effectively in the games involving their American classmates.

The game for the fellows involves a largely political-diplomatic scenario, currently set in the South Caucasus region of central Asia. Players assume roles associated with key entites, such as Azerbaijan, Iran, Russia, Turkey, Armenia, the United States, and a regional non-nation state. Student players are thoroughly mentored, with the goal of helping them develop their negotiating skills and understanding of strategic diplomacy and decision making for the Strategic Decision Making Exercise (SDME)—which we discuss next—and to help and advise U.S. players by playing non-U.S. roles in other games. (One of the important learning objectives is to teach the international students how to assume roles and interact with the American students on the basis of those roles rather than on the basis of personal relationships with their classmates.)

This particular game seems to have received a lot of good press in academic circles. CSL has conducted the game for academic audiences at both Georgetown University and Texas A&M University. Their experience is that the university students tend to be more idealistic and conciliatory in searching for diplomatic solutions whereas the International Fellows are generally more conservative and cautious.

Strategic Decision Making Exercise

The SDME is the USAWC's capstone exercise. One of its primary goals is to "pull up" operationally oriented student players two or three levels beyond their current strata in the command hierarchy. The game strives to give the students a chance to apply all the various elements of the courses they have experienced throughout the academic year and integrate them in a single exercise.

The game is played through two "semesters," each of three days, split between the end of one week and the beginning of the next. In addition to creating a natural jump point, the two-semester approach allows the students to be shifted among the player roles from one semester to the next; this gives more players a chance to experience leader and follower game roles. In addition, the game is played in two "worlds" simultaneously, with half the students playing in each world. The worlds start out with the same basic structure and scenario but evolve separately as players make different decisions.

The key concept of this game, from our perspective, is the philosophy and structure for command levels. There are four such levels represented in the game. The top and bottom levels are control—High Control at the level of the NCA is played by faculty; Low Control at the level of operational/tactical execution is played by gaming staff, subject matter experts (SMEs), and others.

In the middle of this "student sandwich" are the students themselves, playing two levels of command. The upper student level is referred to as the Policy level. This could represent the military service chiefs, for example. The lower student level is referred to as the Implementation level. These could be the geographic combatant commanders (such as CENTCOM) or functional commanders (such as SOCOM).

The rough ratio of students to controllers proper is about two-to-one; when considering the total numbers involved, however, the student-to-nonstudent ratio is more like one-to-one. This number includes typically 2 observer-controllers per each of the 15 or so student cells (say 4 or 5 at the policy level and about 10 at the implementation level). Each of the student cells runs from 4 to 25 students.

In preparation for game play, the faculty and control staff develop story lines and branches associated with likely student decisions. They are thus in position to respond relatively quickly to player actions along the main branches, while maintaining some flexibility to modify those story lines to adapt to different player decisions.

During game play, they do observe a tendency for the players to drift off their higher level command roles to dabble in lower level operational matters, but because control drives the pace of the game pretty hard, the players seldom have time to indulge themselves in excursions into the tactical realm. The design requires a lot of detailed information to exist at the lowest levels, but that information is usually restricted to Low Control, so that the latter can answer questions from the players in appropriate detail. The staff of Low Control is trained and experienced in dealing with students who want to jump the chain of command and muck about in tactical details beyond their purview. The game design provides a number of avenues for dealing with particularly troublesome players. These include senior mentors at the active or retired three- and four-star levels, NCA direction (including relieving recalcitrant and insubordinate commanders), and embarrassing media interviews and stories used to punish the guilty.

Other active elements of the game design include key interagency and military meetings; bilateral meetings with representatives of other nations (this is where the International Fellows can come into their own); in-person interactions with distinguished visitors (DVs); and VTCs with serving Congressmen and commands in the field. The DVs often role-play as special assistants to the President and students must create and present quick turnaround briefings to the DVs who must pass the information to the President. This can be a challenge for students used to the PowerPoint Ranger school of DoD briefings

when confronted by civilians who demand less jargon- and acronym-filled information. An added element of the DV visits occurs when the DVs step out of role to provide the students with a real-world description of the life of a senior leader. This has the side benefit of teaching the DVs a little about the next generation of senior military leaders and frequently can help increase the support of other agencies for future participation in CSL wargames.

There is a similar effect associated with Congressional play. What started out as an effort involving one or two Congressmen has grown into a situation in which several Congressmen actively seek to participate—currently, an array of 12 play each year. Not only do they play their game roles during VTCs, but they also provide some active mentoring to the students about how they came across and the potential real-world effects of their performances. A similar learning opportunity arises during media play, which can include extensive television broadcasts within the CSL. So important does the Center consider the media element of the learning process that they use fully 10 percent of the total labor of the game in media-related activities.

We wanted to learn as much as possible about how they controlled the game, so much of our discussion centered on their philosophy and processes for control.

In a manner not dissimilar to that propounded by the Quantico gamers, CSL sees Low Control as a primary source of information for the players. The higher level commanders ask the lower level ones for reports about what's going on, and the latter seeks the details from Low Control.

A critical element of the control philosophy is that Control plays Red—there is no active Red play, nor even a semblance of an independent Red. Because the entire purpose of the game is to reinforce and bring to life the key educational lessons the students have studied throughout their courses, Red play is tied tightly to those learning objectives.

Thus, coordination of control among the High and Low controllers is essential. Their principal "levers" of influence include the media, Red forces, and the feedback from Low Control (which usually

includes the local Country Team, nominally the leading agency for managing the entire politico-military situation). High and Low Control work closely together, with nightly meetings providing the opportunity to develop shared situational awareness and coordinated direction. Every day's activity is pre-scripted and planned. The necessary MSEL inputs are then carefully adjusted as needed, or specific predefined sequences are chosen to meet the current situation and directions in which players are driving events.[8] The most dangerous uncertainties that can lead to serious mismatches between player actions and pre-planned story lines are force-on-force interactions; fortunately, most of the SDMEs seldom get into such situations. Similarly, force-on-force situations are the most likely sources of players dropping down into the weeds; by minimizing opportunities for such interactions, the games minimize the opportunities for players to lose lock on their game roles.

Discussion

The conversation flowed seamlessly from considerations related to the SDME to some of the obstacles to successful wargaming in general. There was general consensus that the biggest obstacles involve resources or rather the lack thereof. Colonel Blakely of the Department of Distance Education emphasized that as much as they would like to use more and more detailed games in their program, the available time and manpower precluded developing such detailed games.

Mr. Ritch Dion, a civilian contractor who is a major player in the JLASS and IFSCNE, raised the subtle point that a critical resource for all games, particularly those at CSL, is expertise. Finding the right expertise is critical. And this is not a problem with a static solution set—one person's expertise must be current to be useful, and drawing senior mentors from the ranks of retired senior officers can walk a fine line between currency and irrelevance. This phenomenon may

8. Tangent alert: MSEL, pronounced MEE-zul, is the Master Scenario Event List, an acronym that has become so perverted in use that you will often see it written as MESL and described as the Master Event Scenario List; some sources even use the right meaning for the wrong acronym, calling a MESL the master scenario event list. End of tangent.

be most pronounced in the increasingly important aspect of interagency activity and how things really work there. One of the major shortcomings of the experience of many of the students is a lack of understanding of how interagency operations are managed and implemented.

A corollary requirement, in addition to expertise and other resources, is an improved set of tools for presenting information to the players in "just the right amount and detail." Someone mentioned a system called the Strategic Wargaming Automated MSEL Injector (SWAMI), which automatically generates message traffic in realistic formats on the basis of MSEL inputs. Unfortunately, we were not able to track down any further information about this system.

A seldom mentioned artificiality can occur when the game creates an information base of great scope and detail and makes it available to the players, but the players are not aware of what is available and how to get at or use it. Unlike real staffs, who live and work with such data and information sources on a daily basis, wargame teams seldom have the same level of awareness and experience with the information tools available to them. Thus information management, writ large, is a potentially serious obstacle to creating effective wargaming environments.

One interesting issue that the discussion raised was the potential for drawing on reserve, and even active duty, military personnel to provide augmentation of the game experts for carrying out large games. Reserves can often be useful to fill technical or logistical support roles, freeing up more experienced game staff for more directly game–related tasks. Active duty personnel can sometimes be very useful playing the role of Low Control because of their current expertise and experience of how real-world operations work.

Another potentially serious obstacle lies in the interactions of the players at the policy and implementation levels. The latter will often sit around waiting for long and detailed guidance from the former, especially at the beginning of the game. Once the lag develops, it becomes difficult to get players back into some easy flow. To avoid slow startup, one of the techniques the CSL gamers use is what they call a "shotgun start." This approach begins the game in a situation in

which some level of operational activity is already underway, based on some pre-existing higher level guidance. Coupled with the detailed descriptions of the game world as provided by the background and scenario information, this approach goes a long way to avoiding the problems of slow startup.

During JLASS games, the students also need to understand their game roles and to have their command structures defined consistently with those roles. Creating this consistency of viewpoints has been a problem with JLASS in the past because the different schools or other sources of players did not always have consistent views of objectives and procedures.

The "Big Idea"

The most thought provoking point of discussion came down to the question, "How much is in the middle of the sandwich?" That is, how many layers and how many players make up the levels between High Control and Low Control? There was an overwhelming consensus that it is impractical to conduct a game of the type the CSL is used to doing if there are more than two levels of command represented by active players. In their fundamental construct, the middle layers are where the education takes place; they are not there just to link the higher and lower levels. (This is an intriguing concept in itself. Under what conditions might it make sense to turn the sandwich inside out, as it were, and have Control play the middle layers and the target audience for the game, students or researchers, play the upper and lower levels?)

The reason for this limit of two levels is that, in their experience (as well as much of our own), using more than two levels of players often results in the creation of "internal feedback loops" that "spiral out of control." That is, the players conduct various actions and interact among themselves without Control's being aware of what is going on. If allowed to expand unchecked, such player activity can result in unrealistic and disruptive situations developing before Control can step in to fix the problem.

If this observation is akin to a universal truth, it argues that truly playing strategic, operational, and tactical games—in which there is free play at all three levels—may be impractical without dealing with the resultant problems of internal player feedback.

Participants

The participants in this discussion included the following representatives from the Center for Strategic Leadership:

- Professor Douglas B. Campbell, Director, Center for Strategic Leadership
- Colonel Robert S. Hume, Director, Science & Technology Division (STD)
- Colonel Philip M. Evans, Director, Operations & Gaming Division (OGD)
- Colonel Frank Blakely, Director, Irregular Warfare & Homeland Security Studies, USAWC Department of Distance Education (DDE)
- Major Randy Vasquez, Strategic Intelligence Officer, CSL-OGD
- Major Kyle Burley, Simulation Officer, CSL Strategic Experiential Education Group (SEEG)
- Colonel Brad Ward, Director, Department of the Army Support Branch, CSL-OGD
- Commander Eric Hanson, USN, Director, Naval Operations (JLASS), CSL-OGD
- Colonel (Ret) Scott Forester, Senior Analyst, CSL-STD
- Mr. Chip Cleckner, Senior Analyst, CSL-STD
- Mr. Ritch Dion, Strategic Communications Operations Specialist, CSL-OGD
- Mr. Lawrence M. Blotzer, Senior Analyst, CSL-OGD.

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Christopher Carlson, Captain, USNR (Ret.)

Christopher Carlson is a well known designer of commercial hobby wargames (mostly in collaboration with Larry Bond on the *Harpoon* and *Command at Sea* naval miniatures wargames)[9]. He is also a senior intelligence officer currently working at the Defense Intelligence Agency. He became aware of the project we have been conducting for the Naval War College's Wargaming Department and offered to talk with us about some of his ideas, particularly those associated with what he calls Decision Node Wargaming.

Much of Captain Carlson's recent work in wargaming for DoD has been in supporting the Halsey Alpha group (War Gaming Department, Naval War College) as a Navy reservist, and focusing on the intelligence community's training and tradecraft requirements. In the case of the latter, the latest gaming buzzword has become "Instructional Alternate Reality Games;" a computer-based role-playing approach that provides "situational learning solutions" through the combination of adult learning theory with story telling and gameplay. One of the biggest issues with expanding the use of more traditional wargames in the education of intelligence professionals is what he characterized as a "marketing problem." This problem revolves around different philosophies of intelligence analysis, one he characterized as the distinction between "reporters" and "analysts." Reporters are "just the facts" sort of folks who seem to revel in the details of a particular situation or event; whereas analysts explore the data to try to understand better what operational possibilities may be derived from the available sources in an attempt to forecast future events.

From Captain Carlson's perspective as more of an analyst than a reporter, wargaming in the intelligence community can be an

9. Bond, Larry L. *Harpoon: Modern Naval Wargame Rules.* Normal Illinois: Game Designer's Workshop (1981) and *The Rising Sun: Command at Sea Volume I.* Phoenixville, PA.: Clash of Arms Games (1994).

important tool in trying to think beyond the conventional wisdom. It is a quintessential tool for exploring alternate or competing hypotheses and applying alternative analytical techniques. It is sometimes very difficult, indeed, to interest senior decision makers in such outside the box approaches, simply because those decision makers are heavily invested within the confines of the box.

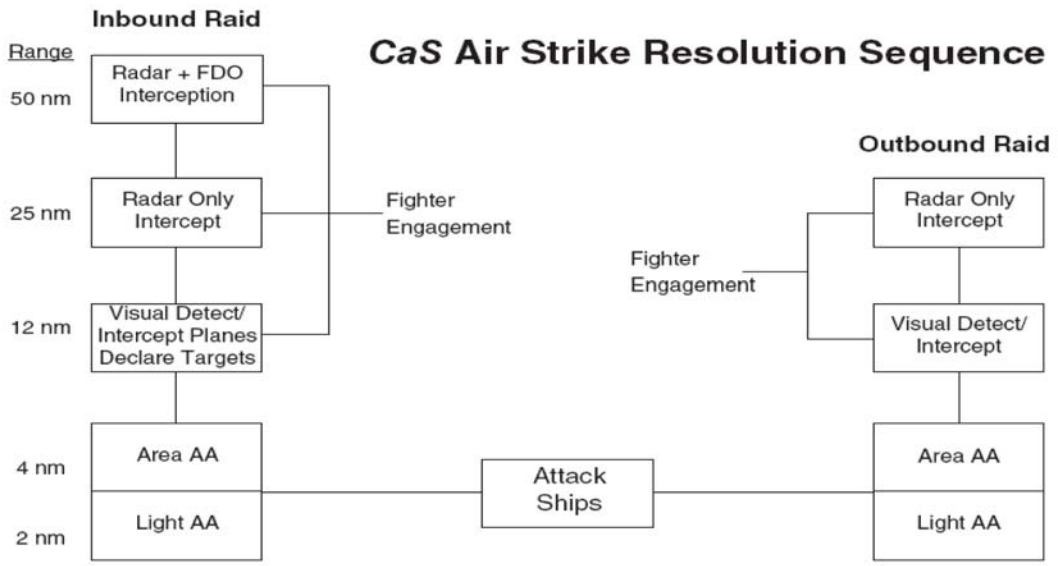
In preparation for our session with Captain Carlson, we had sent him some of our very early game-design ideas, based on previous games we had done for the WGD. In discussing some of these ideas about using certain hobby-game techniques, Captain Carlson argued that a game system that looked too much like a toy game would create its own serious energy barrier to senior decision makers already skeptical of the value of wargaming. He understood our emphasis on ease of use and speed of resolution at the lowest levels to help maintain synchronization and interest at the highest decision levels. His proposed technique is based on a system he has used to conduct multiplayer wargames at tactical and operational scales for both civilian and military wargamers. This Decision Node approach has some elements in common with other systems, as well as some interesting new wrinkles.

The basic idea of the approach is to speed up the resolution process for large tactical engagements. For example, a classic case arises in dealing with interactions of dozens to hundreds of tactical aircraft during a scenario recreating the Battle of Midway in 1942. If carried out using normal tactical-level game procedures, the actions and capabilities of each individual aircraft would have to be represented in detail. It would take many, many hours to play out an engagement that would last only a few minutes in the real world. The challenge of the aggregated or node based approach is to preserve significant tactical decisions without worrying about representing the actions of individual tactical platforms or systems in detail (see figure 1).

The decision node approach instead focuses on resource allocation and battle management, not on the turning and burning of individual aircraft. It does this using an approach that incorporates storyboards and branches. These can be created ahead of time during the design of the game, or created (or modified) in real time as player actions trigger new situations. A storyboard of this type could

incorporate elements of computer flowcharting techniques as well as schematic displays similar to classic naval maneuvering boards. The approach aggregates time, space, and forces to allow a broad outcome for a series of interrelated small-scale actions without dealing in detail with each one.

Figure 1. Carlson's resolution sequence for air attacks[a]



a. From Carlson, Chris, "Resolving Large Air Battles: Midway at Historicon 2006," *The Naval Sitrep,* issue #31, October 2006, pp. 25–27

There are a number of commercial hobby wargames that include such techniques or displays. Chief among them in our experience are Hornet Leader *(GMT Games),*[10] Task Force *(Simulations Publications, Incorporated or*

10. Verrsen, Dan. *Hornet Leader.* Boardgame. Hanford, CA.: GMT Games (1991)

SPI),[11] *and* The Fast Carriers *(SPI).*[12] *Unfortunately, all these games are out of print, though copies can be found on the secondary market.*

Ultimately, Captain Carlson's main focus is to realize that "the operational level is about planning; the tactical level is about procedures." His goal is to find a middle ground between the two, one that he calls "Grand Tactical Gaming." His emphasis is on preserving key tactical decisions by using an event-driven focus, which requires the players to conduct some operational planning while preventing them from dropping down into the tactical weeds. The approach seeks the golden mean of using aggregated statistical models while avoiding both over simplification and swamping players in details.

Captain Carlson very kindly provided us with a set of informal briefing slides,[13] as well as a couple of articles[14] describing his use of the technique during a gaming event, and a sample of one of his aggregated models. These provided additional details and insight.

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11. Balkoski, Joseph M. *Task Force*. Boardgame. New York: Simulations Publications, Inc. (1981)

12. Dunnigan, James F. *The Fast Carriers*. Boardgame. New York: Simulations Publications, Inc. (1975)

13. Included here in the appendix.

14. See Carlson, Chris, "*Command at Sea* Consolidated Bombing Table," *The Naval Sitrep*, Issue #31, Oct 2006, pp. 11–12, and the footnote to figure 1.

Naval War College

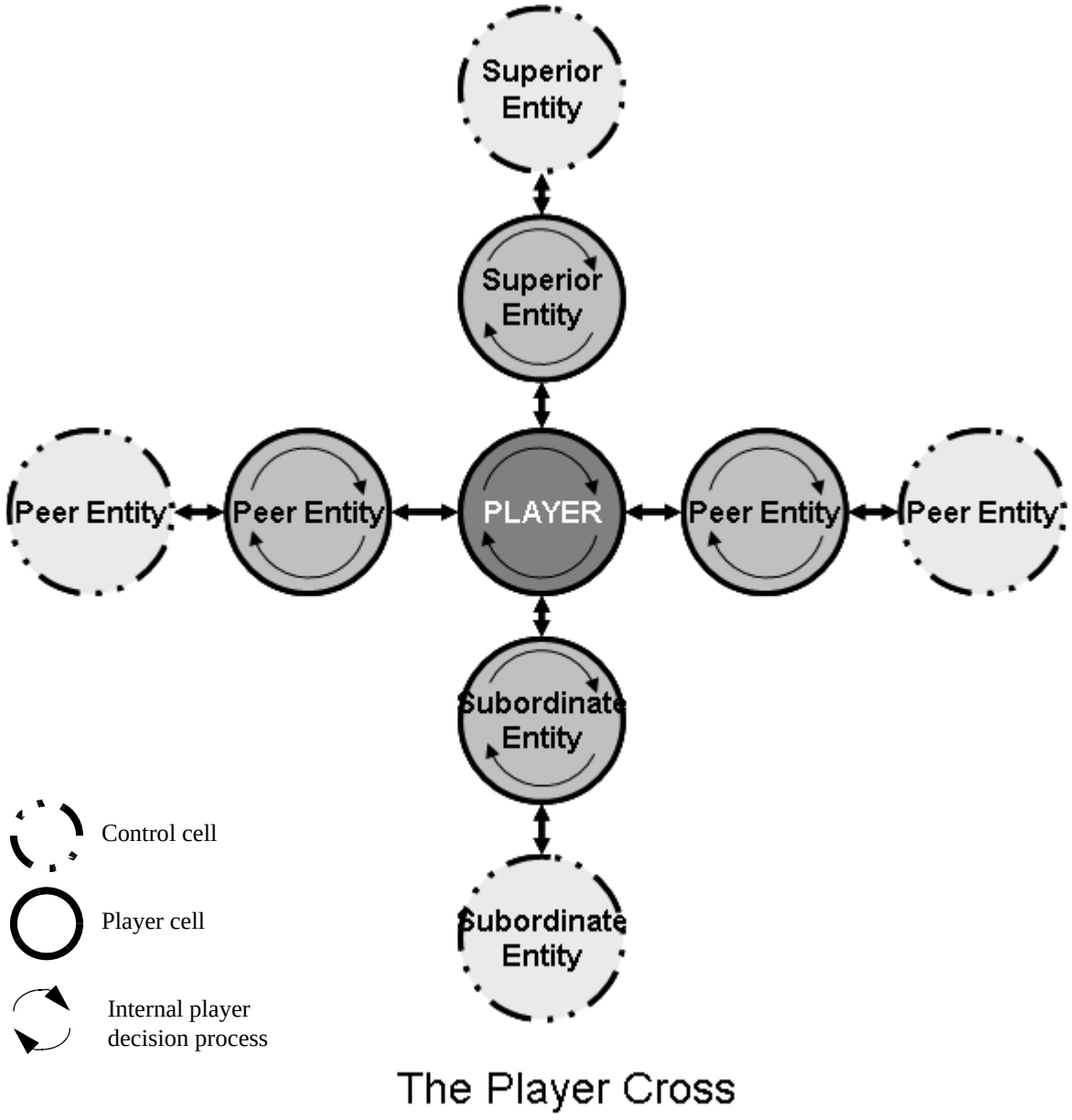
In the middle of our program of interviews with other agencies, we also conducted a conversation with Professors Stephen Downes-Martin and Christopher Weuve of the WGD at Newport. This conversation was a combination of interim report and ground laying exercise for the future course of the research.

We began by introducing the notion propounded to us by the Army gamers at Carlisle that they used a "player sandwich" with no more than two layers of players with a layer of control above and below. We agreed that a general concept might be derived from this idea: that no player level should deal only with other player levels and not at least one control level. Thinking along those lines would allow us to create what we called a "player club sandwich," which might contain more than two player levels as long as there were control layers inserted to avoid the "three-in-a-row" danger of having some player layers interact only with other players and not directly with control. As the CSL gamers described it, the danger associated with this issue is one of creating feedback loops among player levels, which are not directly visible by control.

This discussion led to Professor Downes-Martin's formulating the idea of thinking of control as the C3 network permeating the game. Professor Weuve introduced here the idea of what he called the "Pellegrino Cross," created by and named after Commander Peter Pellegrino, USN (Ret.), another member of the WGD staff.

Figure 2 shows an image of the cross, representing three vertical layers of command and a single horizontal layer of commands at the same hierarchical level in a tiered command system.

Figure 2. The "Pellegrino Cross"[a]



a. The figure and the paragraph immediately following it are copyright 2008 by Peter Pellegrino and used with permission.

> The "Player Cross" represents the activity and relationship of participants in a game with implicit or explicit hierarchy. The game always is focused on the Player Cell at the center. In most military games, particularly at the operational level, there will be cells or entities subordinate to, superior to, and equal to the Player Cell. While these entities may be additional players in their own right, at some point out on the limbs of the cross these entities will be represented by non-players, i.e., the Control Cell. While it should be self-evident that "All that is not a Player is Control," the implications for game manning; level of activity in the non-player cells needed to support the Players; and the potential problems created by cell-to-cell transactions which completely bypass the Players (i.e., inadvertent Control-to-Control transactions) are often overlooked.

In a subsequent email, CDR Pellegrino expanded on this last, key, point.

> The Cross grew from sponsor meetings where under the banner of "More bang for the buck," or adding more headquarter "realism", the sponsor wanted to add additional "players." But they didn't really mean players, they meant other entities which would interact with the "central" player. Short of getting the entire theater and national level chains of command to play, at some point those entities were going to be acted out/reside in White Cells/Control. So Control was getting crowded and was busy enough already!
>
> The nature of the interaction with these other 'participants' had to be discussed as well. Ok, you think you need a JFACC [Joint Force Air Component Commander] for the JFMCC [Joint Force Maritime Component Commander] to interact with. But do I actually need a full blown CAOC [Combined Air Operations Center] spitting out a 2000 sortie ATO [Air Tasking Order] every 24 hours, or will a Response Cell with a guy on phone watch pushing out more or less canned ATOs do? Maybe yes, maybe no, but I needed a way to graphically show what "add a JFACC," or any other subordinate, superior, or peer group could mean to manning, computer support, game tempo, work load, etc. with clients who thought all this game stuff just fell out of a box, or that we had an infinite number of actors to create artificial worlds for the primary participants to play in.

> Lastly, there was the hazard that with all these "not the player" entities residing in a large, possibly distributed Control group, the Control team as higher headquarters (e.g. CJTF [Commander, Joint Task Force]) would task the non-player cell (e.g. JFACC) with something that was transparent to the JFMCC players (assuming this was a JFMCC game) because (1) it was "realistic," and (2) the cast of participants is so large they've forgotten who exactly is "playing." So now I have somebody at one desk in Control tasking somebody at another desk in Control with no true player involvement! Control is now playing with itself, putting into play injects to be answered by...Control.

Based on our earlier discussions with Mr. Simpson and the other Quantico gamers, we considered the issue of whether past Global War Games (GWGs) really attempted play at all of the strategic, operational, and tactical levels. We agreed that many of the past GWGs did not actually do tactical-level gaming, but rather did only adjudication at the tactical level. We were uncertain about whether future NWC games might intend to extend free-play down to the tactical level, but it seems like a worthy goal if we can figure out how to do it effectively.

In addition, both the NWC professors mentioned a Naval War College game called the Northwest Pacific, or NORWESTPAC game. This is a game played with, and designed by, the Japanese. It has usually been run using the "real time with time jumps" technique. The time jumps are pre-determined, and serve (in part) to highlight changes between warfare phases. Thus, the last couple of years the game has taken place over 30 days of game time, with a day of play followed by a nine-day jump. Also, all of the players are at the JFMCC level, with most of the players in the Blue (Japan) or Green (U.S.) JFMCC cells, and a smattering of players in air and ground cells at the same level of command. Communication between Green and Blue players usually happens by one player simply walking over to talk to their counterpart. Because most people were playing their real-world jobs, this approach helped meet one of the game objectives, that of allowing players to become familiar with their real-world counterpart from the other nation.

We also discussed some thoughts about how to conduct strategic-level free-play wargames—wargames in which both Blue and Red NCAs are

played by real players, not control, at the highest level. To explore strategic-level issues, it appears that a game would need strategic-level free play. But in that case, how do you control the game? *Our discussion touched on the notion that the strategic level is largely about defining the rules rather than simply following an existing rule book.*[15]

If we are managing a game with strategic-level free play, then, control is more about deciding where the game should go to maximize insight rather than about what outcomes of game play are most "realistic" on the basis of some rather uncertain definitions of realism. This is particularly the case when the players of the game are recruited largely because they are experts in the field of interest. Such experts are the very people we would normally seek out to help adjudicate the outcomes of the game play.

So, once again, we return to the notions we discussed with the Quantico gamers—closed planning and open adjudication. The strategic players on both the Red and Blue sides (and possibly other colors if doing a multi-chromatic game) would make their plans separately and communicate their orders to their own subordinates. Based on the feedback from those lower levels, the strategic players then could do a joint open adjudication process at the strategic level.

We concluded the conversation by speculating on the beginnings of a potentially practical process and structure for a game that allows us to explore the linkages between strategic and operational levels, and possibly extending to the tactical level as well. The principal elements of this underlying architecture are vaguely the following:

- Free play at the levels of most importance to deriving the insights required from the game
- Closed planning within the vertical and/or horizontal dimensions of the opposing systems

15. See Frank Chadwick's characterization of this issue as presented in Perla, Peter P. *The Art of Wargaming*. Annapolis: Naval Institute Press (1990) p. 242.

- Open adjudication at all levels, involving both Control and the players from both sides to the extent that they can contribute their expertise without letting the proverbial cat out of the bag where surprise and uncertainty are critical to deriving insights
- Control facilitating the adjudication process, largely through serving as the C3 system through which information and directives flow up, down, and across the various command systems.

NDU and JHUAPL wargamers

Participants

Our next discussion included participants from two major DoD gaming groups: Professor Erik Kjonnerod of National Defense University (NDU) and several analysts from John Hopkins University Applied Physics Laboratory (JHUAPL), led by Scott Simpkins. The full roster of attendees included:

- Professor L. Erik Kjonnerod, special assistant to the president, and former director of the wargaming center, NDU
- Scott Simpkins, wargaming proponent and overall director of the Asymmetric Wargame (AWG) effort of January 2008, JHUAPL (a self-proclaimed *Architect* in terms of game-design styles we defined in our 2007 project for the WGD[16])
- Gary Coyle, gamer and rules writer, primarily for tactical games, JHUAPL (also an *Architect*)
- James Hillman, senior analyst and game director for the AWG held in January 2008, JHUAPL (an *Analyst*)
- Steve Phillips, experienced game controller and writer of injects and intelligence reports, as well as expert in virtual gaming environments,; "Mr. White Cell," JHUAPL (an *Artist*)
- Paul Shelton, former USMC, terrorism expert, currently seconded to the Joint IED Defeat Office, leader of the Al Qaeda Cell at the January 2008 wargame; "Mr. Red Cell," JHUAPL (an *Artist*)

16. See Peter P. Perla, ED McGrady, and Michael C. Markowitz, *21st Century Wargaming: Returning to Our Roots*, Oct 2007 (CNA Research Memorandum D0016876.A1/Final)

- Vanessa Wichmann, wargaming researcher and facilitator in the AWG, JHUAPL (an *Analyst*).

Unlike our other conversations, this meeting, held within a week of the MORS *Special Session on a Wargaming Community of Practice*, tightly intermixed discussions focused on our project goals with excursions into topics of more general interest to the wargaming community. We include the full range of these discussions in order to document both aspects of the conversation.

Communities of practice

The meeting began with an extended discussion of the need for creating a "Wargaming Community of Practitioners" as Mr. Hillman described it. He distinguished his idea from the MORS Community of Practice by emphasizing the need for a way for the community of active wargame designers and developers to share best practices in application of wargaming. He seemed to cast the MORS effort more in terms of a necessary focus on theory and principles for wargaming as a discipline; whereas, his vision focused on the practical presentation of problems and solutions.

Professor Kjonnerod pointed out that things have changed dramatically from 20 years ago when the critical mass of wargaming expertise resided within the government or government-affiliated organizations. Today, more and more contractors, particularly for-profit contractors such as Booz–Allen–Hamilton and SAIC, are doing much of the wargaming (*or at least what some people call wargaming*) for both DoD and other agencies. Getting such contractors to share what they may consider to be trade secrets could be a problem, requiring the exercise of personal connections to get access to such information.

Problems of strategic linkage

In reference to our task for the NWC, that of exploring linkages between strategic, operational, and tactical gaming, Professor Kjonnerod opined that this specific tripartite division may be "old hat" in the new world of the 21st Century. Instead, he suggested focusing on more generic terms for the division of labor: policy, planning, and

execution/implementation. He pointed out that within our traditional views of the strategic, operational, and tactical "levels," there were actually multiple "echelons" within each. For example, at the highest levels we are all pretty familiar with the National Security Council, and are becoming increasingly familiar with the Homeland Security Council. But we seldom include the Economic Security Council in our gaming, despite the critical role that economic security plays in overall security.

Non-traditional wargaming concepts

This failure on the part of the wargaming community to include serious economic play has produced an interesting dynamic. Professor Kjonnerod has been involved in discussions with the Federal Deposit Insurance Corporation (FDIC) about developing games to explore issues associated with economic security. Indeed, the FDIC has been developing games on its own, using economic models based on banking and financial sectors, with little reference (until recently) to the expertise about gaming available in the more traditional security community. FDIC is so serious about the use of gaming for both research and education that it is building a dedicated gaming facility in Dallas.

Mr. Hillman played off this idea by pointing out that the MORS effort is likely to increase the visibility of wargaming, as well as improve the focus and energy devoted to the use of gaming in the future to help understand next-generation warfare—including the incorporation of economic and, indeed, the full range of so-called DIMEFIL elements of national power (diplomacy, information, military, economic, financial, intelligence and legal). What he seeks right now is a better organization of current practitioners who can share their day-to-day experiences. Recognizing the obstacles to full participation by the for-profit contractors, he speculated that some consortium of government organizations, FFRDCs, university-affiliated research centers (UARCs), and academic institutions might be the only practical way to create such an organization.

Obstacles to progress

As we walked off the discussion of the potential value for such an organization of practicing gamers, we addressed more directly the issues of interest to the current project, as embodied in the list of four questions we had provided as a starting point for discussion. Mr. Phillips exhibited a more technology-centered point of view than most of the participants in our series of discussions so far; he presented two issues he described as being primary obstacles interfering with our ability to use wargaming effectively to influence policy and operational issues.

Dissemination of results

The first of these problems revolves around dissemination of game results, a perennial problem. He has seen this problem show up in a particular guise during an ongoing game series, Joint Project Optic Windmill (JPOW). This is an international exercise (a term he applied to wargames that include live participants) that focuses on missile defense. JPOW is hosted by the Royal Netherlands Air Force (RNLAF) and the Missile Defense Agency. Typically the event includes live and simulated participants from USA, Netherlands, Greece, Germany, UK, Norway, Spain, and Italy. It is usually held at the missile test range in Crete, Greece or De Peel, Netherlands.

Mr. Phillips's assessment of the general problem was that some participants (as usual, not all) in one game of a series would "get it" by the end of that game. Some of those participants would show up for the next game in the series, and so would have a leg up. But the majority of players in a second game of a series would not have played in the first game of that series. They would thus be at the very start of the learning curve and at a disadvantage compared to the experienced players—as well as being a potential drag on the ability of the second game to build on and extend the insights from the first. If all games were documented, even to a minimal extent, inexperienced players might have a better chance of entering subsequent games in a series with at least a modicum of background information they seldom have available today.

After-action fictions

The second problem Mr. Phillips articulated is somewhat the obverse of the first. He has seen after-action reports of wargames that were little more than pure fiction. Indeed, he has experienced that most disturbing of disillusionments, discovering that the final report of a game was already written, or at least well begun, before play even started. This well-founded concern touches on one of the crucial elements discussed in relation to a professional wargame society or the MORS community of practice—that is, the notion of professional and ethical standards. In some cases, the issue was more pragmatic; specifically, a robust wargame AAR was required within 30 days. To meet this requirement, those in charge of the conduct of the game began to draft the report during the play of the game itself. Perhaps a professional community of interest could help educate sponsors about the downsides of such overly ambitious documentation schemes. For example, the community might set a standard that if an exercise occurs over a 3-week period and includes hundreds of participants and hours of game time, a 30-day "quicklook" may be practical, but a complete AAR should take 90 days or more if it is to be minimally comprehensive.

Sources of failure

Professor Kjonnerod weighed in to recognize the existence of myriad sources for the failure of a game, particularly as we try to apply the gaming instrument to exploring the unknown territory of the future. This is especially the case when former wargame participants endeavor to create games of their own without understanding much about the principles and best practices of game design. Professor Kjonnerod recounted a story associated with the FDIC effort. They never even considered the possibility that articulating objectives for the game before designing the scenario might be a good idea.

This failure to focus on tangible objectives is perhaps the most common failure of inexperienced game sponsors and designers. One danger that results is that attending a failed game can leave such a bad taste in a player's mouth that it casts doubt on the abilities of gaming professionals, not only those who were involved in that particular game, but also the community as a whole. Even worse, in some sense, it introduces doubts about the applicability and utility of

the gaming instrument. It is difficult, indeed, to see a solution to the problem of having poorly done games damage the reputation of the technique and of its expert practitioners. Again, a professional society, with some accreditation powers, might help mitigate this problem, but it is hard to see a practical solution.

Mr. Phillips argued that there are techniques out there that mitigate risk. One method is to allow for a 6-month to 1-year long cooperative planning process followed by a wargame that is conducted over several 1-week meetings during a 6-month period. This extended process forces all participants to reflect on progress and adjust as needed. Conversely, there are times when on the fourth day of a 1-week wargame, it is realized that things have gone awry, and there is no way to adjust. As Professor Kjonnerod said earlier, however, even bad games never seem to "fail" in the eyes of sponsoring or hosting organizations.

Centers of excellence

Mr. Simpkins argued that one way of helping the situation—though not a complete solution—is to establish some sort of center of excellence in gaming. The resources of such a center would be available for practitioners, sponsors, and players alike to learn more about the gaming instrument and see examples of excellence. His vision for such a center is more about a virtual space than a physical location. It would comprise a central repository for storing and making accessible to others databases of contact information for practitioners; reference libraries and other information sources; facilities for knowledge sharing, such as bulletin boards or FaceBook and YouTube types of electronic information sharing; and a compendium of game results. This latter is, of course, a potential bureaucratic nightmare, involving releasability of such results.

In addition, the organization (or organizations) involved in creating and maintaining such a center of excellence would have to take an active role in developing an "outreach" program of sponsoring meetings or sponsoring individuals to attend other conferences to share information among the broader community. The core of the concept would reside in a comprehensive web site, which in addition to the

knowledge-sharing portals and databases might include playable games, special applets addressing particularly ubiquitous issues (such as agent behaviors), and other technological goodies.

We characterized this notion as a "ConsimWorld" for national security gamers.[17] We discussed the issue of who would sponsor (and, incidentally, pay for) such a site. Mr. Simpkins opined that it might make sense to allow many organizations to establish their own approaches and allow the marketplace to sort out which might be the best, such as the Internet competition among Google and other search engines. With the difference being that all the organizations "competing" for click-share among the community would be cooperating to serve that community through shared information and linked sources. Professor Kjonnerod speculated on the possibilities of developing some way to "tax" various gaming contracts to provide limited financial support to such a cooperative competition. It's an interesting idea that overlaps somewhat with some of the ideas espoused at the MORS special meeting on wargaming and analysis of October 2007. But it is still very much in the vision stage of development until someone, or some organization, takes a real first step.

One of the potential services such a center of excellence might provide is a facility for experimenting with, or play-testing, games before actually carrying out an event. As Professor Kjonnerod put it, "An event is not the time to experiment." But as we have all experienced, the time for thorough play-testing is almost never available. This is exacerbated by what Mr. Hillman observed to be the very real possibility that even the most talented and experienced gamers may well make mistakes as we try to apply the gaming instrument in new ways to increase our understanding of new environments. The dangerous effects, alluded to above, that such mistakes may have on the credibility of the gaming instrument and the gaming community can become a real problem unless the gaming culture is willing to accept this potential for error. The culture of analysis and operations research

17. ConsimWorld is a hobby gaming site that has been in existence for several years and boasts thousands of participants from both the industry and the gaming public. You can find it at http://consimworld.com/.

was open to this possibility in the early days of its existence, but today's sponsors don't much like paying for failure.

Mr. Coyle suggested that another possible avenue to explore is building relationships with the academic, business, and educational gaming communities. These branches of gaming have their own organizations and professional journals.[18] There may be other such organizations worth exploring.

All these efforts suffer from the typical problem associated with such grand visions of cooperation: someone must take the first step and then beat the drum to get others to participate.

Professor Kjonnerod pointed out that the Navy's Global War Game of the 1980s was successful because "it had legs." Its scenarios and outcomes derived from and fed into the processes of various DoD academic institutions, such as NDU, throughout the academic year. It also affected operational concepts and the thought processes of operators by exposing the latter to a broader range of thinking and considerations than they might expect to experience in their normal work environment. Even in this new environment, Professor Kjonnerod contended, "If you can show value-added, they will come." The challenge, then, is to create something that people will value enough to sustain over a period of years. For example, several participants speculated on the merits of an interagency, inter-service, intercollegial competition, which has taken place in the past.

One obvious approach is to identify a sponsoring agency that is willing to stand up and say that it values the effort and encourage people to participate. DoD is the obvious source for such a sponsor, but a DoD sponsor may be "anathema" to other potentially valuable and interested parties. An academic consortium of some sort is one alternative, but establishing such a consortium will require a group of individuals to step up to the plate, especially at the beginning, to provide management expertise and marketing firepower. Mr. Shelton asked whether anyone was up to speed on the efforts by Old Dominion

18. *Simulation and Gaming*, for example, is a well-known journal of the Simulation and Gaming Association (SAGA) and its International extension ISAGA. See http://sag.sagepub.com/

University to develop a center of excellence in simulation in the Virginia Tidewater region. No one was current on that effort.

Wargame or exercise—or both?

At this point, Mr. Simpkins raised another perennial issue. Just what is a wargame? He stated that a large number of their professional clients think of wargames in terms of massive exercises, such as Ulchi Focus Lens, or TOPOFF. Mr. Phillips opined that he thinks an exercise includes live participants, though it may have simulated participants and wargame-like activities. An interesting distinction is one that Mr. Phillips made: an exercise is geared for the participants more than those conducting the game, whereas a wargame is less about the participants and more about the objectives developed by the sponsor. The participants are there because of their expertise and it is beneficial for them to get something from the event, but their benefit is secondary to the wargame outcomes.

This distinction may well be a source of the sorts of misunderstandings that create some "sales resistance" initially when a potential sponsor thinks of games in terms of exercises. However, when educated about the true nature of gaming and the much shorter and less expensive development time for most games, compared to a massive live-play TOPOFF event, they are sometimes pleasantly surprised and more open to a game. JHUAPL has apparently experienced this on several occasions when it has successfully built board games for clients.

Command systems and games

In a discussion more directly related to our project, Professor Kjonnerod addressed the issue of multi-level and multi-echelon gaming. Because of NDU's emphasis on policy and operational levels, most of their games—especially those done to support the curriculum—place players in at least those two levels, even for non-war games. As NDU did more of these games, student feedback indicated that the boundaries between the "levels" were becoming more and more blurred in practice. Because NDU began to include multiple echelons within the individual levels, the students—based on their experience—characterized the ongoing changes in the real-world environment as a

shift of the lower "levels" into actually being lower "echelons" of the higher levels. Mr. Hillman characterized the problem in even broader terms, as the need to deal with multi-level, multi-echelon, and multi-organizational issues.

What's more, Professor Kjonnerod pointed out that the old way of thinking about command systems—indeed, a way of thinking embodied in the Pellegrino Cross diagram described in the previous section—is outmoded. The individual circles in that diagram indicate decision processes internal to each element of the command system; in reality, we now have networks of information flow, command, and coordination that cross not only echelons, but also levels of command. We can no longer accurately represent player roles as simple jobs placed within a stovepipe—or a box (or circle). Modern decision makers operate in the context of networks, and so must modern game players.

Ms. Wichmann pointed out that these changes in the way real command and game roles work may lead to some difficulties because they may run counter to the ways we are used to defining and perceiving the results of game play, producing insights in a form different from what we expect. Mr. Hillman pointed out that if these observations are correct, multi-level gaming's definition of boundaries between strategic, operational, and tactical may be blurring to such an extent that, in reality, we are no longer in a multi-level environment at all. The challenge for the designer, then, is to figure out how to represent that—how to design the event to place the players in such an environment.

Mr. Phillips jumped in here with a long description of his vision of a game "without moves"—or perhaps a better description would be a game "without turns." His model seemed to be a common one among on-line games—real-time game play unconstrained by fixed sequences of game moves or actions. The players simply "act and do," as they would in the "real world," rather than "make moves" in a game. He proposed a notion that gaming is evolving away from considering time and space as boundaries. The assumptions of gaming need to move beyond assessing the capabilities of the players or their game-world entities—a process often characterized as defining the

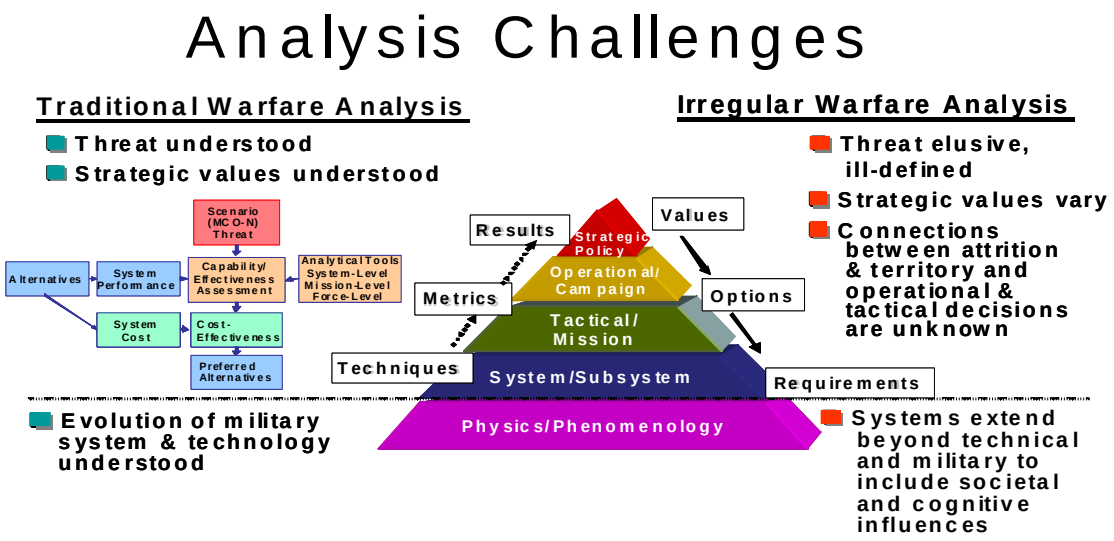
box the players must live in—and emphasize instead the exploring of the edges of that box.

Challenges old and new

Ms. Wichmann also pointed out that such an approach presents a lot of challenges because gaming must be about more than player beliefs and attitudes. Games must show players the consequences of their decisions and actions. Such feedback and consequences are essential for the players to play the game, not only for the analysts who try to extract takeaways from the game play.

At this point, Mr. Simpkins put up a couple of PowerPoint slides Mr. Hillman had created to illustrate some differences in "old" and "new" challenges for analysis (figure 3). Mr. Hillman argued that over the course of the Cold War we had developed a reasonably good understanding of the nature and extent of issues associated with a conventional war in Europe against the Soviets and the Warsaw Pact. We were able to structure analysis of those issues in terms of a hierarchy of levels and associated problem sets for each level.

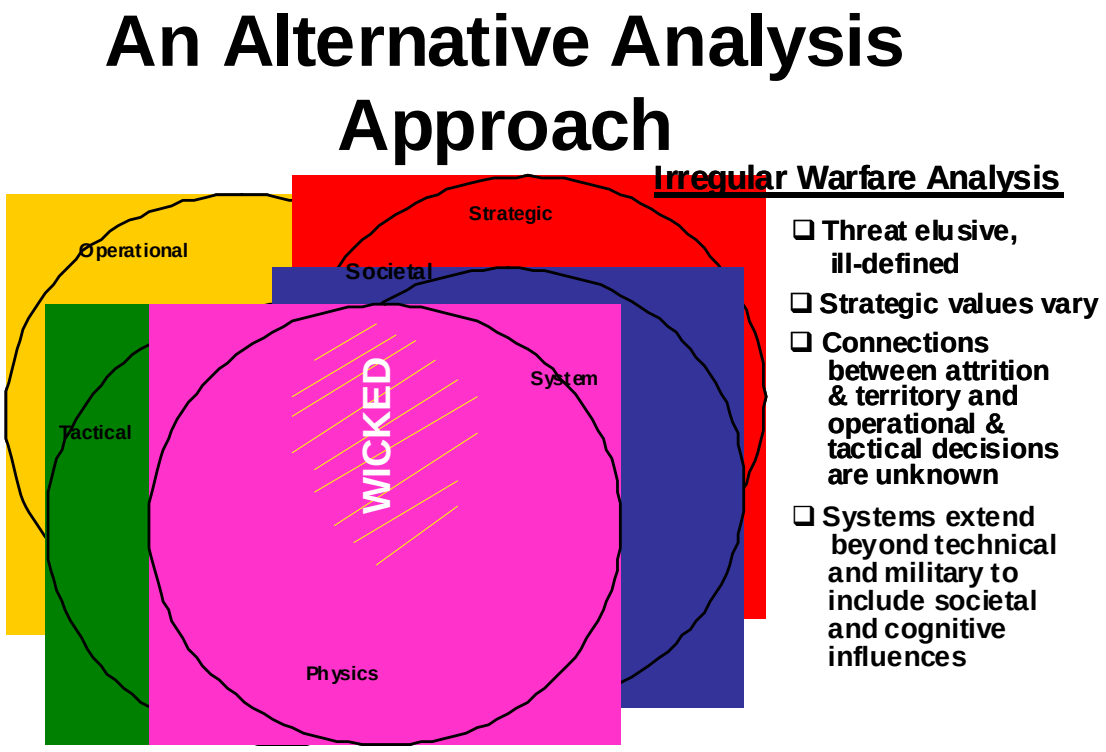
Figure 3. Traditional and irregular analysis challenges[a]



a. Slide provided by JHUAPL.

As we look to the future, however, we face some "wicked problems"[19] in which the overlap of various political, social, economic, military and other types of issues creates a denser thicket of uncertainties that we have to sort through before we can achieve similar levels of understanding (see figure 4). *It is not clear just how well we actually understood the issues associated with conventional warfare (as opposed to our ability to convince ourselves that we did), but it is not hard to agree that our understanding of irregular, or asymmetric, or fourth-generation warfare is lagging behind our need to know more about it.*

Figure 4. Alternative analysis approach to "wicked problems"[a]



a. Side provided by JHUAPL.

19. For a discussion of the concept of "wicked problems," see, for example, http://www.cognexus.org/id42.htm.

Players, controllers, and analysts

Professor Kjonnerod put the problem in perspective by asking the uncomfortable question, "Where do you go to teach someone to be a gamer?" If, in fact, gaming is a powerful tool for helping us better to understand and explore future options, how do we broaden the base of people who can use that tool effectively? At the moment, of course, virtually all training for gamers is on the job training, based on experience of the past. Is that enough? Is it wise? This question does sound familiar; an echo perhaps of the WGD's challenge to CNA for the past several years.

We described the idea of the "player sandwich" as the Carlisle gamers presented it to us, and also the notion of control as the C3 system, which we discussed in the preceding section of this paper. Mr. Hillman posited the generalization of the issue. How do you provide for dynamic control of a game? You need to have some better idea about how to do it before you can teach someone to implement the idea in practice.

If, as much of the discussion seemed to imply, gaming in the future must move beyond the idea of multi-level gaming, perhaps it no longer makes sense to think of the players as the filling of a sandwich contained by Control. Does it make more sense to think about Control as the center of the structure with the players surrounding it around the edges? Does it, indeed, make more sense to focus "Control" not so much on controlling the game play as on capturing what is going on in the game—not so much on managing the direction of the game as on identifying the consequences of player actions and the reasons they took those actions?

These latter elements we at CNA have always attributed to the bailiwick not of Control but of "Analysis." Professor Kjonnerod pointed out that sponsors are more concerned about product than process. *We contend that the product should be precisely about the process. What did the players think and do and why? These issues of the "whys" are, if anything, more important today than during the Cold War. Controlling the game, in the sense of far too many rigid, scripted DoD games, should be more about ensuring that the game produces useful insights from the processes of play than about ensuring the*

players don't escape the box the sponsor might like to imprison them in. Mr. Simpkins pointed out that the "solution space" of a game used to have fairly clear boundaries based on our supposedly deep understanding of the dynamics of conventional warfare. Now, however, those boundaries are in darkness and the play of the game is all about shedding light on those darkened edges of the game environment.

The *Asymmetric Wargame* at JHUAPL

Mr. Hillman described some of the ideas behind the January Asymmetric Wargame that touch on this discussion.[20] That game used a deliberately non-traditional approach to Red play. Instead of the more usual technique in which Red takes some action that immediately confronts Blue with a situation, in this game Red calculated that the effects of its actions would emerge over an extended period of time. One unexpected effect of this approach was that the players at the "tactical level" in AFRICOM began to take more initiative to develop innovative approaches to dealing with threats, partially because they were not jumping through hoops responding to nuisance actions. Unfortunately, many of these innovative ideas were "quashed" by the operational level Blue commander, who also had "one foot in Control." The tactical guys were getting off the reservation and had to be reigned in.

The result of this "conventional" way of thinking proved to be missed opportunities for exploring new ideas. Instead, the lower level players were forced to conform to a more conventional command and control construct that required them to brief and get approval up the chain before they could implement low-level actions. This is, unfortunately, a real-life issue, and the game missed an opportunity to delve into the implications of the contrast between old and new ideas. As Mr. Phillips pointed out, it would have been cool to have some way to play out both approaches and compare and contrast them. Professor

20. Asymmetric Operations Working Group (AOWG). *Al Qaeda and Associated Networks (AQAN) Vulnerability Validation Wargame: Final Report of Analysis and Findings*. FOUO. Johns Hopkins University Applied Physics Laboratory, 28 May 2008.

Kjonnerod opined that this discrepancy could also serve as the trigger for a new game, designed precisely to explore those points of interest.

Game overhead

Mr. Hillman played off this discussion to reintroduce the notion of overhead for games. JHUAPL sees a need to find a way to reduce the number of non-players required to run games, just as the NWC does. In their experience, the number of facilitators, controllers, and gamers grows non-linearly with the number of actual players. Much of the problem seems to stem from the fact that most of the important activities in the game are still done manually, despite the introduction of extensive computer support. Both Mr. Hillman and Mr. Simpkins characterized the situation as "shepherding" the players. The AWG actually was better than most of their games in its ratio of players to support, in this case a little less than 3 to 1 (57 players and 22 support). Other games exhibited the close to one-to-one ratio that the Army gamers at Carlisle described in their large games.

One confounding issue is that the administrative records of many of the APL games count observer/analysts as part of this overhead. *At CNA, our attitude is that the need for analysts to be on hand to collect the critical information is separable from the need for facilitators and controllers to help players participate in the game and to manage the game play.* However, as Mr. Hillman and Mr. Simpkins pointed out, when the bulk of the observer/controller job is to write down what players did, not why, there are more efficient ways of capturing that information, particularly through automated systems for recording such things as unit placement and movement. The key is to create a gaming environment that collects mundane data without the need for a human being to record routine data, like unit locations, by hand.

Some NDU games

Professor Kjonnerod briefly described the way NDU used to run its Crisis Decision Exercise (CDE) program for the faculty. This game, similar in some ways to the Carlisle capstone Strategic Decision Making Exercise, encompassed some 500 students playing in 30 to 40 seminars, each of which was managed by a faculty member, not a

member of the gaming staff. Instead each gaming staff had responsibility for overseeing the operation of three of the seminars. Each seminar played the same scenario, with different students in the same roles, independently of the other cells. Each day of game play ended at noon; the facilitators worked the afternoon to craft the general updates to be consistent with the actions taken in the three cells they were responsible for. The cells could and did behave differently, but only within certain broad bounds. In this way, a relatively small number of controllers could manage a large number of game players.

In the early days of the program, however, the gaming division tried an approach in which they paired two seminars for the same game "world." During the first phase of play, Teams A and B would make policy decisions independently in their shared game world. During the second phase, the teams would exchange policy decisions and become responsible for operational execution of the other team's policy decisions in their shared world. The gamers loved this design, but the faculty hated it. It became too complicated and devolved into more emphasis on playing the game than on addressing the learning points the faculty wanted to emphasize.

The NDU game staff tried a similar approach once with a mix of actual policy-level and operational-level decision makers. That did not work either; the operational players tended to keep quiet during the policy play, but the policy makers did NOT keep quiet during the operational play. This unfortunate game dynamic (*which bears more than a passing resemblance to the way things work in the real world*) prevented the successful implementation of a promising game-design concept—let the policy makers see the entire process of policy-planning-implementing from top to bottom. Then, once they had seen the implications, could they take what they knew after the fact and see how they might have done things differently at the start? Sometimes even the best theoretical designs of the gamers fall victim to the worst practical (*and realistic*) behaviors of the players.

A game for DTRA

Mr. Simpkins and the rest of the JHUAPL team then showed us some of the components of a boardgame they had designed for the

Defense Threat Reduction Agency (DTRA). This game was titled Campaign X and was a multi-level, multi-echelon game. (That is, within the various "levels of warfare" there could be multiple echelons of command. For example, both corps and division echelons at the operational level of war). The focus of the game was on employing new technologies at the theater (operational) level, extending to the tactical level, and incorporating technical engineering-level assessments of the effects of individual devices.

The game board was a large map of the Mediterranean and eastern Atlantic littoral. This map was supplemented by several smaller scale, tactical maps of key choke points; the example they showed was centered on the Bosporus. Other components included hundreds of playing pieces made out of squares of light wood with labels on one side showing the nature of the unit or entity represented by the piece. It was perfectly recognizable by any recreational wargamer as deriving from the traditions of that hobby. (See figure 5 for a small sample of such a hobby game's components.)

In executing the game, several groups of a small number of players (four to six per game) played the game twice over the course of a single day. The designers had expected that the players could get through a move of the game in about an hour; in the event, it took more like 4 hours. One of the problems JHUAPL encountered was a classic one: the difficulty inexperienced players have at managing the physical components of a boardgame while staying focused on the cognitive processes of deciding what to do. The players had trouble managing both the large amount of information the game presented them and the large number of playing pieces. The players themselves came from operational-level organizations and their insights concentrated on that level of play—despite the fact that the game made them responsible for tactical-level decisions as well. Indeed, because the sponsor's goals focused on technical issues associated with the use of equipment, the operational-level insights proved less interesting to DTRA.

Figure 5. Example of a commercial hex-map and counter wargame[a]

a. Image from the game *Totensonntag* published by Lock 'n Load Publishing in 2007; used with permission. This game deals with the battle of Sidi Rezegh in November 1941 during the British Operation Crusader campaign in North Africa. The hexagonal grid overlaid on the map regularizes the positions and actions of the combat units. The latter are represented by the colored cardboard squares. These counters contain information detailing the identity and type of unit the counter represents as well as various numerical ratings for its movement and combat capabilities.

Some future visions

We at CNA have witnessed more than one occasion in which the processes and conventions that seem so natural and easy to follow for a gamer prove impenetrable and unmanageable to a non-gamer cast as a player in a game. Mr. Hillman posited that the *Mosbe* system created by BreakAway Games, Ltd. might have made the game easier for the players to manage. *We were skeptical. This is one of the areas of exploration that we have been*

thinking about in this project, without our yet coming to a single definite conclusion—who should interface with the instrumentality of the game platform, if one exists? Under what circumstances should we restrict that contact to the experienced gamers/facilitators that form part of Control, and when should we allow the players themselves to manipulate that instrumentality?

A fairly long discussion of this issue ensued. As Mr. Hillman correctly pointed out, the emphasis of modern computer-game technology (and boardgame technology as well, to be fair) is all about enhancing "playability." Modern games for platforms such as Playstation 2 or Wii all tout their "natural" interfaces and "intuitive" game play. Not all live up to their claims. Nevertheless, as Mr. Phillips argued long and hard, the electronic game industry had made great strides in these directions, and the current and coming generations of leaders, analysts, and experts are more and more familiar with the conventions of the electronic game environment. As a result, he argued, the trend in game design should be away from non-player "pucksters" and toward giving the players themselves access to the underlying game system. Not only would such an approach reduce the overhead of large numbers of support personnel required to run the games, but also it would give the players a more realistic experience as command and control systems evolve in the same direction. The price of admission may be that players would have to spend "a couple of days training on the system" before beginning game play. But the new generation of players should be able to become proficient enough in that short time to dispense with the need for numerous support staff. Even more important, he argued, this approach will be essential as gaming moves away from a rigidly managed move-based system to the more organic turnless game. *The downside of such an approach is that as the processes the players use to play the game more directly mimic those of the real world, the more the number of players must grow to approach the size of real-world staffs, so that they can manage all the information and processes involved.* [21]

In the context of the turnless game, Professor Kjonnerod expressed his own surprise that the relatively new concept of the "six phases of

21. See Perla (1990) pp. 212 – 224 for a discussion of related issues.

warfare" already seems to be going away. Many of the underlying constructs involved in that framework (the relatively clear distinctions between phases) had always been a bit blurred at the tactical and operational levels—for example, the USMC's concepts of the "three-block war"—but now he is seeing a similar blurring at the strategic/policy level as well.

Here, Mr. Shelton weighed in with a, "Yes, but." One of the biggest dangers of setting game players in front of a computer is the tendency for them to shift into "game focus" rather than "think focus," which is where we really want them.

One of the most prominent aspects of the kind of conflict we are involved in now with middle-eastern cultures is a more integrated approach to what Clausewitz's famous dictum stated: "War is an extension of politics with other means." There has been a long tradition of Western warfare that saw much of the political "talk" give way to the military "fight" until one side decided it had lost the fight and had to talk its way to a least-damaging resolution of the conflict. In the current middle-eastern and south-Asian struggles we are less in the mode of "talk-fight-talk" than "talk-talk-fight-talk-fight-fight-talk…" We are learning that doing nothing can be every bit as critical an action as launching an air strike. Our enemies are living in an inherently multi-level culture, one in which individual humans at each echelon are less cogs in a Western-style hierarchy than independent actors in network or dyadic relationships.[22] Nor are our enemies as focused on "kinetic" solutions as we have been traditionally. "Hizbollah's most important successes are not kinetic—though they have had some—but rather are social."

Professor Kjonnerod pointed out one of the challenges posed by Mr. Shelton's reading of the current environment. What are the "rules" of adjudication for societal, rather than kinetic, effects?

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22. See our discussion of Khuri, Fuad. *Tents and Pyramids: Games and Ideology in Arab Culture from Backgammon to Autocratic Rule*. London: Saqi Books (1990)in *21st Century Wargaming*.

Here Mr. Phillips proposed a radical vision of future gaming by claiming that there can and should be no adjudication whatsoever. Instead, you must observe the effects of actions on the participants, rather than adjudicate them. His example derived from Massively Multi-Player On-line Game worlds, such as *Second Life*. Players act. Other players react. The reactions are what counts, not some ultimately artificial adjudication.

There is a core of an idea here, but it is one that requires further thought and which appears to have only limited applicability to the types of games we are focused on. The effects of a player's actions do, indeed, cause reactions by others, but those reactions are, at least in part, affected by what physical effects the original actions produce. And despite the dismissal of time and space as constraints, which Mr. Phillips espoused earlier, the reality remains that if I want to explore long-term effects of short-term actions I am not likely to want to wait to play them out in Second Life *in real time. Balancing all these elements seems to be a formidable challenge we have to face as gaming moves into the future.*

Loose ends

As we wrapped up our discussion, a few more interesting points came to the fore.

- Mr. Shelton cautioned that one of the biggest mistakes gamers can make (and so often do) is to force Red into using Blue processes, for decision or for action.
- Mr. Simpkins stated that JHUAPL has begun a process of building models of "social identity" with the idea of incorporating them into their games, and they have on staff a cognitive engineer to help work on these models.
- Mr. Hillman remarked that actions have observable effects and that the gaming environment must ensure that effects, observations, and interactions are realistic.
- Finally, Mr. Simpkins pointed out that the kinds of games envisioned by Mr. Phillips, based on concepts similar to *Second Life* (and indeed any of the Artist-style games) require a long time to play to derive their most valuable benefits; they must be immersive experiences.

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Air Force Research Laboratory

Our discussion with the Air Force Research Laboratory (AFRL) included Colonel Matthew Caffrey, USAFR (Ret.), the chief of AFRL's Wargaming Policy & Planning Division of the Plans and Programs Directorate, and Mr. Terry Christian, the lead modeling and simulation engineer at AFRL.

Colonel Caffrey began by reminding us of his efforts in the late 1990s and early 2000s to articulate the principles of what he was then calling "third-generation wargaming." This concept grew out of some of the work Colonel John Warden, USAF, and others had done to describe systems-level warfare and the Desert Storm concepts and experience.[23] One of the key items of third-generation wargaming was the recognition of the importance of John Boyd's concepts of warfare, especially the OODA Loop (for observe, orient, decide, act).[24]

Colonel Caffrey agreed with our thesis that a fundamental problem of multi-level wargaming lies in the different speeds of the OODA loops required for operating at the different levels of warfare. At the lowest tactical level, that loop may be as short as seconds; at the highest strategic levels it could be as long as days, or even months. The so-called "cast of thousands" approach of manning multi-level games with large staffs does not solve this problem—indeed, it may aggravate it. There is no apparent technical solution to this issue as long as you expect human beings to play all or most of the roles at multiple command levels. As Colonel Caffrey described it, it is not a technical problem; it is a "way the world works" problem.

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23. See, for example, Warden, John A., III. *The Air Campaign*. Washington D.C.:National Defense University Press (1988).

24. John R. Boyd never published a formal text embodying his ideas. His major work is a long set of briefing slides, titled *Patterns of Conflict*. A photostatic copy of his original briefing slides is available in pdf form on-line at http://www.d-n-i.net/boyd/pdf/poc.pdf.

AFRL approaches

One approach that AFRL has taken to reducing the effects of this difficulty shows up in what it calls the AFRL Future Long-Term Challenges (FLTC) game. This game plays out in two distinct phases. During phase 1, the players focus on deliberate planning, and they may articulate system and force requirements to deal with possible contingencies several years in advance of the game's designated time period. During phase 2, the same players play similar or identical roles, but they now must deal with crisis-action planning and response. The multi-phase design allows the multi-levels of play to proceed at the speed of their own natural decision-cycle, without forced interaction, and so can avoid many of the problems associated with the incommensurate decision cycles. This approach retains the flavor of having everyone participating in the game showing up at the same place and the same time, even though the different phases deal with different pieces of the problem.

Another approach accepts that a multi-level game can also be managed as a multi-venue one, with different players playing from different locations. Furthermore, the game could become asynchronous—one in which different player sites, groups, or individuals could act on their own time line rather than all players being required to be "playing the game" at all times. This approach allows the lower level, tactical players to spend the larger amounts of time required for their detailed efforts while allowing higher level commanders to "check in" to the game for much shorter periods of time, to receive briefings and updates. In some ways, this approach is more realistic than those in which all players are present all the time. For example, in the operation of a JFACC headquarters, the ATO planners typically work constantly on building and updating the ATO, but the JFACC himself seldom receives more than one or two briefings about the process during the day.

When using this multi-venue, asynchronous approach, the higher level players will typically have to provide more realistic (and more concise) guidance to the lower level players. Such guidance could take the form of well-defined rules of engagement (ROE), commander's intent, or other policy directives. The lower level players

would be required to live within the constraints of such orders until they could get relief by appealing up the chain of command.

Artificial intelligence

Colonel Caffrey's thinking is that the ultimate solution to the problem of multi-level gaming is to create models with artificial intelligence (AI) routines to replace lower level tactical commanders. There are at least three key advantages of using such an AI technique:

- First, by designing the AI in such a manner as to allow the human players to establish certain key parameters for the AI, the approach enhances the credibility the players attribute to the AI routines because, after all, the AI is simply following the orders and priorities established by the players themselves.
- Second, because the AI can act at computer speeds and interface directly with a computer-driven assessment system, the speed with which higher level commands can be carried out increases dramatically. Instead of waiting for human players to take higher level orders and attempt to implement them by playing out the lower level activities at human speeds, the AI could implement and resolve the actions nearly instantaneously.
- Third, by replacing human players at the lower levels of play, using AI increases the possibility for introducing and controlling the effects of camouflage, concealment, and deception. Again, such effects could be built in to the assessment routines of the computer model itself, providing the AI with only the information the designers deem appropriate.

Colonel Caffrey's enthusiasm for the prospects of moving farther and faster in this direction are driven in part by his recognition that the technology provides two levels of innovative possibilities. First, it could allow us to do game control and assessment more effectively. Second, it allows us to envision a new application of wargaming. Because the AI technique can implement decisions so much faster than human players, it opens up the possibility of using gaming technologies to set up and play games during the course of a real-world

operation, not only before the fight begins. He used the analogy of an inertial guidance system: once you get the game started, you can continue to observe its trajectory, making course changes to respond to developments in the real world, and so allowing you to track and test out alternatives before taking action.

Another benefit of the computer-AI assist is to allow the game to explore a much longer period of time than typically is the case with in-person games. Using a well-designed AI system, the nights and weekends could become active operating times during which the AI can explore the battlespace more thoroughly, or extend the time span of the game to cover longer periods of time or explore alternative tactics and strategies.

The dangers of using a standard time-step approach to try to accomplish the same things were illustrated by the story Major General Charles Link, USAF, liked to tell about his participation in a large, computer-driven game of a major contingency. At the end of one day, the air players gave direction to the controllers to continue to pound the enemy in certain locations. When the players returned, they discovered that the game controllers had made a multi-week time jump from the end of the previous day's play. What was worse, the enemy activity they allowed during this time warp was dramatic, completely altering their axis of advance on the key friendly capital. When asked what Blue airpower had been doing during all this time, the controllers said that they had been pounding the now-empty enemy positions, according to the last strategic direction provided by the players. A well designed AI would (presumably) have prevented this from happening by switching targets as soon as the reality of the enemy situation became clear.

As Colonel Caffrey argued, this integrated approach of using human players to provide policy, strategy, and intent guidance at strategic and operational levels, and allowing computer AI to run the fight—within those constraints—at the tactical level, merges aspects of closed-loop computer simulation with more traditional man-in-the-loop gaming techniques. The approach to allow human players to establish the key parameters for the AI system increases the potential credibility of those systems among the human players. The speed with

which the tactical AI is able to execute its moves, in turn, allows the combined human-AI team to dig deeper and look longer at the issues involved in the game.

Such an approach should be valuable for both educational and research games. Indeed, Colonel Caffrey argued that starting the games out in the educational environment would ultimately enhance their reputation and capability to support the research environment. Using educational gaming to prototype systems allows early development problems and bugs to work their way out of the system in the relatively benign educational environment. Students can help identify problems, create solutions, and generate new concepts of operations that stress the game before analysts and operators apply the game to more operationally and strategically important issues in a national research agenda. An additional advantage of this approach arises from the fact that once the software is ready for use in the operational and research environments, there will already be a cadre of former students who know how to use it—and more importantly, know its value.

State of the art?

But does the state of game AI support this vision today? Colonel Caffrey argues that the rudiments of these ideas have been developing for more than 20 years, as evidenced by the games created in the 1980s and 1990s by the Australian computer game company Strategic Studies Group, or SSG. Such games as C*arriers at War* and *Europe Ablaze* incorporated AI routines at all command levels that were pretty sophisticated for the time (in fact, are probably still relatively sophisticated today). Players could choose to assume any role in the command chain while the computer routines played the other levels of command. You could even toggle back and forth between human and computer control of the various command positions. Unfortunately, these games are long out of print and difficult to find.

Colonel Caffrey also mentioned that three or four year ago he had discussions about this subject with representatives of U.S. Army gaming, who were optimistic about applying existing techniques to building tactical-level AI routines at company level and below. They were

less sanguine about our ability to represent battalion level and above. The issue is one of complexity—at the lower levels, decisions are largely about fire and movement; once you bring in the logistical, engineering, and coordination issues at battalion level and above, the AI is both less capable and less speedy. Nevertheless, Colonel Caffrey suspects that over the past several years both the Army and commercial games have made progress in building technology on which we can base future developments.[25]

Mr. Christian weighed in with a very interesting suggestion related to the issue of the credibility of AI systems. Our discussion characterized this idea as a wargaming "Turing Test." Mr. Christian's notion was to play a live staff along with an AI staff, the latter operating as a supporting unit. This would allow an evaluation of the performance of the AI, both in the tactical environment of the game and in its ability to appear to the human game players to be another set of human decision makers.

In this regard, Colonel Caffrey pointed out that the National Training Center (NTC) is already moving in this direction. As its program expanded from the initial capability to service a single battalion at a time, the NTC is routinely operating dual battalions on the line, as well as a brigade headquarters controlling both of them. In addition, a third battalion of the brigade is plugged into the fight using a virtual system linked into the NTC playing field. Finally, constructive units are incorporated on both flanks of the brigade to simulate neighboring units. This innovative integration of live, virtual, and constructive gaming entities is providing a convincing answer to the question of why you would ever want to do all three at once. In the past, the U.S. Army has looked on such hook-ups primarily as a way to save money. In the future, it may become possible to allow units to train for missions that are currently beyond the capability of the NTC to manage (because of time or space constraints) by a creative application of these techniques.

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25. Indeed, the Australian game design company Panther Games has produced some very sophisticated AI at the battalion level and implemented it in their games *Highway to the Reich* (2003) and C*onquest of the Aegean* (2006).

Air Force Wargaming Institute

We were able to conduct a long-distance teleconference with members of the faculty and staff of the LeMay Center for Doctrine Development & Education, organizational home of the Air Force Wargaming Institute. The participants in the teleconference included:

- Colonel Russ "Rudder" Smith, USAF, the Director, Warfighting Applications, LeMay Center for Doctrine Development & Education
- Lieutenant Colonel Dan Novak, USAF (Ret.), LeMay Center/WAOR
- Lieutenant Colonel Douglas Watkins, USAF, LeMay Center/WAO
- Mr. Carl Swenson, LeMay Center/WAOO.

Academic gaming

As is the case with the Army's Center for Strategic Leadership at Carlisle, the overwhelming focus of the AFWI is on educational gaming. They are responsible for supporting games for the various schools at Air University (particularly the Air and Space Basic Course, or ASBC), as well as senior-level games, primarily the Joint Land, Air, Sea, and Space game (JLASS), which we discussed above in the section devoted to the Army's Center for Strategic Leadership.

Because of their educational emphasis, much of the day-to-day work and thinking at the AFWI revolves around supporting classroom games. One of the principal constraints of the classroom environment is that the individual instructors are the linchpin of the game operations. As Lieutenant Colonel Novak described it in reference to Colonel Caffrey's earlier discourse on the growing importance of

using artificial intelligence (AI) in games, the "instructors have been the AI" driving most classroom games. Success in such games depends heavily on the individual instructor's ability as a storyteller. Because such abilities can differ widely, academic games can vary widely in the breadth and depth of experiences they can provide the students.

Multi-level gaming

The AFWI conducts games at the various levels of war—tactical, operational, and strategic. Although methods of control and adjudication can vary, the usual pattern is to rely on models and simulations to assess the outcomes of player actions at the tactical level, and to rely on subject matter experts (SMEs—including the instructors for student games) for operational and strategic levels.

Much of our discussion revealed that the attitudes and insights expressed by Colonel Caffrey in our talk with him are held broadly at AFWI as well. Not surprising, perhaps, given that Colonel Caffrey spent many years working in the Air University environment. In particular, the underlying framework of the AFWI's games ranges from the deliberate planning process, through crisis-action planning, and on to execution. The new concepts associated with adaptive planning are just recently beginning to enter into the games at Maxwell.

As Colonel Smith pointed out, in the past one of the biggest problems with doing multi-level gaming was the need to find a way to represent in a week or two devoted to the play of a game the dynamics of what, in the real world, would take months to unroll. *In that context, we see again the central issue of integrating the differences in times of the decision cycles at different levels of command.* How does one game get at the range of real issues associated with those various levels of war within a short time span of actual game play? Lieutenant Colonel Novak was in complete agreement with Caffrey that the most promising way ahead to addressing this problem lies in the promise of AI support to the game process.

To that end, Colonel Smith described a project that Air University schools and the Air Force Research Laboratory (AFRL) co-sponsored with the software and AI contractor Stottler Henke. He mentioned a software tool named SimVentive developed by Stottler, which uses their AI software called *SimBionic*. Stottler developed four software applications of increasing complexity up to a theater-level simulation. Colonel Smith opined that the AI routines are somewhat rudimentary and that the applications do not go as high as the strategic level.

Our subsequent brief investigation of the Stottler Henke website (http://www.stottlerhenke.com/index.htm) produced the following information extracted from the SimVentive page.

> *Need*: The use of wargames in the Air Force curriculum to date has been hindered by the significant amount of time and effort required to develop new wargames. Existing wargames built for Air Force students are disparate, one-off efforts, implemented on different platforms, with drastically varying interfaces that impose a steep learning curve on the student and waste valuable classroom time. An even larger concern is tomorrow's wargames. Because warfare can change so quickly, as evidenced by the events of the last decade, the Air Force's curriculums must change just as swiftly. Using current wargame development methods, however, the construction of wargames necessarily lags behind current events and modern military theory. Instructors must rely on programmers—who often do not have the necessary subject matter expertise—to build the wargames for them to use in their courses. This is costly, slow, and error- prone.
>
> *Solution*: Stottler Henke developed the SimVentive™ toolkit, originally named Warcon, that helps Air Force instructors create a wide range of single- and multi-player training ("serious") games quickly and easily, without programming. SimVentive incorporates the award-winning SimBionic® intelligent agent toolkit, so instructors can define intelligent simulated behaviors of devices, characters, computer-generated forces, and other simulated entities simply by drawing flow charts. SimVentive's user interface capabilities support 2D and 3D graphics, audio, video, interactive maps and images, HTML, and standard GUI controls. Scenario authors can extend SimVentive's power by integrating

Java™ software and user interface components. Using this toolset, Air Force instructors can design and deploy new wargames into their teaching curriculum more quickly and increase the quality and sophistication of these training games.

Status: In September 2006, Stottler Henke delivered the SimVentive system and four wargames developed using SimVentive to support Air University's curriculum. In December 2006, Stottler Henke released the commercial version of the SimVentive software. According to Lt. Colonel Dan Novak, USAF Retired ACSC Chief of Wargaming and Course Director at Air University, "I see this model growing in use beyond Air University classrooms by empowering instructors to make changes to a wargame or simulation, based on the needs of their students, without having to process software change requests in a system which can take weeks if not months to complete. Given time and a growing community library of SimVentive scenarios, this software will change the way instructors use games and simulations in the classroom."

Related Applications: The SimVentive toolset can be used to create a wide range of training simulations and serious games without programming. SimVentive already has been piloted to develop games that train emergency medical professionals to respond to an anthrax attack, and military commanders to devise an air campaign to compel an adversary to negotiate. Another SimVentive-based game currently under development will teach flight controllers and astronauts to apply their understanding of spacecraft systems and their interactions to diagnose and recover from unexpected failures.[26]

Lieutenant Colonel Novak stated that they are ultimately hoping to integrate the Stottler Henke work with another effort sponsored by Joint Forces Command. The participants noted that the acronym for this system is ILES (though there was some question about what the acronym stood for). Colonel Smith recalled that he had first heard about it at an I/ITSEC and that it began at NORTHCOM. Our subsequent investigation online produced some hits for ILES as Immersive

26. See http://www.stottlerhenke.com/solutions/training/simventive.htm.

Learning Environments. The abstract[27] of a paper presented at the I/ITSEC in 2005 is as follows:

> Development of an Immersive Learning Environment for U.S. Northern Command (USNORTHCOM)
>
> Dr. Stanley Supinski[A1], Upul Obeysekare[A2], Dr. Robert Wisher[A3]
>
> [A1]NORAD/USNORTHCOM, Colorado Springs, CO
>
> [A2] Concurrent Technologies, Corporation, Johnstown, PA
>
> [A3] Office of the Deputy, Under Secretary of Defense for Personnel and Readiness, Washington, DC
>
> Abstract:
>
> The rapid establishment of the U.S. Northern Command (USNORTHCOM) after 9-11 created significant training and education challenges. The North American Aerospace Defense Command (NORAD) - USNORTHCOM) (N-NC) needed to swiftly develop requirements for an education, training, and mission rehearsal capability to support both Department of Defense and interagency partners in meeting new homeland defense operational knowledge requirements. Meeting these needs involved developing open architecture tools, processes, and procedures to meet the time demands of a quickly evolving net-centric operational capability. In response, the Office of the Secretary of Defense organization responsible for Training Transformation sponsored the development of a next-generation capability called Immersive Learning Environments (ILES).
>
> ILES is an exercise framework for handling activities associated with the complete training life cycle from initial establishment of training objectives to final After Action Reviews, while capturing Lessons Learned throughout the process. This framework traverses individual, small-team, and enterprise levels of education, training, and mission rehearsal activity.

27. See http://ntsa.metapress.com/app/home/contribution.asp?referrer=parent&backto=issue,62,153;journal,3,9;linkingpublicationresults,1:113340,1.

> The proposed standards-based exercise framework consists of five subsystems: Event Sequence that provides time-based exercise activity management; a Common Tools Interface that provides access to tools; Reusable Training Objects for representing training content; a Learning Management System that tracks training-related data such as participant profiles, performance levels, and participant progress, and a Data Repository for exercise database management services. The Event Sequence and the Reusable Training Objects are original concepts that innovatively address unique requirements.
>
> The Event Sequence uses Nodes to represent time-based activity chunks either at the individual or at the group level. Decision, Injector, Observer, and Mentor Nodes are also used for providing a highly dynamic "what-if" experimentation platform. The Reusable Training Objects will be based on specifications in the Sharable Content Object Reference Model (SCORM®) model, with extensions to handle group-based learning activities and High-Level Architecture for linkages to modeling and simulation.

This abstract seems consistent with our discussion of the ILES. Lieutenant Colonel Novak described it as a system architecture that allows users to embed other software tools (such as mapping software) into a server-client or a web-based environment. Lieutenant Colonel Doug Watkins described its ability to help an instructor develop a game around a core timeline, to monitor the decision making of each individual player, and to drive the action in the game using either a decision matrix or direct input from instructors. Advanced features include the use of avatars to handle pre-scripted events and actions as well as an ability to create new inputs on the fly. It appears from our brief review of information on the Internet that the other services (Army and Navy) have embraced something they also call ILES and have been developing their own environments. It is not clear from these sources whether these uses refer to a particular system or to the general concept of immersive learning environments.

Colonel Smith commented that AI-based approaches such as these have the great advantage of removing or reducing the effects of personality (particularly of instructors) from the execution of a game. It helps to bring the baseline of expertise up to a higher level because

it reduces the variation of expertise and storytelling talent across instructors and other game SMEs. Lieutenant Colonel Watkins pointed out also that using a system such as this allows the game designers to script more realistic lines of scenario events based on a broader range of expertise than is available to individual instructors.

Scope of Air University's gaming

Although we did not explore the full range of gaming done by AFWI and Air University as a whole, we did touch on at least three levels of gaming they are involved with.

At the lowest of these levels are the student games for the Air and Space Basic Course (ASBC). At this level, the games focus on strike planning, with the instructor representing the wing commander and the students doing the detailed planning of strike and support packages.

The next level up is the Air Command and Staff College (ACSC), where the level of play is operational and strategic, focused on deliberate or crisis action planning for theater operations.

The highest level games are played at the flag officer level as well as at the War College level, and include the JLASS elective program. The latter involves the largest numbers and most senior levels of players from all senior Service schools. At these senior level games, many of the active players are from outside Air University, with students and instructors frequently role playing positions at higher and lower levels in support of overall game Control. At all these levels of games, the participants in our discussion held out great hope that the ILES techniques or systems can help create what they called the "proper culture" and realistic role simulations using avatars.

The real value Colonel Smith sees in the adoption of the ILES system may lie in its application to the student games. As he pointed out, the largest games they run at AFWI are those involving senior officers, because typically games like JLASS draw players from other Services and Service colleges, and Air University contributes subordinate players, controllers, and role players. The most numerous games, of

course, are the small games played by the individual seminar groups in the various schools. These are the games most in need of AI support to reduce the overhead of game-management tasks that the instructors must carry out, and allow them to focus on helping the students learn the most important lessons. This is particularly important in exploring joint and interagency issues. It is difficult for individual instructors to create high-fidelity representations of such environments without improved tools for applying AI and other information technology.

Issues of game control

We asked the participants their views about game-control issues and how they control their games. In a nutshell, they saw the same general need as the Carlisle gamers for high- and low-level game control. At AFWI, however, they use a dual solution. At the lowest tactical levels, they rely on computer models and simulations to represent the outcomes of player actions and logistics flow. The models they use are generally standard DoD models and simulations, such as the CFAST (Collaborative Force Analysis, Sustainment, and Transportation) model of time-phased force deployment and logistics. At the highest, strategic levels, on the other hand, the results are usually derived from the expertise of senior officers and SMEs.

Institute for Defense Analyses

Our discussants from the IDA Simulation Center included:

- Mr. Thomas Allen, Center Director
- Dr. Sue Numrich
- Dr. Terry Heuring.

Sprint and drift

Dr. Numrich recalled a technique used by the Naval War College some years ago, which at the time they termed "sprint and drift." This technique attempted to compromise between the mechanical need for much of a game's play to be at near-real-time speeds, with the substantive need to cover longer-than-real-time spans of game play. The technique, as she recalled it, involved the use of the Joint Semi-Automated Forces (JSAF) system to provide for near-real-time control and communications among the various game commands and entities during the working day. Overnight, however, the situation from JSAF would be handed off to the NWC gaming system (the follow-on to ENWGS (the Enhanced Naval Warfare Gaming System), as she recalled it, but she was unable to name it precisely). The "pucksters" would then run an extension of the JSAF situation for several days of game time. Despite this disparity in time scales, as she recalled it, the pucksters still could not keep up with the pace of the real-time game.

Urban Resolve

Mr. Allen described similar experiences with the *Urban Resolve* series of "experiments" run by Joint Forces Command (JFCOM) around 2005 and 2006. During *Urban Resolve 2005*, the experiment (which comprised several runs of a game or game-like substance) used JSAF to explore an Iraq scenario. Play centered on the division-level

command with responsibility for Baghdad. The division reported to a higher-level corps command, and in turn controlled two lower level brigades. Play at the division and brigade levels progressed through a series of vignettes. The experimenters used the vignettes to explore operating concepts and C3 structures and systems.

The following year, JFCOM ran *Urban Resolve 2015*. This experiment added additional higher-level commands, such as a JFACC, and also employed distributed player cells operating from different locations. In both cases, the small number of game runs available at the divisional level limited the sponsor's ability to extract statistically valid information from the details of the game play. At the higher levels of play, results were assessed by discussion among senior SMEs.

Dr. Heuring pointed out that IDA also did some preliminary assessments of the *Urban Resolve* games, using the *NetStrike/Mosbe* software system created by BreakAway Games, Ltd. These games were played prior to the larger-scale *Urban Resolve 2005* event in an attempt to improve understanding of key variables that *Urban Resolve* hoped to explore. This smaller game (with only a couple of dozen participants rather than the hundreds involved in *Urban Resolve*) focused on the use and integration of sensor systems organic to the brigades and division with higher level sensor systems resident at corps or above.

Mr. Allen observed that during *Urban Resolve 2015*, the players at the lowest level of play (the tactical level) were concerned about the relative sparseness of events that they had to deal with. This effect was probably not unrealistic—real combat has often been described as hours of boredom followed by minutes of terror. Nevertheless, the tactical-level players were concerned that they were not getting much value out of their involvement in the experiment. At the highest level of play (the strategic level), on the other hand, the experiment used time compression to speed the pace of decision making at that level. This approach resulted in an unrealistically fast pace of crises and events to which the senior decision makers were force to respond.

The video-game effect

Dr. Heuring pointed out that this behavior is consistent with something he has observed, and which he calls the video-game effect. It is a tension between what players have seen in video games (constant activity and rapid decision making) and what war is like in reality (boredom and terror). Based on his experience with *NetStrike*, he believes players begin with the desire for a realistic experience. After they have played the game once, however, they begin to want a shoot-'em-up video game. That is, their emphasis shifts from experiencing a realistic representation of an operation to playing a video game. This means that they are most interested in winning the game—by whatever means, regardless of its realism.

Dr. Allen concurred with this observation. He pointed out that in real war there are no rules, so the players begin to adopt that attitude in the game as well. This may be an admirable exposition of competitive attitudes, but it may also be at odds with the goals of the exercise.

Building Frankenstein's monster

Dr. Numrich recounted a tale of horror regarding a JFCOM attempt to connect two automated gaming systems focused on different levels of warfare so that they would automatically coordinate real-time and faster-than-real-time systems. The project involved connecting (or "federating") the JCATS system (the Joint Conflict and Tactical Simulation) to what she recalled was the predecessor to JWARS (the Joint Warfare System).

One of the pathologies that arose in this process stemmed from the attempt to link up a "command level" system (played at aggregated unit scales and faster than real time) to a unit- or entity-level, real-time system. It proved very difficult for the programmers to come up with an automated technique for "passing intent;" that is, for the senior player at the command level to specify his commander's intent to the next level of command in such a way that the units or entity at the lowest level of resolution would act in accord with that intent. They needed to develop an interface to parse the intent from the aggregate level into commands understood by the lower level.

Dr. Numrich opined that the better solution would be to construct a C4I system connecting the games so that a human commander would be able to direct the actions of the lower-level units or entities in accord with his own understanding of the higher commander's intent—that is, an approach that is more representative of the roles of the different levels of command—rather than attempting to simulate different levels of activity. As it was, the attempt to automate this translation of intent took years to implement, using an iterative process that actually involved human decision makers in the interface to help the programmers determine "realistic" routines.

At this point we repeated Colonel Caffrey's telling of General Link's experience with the disconnect between player intent and control's interpretation of it, which we described in the section about AFRL. In this case, General Link's intent had been interpreted strictly by the game's pucksters, resulting in a grossly unrealistic outcome calculated between player moves. Mr. Allen told a similar story of his involvement with another Air Force game in which the overall commander, who was not familiar with Navy operational concepts, gave orders to implement a particularly unfortunate action by Navy forces. In this case, the controllers were familiar with Navy practice and did not implement the instructions precisely as the commander had stated them. Instead, they acted the way they believed that Navy commanders would have chosen to act in the circumstances and under the general guideline of the commander's intent. When the player saw what the controllers had done he was at first unhappy that his orders had not been carried out, but when he understood why the controllers had done what they did, he realized his own error.

All of these stories indicate strongly that human players are important assets at the command levels above the mechanical operation of the game system or computer simulation that drives the production of combat or other important interactions. This is, of course, an expensive proposition in terms of the numbers of players—and experienced players at that—required to represent the command levels in a multi-level wargame. Of course, this is precisely the issue that we are attempting to wrestle to the ground in this project.

Dr. Numrich described other approaches to the issue that she has seen. One approach stopped the ongoing play of the aggregated (high-level) game until the entity (tactical) game could finish playing out. Then the high level game could resume. This is expensive in terms of down-time for the senior players. A system that would allow for individual players or subsets of the game to stop playing temporarily without shutting the game down completely (a truly persistent game environment) may be one way around the down-time problem. To implement such a system, however, requires the creation of credible routines to control the decision making positions abandoned by the players during their absence and still do a credible job of managing things.

Dr. Numrich also raised the issue of playing the different levels asynchronously. This idea has been used before and has proven reasonably successful at reducing the problem of one level's being overwhelmed with responding frantically to unrealistically rapid events while another level is bored by the slowness of its event schedule.

Mr. Allen brought out the interesting point that under certain circumstances it may be possible to mitigate this problem by allowing the less active level of players to watch what is happening at the more active level. This might give those players deeper insights into important issues. He described such a case involving Navy surface and subsurface commanders watching tactical play of their subordinates and coming out of the experience with some ideas about how better to manage the integrated ASW battle.

The trick, of course, is to identify—especially ahead of time—the possibility that your particular case lends itself to these specialized techniques. Ultimately, this question is strongly dependent on the goals and objectives of the game. Indeed, the whole process of designing and playing multi-level games must stem from the objectives that require such a structure.

Although different games will have different objectives, all games will produce some amount of education for their participants. This seems an especially powerful, if sometimes secondary, objective for multi-level games. Bringing together leaders of different levels, different

organizations, perhaps different nationalities, creates an opportunity for sharing experiences and attitudes that cannot and should not be ignored when considering whether and how to produce a multi-level game.

The IDA team discussed some examples of past games they participated in that exhibited this educational value, including games at Newport, games and exercises at operational commands, and games for the intelligence community. One of the latter, produced by IDA, took the form of a scavenger hunt through the on-line world of *Second Life*. It made use of what has come to be called "augmented reality." The players played the game using their own desktop computers and had access to the full range of capabilities they would have during their day-to-day jobs. Using a similar approach, wargame players might be able to participate in a multi-level game using the same command and control systems and networks they operate on a daily basis. The trick remains in figuring out how to make use of such systems as part of an integrated structure of players, controllers, and flexible time management.

A different philosophical approach is embodied in IDA's S.E.N.S.E. gaming system (Synthetic Environments for National Security Estimates).[28] IDA has applied S.E.N.S.E. to several programs designed to educate newly democratic states in eastern Europe and elsewhere about some of the subtle and intricate problems of making a democracy work. Dr. Numrich characterized this system as one that uses minimal computer infrastructure as a subsidiary and aid to the real dynamics of the game, which focus on person-to-person contact and collaboration. Apparently, the Google people are developing a (conceptually) similar on-line space to assist international cooperation dealing with real-world problems. IDA has recommended that SOUTHCOM look into using this new environment for its own operations, with IDA's support.

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28. For a brief description of S.E.N.S.E. and its application to complex contingencies, see Richard H. White, *et al. An Introduction to IDA*'s *S.E.N.S.E.™ — R.S.A. Project*, Sep 1999 (IDA Document D-2377), available online at http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA371409&Location=U2&doc=GetTRDoc.pdf

Appendix: Captain Carlson's briefing slides

This appendix contains the briefing slides provided to us by Christopher Carlson, Captain, USNR (Ret).

Decision Node Wargaming Approach

Christopher P. Carlson

Outline

Decision Node Wargaming

- What is Decision Node Wargaming
- "Grand Tactical" or Operational-Tactical Gaming
- Ancient History: *Blue Water Navy* board game
- Integrated Air Defense Modeling – *High Tide*
- *Command at Sea*: Carrier Battles
- Ground Combat – *South Atlantic War*
- Attack Model Flow Charts
- Story lining scenarios
- Electronic board game applications

What is Decision Node Wargaming?

Decision Node Wargaming

- Gaming approach to focus on key operational or grand tactical decisions that players need to make
  - Focus more on resource allocation and mission goals
  - Not as concerned about unit movement between decisions
- The nodes represent significant events requiring players to make a decision or respond to an outside stimulus
  - Decision events can be pre-planned mission requirements
  - Reaction to an attack
- Attacks are resolved using aggregated combat models based on physics
  - Preserves some operations research
  - Can use expected value results or die rolls
- Cards can be used to insert geo/political issues, severe weather, or technological developments that complicate the players' world (random events)

Tactical vs Operational Gaming

Decision Node Wargaming

- Tactical level game play *focuses on procedures*
  - Event drive, largely reactionary
  - Decision cycle is in "real time," measured in minutes
  - Span of control is at the single ship or small formation level
  - Can become mired in details; dramatically slows game play
- Operational level game play *focuses on planning*
  - Objective or effects driven
  - Decision cycle is measured in days or even weeks
  - Span of control is at the theater level
  - Simplification ignores effects of most tactical issues
- In their pure form, neither approach is entirely appropriate for NWC objectives

Grand Tactical Gaming

Decision Node Wargaming

- Grand Tactical is the middle ground between the tactical and operation levels
  - Decision cycle is measured in hours (4, 6, or 8 hrs)
  - Span of control is at the CSG/ESG commander level
    - Component commander on COCOM staff (GFCC, MFCC, etc)
  - Event driven to preserve key tactical decisions
  - Prevents players from getting stuck in the weeds
  - Requires some operational planning
  - Aggregated statistical models are used to speed play
  - Avoids over simplification and detail swamping
- Grand Tactical concept brings NWC students up to a level concomitant with their studies while preserving some tactical decision making

Ancient History: *Blue Water Navy*

Decision Node Wargaming

- Started out as an alternative game design to the Victory Game *Fleet* series
- Basic concept started in 1989
- Looked for ways to allow realistic decision making at the carrier battle group level without all the administrative baggage associated with miniature rules
- Several small games were tested, mixed results
- Little interest in a detailed board game by GDW
  - *Harpoon* Captain's Edition – 1990
  - Development of *Blue Water Navy* stopped around 1992

Ancient History: *Blue Water Navy*

Decision Node Wargaming

- Game board using either hexes or squares
  - 50 nm across (radar based – 25 nm radar horizon)
  - 60 nm across (chart based – 1 hex = 1 degree)
- Time scale
  - 4, 6, or 8 hour turns
  - 6 or 8 hours were preferred, balance between speed and length of day/night
- Turn Sequence
  - Strategic or operational phase
    - Strategic sensors
    - Repair and logistics
    - Reinforcements
  - Operational or Grand Tactical
    - Two cycles of movement, detection, combat

Ancient History: *Blue Water Navy*

Decision Node Wargaming

- Ship damage capacity and weapon damage potential based on the Harpoon missile
- Simplified sensor models
  - Radar and visual: Cookie cutter
  - Sonar: die roll with a d10 or d20
- Combat resolution tables based on Harpoon miniatures game rules
  - Incorporated ECM, weapon system technology levels
  - Limited discussion on formations
  - Mine warfare included
- Attacks were walked through a node based flow chart
- Some provision for rudimentary logistics

Integrated Air Defense Modeling – *High Tide*

Decision Node Wargaming

- High Tide dealt with a blue water conflict between NATO and the Warsaw Pact
- Carrier battlegroup air strikes on Kola Peninsula was a daunting problem
  - Large numbers of aircraft on both sides
  - Large numbers of EW radars, SAMs and AAA
  - Virtually impossible to run in a reasonable amount of time
- Used a node-based concept to walk the players through an attack
  - Preserved key tactical decisions on force allocation and general attack approach
  - Simplified and reduced the attack to a manageable level
- Formed the basis of the IADS concept given to Halsey A

Command at Sea: Carrier Battles

Decision Node Wargaming

- Large scale carrier vs carrier battles, such as Midway, were onerous and painful to run
  - Players spent more time on moving the aircraft than in combat
  - Many were trying to "game" the system
- Adopted an air defense node concept to eliminate the unrealistic posturing and push the players' to making decisions on how to execute their attacks
  - Preserved technological advances
  - Forced better CAP allocation
  - Did not care about who was dog fighting who
- Ship attacks considered as "salvos" due to drop on leader assumption (3 or 4 aircraft groupings)
- Very successful – three large scale engagements in 6 hrs

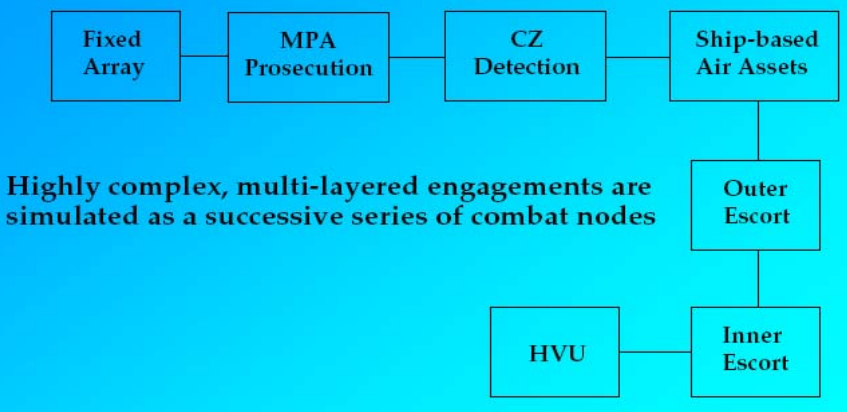
Ground Combat – *South Atlantic War*

Decision Node Wargaming

- Updating *Resolution 502* required coming up with a ground-based combat component to replace miniature system
- Radical simplification was desired
  - Had to support amphibious and air dropped units
  - Had to support some terrain considerations
  - Exact unit locations not desired
  - Aggregated ground combat model required
- Adapted Dupuy's QJM System to function as the ground combat engine
  - With modifications, the GCS developed were acceptable
  - Who won dealt more with who held the ground vice attrition
- Combat nodes or boxes identified areas of fighting where GCS values were dumped into and then shaken, not stirred

Attack Flow Charts – ASW Screen

Decision Node Wargaming



Highly complex, multi-layered engagements are simulated as a successive series of combat nodes

Story Lining Scenarios

Decision Node Wargaming

- White cell can create specific scenarios and then plan out the various game requirements or engagements using an event flow chart approach
  - Generate key decision points
    - Strategic aspect of the game
  - Enables specific concepts to be introduced
  - Allow flexible decision nodes to "pop up" as combat occurs
    - Combat are "vignettes" between key decision points
- Enables better organizing of scenarios, speeds up play, and supports after action discussions and analysis of the decisions that were made
  - Know where to look
  - Simplifies record keeping, built in log function

Electronic Game Boards

Decision Node Wargaming

- Given the lack of good software applications to keep track of unit locations and handle the detection functions, suggest looking at electronic game boards
  - Vassal
    - Java based, good for net-based gaming
  - Cyberboard
    - Preferred option for stand alone machines
    - Easier to use
- Low end solutions to the issue surrounding situation awareness that maintains unit positions accurately enough to allow the game to go on

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