CRM D0012912.A1/Final
September 2005

Wargaming ESG Operations in Support of the Global War on Terrorism

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Approved for distribution: September 2005

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Summary

Background

As part of CNA's support to the Navy in the global war on terrorism (GWOT), the Wargaming Department (WGD) of the Naval War College (NWC) asked us to assist with its wargaming efforts that focus on GWOT. In particular, the WGD sought our aid to develop a concept for an embedded wargaming capability that would allow deploying fleet elements to explore effects-based operations for GWOT-related missions in the context of the Commander's Estimate of the Situation (CES) or other planning processes. The initial goal of the project was to develop a capability to support the deployment of Expeditionary Strike Group 1 (ESG-1). Our early research (conducted by both CNA and the WGD) strongly indicated that this original approach was too limited and not likely to be as useful as first hoped. As a result, we reoriented our efforts toward exploring the characteristics of wargames that would be useful for the WGD, CNA, and others to support the planning staff (N5) of the ESG in a reachback mode.

The threads of research

Our research followed two primary threads:

1. The nature of the ESG and the missions it was designed and trained to perform, contrasted with the missions it has been called on to perform during deployments in support of GWOT
2. The nature of gaming techniques that might best support planning for a deployed fleet unit and how such techniques could best be applied in this environment.

We examined the defining documents for the ESG (the Required Operational Capabilities/Projected Operating Environment), assessed the missions and scenarios used in the ESG's training cycle,

interviewed naval officers and CNA analysts who had deployed with ESGs to understand how the ESGs were used in actual operations, and analyzed operations plans developed—but never acted on—by an ESG staff during a deployment. We used this information to define the key elements of a wargaming system that could support an ESG in such an environment.

Principal conclusions

Our principal conclusions are:

- ESG operations in support of the GWOT are in a state of flux characterized by inconsistencies between the way ESGs are trained and prepared to deploy and the way they are actually employed in theater.
- In such an environment, wargaming is a potentially valuable tool for exploring alternative concepts for command and control, developing shared understanding of new operational concepts, and socializing insights and issues, both among the commanders and staffs of deploying ESGs and between the ESG and other levels of command.
- Effective wargaming in the unique environment of the ESG and the GWOT requires an innovative approach that integrates a representation of tactical-scale forces, capabilities, and outcomes with theater-scale geography and operational- and strategic-level effects.
- Wargaming in this environment needs to represent command-and-control measures and relationships with high fidelity. It also needs to include methods for representing and assessing how the ESG responds as a system to actions and events that may be related only indirectly to (or even completely independent of) enemy actions (for example, the weather).
- These, and other more technical requirements discussed in detail later, suggest the need for a wargaming system with an open design for models and effects (similar to classic Naval War College seminar or tabletop games) but implemented electron-

ically on computer systems in such a manner as to retain the openness of the system.

We conducted a technical assessment of existing software packages that can assist in creating such games. We concluded that such packages are not adequate to meet all the WGD's principal goals. It is possible, however, that they can be used to implement the method of reachback wargaming support the WGD is considering. The NWC's Wargaming Department staff is much more likely than a deployed fleet staff to become proficient at using these software packages to create and run games. The output of the packages can be useful, nevertheless, as a mechanism for the ESG's staff to review the play of the games so as to understand what decisions the NWC players made and for what reasons. The packages can also facilitate the exchange of communications when time allows the ESG staff to review NWC game play and to suggest alternative courses of action or tactical approaches for subsequent exploration.

Recommendation

A full assessment of the potential value of the approach we recommend can only come by creating a prototype system designed to integrate the game model and its representations with a well-defined process for using the game to provide reachback support for a deployed ESG. Our preliminary investigations of existing software packages indicate that the amount of effort required to create the computer version of a previously designed boardgame is relatively small once the game designers learn to use the software packages. Our principal recommendation is that the Wargaming Department pursue development of such a proof-of-concept game and of the procedures for playing it, in cooperation with ESG-1 or other deploying ESGs in the future. In addition, the WGD should explore fully the potential for creating a version of that game that is playable online and in real-time, and also for developing a capability to conduct rapid replay of game moves to facilitate analysis by the reachback wargaming team and review by deployed staffs.

ESG concepts and operations

This project originated with a desire to provide support to the commander and staff of a deploying Expeditionary Strike Group. As a result, understanding the nature of the ESG, its theoretical and actual capabilities, and the kind of operations it is or may be called on to undertake, is fundamental to understanding both the source of much of our thinking and the applicability of the results of our research. This project grew out of a connection in 2004 between the Wargaming Department at the Naval War College and the plans staff (N5) of ESG-1, a group built around USS *Tarawa*, LHA-1. In preparation for a deployment to the Central Command operating area, the N5 of ESG-1 asked the WGD to explore the possibility of providing a more formal tool set to help them conduct the "wargaming" step in the planning process known as "the Commander's Estimate of the Situation," or CES [1]. This section provides some background on the concept of the ESG. The following section will include a discussion of the CES process.

What is an ESG?

The concept of the Expeditionary Strike Group, or ESG, grew out of a Navy initiative to increase the number of its forward-deployed force groupings that could be available to operate independently in support of global missions.[1] As we write this paper, there is no formally accepted doctrine or concept of operations for an ESG. The Fleet Forces Command has circulated a draft instruction that defines a "baseline" ESG. This baseline organization comprises a command element; a Marine Expeditionary Unit (Special Operations Capable),

1. Much of this section is based on information provided in a CNA Annotated Briefing [2]. We profited from discussions with several other CNA analysts, some of whom served as field representatives with deployed ESGs, including Robert Benbow, Greg Cox, and Annemarie Randazzo.

or MEU(SOC), and the squadron of (usually) three amphibious ships it is embarked on (the PHIBRON); a group of (usually) three surface combatants (cruisers and destroyers, or CRUDES); and possibly an SSN capable of firing Tomahawk Land Attack Missiles (TLAMs).

Such a unit embodies a wide range of naval capabilities, which suits the force to operate in a littoral environment, but with some limitations. Another draft document defines the required operational capabilities and projected operating environment (the "ROC and POE") for the ESG. This document characterizes the operating environment envisioned for an ESG as a "limited non-permissive threat" environment. There is some debate about exactly what such an environment looks like; however, the draft ROC and POE describes a "limited non-permissive" environment as one containing multiple types of threats—such as antiship missiles, ballistic missiles, fighter and attack aircraft, electromagnetic jamming systems, surface combatants equipped with cruise missiles, nuclear and diesel submarines, and terrorist threats—but one in which all these threats are present in only limited numbers.

Competing organizational models for the ESG

A major element of investigation across both the Navy and Marine Corps and different fleet commands has been the organizational structure of the ESG's command element. The services explored different alternatives for the command structure in a series of "proof-of-concepts" deployments. Two principal alternatives emerged. One approach was to rely on the classic "shared" command responsibilities of the commanders of the PHIBRON and the MEU (both O-6 level commanders) and the long-established norms of the "supporting-supported" relationships, with the newly added CRUDES and SSN elements fitted into the picture. The other approach added to the integrated force a staff led by a flag or general officer. Because ESG-1 uses this latter style of command structure, it is the one that we assume in what follows.[2]

An ESG at sea in a time of GWOT

We researched the kinds of missions and operations ESGs are trained to carry out and the actual operational taskings they have received during recent deployments. This research indicated that ESG operations in support of the GWOT are in a state of flux. The use of the ESG in the manner in which it was trained, as an integrated multidimensional warfighting organization, has been unusual once it arrives in theater. In most cases, the ESG has been broken into component pieces and dispersed across the theater in functional groupings rather than concentrated to take advantage of its synergistic capabilities. Most often, the MEU has been deployed ashore almost immediately, reporting to the land component commander. The SSN has similarly been detached on special missions, leaving the amphibious ships and surface combatants to conduct maritime missions, such as protection of gas and oil platforms in the northern Gulf, or maritime surveillance and interdiction operations against potential terrorist or criminal uses of the seas.

Our research and discussions with both CNA and Navy sources allowed us to develop a more complete picture of the nature of the unique requirements of the ESG's operational environment during current GWOT operations. Particularly useful in this regard were an extensive series of classified planning documents and briefing materials related to a contingency operation that ESG-5 planned in detail (but never carried out) during its 2005 deployment to Central Command (CENTCOM).

Although we cannot discuss the location and nature of these contingency operations in any detail, an outline of some of the actions that were foreseen as possibilities is a veritable smorgasbord of ESG capabilities and challenges. Some of those capabilities potentially required included:

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2. For a concise introduction to the ESG concept, alternative command organizations, and potential approaches to assessing the relative merits of such organizations, see [3], which is also available online at http://www.dodccrp.org/events/2005/10th/CD/papers/364.pdf.

- Conducting both compliant and opposed boarding operations of merchant ships at sea under carefully defined rules of engagement
- Delivering amphibiously based Marines and other special-purpose ground forces to conduct raids and attacks against targets ashore, using both vertical insertion and across-the-beach landings
- Providing both fixed-wing and rotary-wing air support for boarding and insertion operations
- Using the gun systems of Navy surface combatants to make direct attacks on surface shipping and targets ashore and to provide naval surface fire support for inserted ground forces
- Integrating special-purpose ground forces into the planning and execution of landing and boarding operations conducted by the MEU
- Coordinating the deployment and operation of sea-, air-, and land-based information warfare assets and systems from across the entire theater
- Conducting detailed operational and tactical planning, and real-time command and control of complex, multidimensional activities
- Securing and treating injured civilian and military personnel
- Identifying, seizing, and detaining criminals or terrorists
- Coordinating with host nation political and military authorities in a complex and uncertain environment.

Modeling such a complex environment requires representing a wide range of capabilities in detail—indeed, down to the level of a single gun system on board a surface combatant or a single Marine Corps fire team—in the context of operations that might extend over hundreds of miles. But it must also deal with the possibility that the decisive actions may be concentrated in time spans measured in minutes or hours. This scope of modeling presents an unusual challenge for many existing wargaming systems.

Design challenges of an ESG wargame system

The design of any wargame system must flow from the purposes for which it is created. The underlying purpose of the wargame system this project was designed to investigate underwent some fundamental changes over the course of our research. Our investigations into the origins, development, and operations of the ESG highlighted some of the key elements that any gaming system must represent if it is to be a useful tool to study and apply to the GWOT environment. The system must be able to model:

- The complex multidimensional operating environment
- The theater-wide geographic scale of ESG operations
- Detailed command-and-control considerations
- The actions and effects of small numbers of forces conducting complex joint, combined, and interagency missions of wide scope against non-traditional enemies and unusual threats and capabilities.

Wargaming to what end?

Importance of defining objectives

Defining the objectives of a game or game-system is fundamental to bringing that design to a successful conclusion. This seems obvious. Nevertheless, it is frequently the case that the real objectives of a game-design effort get lost in the mists of time as the design team steams full speed ahead into creating models and scenarios. One reason that keeping your eyes on the prize is so important in game design is that the creative process of designing a game can easily take on a life of its own. The game system becomes its own end, and creating a system that somehow models "reality" in newer, "cooler," or more "realistic" ways overtakes the real objectives as the driving force

behind the process. Only by recognizing the true objective, however, can a game designer make reasoned decisions about the tradeoffs inherent in the game-design process.[3]

Original objective of the study: supporting the CES process

This paper originated as part of a specific effort of game design. That effort focused on creating a wargaming system to help the commander and staff of ESG-1, centered on USS *Tarawa*, in its deployment of the summer of 2005. The ESG was looking to the NWC to provide a better means for carrying out the wargaming step of the process of creating a Commander's Estimate of the Situation (CES).

As taught at the Naval War College (see [1] for course materials), the generic process for creating a CES consists of six principal steps:

1. Joint intelligence preparation of the battlespace and mission analysis
2. Development of courses of action
3. Analysis of courses of action
4. Comparison of courses of action and the decision
5. Development of plans and orders
6. Transition.

Within this broad scheme, wargaming is the essence of step 3, the analysis of opposing courses of action. As currently carried out by most staffs, this step is largely seen as an ad hoc *bogsat*. (Bogsat is wargaming jargon for a "bunch of guys sitting around a table." It is a euphemism for a formless discussion frequently called a "wargame" and is a technique enamored of those who do not really understand wargaming. Sometimes the term is spelled *bogsat**t***, with the second "t" signifying "talking." This, however, is a redundancy, because the very essence of the bogsat is talking!)

3. For a more complete discussion of the art and science of wargame design, see [4, 5, 6].

Revised objective: reachback support

After we began work on this project, the preliminary research conducted by both CNA and the WGD strongly indicated that our original approach was too limited and not likely to be as useful as first hoped. We then decided to reorient our efforts toward exploring the characteristics of wargames that would be useful for the WGD, CNA, and others to support the planning staff (N5) of the ESG in a reachback mode. Real-time support for operations and plans demands that the ESG staff and its support from NWC and CNA develop and play operational games within a potentially short operational-planning window (possibly as short as a couple of hours if it is to be useful as part of the USMC Rapid Planning Process).[4]

Recognizing the practical problems with such an approach, the ESG N5 asked the NWC to consider the possibilities of having the WGD (and CNA) develop a capability to conduct a series of wargames based on expected missions that the ESG might face in the region of its deployment. The NWC could then play such games prior to the ESG's receiving operational tasking for similar missions. In doing so, the NWC could develop some game-based insights to help inform the ESG about key considerations for such missions even before they were tasked. These games and insights would provide the ESG's staff additional material to assist with contingency plans and operational demands. Such a program would also help the NWC develop specific expertise in the region and mission types, which the ESG could call on in a short-fused planning situation.

This shift opened up new possibilities. A gaming system designed primarily for use by a deployed staff at sea is subject to severe design constraints—not the least of which is a requirement to be learned and applied quickly by a staff with little time and less inclination to learn a specialized system of potentially limited applicability.

By focusing on reachback, we opened our horizons of exploration to a wider range of gaming concepts that could demand more from the

4. See, for example, *Standing Operating Procedures for Rapid Response Planning Process, Final Draft*, August 2003 [7]. The version we consulted was used during the first deployment of ESG-1 during 2003.

users of the system without requiring them to divert their attention from high-priority operational jobs. It also made possible the use of more complex and specialized software, as well as software in early stages of development. Such software would be less welcome and useful aboard ship.

Similarly, by reorienting to supporting longer term planning for the ESG's N5 staff, rapid (even real-time) turnaround for wargaming efforts would be less necessary. The N5 shop tends to look farther out into the operational horizon than the N3 (Operations) shop, for example. In addition, conducting wargames in an evolving and dynamic environment, such as that associated with ESG operations, can place heavy demands on the technical gaming knowledge and skill levels of its practitioners. Such experienced wargamers are readily available at the WGD and CNA but are not so likely to be found among a deployed ESG staff.

As a result, our research, analysis, and design efforts took a subtle course change. The complexities of wargaming ESG operations in support of the GWOT remained the basic context. But the concepts and tool sets that we could apply to wargaming the problems expanded significantly because experienced wargamers and analysts would be using those tools in a more academic setting, one which made available both more time and more research tools than a deployed staff could count on. We could now explore the possible utility of a more sophisticated approach to wargaming, and consider some broader applications for its use, including (a) helping the NWC support operational planning for an ESG by wargaming different courses of actions related to operational missions that the ESG expected to face during its deployment, even before the ESG should have received any actual tasking; (b) exploring the operations, effects, and implications of alternative command-and-control structures for an ESG; (c) considering more thoroughly the diplomatic, information, and economic aspects of effects-based operations, along with the military ones, in the context of the GWOT and expected ESG operations in theater; and (d) researching the application of wargaming to Fourth Generation Warfare and, more broadly, the adaptation of the overall CES process to Fourth Generation Warfare.

On one hand, a game system to support reachback play at the NWC could be more mechanically challenging than one designed for use by a deployed staff. On the other hand, the goal of the reachback effort remained ultimately to provide support to the ESG staff. To achieve both goals, the game system had to capture the key elements of the operations of ESGs as applied to GWOT missions while remaining easy for both the NWC players and the ESG staff to understand.

An unusual operating environment

Regardless of the specific objectives of building a gaming approach to support the ESG, any wargame design must address the same fundamental physical context. What makes the ESG and its operating environment during the GWOT unique? And how can we represent those unique features in a wargame system that will allow us to achieve the objectives for its use?

Our assessment of ESG experiences was based on Navy, Marine Corps, and CNA sources. It is important to point out, however, that we conducted this assessment to set the context for a game system, not to analyze ESGs and their operations for any other purpose. This assessment enabled us to develop a more complete picture of the nature of the unique requirements that the ESG and its operating environment place on a gaming system. At heart, it remains an impressionistic painting, not a high-resolution photograph.

Based on these investigations, we conclude that some of the key elements that any gaming system addressing how an ESG might operate in the GWOT environment must include (a) an embodiment of the multidimensional operating environment, (b) the theater-wide geographic scale of ESG operations, (c) a heavy emphasis on representing command-and-control considerations in great detail, and (d) the representation of small numbers of forces conducting complex joint, combined, and interagency missions of wide scope.

This assessment points to the need for an innovative approach to wargaming that combines representation of tactical-scale forces and theater-scale geography. It must represent command and control measures and relationships with high fidelity. And it must include

methods for representing and assessing how the ESG responds as a system to actions and events that may occur that are only indirectly related to (or even completely independent of) enemy actions. (Examples include political-military decisions at levels well above the ESG, operational accidents outside the scope of the ESG's control, and weather effects and the effects of other variables that are difficult to model in any rigorous way but whose influences could prove critical to the course and outcome of the ESG's activities.) Finally, the new approach to wargaming ESG operations must place the actions an ESG may take at a local level into the broader strategic context.

Tactical-scale forces and theater-scale geography

To give you a tangible idea of the nature of an ESG and the forces comprising it, table 1 lists the commands and ships that deployed with the first ESG in 2003, as described in [3]. It comprises a grand total of six surface ships and one submarine, along with the MEU (SOC) and various support detachments. Not exactly a fleet, but still a force with a broad range of tactical capabilities.

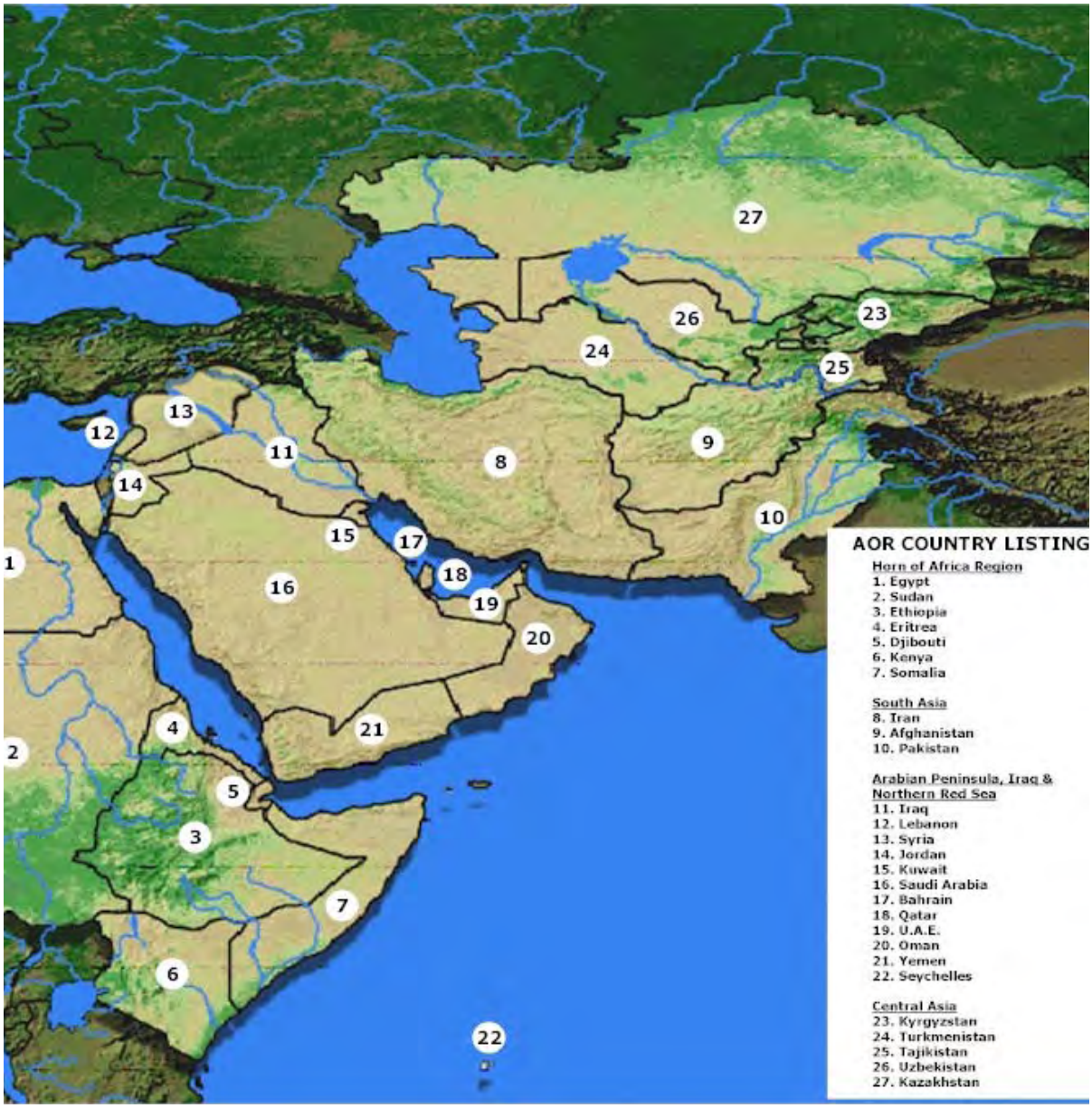
Table 1. Commands and ships that deployed with ESG-1 (2003)[a]

Commands	Ships
COMEXSTRIKGRU One	USS *Peleliu* (LHA-5)
13th MEU (SOC)	USS *Ogden* (LPD-5)
COMPHIBRON Three	USS *Germantown* (LSD-42)
TACRON-11 Detachment 4 (Tactical Control Squadron, control of air operations)	USS *Port Royal* (CG-73)
BMU-1 Detachment C (Beachmaster unit, to support amphibious operations)	USS *Decatur* (DDG-73)
ACU-5 Detachment C (LCAC unit)	USS *Jarret* (FFG-33)
ACU-1 Detachment E	USS *Greenville* (SSN-772)
EODMU-3 Detachment (Explosive Ordnance Disposal Unit)	
Fleet Surgical Team 5	
Fleet Info Warfare Center Detachment	
HC-11 Detachment 9	
HSL-37 Detachment 1	
HSL-49 Detachment 3	

a. Based on [3].

When compared with the theater in which this group is expected to operate, the area of responsibility (AOR) of U.S. Central Command (CENTCOM), it appears to be a tiny force indeed. (See figure 1.)

Figure 1. CENTCOM AOR[a]



a. Taken from CENTCOM website, http://www.centcom.mil/images/27_AOR_Map.jpg

ESGs deployed to CENTCOM could be called upon to conduct missions ranging from the Red Sea to the coast of Pakistan, or from the Persian Gulf to the Seychelles. And those missions could involve moving the entire ESG, or simply a small party of Explosive Ordnance Disposal (EOD) personnel.

Centrality of command and control

In such a situation, task organization and the speed and efficiency of coordination with other theater assets (such as P-3 reconnaissance aircraft, or USAF KC-135 tanker aircraft) are essential. So too is the ability to plan and control tactical or operational missions in the context of delicate diplomatic circumstances involving potentially dozens of nations. Managing the activities of the group in such situations requires a careful balance of tight control from the top along with flexible and responsive organizations at the sharp end. An ESG might be called on to make overt air or amphibious attacks in response to overt threats, or covert insertions of small reconnaissance teams in order to acquire critical information to prevent precisely such overt threats from arising. What's more, the ESG may be called on to conduct both overt and covert missions tightly compressed into a few minutes of time but spread out across a thousand miles of space.

Because of these facts, a useful game of ESG operations simply cannot assume away or abstract the ESG's C4ISR system (command, control, communications, computers, intelligence, surveillance and reconnaissance). The game must represent explicitly an ESG's ability to manage and coordinate the activities of the organic and attached forces under its control. This function is one of the primary duties of the ESG's commander and staff and, thus, is the proper focus of a game system designed primarily to support them.

Representing complex and unpredictable effects

Similarly, the operating environment of an ESG exhibits a high degree of complexity and unpredictability. In surprisingly short periods of time, that environment can change in any of a number of different dimensions (political, diplomatic, military, economic, environmental, social, or informational). Under such circumstances, wargames are far less useful for any predictive power they might have

than for their ability to help provide staff officers and commanders opportunities to get some synthetic experience at dealing with those complexities and uncertainties.

A wargame or wargame system to support an ESG should thus allow the players to confront and think through contingencies that might cause serious ramifications in terms of mission failure or loss of lives and property (of the ESG or even of civilian infrastructure ashore) if ad hoc improvisations fail to account for such factors. Examples of such pseudo-random events abound in the real world. One "what if": What if the Navy ships that were the presumptive target of a rocket attack in Jordan in August 2005 had been in port to onload important special equipment for a covert operation scheduled on a tight timeline? The rapid evacuation of the port that took place could have forced a delay, or even cancellation of such an operation. A game in which such a possibility exists would challenge players to develop a plan in such a way that a threat of that nature would have the least possible effect on subsequent operations.

Desirable qualities for an ESG wargaming system

As you can see from the discussion in the previous section, an ESG wargame in a GWOT environment will have to be comprehensive, multidimensional, and flexible in its approach to representing the characteristics and operations of an ESG, its supporting capabilities, the adversary, and the broad context of operations. In addition, the instrumentality and processes of an ESG game should have some very specific qualities.

It should be electronic

A fundamental decision in defining a wargaming system for exploring ESG operations is whether to use a tabletop game system—either a seminar-style game or a commercial-style boardgame—or an electronic game system—either using purpose-built software or adapting existing DoD or commercial game systems. If we envision the game system only as a tool for the reachback team to use for purposes of analysis, the choice of modality, whether tabletop or electronic, could be left open to the preferences of the team itself or to the demands

of the situation under study. In this case, however, the fact that the gaming we envision is to support the needs of the ESG, it is important that the NWC be able to report not only the outcome of the game, but also the course of the game and the rationales for the decisions the players made during play.

This added requirement argues for some sort of electronic means of—at the very least—recording and displaying the play of the game so that the ESG's staff can readily study the way the NWC played out the situation. Tabletop-game equipment, such as paper maps and small playing pieces, can quickly become impractical for use at sea. Ideally, the minimal requirement would be an electronic game system that could play back the action carried out by the NWC during the game with little intervention by, or expertise required of, the ESG's staff.

On one hand, then, the system should be rich enough to enable the NWC to conduct and record the play of a wide range of potential scenarios. On the other, it should be clean enough for the ESG's staff to replay the course of the NWC games easily so that they can readily see and understand what happened and why. These counterbalancing requirements pose an interesting, and common, design dilemma. Regardless of the specific technical solution to the design of the system for game play, however, there appears to be no practical alternative to using an electronic system for delivering the details of player actions and decisions to the ESG's staff.

It should use open systems

A problem with most commercial computer games is that they are essentially a black box to the players. Even games that provide the players some ability to create their own maps and playing pieces seldom go as far as allowing the players to modify the parameters that drive the game's engine.

To be useful to the ESG, a computer game cannot be such a black box. The staff must be able to see and understand the sources of models, data, and outcomes. They must be able to assess the validity or credibility of the parameters, and they must be able to adjust them to meet their own expectations or analyses.

At the same time, the underlying models and game engine must be well defined, rigorous, and auditible in its relation of cause to effect. Once again, it comes down to the requirement that the players of this game must be able to understand and accept the validity of the game's models and data to address the questions of interest.

Ultimately, no game designer can dictate to the potential players how they must use the game. The "professional judgment" of experienced operators is always important in any application of gaming. So too is the need for a comprehensive audit trail to protect against the dangers of inconsistency, wishful thinking, and self-fulfilling prophecy that can seduce the most experienced of players.[5]

It must be easy to use

Finally, any game to support an ESG must be easy to learn and to use. No one, not even the WGD or CNA, is likely to have time to develop experience and expertise in a highly complex and idiosyncratic game system. Even more difficult is to maintain such levels of expertise over time when use of the system may be aperiodic and infrequent. Even if the primary mode of using the game were to involve the ESG's reaching back to Newport for game "runs" and results, rapid response would be at a premium; spending time to spin up the WGD staff or supporting CNA analysts on the use of the game would be a potentially serious drawback.

Furthermore, though play by the ESG's staff is not envisioned as the primary mode for using the game, if the staff were themselves able to understand the mechanics of the game, it would be a big plus. This would allow the staff to understand better the games played by the NWC in the "preplay" mode, and also to assess better how to integrate the insights derived from the game into operational planning by the staff. The preplayed game could also serve as the foundation, or "base case," game, which the staff could vary in their exploration of alternative concepts of operations. Finally, the easier the game is to play and the faster the game may be played to conclusion, the larger the

5. See *The Art of Wargaming* [4], especially pages 163–182, for further discussion of some of these ideas.

number of games that can be played in a fixed period of time. More games can produce a wider ranging exploration of options, more thorough assessments, and deeper insights.

Computer-enabled boardgames

How can we design a game system to meet the many and varied demands placed on a tool intended to help the NWC provide effective gaming support to deployed ESGs and other commands? Based on our analysis of the requirements and our previous experiences working with the WGD, we propose a course of action. Our recommended approach starts with designing a boardgame or tabletop game and concludes with porting that game to a computer environment.

Conversion using available commercial software

The commercial wargaming community has produced a number of software packages intended to allow players to convert existing tabletop games into a form playable using a computer (or, indeed, to create new games using techniques of tabletop game design but producing original games using the software). We examined several such packages to evaluate their suitability and feasibility for use by the NWC. Principal among these were the *Aide de Camp II* software from HPS Simulations[6] and the *CyberBoard* freeware software.[7]

Comparing *Aide de Camp II* and *CyberBoard*

CyberBoard and *Aide de Camp II* are best described as electronic bookkeeping aids, which facilitate the play of boardgames by email. The programs assume that players own and are familiar with the boardgame to be played, and neither program has an artificial intelligence capability. Opposing sides must be played by human players because there is no inherent computer opponent, as is the case with most

6. For information about this software, try the HPS Simulations website at http://www.hpssims.com/pages/products/adc2/ADC2-Main.html

7. For more information, go to http://CyberBoard.brainiac.com/

commercial wargame titles. The creators of the games must manually port them to electronic form. Completed games are called "Game Boxes" in *CyberBoard* and "Modules" or "game sets" in *Aide de Camp*.

Many game boxes and modules created by other users have been made available for download on various websites, including those of some boardgame manufacturers. Both software packages provide tools to create additional games by either scanning in and modifying existing work or by manually designing an entirely new game.

We compared the version 3.00 beta of *CyberBoard* and version 2.15c of *Aide de Camp*. This is a comparison of the game-creation aspects of the two programs and does not explore the game-play functions of either.

Game creation

The process of creating a game using these software packages is quite similar. Both require the user to create map symbols and define information for the game pieces before creating the maps and pieces themselves. Both have fairly robust graphics editors and provide limited features with which to create the game components.

In *CyberBoard*, game creation consists of creating a Game Box within which the user creates the basic graphical elements required in the game. The creator of the Game Box then uses those elements to construct the gameboards, the playing pieces, markers, and other components necessary for the game. It is possible to import any pre-existing sets of graphics or pieces from another Game Box or to import external art that has been saved as a bitmap.

In *Aide de Camp*, game creation is organized in a slightly different manner. You can create the graphics used to construct the maps, pieces, and other components outside the context of a given game as a set of raw material. You may then construct the game itself by combining the desired components into a Module. As with *CyberBoard*, you can import pre-existing bitmaps to provide ready-made art for the maps and pieces.

Alternatively, both *CyberBoard* and *Aide de Camp* allow you to create the basic artwork by hand using a pixel editor/painter routine that is an integral part of the software. This requires the user to fill each pixel

of the desired image with a specific color to create the larger image. Each piece of art needs to be replicated for three levels of zoom. (During game play, the images are not automatically scaled and the maps and pieces can be viewed at three zoom levels—hence the need for the replication.) Once the basic artwork is complete, you can begin to create the higher-order components, such as maps and playing pieces.

In both systems, creating the maps involves another pixel-editor, but, rather than using a solid color, the user employs the map-art created with the graphics editor to fill areas of the board. Frequently these areas consist of one or more hexagonal or square spaces. You also use the map editor to define characteristics of the separations between spaces, the "hexsides" of an hexagonal grid, or the borders between other types of spaces, regular or irregular. This capability enables the user to match certain geographical features, such as rivers, national borders, or mountain ranges, with the separation between spaces occupied by playing pieces. (This is a feature found in a majority of commercial boardgames.)

When complete, both *CyberBoard*'s Game Box and *Aide de Camp*'s Module contain all the components required to play the game, except possibly for printed material, such as charts and rules. When creating new games, both programs provide for importing the art, pieces, and maps from previously created Modules and Game Boxes.

Differences

As you can see from the discussion above, *CyberBoard* and *Aide de Camp* are very similar in their features and approach to creating an electronic version of a boardgame. Their differences lie mainly in their user interfaces and the organization of features and processes. Which approach is "better" becomes largely a matter of personal preference. The only notable difference between the two packages lies in the map editor. *CyberBoard* seems to have more features for creating maps. This feature-set doesn't seem to add unique capabilities that *Aide de Camp* actually lacks—indeed, the final results observable in available Modules and Game Boxes are almost indistinguishable—but seems to make creating the maps in *CyberBoard* a bit easier because of some tools that are not available in *Aide de Camp*.

Strengths

The games that can be created or imported by the systems seem to be limitless. *Aide de Camp* comes with a few simple sample Modules that illustrate this, such as backgammon, chess, and Monte Carlo, but *CyberBoard* clearly has similar capabilities. Editing existing maps and pieces, while not trivial in either package, is not terribly difficult.

Altering existing graphics using the pixel-editing capabilities of the systems, while time-consuming, will allow you to produce aesthetically pleasing artwork with some practice and care. *CyberBoard's* map editor has a few advanced features not available in *Aide de Camp*, such as simple tools for creating polygons.

For the goal of creating electronic versions of games in order to play via email, both programs are fully equipped and capable of accomplishing that goal.

Weaknesses

Although *CyberBoard's* map editor has some powerful features, its user interface is not particularly user-friendly or intuitive. With some practice and exploration, the formidable interface can be mastered and can save a designer much time relative to using *Aide de Camp*, but the initial task of setting pen to paper (so to speak) is much more confusing and difficult.

One aspect of *Aide de Camp* that caused us some difficulty in our experiments with the software is its use of an automatic gridding system for placing pieces on the gameboard. This system creates an invisible grid on the board, even when using a scanned map. When a playing piece is placed on the board, it will automatically snap to the nearest grid location. If this grid corresponds precisely to a grid on the actual playing surface the feature is a boon to keeping playing pieces in proper locations. Unfortunately, it is frequently difficult, especially when using scanned maps, to align the invisible grid with any actual grid or placement boxes on the gameboard. Even more unfortunately we were unable to find a way to turn this snap-to-grid feature off. As a result, we encountered some insuperable difficulties creating a gameboard that mixed both playing grids and off-map tracks. The unwary designer can thus discover that much effort may

be necessary to create anything more than a standard square- or hexagonal-grid gameboard.

The fact that both *CyberBoard* and *Aide de Camp* lack true drawing tools to create specialized artwork is also unfortunate. It might be faster for the designer to employ a proper graphics program (such as *Photoshop*) to create the necessary symbology and then import the work to produce greater detail and visual appeal in the game's components. For applications of the kind we are most interested in, importing official symbology such as standard map symbols and symbols used in the Navy Tactical Data System may provide the best option for most game elements—provided those symbols can be converted to bitmaps, the only external graphics formats these systems can use. *CyberBoard* comes closer than does *Aide de Camp* to the ideal of an all-in-one system, an assessment driven by the more powerful map editor available in *CyberBoard*. Perhaps the weakest feature of both programs is the lack of an intuitive interface and rich options for accessing important functions with a simple right-click of the mouse.

Conclusions

Neither *CyberBoard* nor *Aide de Camp* is blessed with an optimal user interface. From a design perspective, there is at best a slight advantage in favor of *CyberBoard*. At present, however, *CyberBoard* is a freeware package and, as a result, has encountered some bureaucratic obstacles to installing it on government computer networks. *Aide de Camp* is commercial software, available through standard retail sources and it appears to be more acceptable to some government computer centers. Feature-wise, there seems little to choose between them when it comes to creating games. As a result of the smoother path to installing *Aide de Camp* on the NWC computer network, we continue the discussion below on the basis of using *Aide de Camp* as the software package for creating a computer-enabled game.

Table 2 summarizes our comparison of these two packages.

Key elements of the conversion process

To convert a boardgame to an *Aide de Camp* module requires an understanding of both the original boardgame and the software.

Table 2. Comparison of *CyberBoard* and *Aide de Camp* software

Feature	*CyberBoard* (CB)	*Aide de Camp* (ADC)
Map creation and editing	Provides additional drawing tools not available in ADC, along with an interface that is similar to that of art programs, such as *Photoshop*.	The import process for using external artwork is a little more intuitive and obvious.
Creation of game pieces	Same comment as above. In addition, provides simultaneous views of all three zoom levels for the piece being created.	Same comment as above. In addition, the smallest level of magnification provides for more detail then CB.
Player controls/user interface (UI)	CB has a somewhat cleaner and more pleasant UI. Players have some useful controls at their fingertips, such as sending messages and providing notes for specific pieces at specific times.	ADC provides some intuitive UI options that CB omits. There is some flexibility available to the players that is not available in CB without redesigning the scenario.
Cost	Free	$60 (each player needs a copy)

Because *Aide de Camp* is intended to allow a developer to convert into electronic format boardgames and card games with a wide variety of characteristics, the developer of each game project should carefully think through the characteristics of the game in question to take maximum advantage of the flexibility of *Aide de Camp* while minimizing the possible drawbacks of some of the design compromises inherent in any such widely applicable software package. This description of some of the steps we developed during our exploration of *Aide de Camp* is an example of that process rather than a recommendation about standard operating procedures. Nevertheless, it can provide a new, or potential, user of the software with some basic "safety" tips.

In a nutshell, the process looks like this:

- Assemble and assess all the physical components of the boardgame.
- Learn the basics of the *Aide de Camp* software.
- Storyboard the conversion plan.

- Create basic digital design elements for game components.
- Create or convert the game components.
- Integrate the components into the complete game set.
- Test the package for completeness and usability.

Assemble and assess all the physical components of the boardgame

This seems fairly obvious, but all too often the obvious gets overlooked in a process like this. Most boardgames consist of only a handful of components, primarily the gameboard and the playing pieces. But some games also require the use of off-map displays, which may be critical to facilitating play of the game. Game sets created to support commercial boardgames can frequently ignore such additional components because the user of the game set may be presumed to own a copy of the existing commercial game and so will have these extra components available to support play of the *Aide de Camp* version as well. To enable play using only the electronic game set, however, the designer must assess which of the necessary physical elements of the boardgame have to be represented electronically and how best to take advantage of the system to make them easy to use by the players.

Learn the basics of the *Aide de Camp* software

To use the *Aide de Camp* software effectively, the developer must understand clearly some software-specific concepts, such as *pieces*, *classes*, *class values*, *hidden symbols*, and *force pools*. The essence of the conversion process is to find the best software concepts to translate the boardgame components and procedures. A beginner—eager to start building a game set and confident in his ability to learn how to use the program as he does the conversion—may easily stumble into misunderstandings and blind alleys, especially if he thinks in terms of designing a game engine (or functionality), not building a database (program's internal representation).

It is not surprising that learning the software begins with reading the user manual and help files. These files are available only in electronic form on the *Aide de Camp* CD-ROM. Unfortunately (if perhaps not surprisingly), these files are not as helpful as you might hope. In addi-

tion, it will usually help immensely to spend some amount of time (in our experience, at least a day or two) studying the structure and organization of several existing *Aide de Camp* game sets. (A vast array of these modules is available online.) Spending time seeing how others have successfully (or not) solved problems similar to those facing your design task will help significantly in making clear some of the options available to you as you structure your own conversion.

Storyboard the conversion plan

If you have been able to resist the temptation to jump right in and start the conversion process until you think you understand the software, you must continue to restrain yourself a bit longer. With the boardgame already in hand, and after acquiring a working understanding of the software's capabilities, now is the time to plan. Some high-level planning for the steps to take in doing the conversion can save a lot of wasted time and prevent some serious frustration. A useful technique for planning the work is to create a storyboard of the project. The simplest version of such a storyboard consists of a single page of information for each major component of the electronic package, as well as a page for each distinct design element.

The pages of this storyboard should define for each of the major finished components required for the package all the necessary building blocks for creating that component. In addition, it should link each finished component of the *Aide de Camp* module to the element of the boardgame that it represents. (For example, a chart showing the reinforcements scheduled to arrive on specific turns of the game may be implemented in *Aide de Camp* by a Force Pool.) The storyboard thus ensures that all the necessary components of the boardgame are represented by a component of the computer package. Further, it defines the set of basic design elements necessary for creating each such finished component.

Create basic digital design elements for game components

In creating a module from an existing boardgame design much of the conversion process can be simplified if the game map, art for the playing pieces, rules, charts, and tables already exist in digital form. In the case of a game whose components are not already digitized, a consid-

erable amount of scanning might be necessary. Scanning images to create graphic elements for the game is almost always a process of trial and error, and the module's developer should allow time for several iterations of the procedures to get the formats and settings right.

In some cases, using scanned images for a gameboard or playing pieces may not be an option. In this case, the developer will have to create the gameboard manually. As described in the earlier section, there are at least two routes available for doing this—using a graphics program to create original digital artwork and then importing it, or using the graphics capability of the *Aide de Camp* software itself.

Create or convert the game components

Once the basic graphical elements are in hand, you can put them together to create the major game components. The primary components of most wargames are the gameboard or map, and the playing pieces or counters, representing military units as well as game markers.

Gameboard. The first major component to create is often the gameboard. Using the *Aide de Camp* basic symbol editor to create even a simple, abstract, square grid using only a few monochrome "terrain types" can require up to two hours.

For a complex map of actual geography, such as the Arabian Gulf, Korea, or Taiwan, several days of effort might be required. Based on our limited experience, we believe that it would be most efficient to draft the base map in a full-featured drawing program, such as FreeHand, and then import it as a BMP file into *Aide de Camp* (the bitmap format is the only file format supported for import) rather than attempting to use the very limited drawing tools in the program.

Playing pieces. Creating the playing pieces can be a time-consuming process because *Aide de Camp* demands that you create each counter image in three sizes (in order to implement the software's zoom feature). For the largest sized counters, importing artwork originally created in drawing programs can produce acceptable results.

The program can do a reasonable job of shrinking the largest-sized counter images to form the medium-sized ones, but frequently will

require pixel-by-pixel touchup to make them acceptable. Typically, you should create the smallest-sized counters using *Aide de Camp's* pixel editor; this requires a combination of skill and experimentation to produce the necessarily tiny, but readable, graphics. A designer with basic experience at using the software should be able to create an acceptable set of playing pieces of 25 to 100 different types in one to two days. A novice would probably require three to four days to complete the same task while learning the nuances of the system.

Integrate the components into the complete game set

Once each of the necessary components is complete, the module's developer must assemble all of them into a single package comprising the entire game set. One quirk of *Aide de Camp* is that you actually use the Game *Play* module to create the playable game set from the components created earlier. This can be a tricky step and requires the designer to be familiar with the software's concepts of *classes* of game pieces, and how you use that concept to create the set of pieces the players will actually manipulate when they play the game. Doing this final creation process can take widely varying amounts of time depending on the designer's experience, from an hour to several days. Once completed, the actual game is both stored in and played from the actual game-play file (.OPS file type), which gathers into one place all the necessary elements—including the maps and symbol sets, and any other supporting material.

Test the package for completeness and usability

Another obvious step—but one that it is too easy to overlook after all the work involved in the process of creating the set—is to ensure that the game set is actually working correctly. It is not unusual for a design to encounter several minor problems after the designer believes the project is finished. Only by testing the game thoroughly can a designer discover and resolve such problems. One particular feature of *Aide de Camp* requires special care. Unlike most standard boardgames, *Aide de Camp* allows you to incorporate some features of limited intelligence. It is possible to design a game so that the system conceals the identity of most or all of the playing pieces of one side from the eyes of the opposing player. In a game using this feature, it is critically important to ensure that the procedures work correctly for

defining player positions and defining what information the game makes available to each player under different circumstances during play.

Feasibility assessment and challenges

Based on our assessment of *Aide de Camp,* as well as experiments and explorations involving other available game-conversion/creation software packages, it is entirely feasible for anyone with intermediate computer skills and some experience with games and game design—along with a healthy dollop of patience—to convert an existing tabletop game to a computer-enabled version. It is difficult to provide precise estimates of the level of effort required because that will depend on the size and complexity of the game in question. A very rough guideline is that anywhere between one day and four weeks of effort could be necessary. The low estimate is based on an experienced designer using already digitized components to convert a simple game with up to 100 playing pieces, a single gameboard, and no off-board displays or tracking elements needed. The high estimate is based on a new user who must learn the software and start the entire process from scratch—although with an existing boardgame in hand.

The principal challenge involved in the process is creating an effective storyboard and work plan. Once this architecture is defined correctly, the process of creating game components, while potentially time-consuming, is more a question of using basic tools effectively than of employing complex skills requiring sophisticated software.

All the comments above are based on using *Aide de Camp* to convert an existing boardgame to an *Aide de Camp* module. Of course, there is no inherent reason why you cannot design and produce such a module without a previously existing boardgame to copy. Indeed, there are boardgame designers who have taken to using *Aide de Camp* (or *CyberBoard*) to develop electronic prototypes of what they eventually hope to convert into paper-based boardgames. In this case, of course, we must add the principal creative challenge of designing an effective game in the first place to the more mechanical (if still creative) challenges of converting a proven boardgame into an electronic representation of it.

The final set of challenges that we must mention regard conducting, recording, and analyzing game play. Unfortunately, we were not able to conduct much testing and assessment of issues associated with using this type of software to play the games electronically in the intended manner (typically via email exchange of game moves). Personal experience of the authors indicates that some decisions about the design of components (such as the choice between using physically represented displays and the software-defined force pools) can have a significant effect on the player's experience and ease of play. If the players are to take advantage of some of these features, the designers must provide them with effective guidance and direction about how best to use them.

Another issue is the accessibility of information about what actually happened during the play of the game, and about player decisions and the reasoning behind their actions. Both *Aide de Camp* and *CyberBoard* incorporate the ability to record the step-by-step actions taken during a player's moves. Indeed, this the core of how the software enables the play of a boardgame via email. Unfortunately, neither package as currently available provides easy access to this game-play data in any form other than a strictly linear replay of actions. This shortcoming largely limits reconstruction and analysis to speeds no faster than that at which analysts can replay the game.

Ultimately, this means that efficient analysis can occur only if players play the game efficiently in the first place. Once again, it is not the computer software itself that enables this capability but the procedures inherent in both the original design of the boardgame and in any supplementary procedures provided by the module's developer to facilitate its play using the software.

Future innovations

In addition to the email-based approach pioneered by *Aide de Camp* and *CyberBoard*, a new technique is evolving for playing electronic versions of boardgames live online. One software package worth considering for further exploration of this new technique is called *VASSAL*. To a set of freeware game-creation utilities and play-by-email capabilities similar to those of *CyberBoard* and *Aide de Camp*, *VASSAL* adds the

facility to run games in real-time from a server, allowing all players (and observers) to watch as game pieces are moved and combat or other effects resolved. This is a technology and a software package worth keeping a close eye on.[8]

A fascinating possibility offered by these electronic boardgame systems (but as yet unexplored, at least as far as we were able to determine), is the creation of a method for replaying game moves at an accelerated pace. Saving the screen graphics in some sort of editable video mode seems feasible using existing technology. So too does the saving of text inputs (intentions, notes, and other game-play element) into databases and spreadsheets. Some sort of method to enable a fast replay of moves for analysis by a reachback team and for review by a deployed staff would be a highly desirable capability for the application of ESG wargaming to support of future deployed staffs.

8. For more information on *VASSAL*, see http://www.vassalengine.org/community/index.php

Next moves

Game procedures are the key

For a computer-enabled boardgame of the type described in the previous section to allow the WGD to support a deployed ESG, the game's procedures, embodied in its rules and sequence of play, are the critical element. The history of board wargames teaches us that overly complex models tend to drive players into the proverbial weeds in a usually vain attempt to convince those players that the game is somehow "realistic" by overwhelming them with the sheer weight of details. Our assessment is that the critical element any ESG game must represent most effectively is C4ISR. That is where the designers of the game should spend the bulk of their design effort. As Professor Robert "Barney" Rubel, chairman of the WGD, has pointed out repeatedly in conversations, most wargames use artificial models of real effects, but "real command and control is going on."

To facilitate a better representation of real command and control in a game of this type requires well-designed and thoroughly tested procedures. These procedures must be clearly defined and presented so that the players of the game and their audiences on deployed staffs can understand, agree with, and connect to the real-world effects those procedures replicate. Only by getting past the inevitable issues of how well the game represents the essential elements of reality can players and audiences get past the mechanics of the game and start to explore the real issues.

Reachback is a good testing ground

Obviously, it is impractical to conduct thorough tests of such a game system by involving a deployed staff in extended sessions of playing and reviewing the game. But, to be most useful, such testing demands real inputs, real options, and real data. All of those requirements are

best obtained from the deployed staff itself. How to solve this conundrum? Reachback.

By working closely with a deployed staff to define potential missions to be explored in the game, the NWC can pick the most relevant and interesting scenarios to explore. By pulling from the staff the necessary data and parameters important to their planning process, the WGD can maximize the credibility and operational validity of the game.

Once the game is designed and populated with the best available information, the WGD and other elements of the NWC staff can conduct the game at Newport, with little real-time demand on the operational staff at sea. Once the game explorations are completed, however, the NWC should send detailed after-action reports to the ESG's staff. By showing the blow-by-blow unfolding of the game, annotated with the rationales each side had for the decisions that they made, the NWC gamers can provide the ESG staffers with a highly detailed replay of the game. The staffers can then review this replay, evaluate the decisions and rationales, ask questions, and request additional runs of the game—or anything else they feel is important to supplement their incorporating the game and its results into their own operational planning. In rare cases, the staff may even be able to play the game, either among themselves or together with the NWC using email exchanges.

What the ESG game should look like

In summary of our earlier assessments, it is clear that to be most helpful an ESG game must be capable of telescoping back and forth from the wide theater of operations involving coordination of varied assets to the narrow geographic area of the most intense tactical action. It must represent all the assets and capabilities assigned routinely to an ESG as well as any special-purpose theater assets that may be placed temporarily under the control of the ESG or any of its elements. Such assets and capabilities must be represented at the lowest level of detail consistent with the insights the investigation seeks to develop—that is, a *distillation,* not a simulation, not an abstraction. (For an introduc-

tion to the idea of distillation games and their distinction from abstractions and simulations, see [8].)

In addition, the capabilities and objectives of the potential adversaries should be based on the best available historical and intelligence information. By no means, however, should adversary actions be limited to past experience or current projections. This is where the human element of gaming enters the field. Player actions must be consistent with experience and doctrine, but not straitjacketed by it. In the real world, both sides tend to have a pretty good sense of the other's capabilities, but intentions remain clouded in uncertainty. So should it be in the game. Several interesting developments in the commercial boardgaming world may hold promise here, including the card-driven mechanics popularized in such boardgames as *Empire of the Sun* [9].[9]

The approach of designing a boardgame and then converting it to a computer-enabled game is worth further consideration. It involves creating a generic environment first, to explore the critical elements of the operation in a simple physical setting. Can such a simplified version capture the essential elements of the situation? If not, then we can add in more detail as we refine our distillation process to range in on the target.

In some ways, the ESG is a modular concept for designing and using naval forces at the operational level of war. The group as a whole contains a mix of elements with a range of capabilities. In the deployments of ESGs to the CENTCOM AOR, almost always those elements and capabilities are dispersed across the AOR to respond to specific individual needs as the theater commander perceives them. Yet, the theater commander retains the option of reassembling those modu-

9. Card-driven games like *Empire of the Sun* provide the players with a hand of multi-function, game-specific playing cards to mediate their actions during play. Typically, such cards provide special capabilities, and opportunities to circumvent certain of the rules of the game, by playing the cards as "events." At other times, the players may use the cards in a slightly different manner, drawing on other ratings or values on the card to conduct more routine actions.

lar components of the ESG back into its complete, multi-capability package to respond to larger-scale or more complex contingencies anywhere in the theater. If the game system is to be most useful, its design must allow the NWC and ESG staff to explore all of these combinations of capabilities—individual and combined—as well as the transitions between them.

A full assessment of the potential value of the approach we recommend can only come by creating a prototype system designed to integrate the game model and its representations with a well-defined process for employing the game to provide reachback support for a deployed ESG. The Wargaming Department should pursue development of such a proof-of-concept game and of the procedures for playing it, in cooperation with ESG-1 or other deploying ESGs in the future. This effort also should explore fully the potential for creating a version of the game playable online and in real-time, and for developing a capability to conduct rapid replay of game moves to facilitate analysis by the reachback wargaming team and review by deployed staffs.

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