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# Use of a Novel Organizational Structure to Support Complex Decisionmaking During Global Wargame 2000

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## Abstract

Global Wargame 2000 addressed the theme of Network Centric Operations (NCO) with the objective of providing insight into future operations for a distributed, network-centric Joint Force. Network-centric operations are postulated to offer information advantages that include significantly improved capabilities for accessing and sharing information. These improved capabilities will be dependent on emergent technologies, new processes, and novel ways of organizing to enable operators to leverage the anticipated information advantage and reap the full benefits afforded by a distributed, networked organization. New variables and metrics to assess these benefits are currently under development. One variable, described as the “information domain” is influenced by several factors, including the performance of operators, the performance of sensors, and the characteristics and performance of the relevant information infrastructure, or *infostructure*, that links battlespace entities. Global Wargame 2000 was an attempt to gain insight into how to implement these new organizational forms and processes, with the information infrastructure provided by a networked set of well-informed but geographically dispersed forces. This paper will address some of the issues that contributed to developing an effective infostructure for an interoperable command and control organization during global Wargame 2000.

## 1. Introduction

Network-centric operations (NCO) are expected to provide the foundation for successful mission accomplishment by promoting rapid information sharing, more timely development and maintenance of shared situation awareness, and more efficient use of available resources — all lending support to achieving more effective decision cycles. In addition to the new tactics and technological advances that are integral components of NCO, modified human decisionmaking processes and ways of organizing the forces are required to enable Joint military forces to operate in a time span that is shorter than an adversary’s. Network-centric warfare (NCW) describes the way the US military will organize and fight in the 21<sup>st</sup> century. NCW is defined as an information-superiority-enabled concept of operations that generates increased combat power

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by networking sensors, decision-makers, and shooters to achieve shared awareness, increased speed of command, higher tempo of operations, increased survivability, and a degree of self-synchronization (Alberts, Garstka, & Stein, 1999).

“A fundamental lesson that has emerged from multiple domains, including business and warfare, is that the power of a new technology cannot be fully exploited to create competitive advantage without the simultaneous co-evolution of organization and process” (*ibid*, p. 25). Drawing on examples from the business sector of successful implementation of new concepts, processes, technology, and new ways of organizing and empowering people, Alberts, et al, (1999), stress that effective exploitation of all the benefits offered by new technology will also require the co-evolution of the organization and doctrine. Global Wargame 2000 was an attempt to gain insight into how to implement these new organizational forms, and new processes, with the information infrastructure provided by a networked set of well-informed but geographically dispersed forces.

This paper discusses results obtained from analysis of data collected on the ways in which the organization supported, or did not support, the participants in performing their functions. Topics to be discussed include the: adequacy of communication and information flow; effectiveness of the new organization; strengths and weaknesses of the component structure; effectiveness of cross-component functional teams; and the maintenance of situation awareness.

## **2. Background**

Participants at Global Wargame 2000 were organized under a unique command and control architecture reflecting an overlay of functional areas of responsibility across service components. The organizational structure played in GLOBAL was a hybrid of service components crossed with thirteen functional areas (Ground Control/ Close Air Support, Operational Maneuver From The Sea, Tactical Missile Defense, Air Defense, Deep Strike/ Interdiction, Sea Control, Special Operations Forces, Rear Area Security, Intelligence, Sensing and Reconnaissance, Fires Coordination, Effects, Information Warfare, and Logistics). Responsibilities for functional area execution were passed to service component commanders: NAVFOR, MARFOR, AFFOR, ARFOR, and JSOTF (Joint Special Operations Task Force). Thus, these commanders functioned in dual roles as both component commanders and functional area commanders responsible to the Commander, Joint Task Force.

### **2.1 Distributed Game Environment**

Participants were distributed locally at the Naval War College, Newport, RI, in rooms functioning as “player cells” representing operational entities. Additionally, a geographically distributed environment was provided enabling both Commander in Chief play from onboard USS CORONADO in San Diego, CA, and assessment of collaboration between other remote locations using the Global 2000 collaborative tool suite. Several new technologies were introduced to facilitate interactions in this distributed environment, including a web-based architecture, called the Wargame Information Grid System (WIGS), and a collaborative planning and operational environment, the Information WorkSpace (IWS). Additionally, emergent technologies such as the Knowledge Wall were introduced as collaboration, decision support, and course of action analysis tools. The need for extensive collaboration and coordination across functional areas and components to accomplish the mission was recognized as key to the success of this organizational design.

## 2.2 Global Wargame 2000 Objectives

The Global Wargame series are conducted for the express purpose of investigating new concepts, techniques, and tools to assess their operational utility in an environment where participants are free to experiment and explore them. The games are generally played in a future timeframe that takes players outside of their current “comfort zone” which includes existing capabilities and processes as well as those expected to be introduced in the short term. Global puts players in novel situations representing the requirements of the future using representative technologies and operational concepts. Thus, in Global 2000, many of the new elements that comprise a network-centric environment are still in the process of development — some still in the conceptual phase. While many of these network-centric elements were still being articulated, defined, refined, iterated, and fine-tuned, an objective at Global was to further explore these new aspects of NCO. The goal was to understand how these concepts and tools will work together to enable the warfighters to realize the increased speed of command envisioned in NCO. To help develop insights, a questionnaire was developed to obtain information from a sizable sample of the participants. Game participant responses have been taken as constructive feedback to support further iteration of the organization and processes that form the basis for NCO.

## 3. Method

A team of researchers from the Adaptive Architectures for Command and Control<sup>1</sup> (A2C2) research program participated in Global Wargame 2000. A primary goal of their effort was to collect data to further develop an understanding of how the warfighters use the tools and capabilities embedded in the network-centric battlespace provided during Global Wargame 2000 to conduct collaborative planning and synchronized execution. Another key objective at Global was to obtain empirical data as to the effectiveness of the new organization, the anticipated and emergent processes it employed, and to identify user defined enhancements that would better meet the warfighters’ requirements. An end-of-wargame survey was administered using online resources to obtain quantitative and qualitative feedback regarding the effectiveness of this new way of organizing. The survey comprised questions that queried participants on their experiences in, and reactions to, the Global Wargame scenario. Participants responded to the survey questions by rating their responses on 6-point Likert-type scales that ranged from 1 (very little, or not very effective) to 6 (a lot, or very effective).

### 3.1 Post-Experiment Questionnaire

A survey questionnaire was designed to include items to help determine the ways in which the organizational structure supported, or did not support, the participants in performing their functions. Topics included in the questionnaire included the:

- Extent to which they were able to access needed information
- Flexibility of the command and control structure
- Strengths and weaknesses of the component structure in terms of facilitating cross-component functional task accomplishment
- Effectiveness of the new organization, with functional teams and components
- Adequacy of communication and information flow

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<sup>1</sup> The A2C2 research program is an ONR-sponsored, multidisciplinary effort to establish a body of knowledge in current and future joint command and control, and develop and test theories of adaptive architectures.

- How well they were able to maintain good situation awareness

#### 4. Results

Ninety-two participants completed the Global Wargame 2000 Post-Experiment Survey. Mean responses to the survey items were fairly consistent across the twenty items and ranged from 2.5 to 4.1. Many of the findings confirm anticipated issues concerning the novelty of many of the IT tools, the processes employed, and the way participants were organized during the wargame. The survey results also support developing a more detailed understanding of the complex relationships among the processes employed, organizational structure in which the participants functioned, and the IT tools provided. The remainder of this paper provides an aggregated summary of participant responses to key questions included in the survey.

##### 4.1. Access to Information

Access to information is essential for performing virtually all tasks and carrying out all responsibilities during a wargame or when executing a mission. The first survey item asked participants, “How much of the information that you needed were you able to obtain?” The mean rating in response to this item was 2.7, on a 6-point rating scale that ranged from “very little” at the low end to “all of it” at the high end of the rating scale. Participants indicated the types of problems that caused them to have difficulties in obtaining needed information and these responses were grouped into the categories listed in Table 1. Ninety-four percent of the participants who responded to this item (N=82) indicated they experienced some problem/s associated with obtaining needed information during the wargame. These problems will be discussed in the order in which they are listed.

<u>Types of Problems Encountered</u>	<u>No.Responses</u>
Lack of Content or Information Non-Availability	15
Lack of Access to Information or System Non-Availability	16
Lack of Knowledge on Where to Find Information	9
Training on Systems and Organization	9
Lack of Integration of Information	7
Time Delay	4
Miscellaneous	12

Table 1. Types of problems experienced in obtaining needed information.

**4.1.1 Information Non-Availability.** Participants’ responses indicate timely, relevant, and useful information was often seen to be unavailable, presenting the largest problem category. The main issue was difficulty in obtaining mission critical information, e.g., threat missile locations, information on weapons and tracking and targeting systems. Weapons files did not contain all the information needed for the weapons used, such as which aircraft they were carried on. Respondents also indicated that other types of information, such as the weather in the area of responsibility were difficult to obtain. A separate, but related, issue was a lack of common or

shared understanding of what decisions needed to be made, when, or what to do with the results of a decision once a decision had been made.

Players also perceived a lack of a common database, interfaced with tailored applications for each mission function. Other issues, related to information non-availability, included the following: (i) contradictory information was provided by the various tools; (ii) the TAPS model did not provide tactical ballistic missile (TBM) engagement results sorted by threat origin matched to defended asset; (The inability to break down the TBM threats by threat origin appeared to impact Blue's ability to assess the effectiveness of TBM defense design.); (iii) important data was "hidden" in places that were difficult to find due to the lack of an intuitive user interface; and (iv) users found it necessary to access several tools to obtain needed data and had to shift between systems to do the same job. One suggestion is to provide a visual or audible way to inform the user that information had changed or been updated in the database.

A number of factors may have contributed to these results. First, players were initially unfamiliar with both the operation and capabilities of the IT Tools. (See Hutchins, et al., 2001, this proceedings, for a companion paper on the use of information technology to develop a collaborative decision support system for command and control.) This was mitigated to some extent as players gained proficiency through game play. Second, operational requirements for information exchange and knowledge development were not common especially in the initial phases of game play with the novel organizational construct. As operational utility assessments by players developed, a natural prioritization of information requirements emerged which appeared to drive players to establish business processes that consolidated information flow. Third, the technological infrastructure varied in maturity. Information and capabilities were "suite" based vice individually "tool" based requiring players to access and update information in multiple environments with different collaborative functions. Finally, a multiplicity of tools functioning at different echelons caused a disparity in operational perspective. For example, the Knowledge Wall ultimately provided a useful information resource for the knowledge manager/warrior at the CJTF/Staff level. While subordinate echelons were required to populate their specific areas of the Knowledge Wall, they were not provided ready access to each other's information at the subordinate level.

**4.1.2 Difficulty in Accessing Information or Systems.** In addition to perceptions of lack of information availability in the battlespace, respondents indicated additional issues specifically associated with human-machine "interfaces." Respondents identified some processes that amplified these issues. For example, Global 2000's organizational structure "dual-tasked" or multitasked many players. Specific requirements such as being responsible for developing concurrent plans in addition to having a mission area responsibility, presented difficulty for some respondents in monitoring current operations while simultaneously gathering information for planning purposes. Time constraints and multi-node coordination required for planning made it difficult to stay abreast of the developing situation. One recommendation to address this situation was to have IWS up in chat mode, so the person could "eavesdrop" on most issues. Some respondents tried minimizing the various display windows to enable them to monitor several tools concurrently. However, players found that the monitor was not large enough to effectively view four displays. Another set of comments revealed that the SITSUM did not always refresh itself when new information became available. This meant the user had to exit and reenter the page to get new information.

Technical difficulties with some of the collaborative systems (particularly early in game play) resulted in sporadic access to IT tools. This caused a process adaptation substituting face-to-face information exchange and use of email (not originally provided as a collaborative tool) as a surrogate means of information exchange. Respondents also identified other process/interface issues including: insufficient player participation in the morning briefs, lack of access to intelligence, insufficient permissions to access information in the system, slow system response in providing requested information, and delayed or lack of response to follow up requests. This last item was referred to as the “fog of knowledge management” referring to the vast amount of information available and the huge number of requests for information and replies in a network-based organization.

Implications: As with issues associated with availability of information, access to information issues identified by players reveal several implications. First, technological capabilities, organizational structure, and business processes are inextricable in network centric operations. Tools appeared useful to players only to the extent that they supported the ability to develop and maintain a shared understanding of priorities and the situation. Key outcomes from Global 2000 appear to be development of a set of specified information exchange requirements at a process level that can be facilitated through developing technologies. NCO/W’s focus on the network of warfighters implies that technological innovation, organizational design, and business processes must be concurrently developed.

**4.1.3 Lack of Knowledge of Where to Find Information.** Information was spread throughout the entire system of collaborative tools — as it would be in the real world. However, the novelty of the systems and the lack of familiarity with system operation created a situation where many participants felt it was difficult to know where to find the needed information. Many of the comments in this category had to do with the lack of familiarity with IT tool operation, e.g., “initially it was hard to determine what tool has the most reliable and current information” [Note: This implies that different tools presented conflicting information, which is a separate problem]. It was often difficult to keep track of all the incoming and outgoing data, especially when participants needed to use several systems at the same time. One participant remarked that he, “eventually found the information, but where to look for the information was not apparent.”

Implications: A fully connected and distributed network-centric environment introduces an acceleration of pace and proliferation of an information/knowledge that requires a dynamic understanding of what key information is required at any given point in time as well as where that information is most developed. A combination of training, mutual understanding of organizational roles/responsibilities, and processes that can synergistically transform data into knowledge is required. Future collaborative tool suites may require decision support tools that convey or help the user visualize key information availability and nodes where it is resident. Training issues are specifically addressed in the next section.

**4.1.4 Training<sup>2</sup>.** Training on operation of the new systems was provided to participants prior to the start of the wargame. However, some participants considered the training to be inadequate.

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<sup>2</sup> This set of responses complements and consolidates some issues revealed throughout the questionnaire. However, these responses are specific to the Global 2000 environment. The broader issues associated with training in future network centric environments are captured in the other sections.



One specific response is revealing: “It took two full days, after training, to learn to manipulate the different knowledge tools.” Another respondent indicated he was still not totally familiar with the systems and what he needed to track and be prepared to respond to at the conclusion of the two-week wargame. The second category of problems encountered was the lack of training on the game’s organization, roles, and responsibilities with specific emphasis on where to go in order to obtain the various types of information that would be needed during the wargame. Participants noted that it took time to form the correct organizational links (i.e., to form relationships) with the proper people who would be able to supply necessary information during the mission. Some participants also indicated that the organization was not intuitive in terms of knowing where in the organization different types of information resided.

Implications: Training is a key enabler of efficiency and effectiveness in organizational function. In future network-centric environments, the combined knowledge of organizational function, business processes, and technological capabilities must be provided via training both prior to introduction to forces to an operational environment as well as in response to changing operational circumstances. Training may require both a continued formalized “schoolhouse” approach as well as technological resources providing just in time training. In a network-centric environment with reachback access to globally available subject matter expertise, ad hoc training requirements may be met via a number of collaborative means including evolving distance learning technologies.

**4.1.5 Time Delay.** Respondents indicated that the need to integrate information from different sources created a time delay in moving from awareness of a situation through decision to taking action. Unnecessary time delay can be decreased by having information displayed in commonly expected locations and by having the person who requires that information being fully trained on where to access the information. Players felt that, given the high quantity of information, determining what information was relevant, from within the “virtual warehouse” of available information, was a huge task, with high time demand. A second contributor to a time delay in gaining access to needed information was due to people using email to receive information as attachments, or to send and receive directions regarding the location for needed information. This slowed the process of accessing information. Moreover, communication was slowed because players were simultaneously monitoring other systems.

Implications: To improve speed of command and speed of effects in a network-centric environment requires minimal latencies in the time between when appropriate information is available, a decision is made, and relevant action is pursued. Instead of the historical information generation problem to meet information deficiencies to support command decision making, NCO requires winnowing an abundance of information to key relevant elements in a timely fashion. Better datamining techniques and tools to accelerate definition and communication of information requirements should be an integral part of future collaborative environments.

**4.1.6 Miscellaneous.** A recurrent set of responses indicated that the “common operational picture” was not current and contained too many duplicative tracks. A common database, interfaced with tailored applications for each mission function, is a feature that would be useful to all participants. Additionally, lack of trust in the information accessed by some participants impeded decision making as information was deconflicted, information gaps were filled, and shared understanding of the situation was developed. Specific comments indicated that the

information displayed on C2PC, SITSUMs should be more easily refreshed, and a need for enhanced realism regarding the fidelity of the data.

**4.1.7 Features Desired to Facilitate Obtaining Needed Information.** Throughout their responses, participants indicated features in the information management tools that would be helpful in performing their tasks. These information management features specifically include:

- Better access to Intelligence and knowledge regarding where units were located (requests for information were not responded to)
- Ways to ascertain reliability and currency of information
- More intuitive databases so key capability information can more easily be found
- Tools to help sort through the information overload to determine what is relevant
- Easier access to time-critical data, e.g., assets and weapons available, and battle damage assessment
- Ways to keep better track of incoming and outgoing data
- Shorter delay in updating reports

## **4.2 C0mmand and Control Organizational Flexibility**

When asked about the flexibility of the command and control organizational structure, many respondents expressed concerns regarding roles and responsibilities they felt were ill-defined. For example, with the integration of the NAVFOR organization with the other functional areas, there were multiple owners of the same assets, thus it was unclear as to who controlled these assets, e.g., Streetfighter. Similarly, the lack of a clear distinction between some functional areas, e.g., Strike and Fires, when both these functional areas use the same weapons against common targets, made tracking and tasking of assets problematic.

Several participants expressed concern over what they perceived as the lack of command, direction, and guidance from the top echelons down to decisionmakers at the lowest echelons. This perception is exemplified by the following comment: “One never knew what assets were chopped to whom at any given time, whether something you were being told/asked was an execute order, a suggestion for consideration, a proposal for discussion, or an exploratory suggestion.” In this same vein, regarding email and chats, it was difficult to determine what authority the person sending the message had to send it. Moreover, they felt a mechanism to set priorities or synchronize activities was lacking.

Some participants perceived little synchronization, coordination, or deconfliction among service components. Participants identified a perceived contributing factor as no clear chain of command to help them know how to respond to often conflicting guidance from CJTF and functional/service commands. One participant observed that “when the functional area communities do work well on the net, the vertical authorities lost track of what is occurring and got behind, particularly if cross-Service issues are involved.” The functional structure was intended to provide a mechanism for self-synchronization. This process of self-synchronization is described as the ability of a well-informed force to organize and synchronize complex warfare activities from the bottom up. Self-synchronization is seen as a mechanism to overcome the loss of combat power inherent in top-down, command-directed coordination that is characteristic of conventional C2 doctrine (Hutchins, Kleinman, Hovevar, Kemple and Porter, 2001). Comments from participants suggest that clearer reconciliation of lateral and vertical decision authority is

required for effective implementation of self-synchronization using cross-component functional teams.

### **4.3 Component Structure Facilitation of Cross-Component Functional Task Accomplishment**

Several participants replied that they felt the C2 structure was ill-defined in terms of players having a clear understanding of asset locations, movement, passing orders, and tasking. Respondents also indicated that conflicting tasking was received from different levels of the hierarchy. Particularly for the Amphibious Task Force Commander, who, in many ways is answerable to two masters (NAVFOR and MARFOR) this was frustrating.

### **4.4 Situation Awareness**

Developing and maintaining situation awareness (SA) is an essential element of command and control decisionmaking. Situation awareness refers to the moment-by-moment understanding of the evolving situation and involves knowledge of the decisionmaker's immediate situation, the external environment, what actions need to be taken when, and how the situation is anticipated to change in the near future. The survey asked the participants to identify impediments to developing and maintaining SA for their functional area.

The mean rating for the item that asked: "To what extent have you been able to maintain good situation awareness?" was 3.3, on a 6-point rating scale that ranged from "to a limited extent" at the low end to "to a large extent" at the high end of the rating scale. Qualitative comments were summarized by categories and are presented below. Some of these impediments were a by-product of the game environment, and would, most likely, be mitigated by people having additional training and experience with the systems (tools) as well as greater familiarity with the organization and the individuals who made up the organization.

#### **4.4.1 Impediments to Maintaining Situation Awareness for Players' Functional Area**

The sub-sections below present a summary of qualitative comments that help to explain the relatively low overall rating of SA (i.e., 3.3 on 6-point scale).

**4.4.1.1 Difficult to Visualize.** Specific comments were made regarding visualization related to Information Operations, an area that is very difficult to visualize, particularly in a complex scenario, but may have broader implications. Rapidly changing circumstances, threats, and targets require consolidation of numerous information sources to provide an integrated assessment of the situation, to support decisionmaking, and communication/ implementation of the actions required. Visualization media in network-centric environments must support this capacity.

**4.4.1.2 Lack of Feedback.** Instances listed by participants where outside feedback was not forthcoming included the lack of information from other operational units, the failure of other cells to push information out to other cells (and the additional time required to "pull" the information), and the lack of receipt of up-to-date "intents." It may be that the unfamiliarity with the situation that participants were operating in added to their overall workload and reduced their ability to pass information as often as they might have, had they been operating in a more familiar situation (in terms of tools, people, and organization).

Comments are reflective of the specific Global 2000 environment, but may be enduring in future operating environments. Player comments indicated that: the results of engagements were not readily apparent (although this might also be the case in the real world as well), the level of granularity desired was not clear, they lacked a common operating picture, there was insufficient cross-echelon liaison, SITSUMs were not sufficiently detailed, operational level SA was difficult to maintain due to asymmetrical tactical information flow, some cells were not integrated in terms of the collaborative planning that was required; and some participants could not find information on Red activities in order to anticipate requirements. Another respondent remarked that, “it was easy to stay on top of the threat matrix with the tools provided, but when several strikes were launched by or against Red there were no results, and this same situation occurred regarding strategic threats as well.”

**4.4.1.3 Did Maintain Good SA.** Several participants made positive assertions in response to this question, stating that they did maintain good SA. Participants stated the following: ISR and Intel did a good job; there was good interaction between players, and our group was good at using the tools which greatly facilitated maintenance of SA. Another participant stated that the whole process was easier than in real life (i.e., one didn’t have to see if an asset was available to collect on a target: the asset was always available and you always got the needed information).

**4.4.1.4 Systems were Lacking.** A few respondents listed problems with the tools as impediments to maintaining good SA, such as the difficulty in getting tracks to move on C2PC. Manual manipulation of forces was cumbersome and wasted time in understanding the friendly situation. Additionally, disconnects between the overlays and the MTWS (Marine Corps Tactical Warfare Simulator) on the west coast led to incorrect information in C2PC that affected planning and execution.

**4.4.1.5 Lack of Guidance.** These comments pertained to the new way of conducting operations in the novel organization, e.g., people wanted guidance on the employment of the Amphibious Task Force/Marine Expeditionary Brigade, and more detailed TPFDD, munitions, tracking platforms, and in general, more detail on types of platforms available.

**4.4.1.6 Multiple Systems to Integrate.** This referred to there being too many different operating pictures since everyone did not use the same system and players utilized too many different systems to pass information. One respondent commented that he passed information to tactical commanders in one system, passed information laterally to other component functional commanders in another system, and up to J31 in a third system.

**4.4.1.7 Overload.** Overload had two components: workload and information overload. The overload in workload referred to some players being “double-hatted” and not being able to communicate effectively with the amount of information traffic that was experienced. Another aspect of overload, was *information overload* — that no matter how good the system and the database, the information presented can only be as effective as the human mind is able to read, digest, and assess that information.

## **5.4 Team Performance**

Good team performance includes maintaining SA, providing information to other team members in a proactive way, alerting others to impending decisions and actions, anticipating the needs to provide assistance to team members, adjusting individual task responsibilities to prevent over-

load, and coordinating decisions and actions. Table 2 presents the participants' mean ratings for these survey items, based on 6-point rating scales, that ranged from 1 (very little, or to a limited extent) to 6 (a lot, or to a large extent). Participants were asked to rate their responses to these items from the perspective of within their component/ group and external to the component or group.

A pattern emerged where the mean ratings were consistently higher when rated from the perspective of within the component than they were when rated from the perspective of external to the component. It appears that it was easier to maintain good SA, provide information to others, alert others to decisions, provide assistance, adjust individual task responsibilities and coordinate with other members within the component than it was to engage in these behaviors with those who were external to the component. This may be partially due to all players in a component being co-located in the same cell where additional means or communication were available, e.g., participants within a component using the same chat room.

Survey Item	Mean Rating
Able to maintain good situation awareness:	
- within component	3.3
- for the component most significantly involved	3.4
- for the overall mission	2.5
Provided relevant information to others in a proactive way:	
- within component	3.7
- external to component	2.8
Alerted others to impending decisions and actions:	
- within component	4.1
- external to component	2.8
Anticipated the need to provide assistance to other participants:	
- within component	3.7
- external to component	3.0
Adjusted individual task responsibilities to prevent overload:	
- within component	3.5
- external to component	2.5
Extent to which behaviors were coordinated?	
- within component	3.3
- external to component	2.5

Table 2. Summary of Mean Ratings to Survey Items.

## 5. Conclusions

Network-centric concepts will not automatically translate into effective organizations. The fundamental change that NCO represents is the focus on integrating organizational structure, business processes, and technology to reflect access to globally available resources. Moreover,

there has been a fundamental inversion of the problem warfighters face: it is information winnowing vice generation that must be accomplished to facilitate better timed decision making. Much testing, refinement, iterating and additional exploration will be necessary to “get it right.”

### **5.1 Speed of Information Flow**

In spite of the increased amount of information that can be made available to decision makers, and the decreased time it takes for information to be distributed, a lag in the speed of information flow was observed by participants at Global Wargame 2000. In some cases, participants were slow to synthesize available information and pass it up the chain, in other cases there was confusion regarding whom to pass the information to or from whom to request information.

### **5.2 Familiarity with the Organization and Infrastructure**

Situation awareness and trust in the new tools improved considerably once people gained familiarity with tool usage and established necessary lines of communication. Additional training, prior to game start, may have enabled both the participants, and those who implemented the tools and wanted to learn about the new tools and processes, to reap more benefits from scenario play. The key implication for NCO in future environments is that a combined understanding based on a priori and on-going training in organizational roles/responsibilities, collaborative business processes, and technological function/capabilities is needed.

### **5.3 Trust**

People often distrust a new system and therefore need time to develop trust in the system based on experience and self-perceived utility assessments based on using new systems to “get the job done.” It was apparent that many players were uncomfortable with many new elements that were part of the Global 2000 and reverted to traditional ways of doing things. Future NCO environments must support a robust capacity for the humans in the loop to be able to more intuitively grasp the capabilities and performance enhancements afforded by new organizational and technology systems.

**5.4 Information Overload.** When people are struggling to learn so many new things, all concurrently, their efforts are diluted. Given the broad goals at Global 2000, participants were required to bring their proficiency in tool use up to the requisite level, learn how to operate within the novel organization, and develop relationships and processes for functional mission area responsibilities — all while engaging in the scenario. This created an information overload situation.

**5.5 Lack of Time to Process.** Systems need to be designed to be more user-friendly. Many participant comments indicate that significant time was required to search through the multiple systems provided to find the information they needed to accomplish their tasks. (1) They were not sure which system to go to find the information, (2) systems were not always organized in an intuitive way to facilitate user’s accessing information quickly, and (3) tool users wound up fighting the systems/ tools as well as the war as a result.

**5.6 Low Situation Awareness.** In spite of the tools that were provided to support SA via communication and collaboration, in some instances: (1) people were not aware that information needed to be pushed, (2) there was not enough time to convey the information because people

were busy accomplishing their own specific tasks, or (3) they were unfamiliar with the information needs of other people who were external to their group. The tools are only *tools*. They offer no “magic bullet” to provide perfect SA, or to make explicit an implicit commander’s intent (or a commander’s intent that is not verbalized in a way that is clear to the receivers), or to produce “knowledge superiority.” All of these desirable states, as well as many other desirable decisions and activities, require the cognitive effort of humans. Humans need to receive, perceive, absorb, synthesize, decide on, and respond to information. Humans need to clearly state intentions (no tool can clarify ambiguously stated intentions), plans, desired outcomes, etc. Tools don’t accomplish many of the important tasks that are part of C4I; they merely provide a vehicle to accomplish these human tasks in a potentially more efficient and effective way.

### **5.7 New Organizational Structure: Lack of Congruence of the Mission**

Many participants expressed the perception that participants at different levels within the organization held different understandings of the mission. Participants desired additional coordination of definitions, roles and responsibilities prior to game play. Additional guidance from higher authority was something participants also desired. Research indicates that performance is improved when there is a good “fit,” or match, between the authority structure, resource structure, and the information structure. The IT tools provided must all have a mutual “fit” as well, and must collectively “fit” the mission. In addition, decisionmakers need to develop familiarity with an architecture (including the systems employed to carry out the C2 processes) before they can operate effectively in it. That is, they have to develop organizational knowledge.

## **6. Conclusions**

In summary, exposing participants to so many new elements simultaneously makes it difficult to make definitive statements regarding the value-added by these new processes, tools, and ways of organizing. Enabling players to develop a greater level of familiarity with the elements prior to having them engage in the scenario would allow a better test of the advantages and disadvantages of all the new things introduced at Global Wargame 2000. The lack of definition of the functions of various players, who had authority to make what decisions, who was responsible for various actions, created an organization where people were not sure if the right people were getting the required information. On the other hand, if the goal was to provide an environment where emergent behavior is free to develop so new ways of conducting business could evolve then much was learned. Self-synchronization is a concept that requires change in the traditional concept of command hierarchy and decision control. Many participant questions about roles, resource control, decision authority, information sources and information requirements reflect the range of issues that must be addressed in clarifying how NCO will be implemented in the future.

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