Experience using Collaborative Technology with the United Nations and Multi-National Militaries: Rim of the Pacific 2000 Strong Angel Exercise in Humanitarian Assistance

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Abstract

The Center for the Management of Information (CMI) at The University of Arizona engaged in a joint research project with the U.S. Navy's Commander Third Fleet (Third Fleet) and The MITRE Corporation (MITRE) to use and evaluate collaborative technology during Strong Angel, a humanitarian assistance/disaster relief (HA/DR) exercise. Strong Angel was a part of RIMPAC 2000, a five-week multinational exercise that involved seven nations with over 22,000 people, fifty ships, and 200 aircraft. RIMPAC 2000's Strong Angel set out to satisfy three goals: (1) Develop a mutual understanding of respective capabilities, limitations and expectations among multinational militaries and the main United Nations relief agencies; (2) Create a replicable system for the safe conduct of Strong Angel and subsequent exercises in civil-military interaction for humanitarian support; and (3) Deliver a coordinated response to a population in crisis. CMI, Third Fleet, and MITRE teamed to achieve four objectives: (1) provide a collaborative environment both at sea and ashore within an austere environment; (2) use collaborative technology to establish a forum for the exchange of relevant information between civilian humanitarian organizations and the military; (3) document the flux of combined activities each day; and (4) evaluate the utility of collaborative technology during a civil-military exercise in humanitarian relief. The team met each objective and reports the results in this paper.

CMI, MITRE, & Third Fleet

In 1996, CMI partnered with Third Fleet to develop collaborative processes and technologies to overcome the limitations of performing closely coordinated staff work aboard a U.S. Navy ship. The Third Fleet staff is required to collaborate with hundreds of people internally and across militaries, civilian organizations, and governments during daily operations and in crisis situations. Collaboration across time and space occurs regularly at Third Fleet, so the opportunity to research the impact of collaborative technologies and processes is ideal. The Third Fleet Commander is a Vice Admiral (three stars) and is stationed aboard the USS Coronado in San Diego, California. A detailed description of the mission for Third Fleet is provided in Adkins, et al., (2000).

CMI has a long history of creating and fielding robust collaborative application prototypes and corresponding facilitation methods to enhance the performance of teams working toward a decision or common goal. The result of that work is now embodied in GroupSystems, a suite of collaborative software tools. As the nature and composition of organizational teams have changed in the last few years, CMI has begun to research opportunities for distributed collaboration.

This research has led to the development of a suite of collaborative tools that are designed to operate over the Internet and/or an intranet. These tools allow teams to collaborate on various types of projects in several different settings: same-time/same-place, same-time/different-place, and different-time/different-place. Distributed teamwork has also presented new challenges in meeting dynamics, which is also part of the current CMI research focus.

The Information Technology Center at MITRE brings extensive experience in developing collaboration environments and evaluation methodologies for collaborative technologies and tools (Drury, et. al., 1999). Its computer-human interaction (CHI) research

focus includes usability studies, speech and natural language interfaces, and intelligent information access. One specific strength is hands-on experience with the integration of technologies and tasks, another is developing techniques for capturing and analyzing data on tool usage and collaborative interaction.

MITRE is a not-for-profit corporation working in the public interest, in partnership with government. It addresses issues of critical national importance, combining systems engineering and information technology to develop innovative solutions. MITRE operates through three Federally Funded Research and Development Centers, focusing on the Department of Defense, the FAA and civil aviation, and the IRS and Treasury Department.

Description of Strong Angel Exercise

The Strong Angel exercise was developed in response to changes in the requirements for national defense. According to Kaplan (1996), VanCreveld (1991) and others, since 1989 the world has undergone a transformation that seems destined to remake the understanding of both requirements for domestic safety and sense of *"noblesse oblige."* With the fall of the only other superpower, the international community has watched the increasing number of small-scale conflicts throughout the world and has glimpsed environmental pressures beginning to re-define war. The national leadership has struggled to find an appropriate response, with variable success, occasionally deciding that active intervention in remote conflicts serves our national interest. Unfortunately, the military does not effectively train for such action, and so each intervention has required the re-learning of hard lessons.

Current military thinking was predominantly forged in the crucible of World War II. Military strategies were later shaped by the Cold War and the United States success seemed to prove the worth of the high intensity, force on force perspective. The outcomes in Korea and Vietnam were far less clear and gave a hint of what was to come.

The military now realizes that, with the overarching power struggle gone, so is much of the world's former stability. Small, brutal, internecine conflicts, reminiscent of Korea and Vietnam, have come to dominate the world landscape with violence that often now falls squarely on the backs of the innocent. Civilians have been starved to clear a disputed border area, women raped to instill terror and a religious ostracism, the elderly singled out by snipers for the psychological impact of the brutality, and children mutilated to consolidate fear and submissive compliance. In the face of such barbarity, America often perceives a moral obligation to intervene. In addition, these smaller conflicts pose a risk to global stability on which trade relationships depend, and so, for various reasons, U.S. national interests are involved. As the military has responded, leaders have recognized the military does not possess all skills required to be effective in these new environments.

Strong Angel was designed to force the development of a few required skills. The military challenged themselves to respond helpfully to international agencies that routinely and effectively manage populations-in-crisis. The team formed exercise objectives to ensure all involved would have to learn from those more experienced. Real-world events were used to establish a valid scenario for the exercise.

The scenario had two nations engaged in a low-intensity conflict, with harassment of a minority population within the aggressor country. Harassment quickly became violent persecution, and thousands of refugees then escaped across a border. The country that received the refugees was rapidly overwhelmed and asked for help in refugee management. The UN Security Council passed a resolution requesting international assistance and a Task Force of ships from seven nations was ordered to respond. Multi-national military resources were placed in support of UN relief agencies, and a refugee camp was built.

The exercise, Strong Angel, was held in early summer of 2000 on volcanic dust in the northwest corner of the Big Island of Hawaii near the town of Waimea. With the bulk of the military presence initially in Honolulu, the UN agency participants came to Pearl Harbor and walked onto the USS Coronado, Command Ship for Third Fleet, almost as soon as the mock Security Council Resolution was passed. As the refugee camp material began to be loaded onto amphibious ships anchored in Pearl Harbor, the USS Coronado set sail for the Big Island. Meetings of the Humanitarian Planning Group aboard USS Coronado, at sea, then began in earnest.

One hundred and twenty-five American Red Cross Disaster Services volunteers served as the refugee population. As the Civil-Military Operations Center (CMOC) took shape afloat, preparations to establish a refugee camp ashore revealed a number of unfamiliar details to the UN and military organizations. Only 36 hours had been scheduled to design and establish the camp once the UN and military arrived ashore. The refugees began arriving at about the 36-hour mark, very late in the evening. The consequent urgency lent a sense of realism to the problem because real civilians were arriving by truck into the middle of nowhere at night, with no water, power, sanitation, or shelter unless all cooperating agencies succeeded in their obligations. For additional drama, the Exercise Control Group planted

actors within the refugees to present a range of threats and management problems as the refugees arrived.

The exercise ran for roughly five days with U.S. Marines providing almost all aspects of camp management under UN direction. At the completion of that week the consensus across all participants, including the refugee volunteers, was of hard won success. Strong Angel has since been reviewed as seminal to the development of exercises in humanitarian support and civil-military integration throughout the Pacific Rim.

Strong Angel Environmental Conditions

Austere conditions such as those encountered during Strong Angel dictate heightened precautions and substantial levels of maintenance for information technology (IT) equipment and supplies. IT equipment requires protection from water, dust and temperature extremes. Electrical power is often unavailable or unreliable. Power for IT in this environment requires power conditioners, uninterruptible power supplies, and battery operation where practical, such as with laptops, handheld computers and PDAs, and other mobile gear. Solar panels and AC inverters operated from trucks are expedient backup sources of electrical power.

Commercial grade equipment, usually intended for use in office environments, is particularly susceptible to damage from the elements. Makeshift covers and filters can be utilized to protect the equipment; and compressed air can be used to minimize the accumulation of dust inside equipment. However, for any extended humanitarian operation it will be critical to migrate such equipment into appropriate shelters or ventilated cabinets to prevent contamination by water and dust; and to minimize temperature fluctuations.

For 24x7 operations, a combination power conditioner and UPS capable of operating the telephone and IT network infrastructure for several hours at a time is critical. Intolerance by commercial grade equipment of substantial over or under-voltage conditions necessitates the use of a power conditioner even if a large UPS for long-term backup is not required. A number of new, scalable, portable hybrid power sources such as solar charged batteries with generator backup or fuel cells, can provide long-term, reliable electrical power.

Collaborative Research Context

The research team's goal in a broad sense was to achieve a set of four objectives derived from the overarching goals of the Strong Angel exercise. These objectives were to: provide a collaborative environment at sea and ashore in an austere environment; use collaborative technology to establish a forum to exchange relevant information between humanitarian organizations and the military; document the input and output of HA/DR activities each day; and evaluate the utility of collaborative technology during a HA/DR exercise.

The team devised and implemented a number of workaround field-expedient shortcuts. To gain flexibility and avoid the pitfalls of a traditional wired network, the research team implemented a wireless LAN comprising a workstation server and 21 lightweight laptop computers. The wireless LAN significantly cut down on the footprint of the network and afforded users the opportunity to move machines around easily because they were able to access the wireless LAN anywhere in camp. The server was also a proxy server connected through a T1 line into the Internet. CMI and Third Fleet had already developed appropriate environments aboard the USS Coronado during previous research programs (Briggs, Mittleman, Weinstein, Nunamaker, & Adkins, 1998).

To achieve the second and third goals, the researchers used two software applications. One was GroupSystems, a group support system (GSS) that helps facilitate group interaction (Nunamaker, et. al., 1991). The other was CommandNet, a real time collaborative log used to help the group maintain situational awareness. Finally, the research team evaluated the use of the collaborative systems during the exercise to illuminate issues associated with the development and application of collaborative technology in the HA/DR context.

GroupSystems use during Strong Angel

The team learned through previous sessions with the military and civilian organizations that GSS could be useful in streamlining and coordinating meetings that took place during the exercise. In addition, Nunamaker, et. al. (1991) suggests the GSS lowers the barriers to communication between disparate groups. The researchers hoped to build trust across the military and civilian organizations and further improve the operation by using a GSS. This process was more complex than was anticipated.

The UN team was comprised of field operatives from several UN agencies located around the world, most of whom did not work together regularly or know each other. As would be expected each subgroup worked according to the procedures of the agency they represented. These highly skilled professionals were accustomed to being dropped into austere conditions with little notice or time for preparation. The UN staff

has to use the resources at their immediate disposal to get the relief operation moving. Often, they are subjected to physical danger, illness, crime, politics and the whims of the media and popular opinion. As a consequence, the UN field staff is extremely self-sufficient and wary of outsiders.

The culture and mandate of the UN agencies also stimulates the need for a collective voice. As a political entity, the UN and its agencies must be sensitive to the positions of each member state, the local population, local politics, the host-nation government, nongovernmental organizations, the military and a host of other players. Through experience, UN staff have learned that an effective way to function is to establish positions in private, then provide outside entities with a single united front. This approach, though sometimes cumbersome, allows UN staff to navigate the charged political landscape while still maintaining effectiveness. As a result of the established dynamics of not publicly sharing in-progress ideas,, the use of a GSS by the UN contingent was an issue. However, the reasons for their hesitation in participating were not yet clear to the research team.

Aboard the USS Coronado the research team was prepared to use the collaborative tools to provide decision support and to document the lessons learned by the military and the UN. At the preplanning conference six months prior to the exercise, all the participants recognized the need for recording each day's activities, decisions and information to help others work together in future exercises and actual operations.

A lessons-learned session was scheduled at the end of each day to allow the players an opportunity to distill and record important ideas. The first barrier to the use of the GSS was that the UN body was accustomed to flexible schedules and many of the other meetings were taking longer than was expected. The lessons-learned meeting was the first to be canceled when the day's schedule slipped. During the lessons learned sessions that did take place there was an apparent resistance to using GSS by the UN participants. On several occasions they were observed moving the keyboards out of the way when sitting down. Even with instruction, they were reluctant to make entries in the GSS. The military participants, on the other hand, were willing to use the system but did not because of the refusal of their UN counterparts.

When the UN and military moved to a shore based CMOC, the CMI team noted a marked change in the UN party's adherence to the schedule. The unfamiliar surroundings of the ship were gone and the UN players were in a situation where their responsibilities were clear. UN members began to engage and take on the challenge of teaching the military representatives the finer points of HA/DR operations. The research team, not yet aware of the internal UN decision processes, remained puzzled by the UN staff's firm resistance to the GSS. The UN users argued against the use of the GSS and stated they felt the requirement to use GSS was sprung upon them with no warning.

However, UN participants eventually explained the reasons for not wanting to utilize the GSS. As mentioned before, they prefer to keep discussion private until all agencies can support a united public front, and they felt the GSS might circumvent their decision process. The impression was that recording individual opinions and putting them before the group could undermine the consensus that the UN staff required. In an actual operation, the GSS process may have presented a security risk to the UN staff. Another factor contributing to their reluctance to GSS may have been the familiarity of the military participants with the tool, and a sense of relative disadvantage as new users..

The first lessons-learned session on shore was filled with tension due to the disagreement over use of the GSS. The research team, with support from the military, persuaded the UN group that using the GSS could benefit all exercise participants. After debating the issue, the entire group decided to try using the GSS on a limited basis to record lessons learned. If there were future objections, the GSS could be abandoned.

After a short GSS session, acceptance of the technology increased, and usage expanded throughout the exercise. By the close of Strong Angel, the UN representatives were enthusiastic about using the GSS to facilitate their meetings. Specifically, UN members came to value the speed and efficiency with which points could be brought up and disseminated to the entire group.

Attributes of the GSS alone were not responsible for the increased scope of usage as the situation was influenced by the growing trust between the military and civilian participants. Members of each organization began to identify with their counterparts and to establish productive working relationships.

CommandNet History & Use during Strong Angel Exercise

CommandNet, the collaborative log application used during the exercise, was developed as a direct response to Third Fleet requirements. The Third Fleet staff is distributed through many spaces on different decks. This physical separation has caused difficulties in sharing information and coordinating effort. The Third Fleet staff had been using GroupSystems as a decision and meeting support tool when a Third Fleet Intelligence

officer had the idea of using the GSS to run a 24-hour-a-day distributed meeting. The participants of this meeting would be the intelligence collectors and analysts distributed throughout the ship. By meeting virtually, the group could instantly share new intelligence information and benefit from the group interaction.

This novel use of the GSS expanded to the establishment of numerous collaborative logs that are used for many functions on the ship. There are logs for monitoring intelligence, exercise control, command and control, battle watch, and others. CMI's experience running the collaborative logs allowed researchers to recognize the limits of GroupSystems as a logging tool. GroupSystems software had shortcomings, such as frequent network traffic and extensive client installation requirements.

To overcome these limitations, CMI developed a prototype Java application called CommandNet that specifically focused on logging functions. CommandNet maintains the ease of use of the GSS but utilizes a web browser as a client. Additionally, CommandNet operates effectively under bandwidth limitations.

CommandNet was introduced to Third Fleet during RIMPAC 2000 and Strong Angel. The players in Strong Angel were both civilian and military, so the network was the Internet rather than the classified network used for the military logs. The collaborative log server was set up in California. Ships accessed the server through standard satellite connection while the shore based CMOC users accessed the logs through the wireless LAN's Internet connection. Logging started shortly before the CMOC transitioned ashore and continued throughout the length of the operation.

Description of CommandNet Research

MITRE joined with CMI on a research project funded by the Defense Advanced Research Projects Agency (DARPA)[1] to capture collaborative data and observe human interactions in an operational environment. Specifically, the team set out to capture interactions with a collaborative logbook across groups of users over time, analyze the tool interactions (including the users' ability to adapt to the system), and evaluate the effectiveness of the tool. The MITRE team brought experience in instrumentation, data capture (both automatic and via observations and surveys), and analysis of tool usage and collaborative interaction (Bayer, et. al., 1999, Damianos, et. al., 1999, Drury, et. al., 1999, Finholt and Brooks, 1999, Kurtz, et. al., 1999, Damianos, et. al., 2000a, Damianos, et. al. 2000b).

There were multiple desirable outcomes from this research project. Those outcomes included analysis, visualization, and persistent history of the captured interactions to assist in event recreation and training for HA/DR, intelligence analysis, and exercise control. MITRE's evaluation team provided iterative feedback to CMI, which was useful in the development of the collaborative tools. The ongoing analysis of the captured data is leading to insights on tool usability as well as on tool effectiveness in supporting collaborative interaction and increasing situational awareness. Additionally, experiment results contribute to ongoing research in evaluation methodology and in data collection techniques.

Methodology for CommandNet Research

The MITRE team collected both quantitative and qualitative data. Quantitative data was captured by automatic logging of tool usage and through user surveys. Qualitative data was gathered through participant observation and open-ended interviews. This combination of methods increased confidence in the validity of the results.

Data Collection. Automatic data capture was accomplished in two ways. First, the content of the logs constituted an ongoing record of the contributions made, the times when they were made, and the user identities or roles of the authors. In a few isolated cases, users shared login accounts.

Second, data were automatically captured through server logs. The server logs provided an ongoing event record of human interactions with CommandNet. MITRE worked with CMI to instrument CommandNet for automatic event logging. Data were captured on the server side as users interacted with the tool. Various types of events were recorded, including navigation from one screen to the next, administrative activity, and usage of advanced features. Event logs allowed researchers to discern what the user was viewing, when entries were logged, and whether the user searched or used the headline capability for analyzing the logs. What could not be captured were client side events such as scrolling and opening or closing of browser windows.

A questionnaire was developed to gain feedback on CommandNet and to collect background information on the participants. Survey questions prompted participants to compare CommandNet to other logging systems they had used, to rate the tool's features, and to comment on what they liked and did not like.

[1] MITRE and CMI were funded, in part, by DARPA under contract number DAAB07-99-C-C201 and N66001-00-2-8961.

Background information was collected on rank and specialization, computer experience, experience with collaborative tools, and what media the participant had used prior to CommandNet to capture or access mission critical information. Questions on overall experience were designed to elicit feedback on usability, user satisfaction and ideas for tool improvements.

The design of the questionnaire was for either paper or Internet administration. Technical difficulties prevented the Internet version from becoming operational. MITRE's observer administered the questionnaire verbally and was able to elicit extensive comments on the open-ended questions. Six out of 20 participants responded to survey questions.

Open-ended interviews were conducted to gather contextual information about the situations in which CommandNet was used. Sixteen participants were interviewed, and roughly half of the interviews were audio taped. Interviews took place in formal sit-down interviews scheduled in advance or in impromptu conversations while waiting for meetings to begin. About half of those interviews were audio recorded. Many participants, especially those from the UN agencies, were under considerable time pressure due to the exigencies of the exercise; any time available to respond to questions was valuable.

Interviews focused on how CommandNet fit into the larger picture of what people were doing during the exercise. Specific questions varied, depending on the background and role of the participant. Commonly asked questions included how the use of specific CommandNet logs was decided upon, and how the tool was introduced to the user. Enquiries were also made about modifications participants would like to see in CommandNet, and how they envisioned the tool being used in the future.

An ethnographer from MITRE was a participant observer during Strong Angel and RIMPAC 2000. Third Fleet and CMI initially granted the observer access to meetings and relevant shipboard spaces. She came to be considered a regular member of the Strong Angel community through participation in meetings, operations, and community activities. Daily observation focused on how people interacted with the collaborative technology and with each other and on organizational processes surrounding the use of CommandNet.

Data Preparation. Both quantitative and qualitative data were prepared to facilitate analysis. Quantitative data from the HCI surveys were tabulated in an Excel spreadsheet. CMI had instrumented CommandNet to output server log data into XML documents. MITRE parsed the XML documents to create spreadsheets for manipulation, table creation, and graphical displays.

Qualitative data from surveys were organized by topic. Interviews and notes were transcribed and organized by content. These data were then distributed to the MITRE research team, to provide context for analyzing the quantitative data.

Analysis. Interpretation of observations and interviews conducted during the exercise provided deeper insight into the meaning of patterns found in the server logs. Data from the server logs were used to verify that user feedback reflected actual use of the tool. Thus, comparing data collected through various methods informed the team and laid a solid foundation for analysis and evaluation.

The MITRE research team wanted to understand the usage of CommandNet during Strong Angel and whether the tool features supported this usage appropriately. Contents of the logs were annotated for a high-level view of usage. Participant-tool interactions were profiled over time to look for changes in behavior and adoption or rejection of particular features. Ease of use of CommandNet was investigated particularly since training had been minimal and informal.

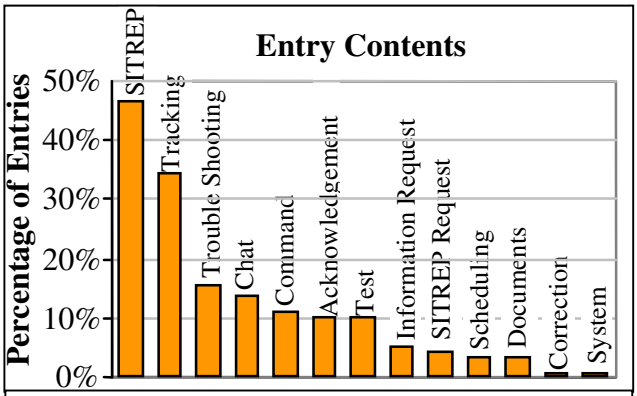

Figure 1 Content entries in Strong Angel logs

Results of CommandNet Research Project

Results of MITRE's evaluation are divided into four categories: characteristics of the user population, basic usage patterns, advanced feature usage, and adoption/diffusion. Below, selected highlights of findings are discussed.

User Population. The user population for CommandNet during Strong Angel consisted of U.S. Marines, UN team members, and Third Fleet representatives. All surveyed members had experience in using computers and had used collaborative tools previously (e.g., e-mail, shared directories; GroupSystems). In the past, participants had used a variety of media for reporting observations and

accessing information including email, paper-based logbooks, and non-web-based versions of CommandNet.

Participants directly responsible for routine communications were often the ones to make entries; while leaders had authority to make decisions about what constituted appropriate usage of the tool. The tool was relatively new to many, so 'appropriate usage' was not always agreed upon or understood. Thus, adoption/diffusion was uneven across the population.

Basic Utility. There was general agreement that CommandNet was effective as a common data repository, making information easily accessible within the civil military context. Before CommandNet, information was gathered, put on a slip of paper, and tacked to a piece of wood nearby. This method often failed to meet distribution needs. Although the information had been collected, the dissemination process lacked efficacy and reliability.

Eighty percent of the users surveyed indicated CommandNet was a useful tool while the other 20% did not respond to the question. Users were also enthusiastic about the ability to scroll back through the logs and review data submitted by others.

Informational Content. CommandNet was most often used for recording situational reports ("SITREP"), tracking resources and people, and general communication and coordination. See figure 1 for content types of entries. Trouble-shooting was another common usage. In fact, CommandNet turned out to be unexpectedly useful in this regard. When the radios intended for ship-to-shore communication failed, CommandNet was the only working communication link between the CMOC ashore and the CMOC afloat..

Ease of Use. During an initial humanitarian response, most people are unfamiliar with each other and the surrounding context (i.e., unfamiliar terrain, politics, logistics, etc.). Yet there is an intense need to coordinate closely and quickly. Effective communication is critical in this kind of environment, and communication support is a major enabler of HA/DR efforts. The design center adopted by CMI for CommandNet -- "Drop-Dead Simple" – met this critical need. One user stated CommandNet was "…very straightforward, easy to use." CommandNet being easy to learn and use was a very significant advantage since many people had to begin work with little or no prior training.

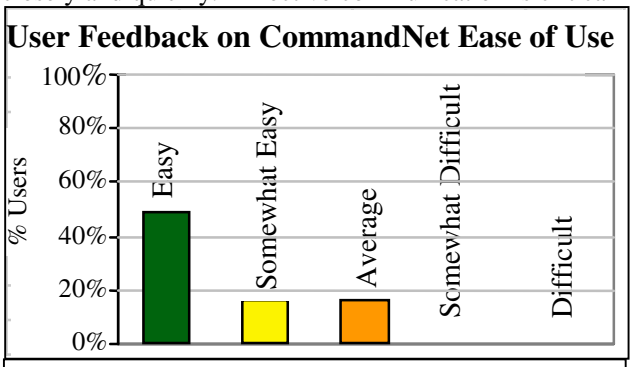

Figure 2 User Ratings on Ease of Use

Fifty percent of the users surveyed found CommandNet easy to use; no one found it difficult to use (figure 2). Sixty-seven percent found CommandNet easier to use than prior methods. The ease-of-use aspect of the tool is also highlighted by the fact that few users received formal training. Many users either figured out how to use the tool themselves or learned by demonstration. Four survey participants were shown the basics of logging in and making entries, one taught himself, and one learned by watching another user.

Usage Limits. With ease of use and critical utility both contributing to CommandNet usage during the Strong Angel exercise, the actual amount of usage was lower than might be expected. Although 23 user accounts were created, just 60% of those users actually made entries, and two of those users were CMI members. There were 105 entries made over 7 days. Furthermore, CommandNet was not in use in the CMOC on ship before the exercise participants moved ashore. The most plausible explanation for the minimal usage involves the lack of advance planning, combined with the urgency of other exercise activities.

Advanced Features. While CommandNet's basic design was "Drop Dead Simple", it also contained a number of advanced features that were not used during the exercise. These advanced features were generally unobtrusive. Some (e.g., categories and importance) were visible, but optional, on the main screen. Others (e.g., search, headlines, preference settings) were recessed; to access them, the user would have to click on a menu item that led to a different web page.

The most commonly used advanced feature was categories. CMI members created 10 categories to use in the logs, but these did not necessarily correspond to categories that participants found useful. Users commented that the category feature was not used as well as it should have been. If categories had been agreed upon in advance and their use discussed by the participant teams, then they might have shown a higher utility for log review and monitoring. Another easy-to-use feature, importance, was used very little during Strong Angel. Just 25% of all active users accessed the web page for user preferences, and a mere 1% of the active users navigated to the search and headline features.

Advanced features were not used for several reasons, mostly related to the short duration of the exercise under 'emergency' conditions without much lead planning. Had the tool been in use for a longer time, there might have been more exploration and experimentation with different features, which may or may not have been adopted by the general population.

Adoption and Diffusion

As suggested above, there were conflicting influences on the adoption and diffusion of CommandNet throughout the Strong Angel population. MITRE's evaluation efforts explored how the influences affected tool adoption and diffusion and led to variations in usage across different sub-populations. In addition to ease-of-use and planning, other influences include (non-) mobility of participant's role in the exercise, effect of urgency of HA/DR contingencies on leadership, and access to CMI support personnel.

The matter of relative mobility is significant. Some people (especially those responsible for routine communications) had jobs that kept them in a single location throughout the day. Others had jobs that involved routine information reporting, and they were the ones most likely to use the tool. Still other participants were involved in the operations of setting up a camp and roaming the site in order to address a wide range of issues. Such people did not have ongoing access to a networked computer that would readily afford them opportunities to access the collaborative log(s). For those participants, the potential usefulness of wireless communications was fairly clear.

To put the tool to optimal use for HA/DR processes would have involved a certain degree of advance planning – i.e., deciding how SITREPs should be prepared for posting, agreeing on what kinds of tracking to use the tool for, etc. Such preparations had not been made in advance in this case, so the usage of the tool was limited by the fact that there was little consensus on how to use the tool. Additionally, there were few leaders available to provide support and reinforcement in that regard. Having just landed in unfamiliar terrain, and facing the imminent arrival of thousands of refugees, HA/DR leaders needed to be much more concerned with securing food, water and shelter for large numbers of people than focused on the learning of a new collaborative tool.

Another factor influencing adoption and diffusion was access to the developers and related support personnel. While one computer-savvy individual took it upon himself to explore and experiment with CommandNet, others needed more support to feel comfortable using the tool. The most frequent users of CommandNet during Strong Angel turned out to be those people who were stationed in the same location as the CMI support personnel. As a result of this close proximity, they could easily ask impromptu questions and get immediate assistance.

Discussion of Results from a Collaborative Technologies Perspective

These results are consistent with current themes in development of collaborative technologies: (a) alignment of 'fit' between technologies and the mission/culture of the user organization, (b) variation in user behavior within and across tasks and user communities, and (c) need for assessment within a mission context.

Successful transition of technologies into operational environments requires organizational commitment, as well as clear requirements and good alignment between the technologies and tasks to be performed. This research shows the military environment is an excellent testbed for assessment and transition of collaboration technologies. The requirement to collaborate is clear, missions are well-defined and the participants are knowledgeable, share doctrine and are highly motivated to succeed

In Strong Angel, CommandNet was not only easy to use, but it directly supported a function structurally integral to naval operations: the keeping of logs and situation reports. Military users knew how to compose and maintain logs and SITREPS and how to share them. However, use of CommandNet was not limited to logging, and its utility as a more general communications medium became both visible and valuable when radio communications could not be established between ship and shore, and CommandNet became the only electronic way of exchanging messages. Users may begin to use a tool for specific purposes, but they evolve their usage and also their requirements into areas not within the original design center of the tool. This highlights the need for analysis of collaborative interaction over time, as users become familiar with collaborative tools and use them in broader aspects of their work environment.

Instrumented data capture, complemented by interviews, questionnaires and other observations, is essential to reflect both quantitative usage patterns and the texture of the social communication that underlies collaboration.

Impact of collaboration technology on a combined Military & UN HA/DR exercise

The introduction of GroupSystems as a collaborative tool in Strong Angel came as a surprise to many of the non-military participants. Despite discussions during the planning meetings, the United Nations agency representatives found themselves on new ground during the initial days of the exercise, and their hesitation was readily apparent. Efforts were made to reassure participants that the material submitted each evening was only for improving interactions, not for keeping an electronic record. Members of the military leadership respected the caution of the UN participants but collaborative technology usage was encouraged.

In a short time the collaboration technology came to serve as a catalyst for bilateral civil-military education. Using GroupSystems, the participants found they could submit a thought anonymously, watch the reaction, guide the discussion in directions they found appropriate and informative, then drop back quietly as the group came to a consensus on that issue. Non-military agencies work mostly by consensus, different from the hierarchical military approach. The participants found GroupSystems, which is designed to optimize consensus-based decision support, helped the military more effectively work in a consensus decision-making mode.

In addition, the GroupSystems technology helped focus the group on the particular goals of the exercise. Each night the senior and middle leadership gathered around the table to think constructively and collaboratively about the day. Since each day contained innumerable examples of differing civilian and military approaches , the evening meeting allowed each facet of the exercise to be evaluated cooperatively. Then each member of the group was able to extract the larger and more meaningful lessons of the day. The computer-supported collaboration sessions also helped participants realize that these few hours in the evening must be an on-going part of the process. Collaborative discussion reinforced the significance of combined participation in maintaining the humanitarian focus.

For the evening meeting, each entry was reviewed by the group as a whole, rephrased by consensus as appropriate, then listed under a topic area and filed for later consolidation. The result was effectively a journal of the civil-military consolidation process, marking a path through the minefields of civil-military cooperation. That collaborative effort each evening was the one constant in an exercise that was forced to flex and adapt across every conceivable impediment, from dust storms to death threats, from having the water supply severed by an auto accident to having an access road declared unusable, and finally finding WWII bombs within the refugee camp itself. The UN and military reviewed the interaction each evening and planned both to solve the immediate problems and to develop management tools for such events in the future.

A frequent refrain in any civil-military operation is that there must be a transition from military support to civilian support just as rapidly as possible. That transition allows both for the military to go home and for the continuation of national will to accept military participation. One result of the collaboration technology in Strong Angel was a template for the transition developed through a cooperative effort between the UN agency representatives and the U.S. military, particularly the Marine Corps. Participants stated it was unlikely such an effort could have been so productive without the collaborative practice forged by GroupSystems.

Although the collaboration techniques developed throughout Strong Angel were far from perfect, everyone learned a great deal about where software like GroupSystems is more and less valuable. It is not easy, for example, to address issues that require a sequential conversation or significant depth. Technologies such as GroupSystems are not designed for those purposes. The military and the UN took other opportunities to sit down and discuss the philosophical differences between them and to look at future opportunities for the evolution of what appeared to be a useful exercise. Participants soon saw, though, that the fruits of those discussions were reflected in the topics addressed later that evening as the lessons-learned were captured on GroupSystems for the day.

In sum, collaboration technology served as a tool for introducing disparate groups to each other, and it accelerated the productive work that each group needed to accomplish. Such a resource holds much promise for improving both exercises and real-world operations that cross civil-military boundaries. Significantly, a senior UN representative stated that, “accelerated integration improves the rate of real lives saved, and we agree that all proven tools should be incorporated routinely.” Several plans for future civil-military exercises and operations now incorporate collaboration technology as one mechanism for doing a better job.

Future Directions

A multitude of factors made collaboration difficult during Strong Angel. First, collaboration between organizations whose missions are both different and unfamiliar is demanding. Second, past interactions between some organizations have created actual and perceived strains and rumors regarding how each does business. Third, participants came from different cultural backgrounds and used multiple languages to communicate. Fourth, the environmental conditions

were extreme, and the pressure of making critical life threatening decisions under time constraints added to the difficulty associated with collaborative decision-making.

These difficulties were balanced by the strong motivation of participants to perform their mission well. Because the participants in Strong Angel came to the exercise with extensive experience in actual humanitarian assistance efforts and knew first hand the human consequences of ineffective collaboration. . They found the opportunity to explore collaborative techniques genuinely worthwhile.

One lesson learned is that humanitarian organizations will usually sacrifice geographic proximity, and trade-off travel time to the refugee site, in order to provide reasonably comfortable, secure working conditions for their staffs, information technology, and communications equipment. Not only does this minimize wear and tear on equipment, but it also alleviates a significant degree of stress on the humanitarian workers, enabling them to work more effectively. The dust, wind, rain and extremes of temperature exacted a significant toll on the individuals working in the camp. Relocation to a secure, environmentally protected workspace would be an extremely high priority for humanitarian organizations confronted with the conditions encountered during Strong Angel.

This study was instrumental in shaping CMI's thinking on how to develop collaborative technology and processes to support decision-making under the constraints of humanitarian assistance efforts. One future research direction is to develop processes to integrate collaborative technology in a self-sustaining community within the infrastructure of a humanitarian assistance effort. Briggs, et. al. (1999) suggest focusing on identifying and supporting repeatable processes early in the event to promote the transition of a technology within an organization.

A second research direction is to identify collaborative requirements in humanitarian assistance efforts and to modify CommandNet to increase situational awareness among participants in an operation. The objective of CommandNet is to improve communication and shorten the decision cycle by making collaboration and information sharing routine. CommandNet could constitute an operational information clearinghouse, improving situational awareness for all participants during humanitarian support operations.

A third research direction is to focus on the lessons-learned from working in a CMOC afloat and transitioning to facilities ashore. Research on using collaborative technology in portable self-sustaining units that function in various austere environments is required to improve the capabilities of Civil Military Operations Centers. Finally, it is crucial to continue research on assessment of collaborative technologies in operational environments, collecting both quantitative and qualitative data about user interactions and judgments on tool use.

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