Collaborative Data Collection during Strong Angel and RIMPAC 2000

Final Report
for
DARPA ITO
CVIM Program

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Executive Summary

This is the final report for Data Capture During Strong Angel (DARPA contract # DAAB07-99-C-C201), describing MITRE's evaluation of the CommandNet collaborative groupware tool used during RIMPAC2000, a Third Fleet multinational exercise that included Strong Angel, a humanitarian aid and disaster relief (HA/DR) scenario involving both military and non-government organizations (NGO). During this effort, MITRE worked in partnership with researchers at the Center for the Management of Information at the University of Arizona who developed CommandNet, and with the US Navy Third Fleet.

CommandNet is a web-based electronic logbook used to capture data and observations that were shared within and across command centers afloat on the USS Coronado and ashore at a simulated refugee camp on the island of Hawaii. Users during Strong Angel included military personnel and members of a United Nations team involved with management of the refugee camp. The exercise provided an opportunity to collect data across groups of users collaborating over time in an operational environment, analyze the technological, social and organizational processes characterizing such collaborative interactions, and evaluate effectiveness of a collaborative tool in an operational civil-military scenario

CommandNet was instrumented for automatic capture of usage patterns, and in addition, a participant observer collected qualitative data on-board the Coronado and at the refugee site. The analysis of both quantitative and qualitative data on CommandNet usage collected during a month of RIMPAC, including the five days of Strong Angel, is presented in this final report.

Quantitative data came from both automatic data capture and from user questionnaires. Automatic data capture included actual content of the CommandNet logs, such as text entries with associated timestamps and user identities, plus instrumented capture of events from the CommandNet server, such as navigation from window to window, or use of a feature. Survey questionnaires were used to get background about users, such as rank, specialization, and experience using computers and collaborative tools, and to elicit data about CommandNet features and overall user reaction to the tool.

Qualitative information about usage was gathered through comments in the questionnaires, interviews with users, and observations by a trained ethnographer who was on-board and ashore throughout the exercise and was eventually accepted as a fellow participant. The open-ended interviews were conducted to gather contextual information about the situations in which CommandNet was being used, and how CommandNet fit into a larger picture of what users were trying to accomplish during the exercise.. The emphasis of the observations was on how people interacted with the collaborative technology and with each other, and on organizational processes surrounding use of CommandNet. Daily field notes were maintained, and recorded interviews were transcribed.

The two types of data illuminated each other in several ways. Observations about usage were supported by hard data. Quantitative usage patterns out of the norm could be explained by field notes indicating that some event had disrupted regular operations. Event tracking could be used to verify user comments. Together the two types of data provide a picture of usage, utility and user reactions, all situated within the social and organizational dynamics of collaborative activity.

Virtually all users found CommandNet useful and generally better than hardcopy logbooks previously used. They appreciated the availability of a common repository of current information that was easy to access, even remotely, and easy to monitor and review. The tool was especially useful during the overlap at shift changes, when the outgoing staff could update the incoming staff by reviewing the shift's logged entries.

Because of its web interface, CommandNet was easy to use, which was good because training was limited or non-existent. Many users just learned by example, watching another user make an entry, or modeling their entry on an existing one. One factor that negatively affected usability was the interaction between CommandNet and the communications network infrastructure that sometimes caused delays in response time when an entry was submitted. The screen might go blank for minutes, causing users to repeatedly click on Submit and to inadvertently generate duplicate entries. Another usability problem that frustrated users was a log refresh that could occur while the user was scrolling through entries and would reset the log screen to the top of the entries.

Very few users exploited any of the advanced features supported by CommandNet, including marking an entry for Importance (a priority level) or with a Category (a classification label), grouping related entries under Headlines for analysis, Searching by keyword or by category, or setting User Preferences such as refresh rate. In general, users converged on the basic log entry submission and review process required for their work, and did not explore further use.

Collaboration is an inherently social activity that does not lend itself to controlled experiments, especially in operational environments involving hundreds of people, millions of dollars of equipment, and a mission to protect refugees. Also, CommandNet was just one of many technologies used during the exercise to complement face-to-face interactions, and it is not easy to isolate its contribution from those of other tools.

However, some general observations can be drawn. As a tool for asynchronous coordination, CommandNet provided shared information for situational awareness, support for smooth transitions over shift changes, and a historical record for replay and accountability. It was also useful for synchronous coordination among distributed participants. Logs were used for communication between ship and shore and between the refugee base camp and remote command center. They were useful helping a group resolve ambiguities, clarify interpretations and reach a unified view, a process which was critical to the civil-military coordination required for the exercise.

For robust evaluation, it is necessary to have complementary data, both quantitative and qualitative, and to use complementary levels of analysis, such as usage patterns, human-computer usability factors, and organizational structures and processes. It is also essential to have complementary organizational perspectives, such as CMI's view as CommandNet developers, MITRE's view as collaboration technologists and evaluators, and the Third Fleet's view as operational users.

Transition of a collaborative tool into an operational environment is easier if the capabilities of the tool match the requirement of the mission. The basic element of CommandNet is the log which is a particularly good fit to Navy operations because maintaining logs is an integral process that everyone knows how to do. Successful transition also requires organizational commitment to collaborate, to use the tool and to evaluate its use. Such commitment by the Third Fleet made this study possible.

For the same tool, usage patterns differ by user roles and missions. In RIMPAC/Strong Angel, eight different logs yielded eight different usage patterns. It is also apparent that usage patterns evolve over time, and eventual familiarity and increased expertise might prompt more users to try the advanced features of CommandNet they had originally ignored.

Introduction

This report describes an evaluation by MITRE of utility and usability of the CommandNet collaborative groupware tool in the context of RIMPAC. RIMPAC is a major Third Fleet multinational exercise held every two years with participating forces from the United States, Australia, Canada, Chile, Japan, Korea and the United Kingdom. Held in June of 2000, RIMPAC2000 was made up of several exercise phases, including Strong Angel, a humanitarian aid and disaster relief (HA/DR) scenario involving both military and non-government organizations (NGO).

CommandNet (CN), developed by researchers at the Center for the Management of Information at the University of Arizona, is a web-based distributed information-sharing environment that supported various command centers both on-board the USS Coronado and on-shore at a simulated refugee camp on the island of Hawaii. CN is an electronic logbook used to capture data and observations that were shared within and across command cells to contribute to situational awareness. Via CommandNet, users can enter information into logs (viewable by others in their logbook community), combine log entries into groups ('Headlines'), and access relevant entries using key word and category searches. Users during Strong Angel included military personnel and civilian disaster relief staff, such as members of a United Nations team involved with management of the refugee camp.

Because of MITRE's leadership of the Evaluation Working Group (EWG) of DARPA's Collaboration, Visualization and Information Management (CVIM) programs, and its experience in evaluating collaboration technologies, DARPA tasked MITRE to document and analyze the usage of CommandNet in RIMPAC2000, focusing primarily on Strong Angel. An objective of the study was to provide useful feedback that might guide CommandNet usage and training decisions by the Third Fleet and future design choices by developers.

Period of performance of this effort was January through September 2000. Prior to the summer exercise, MITRE staff became familiar with the evolving CN environment, contributed iteratively to the design and development of the CN version deployed in RIMPAC, and specified instrumentation capabilities needed for automatic capture and analysis of usage patterns. During the exercise itself, a MITRE observer (JB) collected qualitative data on-board the USS Coronado and at the refugee site. The analysis of both quantitative and qualitative data on CN usage collected during the exercise is presented in this final report.

Methodology

We collected both quantitative and qualitative data. Below, we discuss details of the data and how the data were gathered. We also describe how the data were processed and how the various types data complemented each other to provide a more accurate picture for evaluation.

Data Collection

The initial phase of this effort was focused on becoming familiar with CommandNet general capabilities and providing insight in usability features to CMI. For several months preceding RIMPAC2000, MITRE used evolving versions of CommandNet and provided feedback to CMI developers on usability of the tool and on instrumentation necessary to gather usage data needed for assessment. These interactions included regular pilot testing sessions in which MITRE and CMI exploited CommandNet design features and stressed the environment. MITRE developed its own scripts and tools for eventual processing of data generated by CommandNet during the summer exercise. MITRE also developed a questionnaire to elicit background information and feedback from Strong Angel and RIMPAC users of CommandNet.

During RIMPAC2000, and Strong Angel in particular, MITRE collected two types of data: quantitative and qualitative.

Quantitative data came from both automatic data capture and from user questionnaires. Automatic data capture included (a) content of the CommandNet logs themselves, and (b) instrumented capture of events from the CommandNet server. The log content constituted of an ongoing record of what was entered, associated with time of entry and the user identity or role of the author. Instrumented event capture on the server recorded events such as navigation from one screen to another and usage of features such as Search and Headlines. All collected data were maintained at the appropriate security classifications.

Not available in any automated way were client side events such as scrolling or opening/closing of browser windows. That is, it was not possible to have an accurate fine-grained view of what a user might be looking at all points in time.

Survey questionnaires were used to get background about users (e.g., rank, specialization, computer experience, experience with collaborative tools, etc.), and to elicit data about CommandNet features and overall user reaction to the use of the tool. Users were asked to rate each of the CommandNet features on a 5-point Likert scale, with additional space for comments. Questions on the overall user experience were a combination of Likert scale questions and open-ended questions designed to elicit feedback on usability, user satisfaction and ideas for tool improvements. See Appendix A for the actual survey used.

Qualitative information about usage was gathered through interviews and observations by a trained ethnographer (JB). Open-ended interviews were conducted to gather contextual information about the situations in which CommandNet was being used. Because of time constraints, format of the interviews varied considerably, from short impromptu conversations to scheduled tape-recorded sessions. Interviews focused on how CommandNet fit into a larger picture of what users were doing during the exercise. The interviews also included questions on how participants decided to use CommandNet as well as how they were introduced to the tool.

The trained observer came to the exercise several days before the beginning of Strong Angel and remained throughout the rest of RIMPAC2000. In addition to observing CommandNet interaction onboard the USS Coronado, JB also participated in the on-shore component of Strong Angel. She came to be considered a regular member of the Strong Angel community, and participated in meetings, operations and community activities. The emphasis of the observations was on how people interacted with the collaborative technology and with each other, and on organizational processes surrounding the use of CommandNet.

Data Processing and Analysis

Both quantitative and qualitative data were prepared to facilitate analysis. Quantitative data from the HCI surveys were tabulated in an Excel spreadsheet. The automatically captured events from the server logs were parsed into spreadsheets, as well, for data 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 research team to provide context for analyzing the quantitative data.

Interpretation of observations and interviews conducted during the exercise provided deeper insight into the meaning of patterns found in the server logs. Conversely, the quantitative data supported theories and observations of particular behavior. In addition, 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 research team wanted to understand the usage of CommandNet during Strong Angel/RIMPAC 2000 and whether the tool features supported this usage appropriately. Contents of the logs were annotated for a high-level view of usage and style. 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.

Results

First, to provide appropriate context, we discuss the CommandNet user population in both Strong Angel and RIMPAC exercises. Then we provide an overview of the utility and usability of CommandNet, describing basic features as well as some more advanced features. For more detailed results, see Appendix B. A full CommandNet Usability Report is included as Appendix C.

User Population Characteristics

The Strong Angel user population for CommandNet consisted of both military and non government organizations: US Marine Corps personnel, UN team members, reservists, and ComThirdFleet representatives. The RIMPAC user population was all military: primarily US Navy with some Army and Marine representatives, and military personnel from non-US countries.

All of the surveyed members of the user population had some experience in using computers, and all had used some type of collaborative tool previously (e.g., email, shared directories; some had even used GroupSystems[1]). In the past, participants had used a variety of other media for reporting observations and accessing information including email, paper-based logbooks, and older (non-web-based) versions of CommandNet.

Participation differed relative to user roles within the operations efforts. Those directly responsible for routine communications were often the ones to make entries while those higher up in the hierarchy (leaders) had authority to make decisions about what constituted appropriate usage of the tool. With a tool relatively new to many, 'appropriate usage' was something not always agreed upon or understood, and so adoption/diffusion across the Strong Angel population was relatively uneven.

Utility and Usability

Overall, CommandNet users found the tool better than a hardcopy logbook. There was general agreement that CommandNet was effective as a common data repository, making information easily accessible within the HA/DR context.

> *"Before, we would get the information and put it on a slip of paper and thumbtack it to a piece of wood or something. Not everyone would have access to this piece of information. We never had a problem of collecting the information before - just a question of how we disseminated it."*
> *- CommandNet user*

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1 GroupSystems, a group support system designed to facilitate group interaction, was developed by CMI.

We surveyed 24 out of 110 CommandNet users. The low response rate was due to time constraints and tight schedules. Over half the participants surveyed indicated that they found CommandNet to be a useful tool. See figure 1, below. The participants were also enthusiastic about the ability to scroll back through the logs and review or monitor data submitted by others. This ability to review past entries was particularly useful during shift changes when the overlapping shifts could use CommandNet as a focal point in discussing events that had occurred.

Basic Usage

The simplest and most commonly-used feature of CommandNet was entry creation/submission. With little or no training, participants found CommandNet easy to learn and use for logging entries. Figure 2, below, shows that 70% of the surveyed users found CommandNet easy to use. No one found it difficult to use.

CommandNet was also easy to administer. Administrators were given access to creating user accounts, editing entries, and adding new categories to the logs.

One of the biggest complaints about the use of CommandNet was the slowness of the system. The performance issues were confounded by network latency. When a user submitted an entry, the screen would go blank, sometimes up to several minutes, before the updated list of entries would reappear.

> *"It freezes up ... When you need it the most, you are unable to use it."*

Log refresh was also distracting and frustrating to users reviewing the history of events; when the screen refreshed, the entry list would be reset to the latest entry. Although CommandNet provided multiple ways of controlling the refresh (the user could change the refresh rate or disable it altogether), only about one fourth of the user population ever took advantage of these features. Since few participants received any training in CommandNet, the refresh features were probably overlooked.

When an entry was created, the user had the option of adding an associated category and an importance level. A category provided a visible label while importance allowed the users to prioritize an entry. Depending on user preferences, both category and importance could be displayed alongside the logged entries.

Categories potentially made it easier for users to identify meaningful entries quickly; the advanced search feature (see below) also enabled users to search the entry list by category. Categories could be created by anyone with the right administrative permissions. What we found was that categories were used in just three of eight logs. Those responsible for deciding how a log would be used either dictated that categories should be used – and then they were used – or did not make a decision regarding category usage – and so they were not used. A new, untrained user was more likely to learn by example and create entries similar to those already in the log; if categories were not used, the new user would not use them either. In some cases, the existing categories did not necessarily correspond to categories that participants found useful, and an entry would be submitted without a category. 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 may have shown a higher utility for log review and monitoring.

Unlike categories which could be created by an administrator, importance levels were predefined. A user could choose from 'Routine' (the default), 'Priority', 'Immediate', or 'Flash'. However, the importance levels were displayed as 'R', 'P', 'O', and 'Z'. Some users said they never used importance because they

did not understand their definitions. Others simply did not associate the single-letter display with a level of importance. A few users commented that there was no need to prioritize entries since they were involved in nothing more than an exercise. Importance levels were used in just three of eight logs. It is interesting to note that these three logs were not the same subset of logs in which categories were used.

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 exercises. These advanced features were generally unobtrusive. The search, headline, and user preferences features were recessed; to access them, the user would have to click on a menu item which led to a different web page.

The results of the survey indicate that the search and headline feature were not used by participants. The event records show that about one fourth of all users viewed those pages, a few users even attempted to perform a test search or create a headline, but no searches were saved and no headlines submitted.

Users were more likely to change their preferences, including what information was displayed, the time offset, and the refresh rate.

The fact that advanced features were used so infrequently may be explained by several reasons, most being related to the short duration of the exercises under 'emergency' conditions, without much lead planning, and the frustration experienced by users due to the system's slowness. Had the tool been in use for a longer time during non-exercise periods, there might have been more exploration / experimentation with different features, which may or may not have been adopted by the general population.

User Communities: Scenarios and Usage Patterns

Each CommandNet log was created for a particular community of users. Decisions regarding the usage of each log were mandated by different people. In some cases, no decisions were made, and participants tended to follow the example of those who used the tool before them. As a result of these variations, each log was used quite differently.

In this section, we provide some context by discussing the characteristics of each user community. Then we briefly summarize how each log was used. We distinguish the user communities participating in the Strong Angel exercises from those participating in other RIMPAC exercises because the participant groups differed greatly and their use of the tool varied as well. For more details on tool usage, see Appendix B: Detailed Results.

Strong Angel User Community

Although there were three distinct CommandNet logs created and used during Strong Angel, there was too little data collected over the short exercise to warrant separate discussions of each log. Below, we profile the Strong Angel logs as one.

CMOC User Community

Context

The term 'CMOC' normally refers to the 'Civil-Military Operations Center', a specially designed conference center aboard the Coronado. 'CMOC' was also used during Strong Angel exercise to refer to the group of representatives from "civilian" (UN) and military (Navy, Marines and Army) organizations that used the CMOC space to discuss and plan their cooperative efforts.

During Strong Angel on the Big Island, a large tent was set up to support CMOC group activities. This 'CMOC Ashore' contained tables, chairs, and laptops. It housed the frequent meetings of the 'CMOC' group, and was also utilized as a daytime shelter from the dust by some participants. The laptops in the tent were connected to a LAN and ran collaborative and internet software, including CommandNet. At various times throughout the day, someone sitting at the table would use the laptop in front of him or her to review and/or make entries to the CMOC log(s) in CommandNet. Occasionally military officers would come into the tent specifically to use CommandNet. Other people accessing the logs with any regularity included the Civil Affairs officers who were also stationed inside the CMOC tent, and a couple of UN communications people in the UN tent who had CN on their machines hooked up to the same LAN.

At the start of Strong Angel's ashore component, one CommandNet log was established for the 'CMOC' and another for the Marines. However the Marine officers were too busy with other responsibilities to explore using the software. The CMOC log attracted a range of people, and eventually two other logs were spun off – a Civil Affairs log, and a 'CMOC Afloat' log, each in an effort to separate low level tactical information from items of interest to higher-ups. The 'Civil Affairs' log was created to support communication between Civil Affairs officers at the base and refugee camps; its use was limited because it depended on a radio antenna for its internet connection that was frequently not working. The 'CMOC Afloat' log was set up when the HF radios intended for ship to shore communication failed, and CommandNet became the only ship-to-shore communications link for the CMOC group.

Usage Profile of Strong Angel Logs

Strong Angel participants differed from participants in RIMPAC 2000 exercises in that Strong Angel users received more training from CMI staff. Overall, they were pleased with the training they received and found the tool easy to use.

> *"It was good. They showed me the basics, and if I had any questions, I knew who was around to ask. I mean if I was in my office by myself, I could probably figure it out on my own. I think it's very simple so you don't need a lot of training which is what I like about it."*

Strong Angel participants used CommandNet mostly to record situation reports and tracking events, both people and resources. There was also significant use for troubleshooting, chat, request for action, acknowledgment, and testing. The category feature was used consistently in the Civil Affairs log, about half the time in the CMOC log, and not at all in the CMOC Afloat log. Surveyed participants had mixed reactions to the use of categories.

> *"Could be useful if we used it. Problem is we don't use it well. "*

Although the search feature was not used, some of the participants thought it was a good idea to have.

> *"Reusability of saved searches is an important feature."*

Overall, Strong Angel participants surveyed said that CommandNet was easier to use than other comparable systems. They found it useful, appropriate for the exercise, and easy to use. Most commonly requested features included chat or a log reserved for side conversations, and the ability to add attachments.

RIMPAC User Communities

There were five logs used during the RIMPAC exercises: one for each of the BWC, JCCC, Intel, CFACC, and CECG communities.

BWC in the JOC

Context

The user community for the Battle Watch log is primarily the officers standing the Battle Watch in the Joint Operations Center (JOC). The purpose of the watch is to support the situational awareness of the Battle Watch Captain (BWC), who is the "eyes and ears" of the Admiral and the Chief of Staff (COS). In addition to the BWC and the Assistant BattleWatch Captain (ABWC), six or seven other officers are also stationed in the JOC to support the BWC in this capacity. These "anchors" have various backgrounds including: Underwater Sea Warfare (USW = submarines), Intel, Ground Forces (Army), and Coalition (other countries).

Information arrives in the JOC via a variety of sources: Microsoft NetMeeting Chat, high frequency radio, telephone, CNN TV, various collaborative applications used by anchors, maps, briefings, web sites, software displaying common operating picture maps, etc. Different people within the room attend to different sources so that some messages are received by all, many by several people, and others by only a single person. As relevant items of information are identified by participants on the watch, they are mentioned and discussed, either with one or two other people close by, or spoken more loudly across the room. Much of the "information" that comes in is incomplete and/or ambiguous and needs further clarification before it is considered to be useful or actionable. Under the discretion of the BWC, such information is entered into the (CommandNet) BattleWatch log by the ABWC. The text of the message is usually dictated by the BWC to the ABWC. The CommandNet log is projected onto a portion of one of three large screens in the front of the semi-darkened room; these many of the other software applications that are in use concurrently.

The Battle Watch is maintained around the clock by officers on six-hour shifts. Before an official shift change, officers from the incoming shift will arrive about a half an hour early to talk with their outgoing counterparts about what has been happening to gain current situation awareness. At this time, CommandNet is often maximized on the screen and used as a review tool by scrolling back through the last six to twelve hours of logged entries. Officers at other locations around the ship also have access to the log -- most who do only monitor the log and do not make entries.

Usage Profile of the BWC Log

The Battle Watch Captain's log was used as an operational log. During Strong Angel, entries were mainly about trouble shooting, personnel, tasking, and scheduling. During the RIMPAC war exercises, entries shifted towards sitreps, tracking of forces, reports, and casualties. A portion of these entries contained information from other logs (CFACC, Intel, and CECG).

The MITRE Corporation

The BWC log was used throughout the entire month, during both Strong Angel and RIMPAC exercises. There were typically about 22 entries a day, but activity increased from about 20 entries a day to 60 during the exercises. Entries before the war exercises were made by the Battle Watch Captain. During the exercises, the Battle Watch Captain dictated the entries to the Assistant Battle Watch Captain.

Before using CommandNet as a means of reporting observations and accessing information, participants had used a local log (the greenbook), email, and a previous version of CommandNet referred to as "the collaborative logbook." There was infrequent usage of the category and importance feature. More advanced features (search and headlines) were not used at all. Most everyone learned the basic tool usage from watching someone else, and they all thought CommandNet was relatively easier to use than past methods of recording observations and accessing information.

Overall, BWC users surveyed judged CommandNet to be somewhat useful, somewhat easy to use, and very appropriate to their job. What users liked most about CommandNet were ease of use and its value as a permanent record of events. They commented on how easy it was to add entries and how easy and useful the scroll back feature was.

JCCC User Community

Context

The JCCC (Joint C4I Control Center, or tech support) log was unrelated to the RIMPAC or Strong Angel exercises. The JCCC log was primarily used in a small room on the ship containing several people and numerous computers and monitors. The people using it (making entries) are enlisted people who are providing tech support and system maintenance to people on the ship. MITRE's participant observer was not able to spend a lot of time in this room, and consequently we do not know a lot about what went on in the room.

The use of the log by this group was established by an operations deputy. Previously, they had been using a Microsoft Word document for this purpose. CommandNet was preferred to Word because it made it impossible for the entries to be changed after they had been submitted. One of the staff served as administrator for the JCCC log.

Usage Profile of the JCCC Log

The JCCC log was created for use in the Joint Command Control Center. The JCCC log was used for technical support: logging troubleshooting events, maintenance, and system and network status. The users in the JCCC community were all regulars and were accustomed to logging entries in other tools like an Excel spreadsheet, Word document, or local logs (greenbook). None of the users interviewed had received any training; they learned to login and make entries from someone on the previous watch. The log was in use for 16 days. The activity level in the log was fairly constant throughout its use. A typical user averaged about seven entries a day.

Compared to methods utilized in the past, JCCC users found CommandNet "*easy to use*" and, according to one person, "*about the best I've seen*." They liked the fact that the entries were numbered because they could refer to them by the number. Indeed, about 3% of the entries contained references to other entries. Interviewed users also liked the automatic time stamps associated with each entry. Another well-liked feature was the ability to scroll back through the history of logged events. Users reportedly reviewed the log at the beginning of their shift and sometimes also at the end.

Not one user complained, during our interviews, about the slowness of the system. That was surprising considering that 5% of the entries were duplicates resulting from hitting the submit button more than once before the system had time to update the logs. The JCCC log had a higher percentage of duplicate entries than any other log. More than one user requested the ability to edit entries; there were numerous typographical errors.

Other than for simple data entry, the JCCC user community did not use CommandNet for anything else. The easy-to-use category and importance features were not used to annotate entries, and none of the more advanced features (search, headlines) were used at all. A few users viewed and changed the user preference settings, but the refresh feature was not used.

The JCCC community found CommandNet somewhat easier than other tools. Overall, it was rated as somewhat useful, somewhat appropriate, and somewhat easy to use.

Intel User Community

Context
MITRE's participant observer did not have access to the spaces in which most of the Intel officers worked. Upon questioning, she ascertained that there were often between eight and nine people in such a room, and discussion of what incoming messages meant was frequently a prerequisite before any entry was made in the log.

Usage Profile of the Intel Log
The Intel log contained more entries than any other log. It was used heavily during the RIMPAC exercises. In fact, activity increased drastically from fewer than 10 entries a day to a range between 65 and 125 a day. In addition to making entries in the Intel log, the typical Intel user monitored the BWC log. Before the RIMPAC war exercises, entries consisted of reports, general information, and information on the enemy forces. During the war exercises, entries consisted of sitreps and tracking information. Some of the entries were Intel messages pasted directly into CommandNet.

At least one third of the surveyed population was reservist. All were computer users and familiar with email and shared directories. Other comparable methods for making observations and accessing information were Microsoft Excel spreadsheet, Microsoft Word, local logs (greenbook), and older versions of CommandNet. No one surveyed had received any training.

Unlike other logs, the category feature was used heavily, and most (67%) found it both useful and easy to use. The importance feature was used regularly in the Intel logs, too, but was rated as less than useful.

> *"I don't prioritize reading based on that since I read them as they come in. I don't do this often enough to remember what 'O' and 'P' mean."*

A couple of users made several searches more than once. Searches were rated useful, helpful, and easy but were considered slow and not so intuitive. One person suggested that it might be easier to use the 'Find' feature of the browser. The headline feature, an analytical feature for grouping entries, was not used, but a few people explored the page.

Most users said CommandNet was somewhat easier than other systems and not any faster. Everyone interviewed thought it provided better analysis. Overall, they unanimously found it useful, appropriate, and easy.

Below are some comments about what the Intel community liked.

> *"auto log entry time, precedence level, originator, as much space as needed to write whatever"*

> *"The fact that it's quick, easy to use, research tool for current events. It's a log. Recap events go back and figure out what's going on. Keeps key nodes on ship apprised of what's going on."*

> *"Very intuitive ui. It gives me access to real time info."*

Requested features included the ability to force refresh, chat, and the capability of adding attachments.

> *"I would like more info. It would be nice to have a way to ask questions. If I am unclear, I send out email. The log is not meant to be interactive."*

CFACC User Community

Context
The Coalition Air Force Command and Control (CFACC) log is similar in many respects to the Battle Watch log, with some significant differences. It is primarily used in one section of a large open room -- the CAOC (Coalition Air Operations Center). Other sections of the room are used for various Intel and planning activities related to air operations. Similarly, there are multiple screens in front, but they are computer monitors, stacked two levels high. There are more maps of different kinds and fewer other collaborative applications.

Most of the people in the CAOC are Navy pilots. The Watch Officers are junior officers (who have never done a watch before); they sit closest to the computer monitors. The action in the CAOC is much faster than that observed in the JOC. People come together quickly, have short conversations, and then break up their conversation formations more rapidly; more people are standing (and walking in and out), and fewer are sitting.

The explanation given for why the CAOC is kept separate from the JOC, and why there is no Air Operations Anchor in the JOC, is that the CAOC is mostly tactical, while the JOC is (trying to be) more operational. In general, things happen a lot faster in the CAOC – planes fly much faster than ships sail, and everything else is affected by that difference.

Usage Profile of the CFACC Log
The Coalition Forces Air Command Control Log was used for just six days during the RIMPAC exercises. There was little activity in the log, about 44 entries a day. Two thirds of surveyed participants were regulars, one third were reservist. All were users of email, chat, shared directories, and document

management software. Tools used in the past to record observations and access information included Microsoft Word and local logs, or the greenbook. Two thirds of the surveyed population received no training on the use of CommandNet.

Categories were not used, and none was available. The importance feature was used in this log although some users chose not to prioritize their entries: the exercise was "*not really a war.*" Advanced features were not used at all. And, unlike users of the other logs, the CFACC group did not record their shift changes.

In general, CFACC log users liked the automatic timestamp associated with each entry. They liked being able to see other people's entries and other logs (BWC).

CECG User Community

Context
The Exercise Control staff used a CommandNet log during the RIMPAC exercise. They sat in the JOC (usually two people, together) and used their log in only that single location. They found it useful for changing watch shifts and as a historical record, but did not find much use for its distributed nature.

Usage Profile of the CECG Log
The CECG log was created for the Coalition Exercise Control Group. The purpose of the log was for recording significant exercise events and operational activities. Everyone surveyed was a regular. All were experienced computer users and had used email, chat, and shared directories. Most had used Microsoft Word in the past for similar event logging. According to our survey, no one interviewed received any training on the use of CommandNet. The log was in use for eight main days. All entries were made by the CECG watch officer. About 24 entries were made a day, possibly by at least two different people or shifts per day (there were two shift changes logged per day).

CommandNet was used by the CECG user community mainly to log entries. People interviewed said they used the scroll back feature at the beginning of their watch to review previous entries. There was a belief expressed by two users that no one was looking at the logs, although there was some evidence that there were people who logged in just to monitor the logs. No features were used other than change in user preferences. The lack of feature use could be attributed to the lack of training or to the urgency of the situation.

> "*When it gets busy, I only want to make entries.*"

Most popular positive comments about CommandNet were regarding numbered entries and automatic timestamps. Slowness of the system was a common complaint. According to one participant, the slowness made CommandNet unreliable as a means of communication: "*when you need it most, you're unable to use it.*"

Discussion

Social and Organizational Implications

Collaboration: Tool Use is Dispersed, Not Modular

Human collaboration is not easily separated from a larger social context. Using a collaborative tool is only one small aspect of a much larger ongoing process. People collaborate not just with the tool but in a multiplicity of forms and in an ongoing way. Evaluating the utility of a collaborative tool involves looking beyond human-computer interactions, in order to identify how use of the tool changes the larger context of collaboration. This kind of evaluation cannot be done in a controlled experiment as many human-computer interaction studies are done, since real collaboration is always socially situated.

Evaluating a collaborative tool to gain knowledge of its impact in an operational setting involves looking at a much larger phenomenon. The current case, evaluating CommandNet in an operational context, situated the use of the tool in exercise operations involving hundreds of people and millions of dollars worth of equipment. In this context, the use of CommandNet was often commensurate with phone, radio and physical transportation. People used CommandNet at least once a day and often several times or more an hour, interspersing tool use with lots of other collaborative activity, including human-human interactions and utilizing other collaborative software.

To bring some order to the multifarious ways that tool use affected the broad social context, we consider several broad categories of social implications of CommandNet use. First we consider how use of the tool supported coordination over time, via asynchronous communication; then we examine how use of the tool supported coordination over space, or synchronous communication. Finally, we consider some of the issues involved with adoption and diffusion of the tool in the available population.

Coordination Over Time: Asynchronous Communication

Situational Awareness
Perhaps the simplest use of CommandNet is as a reminder of what has occurred. This is the way it is used to support situational awareness (SA), its primary requirement When a new event occurs, people can refer back to the tool's event history for context in interpreting the current situation. What was significant about this was that CommandNet was designed, presented, and used as a log. In the Navy, the 'log' already exists as a communication genre; people know how to use logs and so were readily able to make use of the tool thanks to its simple design.

Reference for Shift Changes
CommandNet was frequently used during shift changes. In an operational setting (24/7), people take turns filling different positions; most military operations involve shifts, and the shift change is an organizationally significant event. Shift changes are when organizational continuity is enacted, spanning individual experience. Those who are not present during certain events can be briefed.

BattleWatch shift changes are a prime example. When the incoming BattleWatch Captain (BWC) arrived, the outgoing BWC would open CommandNet and review the log(s) to identify significant events for discussion. The incoming BWC would regard the log as an indicator of recent events relevant to the watch and that knowledge would form the context for events to come. More detailed examination of how shift changes are carried out is important to future efforts.

Log as Historical Record
Logs are maintained as a historical record, useful if there is a problem, to trace back for increased insight and understanding about what happened. They provide support for social accountability which is important to maintaining organizational order. The Navy has historically maintained logs for various operations, and it is because of the Navy's familiarity with logs that CommandNet was created to be used as a log. The importance of this fact should not be overlooked; collaborative technologies are especially effective when they are introduced into a population already used to communicating in certain ways that the technology can then support.

Training through Learning by Example
Especially during an exercise, many of the participants are unfamiliar with their positions. People who are new to an operation often learn by observing and imitating what they see around them. This applies, in particular, to entries they see in the log. Log content is considered by many novices to be an indication of the correct or proper format for entries; any new entries they make are likely to be similar in form and content to the ones that are already there. Since training is acknowledged as a key aspect of exercises, although it is often undersupported with resources and planning, the importance of having sample entries and/or templates prepared ahead of time should be highlighted. For example, there probably would have been more usage of categories if the initial entries had employed them.

Coordination Over Space: Synchronous Communication via Log

Distributed Situational Awareness
As a web-based tool, CommandNet was used to support coordination distributed over space. People used the log to stay coordinated with others who were physically remote, often in place of telephone, radio, or physical transportation. For example, Intel analysts located on three different decks of the ship could work collaboratively without needing to walk around to all the spaces. CommandNet was perceived as an improvement over radio communication as it was more intelligible; similarly, watchstanders at CMOC and refugee camps could coordinate without walking 2 miles in dust (or by a half hour HMV trip).

Distributed Sense-making
In an operations center, messages come in over a multiplicity of channels and are often incomplete or ambiguous; interpreting the messages takes a collective effort. In this situation, a single shared view is one key to coordination. In the Joint Operations Center, the log is displayed in the front of the room, where people (literally) "share a common view." This provides a common ground for interpreting incoming messages. Once something is in the log, it is agreed to be "what really happened". Prior to that there is confusion and sense-making in the JOC room. The same sense-making process also goes on in the JAOC and the Intel spaces. ("*Oh yes, there's eight to nine people in that space, and they all discuss what should be entered for each entry in the log.*")

The sensemaking process is further accentuated during exercises when many of the participants are not yet trained, and are trying to figure out what is happening. What winds up in the log may still be 'wrong' and need to be fixed later, but it serves as a common indicator of agreed-upon reality that everyone can then base their future work on, and by doing so, stay coordinated with each other. Through this process, personnel construct organizational continuity/cohesion -- not only with respect to the entries in the log, but with respect to their relationships to each other that are hammered out by way of discussions about what should go in the log. (E.g., this may be why humor is such a regular feature of conversations in the JOC.)

Increased Social Accountability

Another factor in social and organizational processes affected by the use of CommandNet, and other distributed collaboration tools, has to do with people's work being visible at a distance -- not only geographically, but status-wise. People higher up in the hierarchy can more easily see and monitor what people at lower levels are doing. From one perspective, this has both advantages and disadvantages -- leaders may want more detail, but also may have to struggle not to get mired in irrelevant details. For example, during RIMPAC, the Chief of Staff said he was not interested in looking at the logs because the level of detail was too distracting for the strategic level of focus he needed to maintain.

From the other perspective, it also has positive and negative effects. On the one hand, it is a form of visibility which can lead to greater recognition of work performed. On the other hand, it can also lead to extra work around making a good impression, as demonstrated by the numerous requests we received for enhanced spell-checking and editing capabilities. Disadvantages associated with distant collaboration are accentuated by power differentials. Sociologist Judith Perrolle points out the importance of informal "backstage" regions in which people can act without fear of being seen from outside/above, as critical to moral development as discussed by Habermas.[2] (E.g., informal support over Microsoft NetMeeting during presentations to the Admiral). This is a very thorny problem with important arguments on both sides, and will not be settled easily or unilaterally anytime soon. It bears significantly on the difference between a formal log and an informal chat, and is a good reason to keep them intentionally separate.

Adoption and Diffusion

There were conflicting influences on the adoption and diffusion of CommandNet throughout the Strong Angel and RIMPAC populations. This section explores how these influences affected tool adoption and diffusion and led to variations in usage across different sub-populations. In addition to ease-of-use, influences identified include:

- (non-)mobility of participant's role in the exercise

- time pressures and urgency of exercise contingencies on leadership

- access to CMI developers and support personnel

The matter of relative mobility is significant. Some people (especially those responsible for routine communications) had jobs which kept them in a single location throughout the day. Others were involved in the operations of setting up a camp and roaming two sites in order to address a wide range of issues; these people did not have ongoing access to a networked computer that would readily afford them opportunities to access the collaborative log(s). Those people who were unfamiliar with the tool and had the time to learn it were people with stationary jobs on the front lines of information reporting. For those with mobile responsibilities, the potential usefulness of wireless communications was fairly clear; changes are anticipated in that direction.

During exercises, leadership needed to be much more concerned with fighting a war or securing food, water and shelter for large numbers of people than focused on the complexities of adapting to a new collaborative tool. To put the tool to optimal use involves a certain degree of advance planning – i.e. agreeing on what kinds of tracking to use the tool for and in what formats, etc. Such preparations had not always been made in advance, and so the usage of the tool was sometimes limited by this fact.

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[2] Perrolle, J. A., *Privacy and Surveillance in Computer Supported Cooperative Work* , http://www.ccs.neu.edu/home/perrolle/privacy.html

Another factor influencing adoption and diffusion was access to the developers and related support personnel. While a few computer-savvy individuals took it upon themselves 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 had legitimate reasons to be in the same location as the CMI support personnel on an ongoing basis. As a result of this close proximity, they could easily ask impromptu questions and get immediate assistance.

Lessons Learned

Technical Transition

CommandNet came directly from a technology development environment and was installed in a Sea-Based Battle Laboratory for use in an operational exercise. There are many factors that affect the successful transition of technology into operational use, and one of the most important is a clear and early commitment by the operational organization to use the technology. In the case of Strong Angel, the decision to include the web-based CommandNet tool was not finalized until the Coronado was underway from San Diego. For users, this meant there was minimal (or no) introduction to CommandNetís capabilities and very little training on the tool, which clearly affected tool usage.

Another important factor for successful transition is that the required infrastructure for the tool be known and in place in the operational organization. Like all collaborative applications, CommandNet interacts with network communications to support real-time response to users, and the requirements for sufficient tool-communications interaction could not always be met during the exercise. This affected user response and ultimate user satisfaction with the tool. Another aspect of infrastructure is security policy, and CommandNet will have to be hardened in that area because of vulnerabilities in its current system administration design. Users with admin privileges appear to have administrative rights over all logs, inconsistent with need for protection of enclaves or communities of interest. Also, editing capabilities are embedded within administrative rights, such that users who have editing capabilities may inadvertently also have administrative privileges that were not explicitly granted.

With respect to effective evaluation during transition, it would be useful for versions of the tool to be staged in a systematic way so that appropriate instrumentation for usage data collection can be specified. If features of the system evolve and are fielded too rapidly, the user and the evaluator cannot form a good model of the system.

Evaluation Methodology

This research project improved our evaluation methodology by illustrating the value of complementary perspectives in the areas of data collection, analysis, and organizational support.

Combining the quantitative data with the qualitative observations created a veritable treasure chest of useful information. The two types of data complemented each other and provided us with a much richer data set, giving us an increased degree of certainty in our conclusions.

Multiple levels of analysis contributed to a more complete evaluation. We performed a traditional HCI usability study on the collaborative tool (see appendix C). We also examined low- and mid-level usage patterns of user interactions with the tool. Finally, we examined the use of the tool from a social and organizational perspective.

The MITRE Corporation

Another important contribution to the evaluation effort included the combined input, support, and perspective of each of the groups involved: MITRE, CMI and the Third Fleet. Together, these three organizations created a strong collaborative research environment.

Conclusion: Collaborative Technology Research Perspective

The research methodology and results are consistent with current themes in the development of collaborative technologies, including

- importance of alignment of technologies with task/mission being performed;

- cultural factors that affect utility and adoption of technologies;

- accommodation of variation in user behavior within and across tasks and user communities; and

- critical need for evaluation within a mission context, and for instrumentation to support automated data collection.

Alignment of Technologies and Tasks

Not only was CommandNet very easy to use, but it directly supported a function that is structurally integral to naval operations: the keeping of logs and situation reports. There was general agreement about what constituted such logs and sitreps and with whom they were shared. Military users were already familiar with the process of log entry and maintenance, and a few even had prior experience with GroupSystems, the predecessor to CommandNet. Some non-military representatives were also accustomed to making regular tracking reports. For such users, there was virtually no barrier between what they needed to do and the tools they had for performing their jobs.

However, use of CommandNet was not limited to logging, and its capabilities were explored in free play. Users recognized its broader communication function, and a few initially exploited it as a 'chat' tool until that was officially discouraged. It is interesting to note that later its utility as a more general communications medium became both visible and valuable when radio connections failed between the Coronado and the command center ashore, and CommandNet became the only electronic way of exchanging messages.

CommandNet was also seen as a useful data repository, and users expressed interest in having more complex data structuring and data management functions as additional features. (It is not clear how well they understood that existing features such as Category could have met some of their needs.)

The point is that users may begin to use a tool for specific purposes, but can evolve their usage, and also their requirements, into areas not originally within the design center of the tool.

Cultural Factors

It is common knowledge in the area of collaboration technologies that successful transition of technologies into operational environments requires organizational commitment (to collaboration, to the tool, and to evaluation), as well as clear requirements and good alignment between the technologies and tasks to be performed. From this research, it appears that military involvement in HA/DR exercises is an excellent testbed for evaluation and transition of a collaborative log tool. The requirement to collaborate across time and place is clear. Missions are well-defined, participants are well trained, they share doctrine and

common understanding of mission components, and they are highly motivated to use whatever means are available to them to succeed.

Variation in Usage

As mentioned in previous sections, there was considerable variation in the usage of the tool and its perceived utility. There were eight different logs used during these exercises, and those eight logs illustrated eight different usage patterns. This is not surprising, given the user communities and the dynamic context in which they were operating. A principal constraint on usage and learning during this exercise was compressed time. Exercise events occurred at a pace that precluded time and resources for training and exploration.

This highlights the need for longitudinal analysis of collaborative interaction and how dynamics evolve over time, as users become more familiar with collaborative tools and use them in broader aspects of their work environment. The current study is a snapshot and what may really be needed is a movie, although the data collection requirements would be staggering.

Evaluation Issues

Evaluation is as inherent a part of tool and technology development as writing code. Without an evaluation framework and real data, there is no principled way to determine what tools are appropriate for which tasks, or even if evolving versions of a tool are actually 'improvements.' This study exemplifies the evaluation issues. It is critical to evaluate tools/technologies in contexts that are meaningful to participants and that require collaboration for effective task/mission performance. Instrumented data capture, interviews, questionnaires, and ongoing observation are all essential to gaining a full understanding of a tool's effectiveness. Analysis must reflect both the patterns from quantitative data and the texture of the social interactions that underlie collaboration.

The MITRE Corporation

Project Participants

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The MITRE Team would like to acknowledge the tireless contributions of Jessica Teague whose assistance greatly helped us to meet our deadlines.

Feedback on CommandNet

Date: ___/___/___

Please take a few minutes to fill out this survey. Your input is greatly appreciated.

<div style="background:purple;color:white">**Background Information**</div>

1. Gender: M___   F___

2. Age Group:
    under 20 ___   20-29___   30-39___   40-49___   50+___

3. Rank and specialization?

4. On average how many hours per week do you spend using a computer?
    0-1___   1-10___   10+___

5. Check all the computer-supported collaboration tools that you have used.
    GroupSystems ___   email___   chat___   whiteboard___
    shared directories___   audio___   video___   document management software___
    other (please specify)_____

6. Before using CommandNet, what media did you use to report your observations, and
    to access information? (e.g. message traffic, notebook, etc.)

<div style="background:purple;color:white">**Feedback on the features**</div>

7. Rate the **category** feature:

Useful	1 2 3 4 5	Useless ___Did not use
Easy	1 2 3 4 5	Difficult

    Comments on the **category** feature:

8.   Rate the **importance** feature:

Useful	1 2 3 4 5	Useless ___Did not use
Easy	1 2 3 4 5	Difficult

    Comments on the **importance** feature:

9. Rate the **search** feature:

Useful	1 2 3 4 5	Useless ___Did not use
Helpful	1 2 3 4 5	Hindrance
Easy	1 2 3 4 5	Difficult

    Comments on the **search** feature:

10. Rate the **headlines** feature:

Useful	1 2 3 4 5	Useless	___Did not use
Helpful	1 2 3 4 5	Hindrance	
Easy	1 2 3 4 5	Difficult	

Comments on the **headlines** feature:

<div style="background:purple;color:white">**Overall Experience**</div>

11. Rate the training you received in CommandNet:

Adequate	1 2 3 4 5	Inadequate	___No training

12. How would you compare using CommandNet with the method(s) you have used in the past? Using CommandNet is

Easier	1 2 3 4 5	Harder	___No opinion
Faster	1 2 3 4 5	Slower	___No opinion
More fun	1 2 3 4 5	More irritating	___No opinion

13. Analyzing logs using CommandNet:

Is faster	1 2 3 4 5	Slower than previous method(s)	___No opinion
Provides better	1 2 3 4 5	Worse quality analyses	___No opinion

14. Rate the overall experience of using CommandNet:

Useful	1 2 3 4 5	Useless	___No opinion
Appropriate	1 2 3 4 5	Inappropriate for my tasks	___No opinion
Easy	1 2 3 4 5	Difficult	___No opinion

15. What did you like most about CommandNet? What things were easy?

16. What did you like least? What did you have the most trouble with?

17. Was there something you wanted to do in CommandNet but could not do?

The MITRE Corporation

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Appendix B: Detailed Results

This appendix details our data findings of CommandNet usage during Strong Angel and RIMPAC 2000 exercises. The data discussed in this appendix were taken from server logs, content logs, questionnaires, and interviews. Tool usage differed greatly between the humanitarian assistance / disaster relief exercise of Strong Angel and the naval exercises of RIMPAC 2000, and so we keep the discussions separate.

We start with an overview of the logs used in the exercises and a user study. Then we examine the use of the Basic Features, making entries, and the associated use of categories and importance. Following that, we take a look at more
Advanced Features such as search, headlines, preferences, and hyperlinks. We include a

Miscellaneous subsection to investigate other observations. Finally, we profile each user community.

Overview of Logs and Users

This subsection provides an overview of the logs and user accounts created and used in both Strong Angel and RIMPAC 2000. Also included is a study on logging in and logging out.

Logs

There were three logs used during Strong Angel on the Big Island and five used during RIMPAC 2000. There were additional logs used for testing purposes plus a few logs created but never used. Table 1 lists all created logs.

Exercise	Log Name	Description
Strong Angel	CMOC	Civil Military Operations Center Log
	CMOC Afloat	JOC Log
	Civil Affairs	Civil Affairs Log
	Test Log	Test log
	New Test Log	Test log for demo purposes
RIMPAC 2000	BWC	Battle Watch Captain's Log
	JCCC	Joint Command and Control Center (technical support)
	Intel	C3F Intelligence Log
	CFACC	Coalition Forces Air Command Control Log
	CECG	Coalition Exercise Control Group Log
	ARFOR	Unknown (little used)
	Test Log	Test log

Table 1 CommandNet logs created for Strong Angel and RIMPAC 2000.

Strong Angel

There were three main logs used in Strong Angel: CMOC, CMOC Afloat, and Civil Affairs. (We exclude all data from the two test logs in all our analyses.)

The CMOC log was the original log created for three groups: C3F at sea, UN agencies on land, and USMC at the CMOC and refugee camps. The CMOC Afloat log was created when a Third Fleet officer requested a log that was not shared with the UN or the USMC. (This log contains some entries duplicated from the CMOC log.) The Civil Affairs log was created to filter information from the refugee camp before it went into the CMOC log. It also supported Civil Affairs communication more generally.

Figure 1, below, shows how many participants used each log. The more heavily-used log, the CMOC log, was used by 18 participants. Both the CMOC Afloat and Civil Affairs logs had 8 users. Note that these counts are not entirely accurate and may be deflated; it was observed that a number of participants made entries under another user's account.
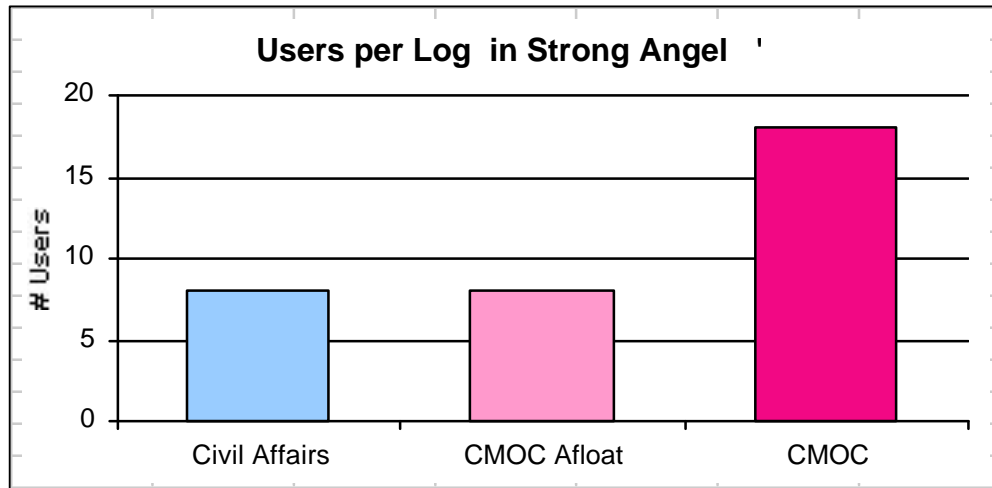
Users per Log in Strong Angel

Figure 1 Number of users in Strong Angel logs.

RIMPAC 2000

There were five main logs used during RIMPAC 2000. The ARFOR log was created and used minimally around its time of creation. It was never used again. Except for this subsection, we exclude all data from both the ARFOR log and the test log in our analysis and discussion.

Figure 2 shows the number of users in each log. The BWC Log had the largest number of users by a significant amount. Note that this graph can be deceptive since some logs were used by multiple people using a single account, or role. As discussed in a later subsection, all entries in the CECG log were made by one account, the CECG watch officer's account. This one account, or role, was used by multiple participants.
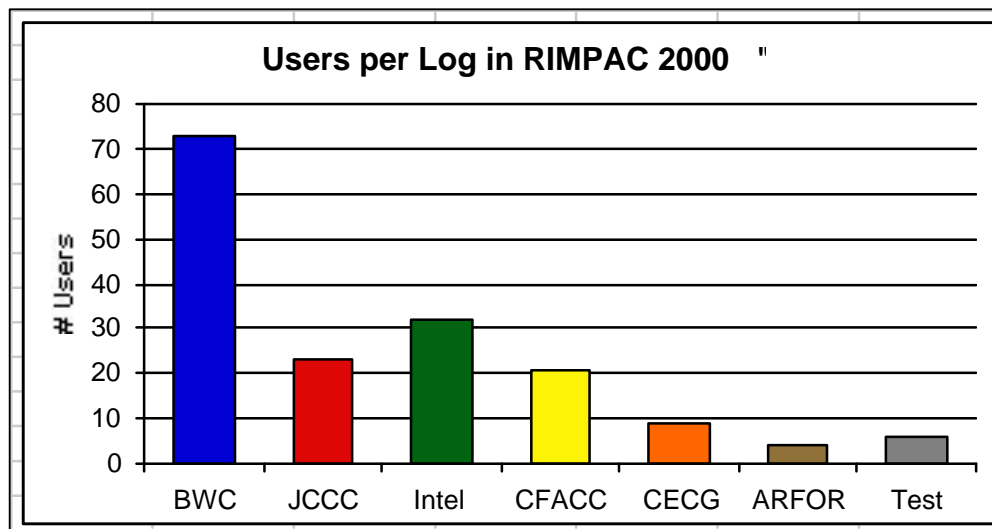
Users per Log in RIMPAC 2000

Figure 2 Number of users in RIMPAC 2000 logs.

Users

We approximate the number of participants using CommandNet during the exercises. The actual number of people using CommandNet and the number of users may differ considerably since multiple people often used the same login account (multi-user role accounts) or made entries under someone else's login account.

Most users had access to one or two logs at most. A few had access to all available logs. People who had access to all logs were usually administrative people.

Strong Angel

There were 23 user accounts created for Strong Angel logs. 20 of those accounts were actually used. Only one account was created for a "role." All other accounts were created for individuals. It was observed that one of the individual accounts was actually used by multiple participants. From the data, it is unknown if other users did not have their own accounts or if no one ever bothered to log out.

50% of those users accessed 2 logs, 40% accessed just a single log. Only 10% had access to all 3 logs, and those were probably CMI members and the MITRE person. Access to logs was determined by permissions set for each user account. Figure 3 illustrates the relationship between the number of users and the number of logs the users accessed.
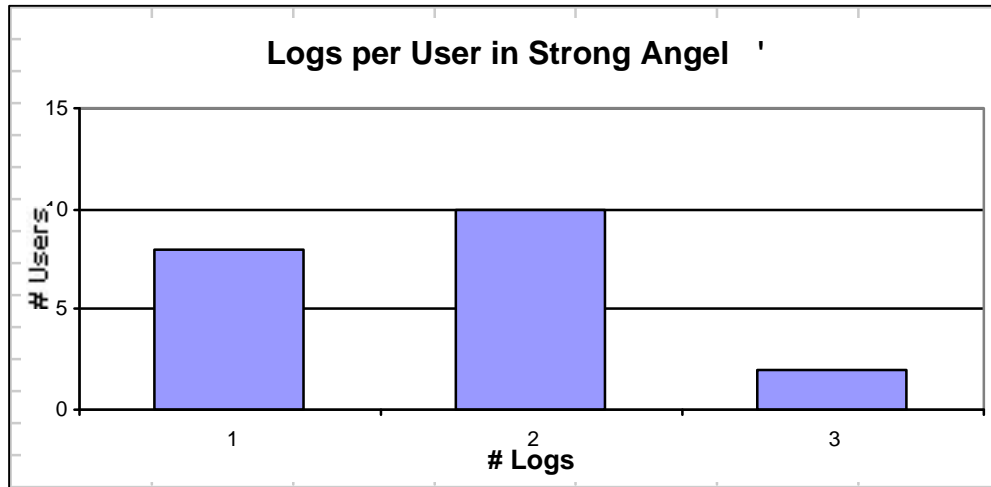
Logs per User in Strong Angel   '

Figure 3 Accessed logs per user in Strong Angel. Some users had access to two logs, while almost as many users had access to just a single log. Very few could access all three.

RIMPAC 2000

There were 332 accounts created for use in RIMPAC 2000. Of those, some were roles used by single users, and some were roles used by multiple users. Of those 332 accounts, only 92 were actually used, and that included administrators and members of the University of Arizona's Center for the Management of Information team plus the MITRE observer.

Many users who did not use their own individual accounts, used CommandNet under single-user or multi-user roles.

Type of Account in RIMPAC 2000 Logs	# Accounts Created	# Accounts Used
CMI	4	3
MITRE	1	1
single-user roles	89	14
multi-user roles	37	13
Individual	201	59
Total	332	90

Table 2 Types of accounts created and used in RIMPAC 2000.

50% of users accessed just a single log in RIMPAC 2000 while 36% accessed 2 logs. Only 1% accessed either 5 logs or all 7.
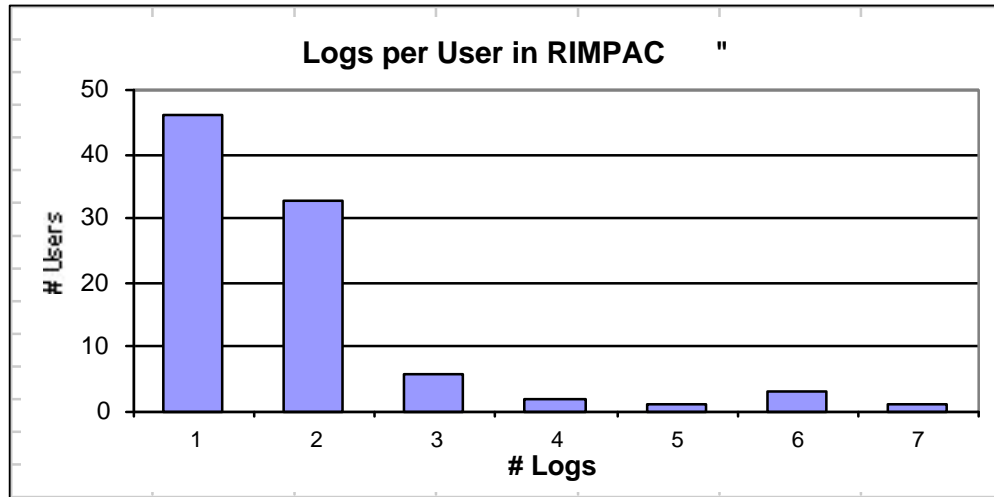

Figure 4 Accessed logs per user in RIMPAC 2000. While the majority of users had access to just a single log, a substantial number of users could access two logs. Very few could access three or more.

Login / Logout

There was no automatic data capture of login into CommandNet. The closest approximation to logging in was taken from the number of times a user chose a log. Users could chose a log upon login or after opening up another log. We approximated login numbers by the number of times the user went to the *Choose Log* screen when no other log had previously been chosen.

A logout button was available in the menu at the top of each window. Alternatively, a user could close the browser window or exit the browser without logging out. In fact, the ratio of logging out to logging in was very low. It appeared that very few users actually logged out on a regular basis (see Table 3).

Frequency of Logging Out	Strong Angel	RIMPAC 2000
Logged out every time	11%	6%
Logged out most of the time (~75%)	11%	0%
Logged out half of the time (~50%)	16%	4%
Logged out infrequently (1-50%)	26%	31%
Never logged out	37%	58%

Table 3 Frequency of logging out of CommandNet.

Strong Angel

In Strong Angel, only 11% of the users actually logged out every time. 11% of the users logged out most of the time (75%). 16% of the users logged out half the time. 25% of the users logged out infrequently (1-50% of the time). 37% never logged out at all. Overall, the logout rate was 27%.

RIMPAC 2000

Users of CommandNet in RIMPAC 2000 logged out much less frequently than users during Strong Angel. The RIMPAC logout rate was a low 6%. Only 6% logged out every time, and over half the users (58%) never logged out at all, while a full 31% logged out infrequently (less than half the time).

Figure 5, below, indicates that the BWC log and the Intel log were opened more than the other logs. The BWC log was opened about 42% of the time, the Intel log about 30% of the time. The CFACC and CECG logs were opened less than 6% of the time. However, this could mean that the logs stayed open longer, not necessarily that they were used less. This graph closely resembles the one in Figure 2 Number of users in RIMPAC 2000 logs. In general, the number of users per log is proportional to the number of times a log was opened. The one difference is apparent in the CFACC log which was probably closed infrequently.
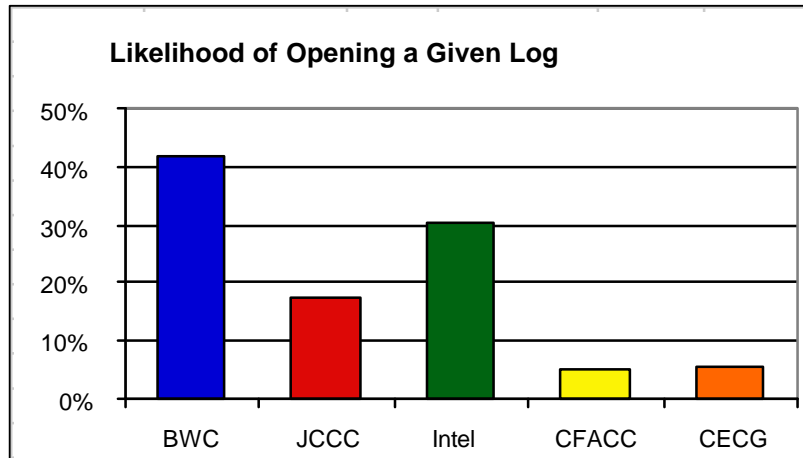
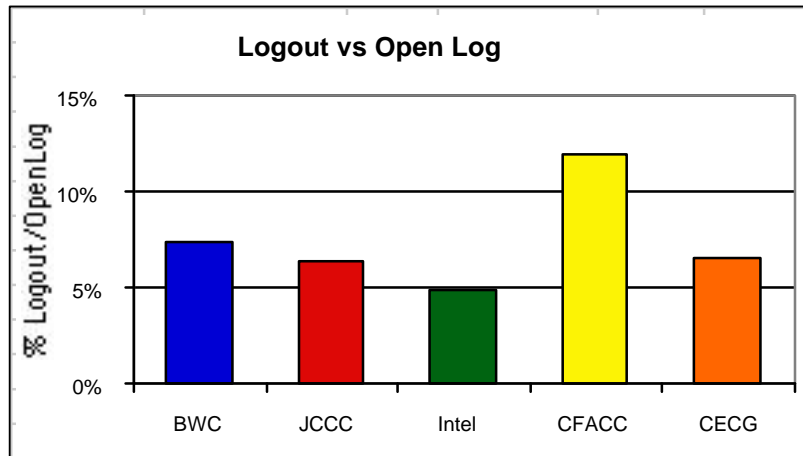**Figure 5 Likelihood of Opening a Given Log in RIMPAC 2000. This graph shows which logs were opened most often.**

Figure 6 Logout versus Open Log in RIMPAC 2000. Users who opened the CFACC log first were better at logging ou t than users of other logs.

Figure 6, at left, shows that users were more apt to logout of the CFACC log than any other log. Since the CFACC log was opened so few times, this indicates that users of the CFACC log were better at logging out with the logout button.
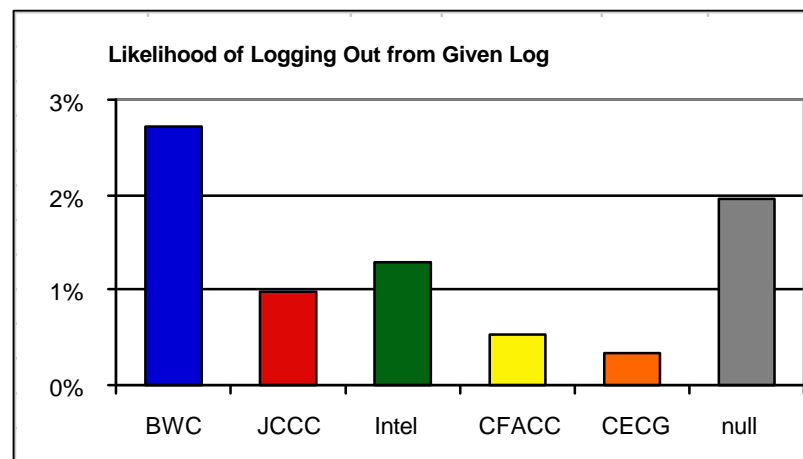

Figure 7 Likelihood of Logging Out from a Given Log.

The last graph in this series, Figure 7, shows the likelihood of logging out from a specific log. The numbers are all small, but more people logged out of the BWC log than any other log. The null column indicates that a number of users logged out without ever choosing a log. In other words, they logged out just after logging in.

The MITRE Corporation

Basic Features

Entries

We examined the frequency of entries made in CommandNet and the wordiness of those entries for changes in patterns over time. We also studied the content of entries, but that is discussed later in the Categories subsection.

Strong Angel

CommandNet was in use for just seven days. Entries were mostly made on just four of those days. Figure 8 illustrates the pattern and number of entries made in CommandNet across all logs. Fewer than 40 entries were made per day. Figure 9 graphs the average number of words used in entries over time. On the 12th, entries were copied from one log to another.
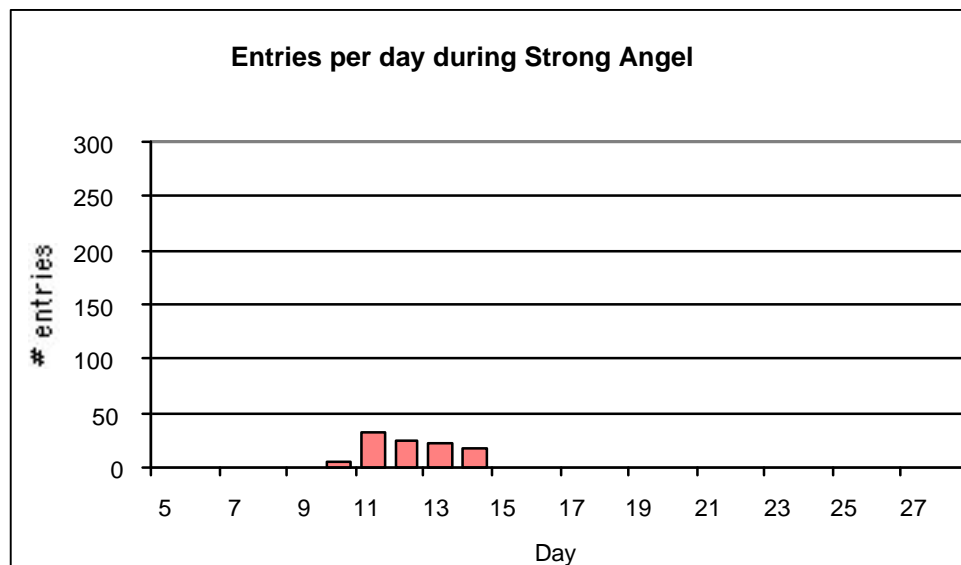
Entries per day during Strong Angel

Figure 8 Frequency of entries in CommandNet per day during Strong Angel.

Average words per entry per day during Strong Angel
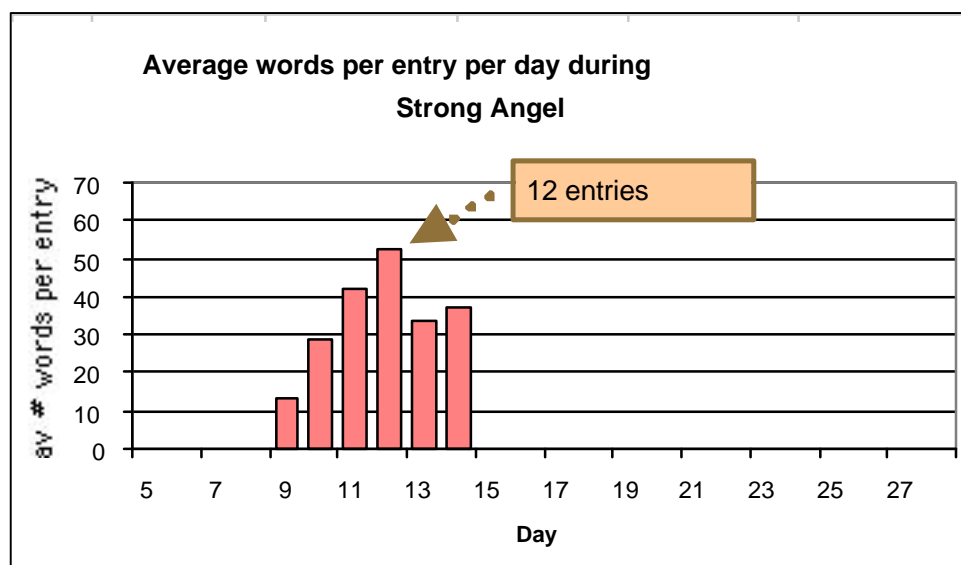
12 entries

Figure 9 Average words per entry per day during Strong Angel.

Table 4 below contains statistics on the entries made in all of the logs. The CMOC log had the most entries, over half the total entries, but the Civil Affair entries were longer, with an average of 45 words per entry. Figure 10 shows the frequency of entries over time by log while Figure 11 shows the average number of words over time by log.

	CMOC	CMOC Afloat	Civil Affairs	Total
total entries	71	23	21	115
# blanks	0	0	0	0
# duplicates	0	0	0	0
# tests	8	2	0	10
clean total (without blanks, duplicates, tests)	63	21	21	105
average words per entry	27	33	45	

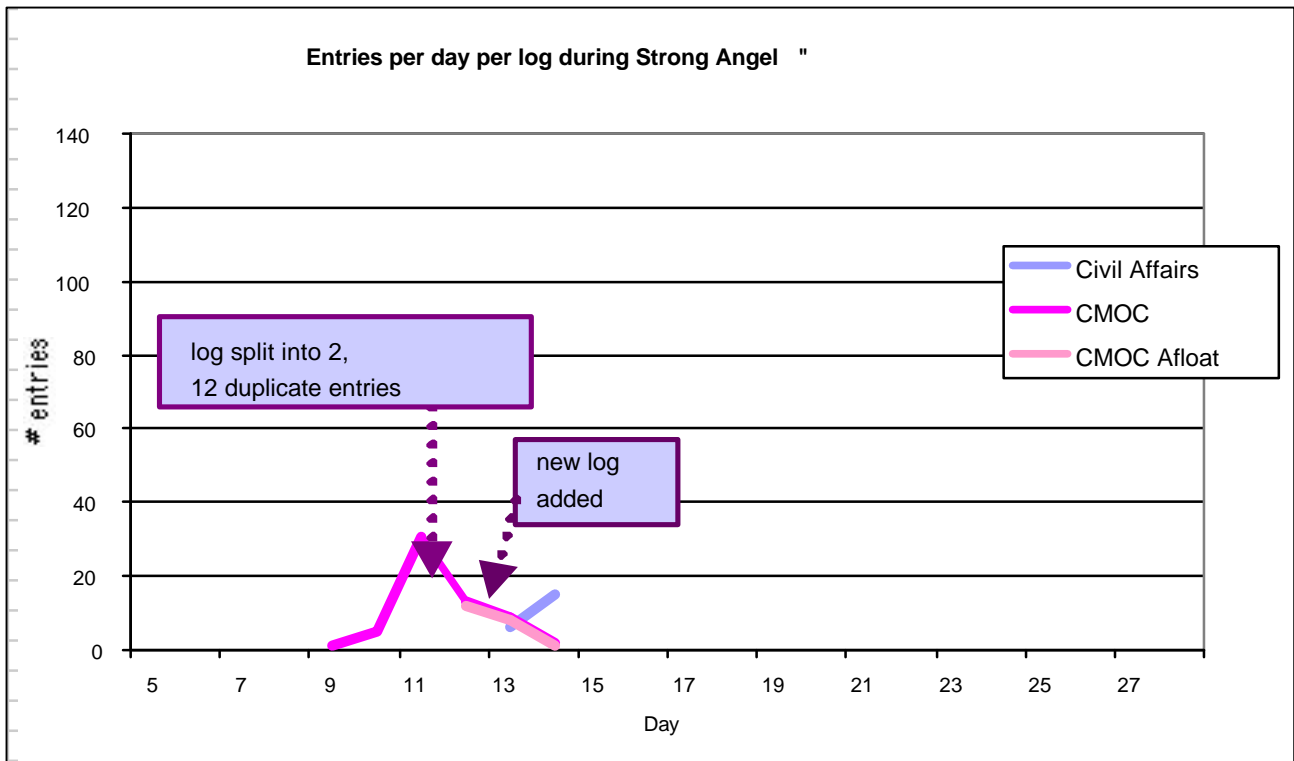**Table 4 Statistics on entries made in Strong Angel logs.**

Figure 10 Entries per day per log during Strong Angel. On the 12th, the CMOC Afloat log was created, and 12 entries were duplicated from the CMOC log. The Civil Affairs log was created on the 14th.
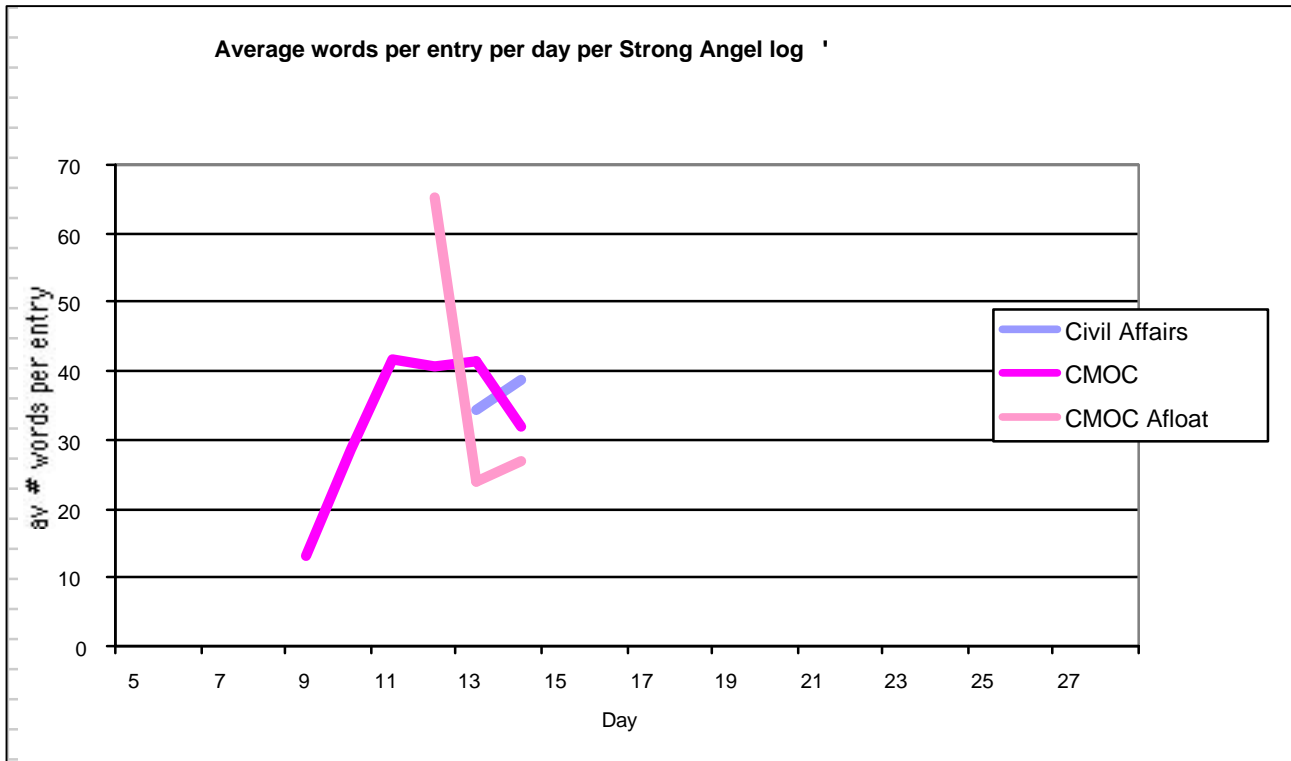
Figure 11 Average words per entry per day during Strong Angel. The spike in the CMOC Afloat log occurs where the partial contents of a document were cut and pasted into the log.

RIMPAC 2000

RIMPAC logs were used considerably more than Strong Angel logs. They contained a total of 2358 entries over 23 days, excluding entries made to the Test Log. 25 entries were tests. 5 entries were blanks, probably submitted in error. 71 of those entries were duplicates, or 3% of all entries. Interviews with users showed considerable complaint that the system was running so slowly that entries were often submitted more than once because they did not appear in the logs within a reasonable time period. The presence of duplicate and triplicate entries supports this.

	BWC	JCCC	Intel	CFACC	CECG	ARFOR	Total
total entries	555	608	705	314	174	2	2358
# blanks	1	1	0	3	0	0	5
# duplicates (% of clean total)	15 (3%)	27 (5%)	17 (2%)	8 (3%)	4 (2%)	0	71 (3%)
# tests	6	3	3	5	6	2	25
clean total (without blanks, duplicates, tests)	534	584	685	301	168	0	2257
average words per entry	22.3	16.3	18.2	18.5	24.4	0	19.2
median words per entry	15	13	13	12	14	0	13
min words per entry	1	3	3	1	3	0	1
max words per entry	305	257	217	422	229	0	422

Table 5 Statistics on entries made in RIMPAC 2000 logs.

On average, each entry was about 19 words in length, shorter than entries in Strong Angel logs. Entries made to the JCCC log, the technical support log, were the shortest.

and Figure 13 show entries and entry length over time. The BWC, Intel, and JCCC logs were used throughout the entire month. The CFACC and CECG logs were not used until the RIMPAC exercises. Activity in all logs drastically increased after the 20th when exercise activity increased.
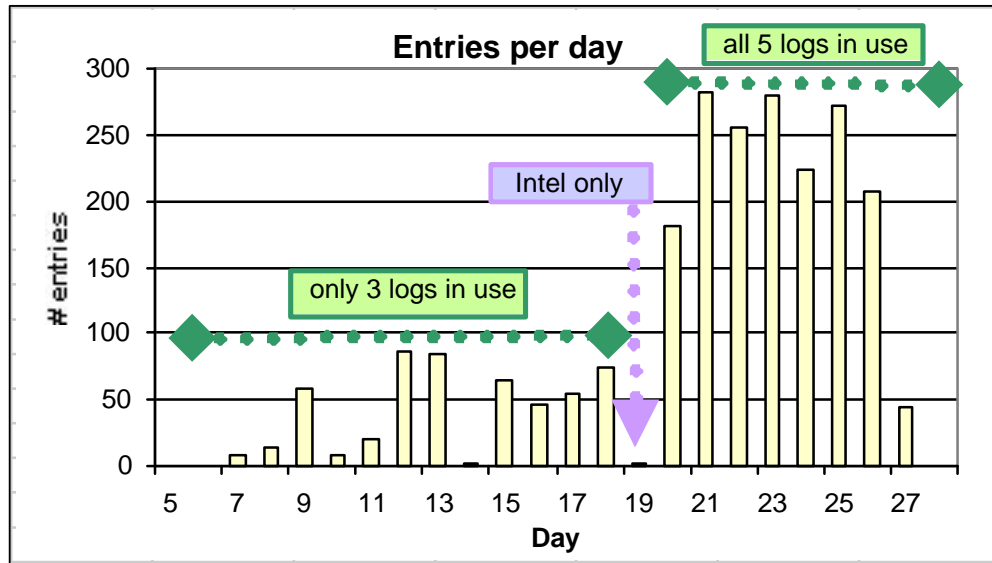
Figure 12 Frequency of entries in RIMPAC 2000. On the 19th, there were only three entries, all in the Intel log.
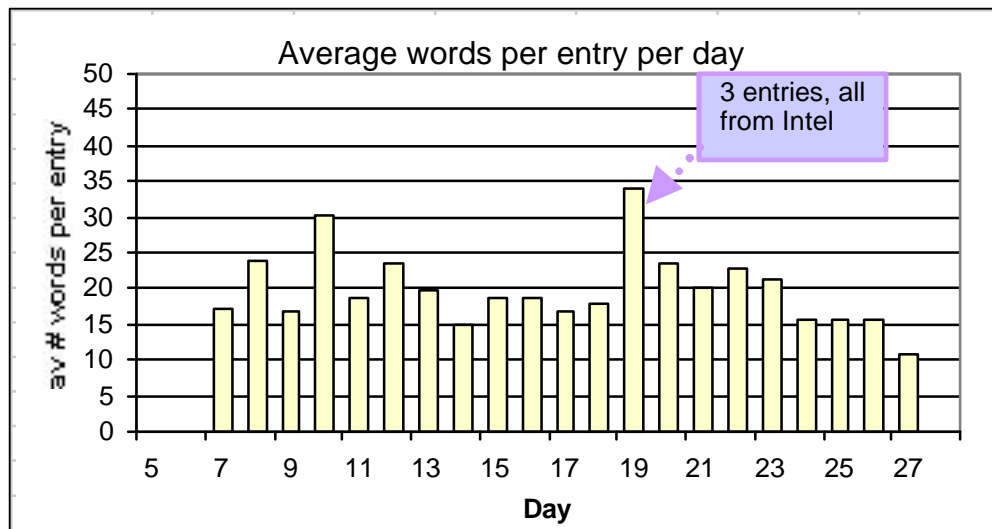
Figure 13 Average words per entry per day in RIMPAC 2000 logs. The 3 Intel entries on the 19th were lengthy.

The same data are separated by log in the graphs shown in Figure 14 and Figure 15. It is clear that the Intel log was used very heavily during RIMPAC exercises. The CFACC and CECG logs were used moderately during the exercises. The JCCC log was used consistently throughout the monitored period. Usage of the BWC log was somewhat consistent but ramped up during the exercises.
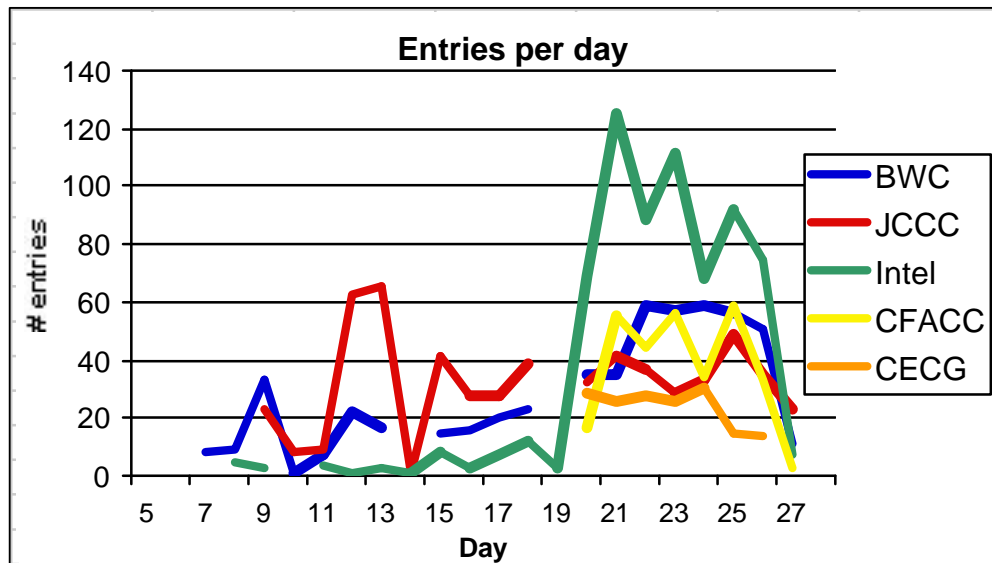
Figure 14 Entries per day per log in RIMPAC 2000 logs. Activity in the Intel log increases considerably after the 20th when RIMPAC 2000 exercises are underway. Activity in the BWC log also ramps up after the 20th. The CFACC and CECG logs are not used at all until that point.
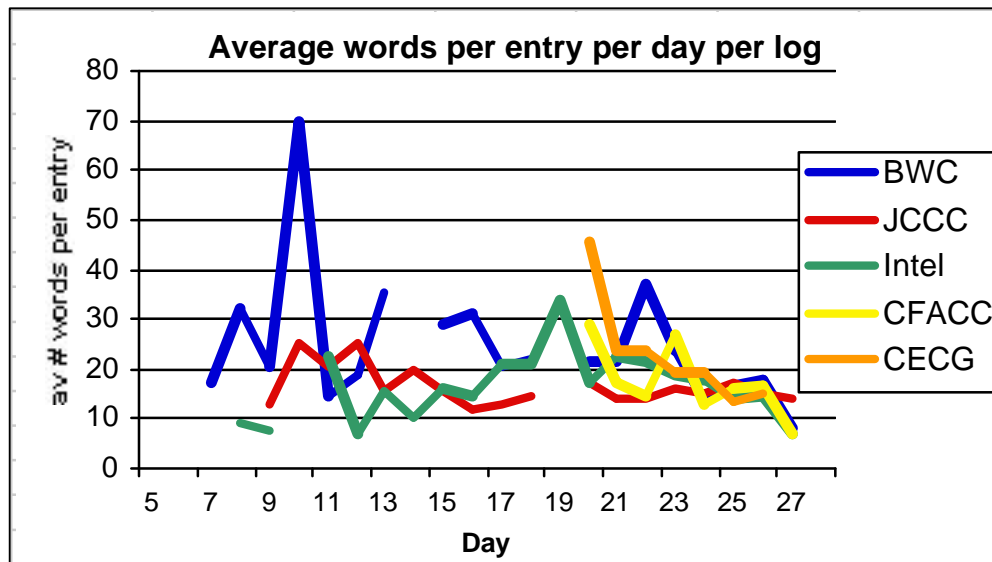

Figure 15 Average words per entry per day per log in RIMPAC 2000 logs. The JCCC logs are the most consistent in length, around 16 words per entry. The length of the entries does not change much even after the 20th when exercise activity increases.

The frequency of duplicate entries follows a pattern similar to the frequency of entries made. (See Figure 16, below.) Most duplicate entries occurred during periods when exercise activity was most intense. Users reported that log updating was so slow that they hit the submit button twice or more.
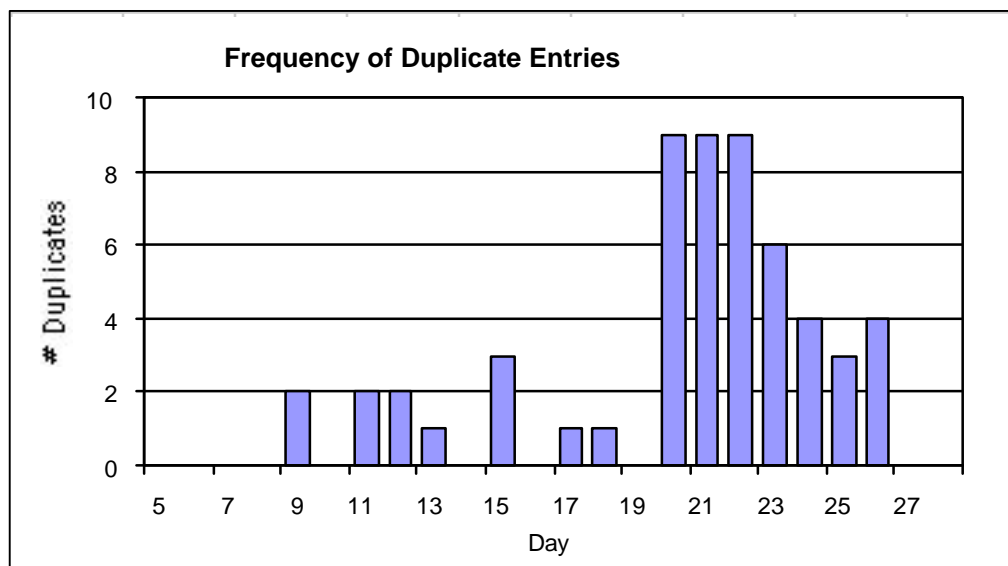
Frequency of Duplicate Entries

Figure 16 Frequency of Duplicate Entries in RIMPAC 2000 logs.

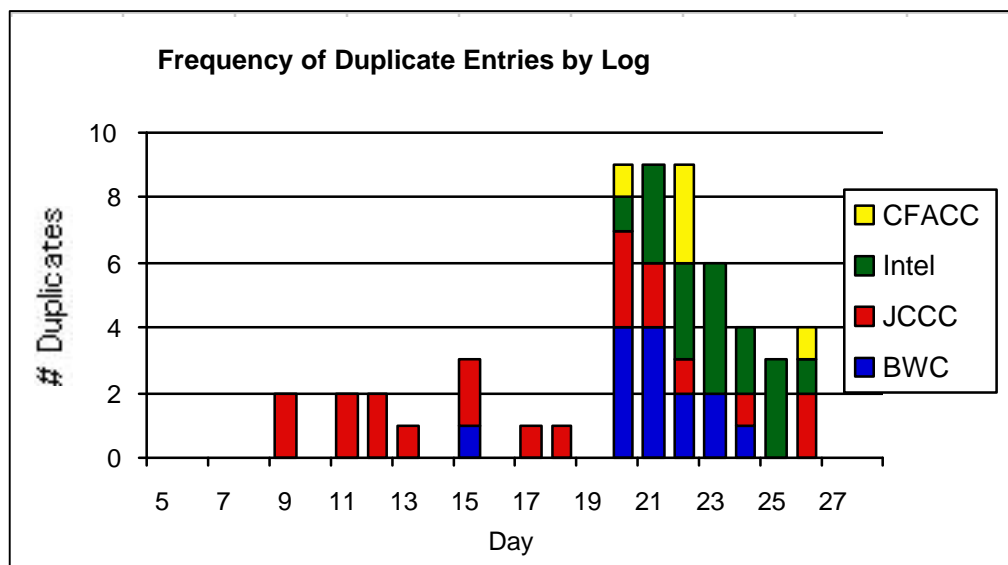**Frequency of Duplicate Entries by Log**

Figure 17 Frequency of Duplicate Entries by Log. The activity peak after the 20th shows that duplicates were made in all logs by the CECG log. Prior to that time period, most duplicates occurred in the JCCC log where the frequency of duplicates appeared to be consistent throughout the entire month.

Categories

The category feature was an easily-accessible feature to creating entries. Before an entry was submitted, the user could select a label, or category, from a dropdown list. The default category was "None".

Categories provided an easy way to classify entries by type. The more advanced Search feature also provided a means for searching by category.

Strong Angel

There were 10 categories created for use in the Strong Angel logs. All 10 were created by CMI members.

Table 6 lists the categories created for use in the Strong Angel logs and how much each category was actually used. Categories were not used at all in the CMOC Afloat Log. Entries in CMOC log used categories just 53% of the time, whereas the Civil Affairs log used categories 91% of the time.

Strong Angel Log	Category	# Entries
CMOC	PW Base	not used
	High Security	not used
	Information	14
	Dispatch	5
	Lesson	3
	Civil Affairs	18
	SITREP	1
	None	34
Civil Affairs	Base Camp	7
	Refugee Camp	14
	None	2

Table 6 Categories usage in Strong Angel logs.

Why were categories used fairly consistently in one log, about half the time in another log, and never in the third log? One possible explanation has to do with learning by example. If a new user saw existing entries with associated categories, he may have been more likely to create entries with categories. Likewise, if visible entries in the log had no categories associated with them, a new user would be less likely to create and entry with a category.

An explanation for the total lack of category usage in the CMOC Afloat log could be that no categories were available. Similarly, perhaps the categories defined in the CMOC log were not appropriate for the type of entry made. Users added categories to entries when there was a match and did not use categories when there was not a good fit.

We pursued this line of thinking and examined the actual entries. We created our own list of categories that we call "content types." We then annotated each entry in Strong Angel with these content types. Note that an entry can contain more than one content type. For example, a SITREP entry often contained tracking information. Definitions of our content types and their frequency appear in Table 7.

Content Type	Definition	% Entries
sitrep	situation report	47%
tracking	personnel, resources, refugees, food, etc	35%
trouble shooting	report, update, or solution of a problem, maintenance, etc	16%
informal chat	chat not related to any of the other categories	14%
request for action		11%
acknowledgment	acknowledgment of a request or that a message was read	10%
test	any type of test entry	10%
request for info		5%
request for sitrep		4%
scheduling	proposed schedule or agenda	3%
report / document	a formal report, article, or document	3%
correction	amendment to prior entry	1%
system	any reference to CommandNet	1%

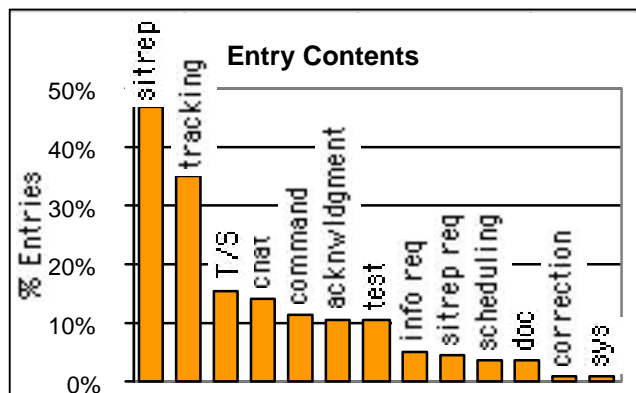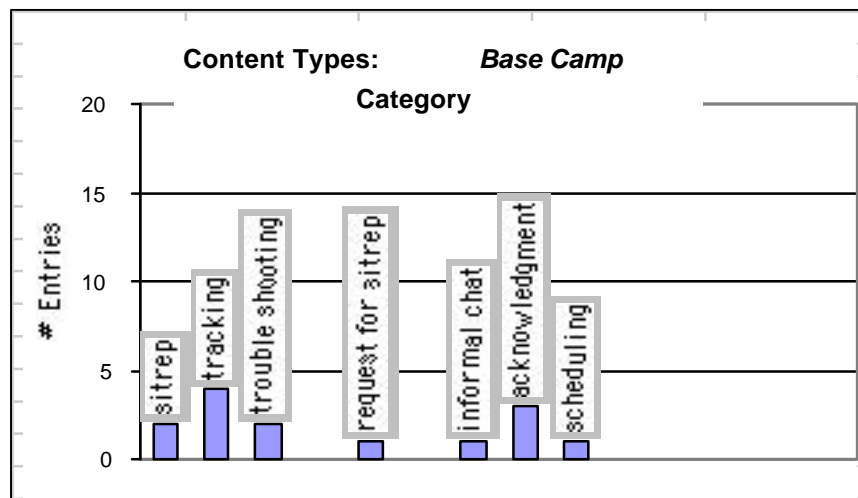**Table 7 Content types and frequency in Strong Angel logs.**

Figure 18 Content types of entries in Strong Angel logs. The most common entry types were situation reports and tracking.

The usage of these content types is graphed in Figure 18. It is clear from the data that CommandNet was used most to report sitreps (47%) followed by tracking information (35%). There was significant use for troubleshooting, chat, request for action, acknowledgment, and testing (all > 10%).

How does the use of categories compare to our annotated content types? The following series of graphs shows the juxtaposition of categories and content types. Each graph represents one category and shows where it overlapps with our annotated types.

'Base Camp' categorized entries atypically contained more tracking entries than sitrep entries. Base Camp entries were also used for troubleshooting, sitrep requests, and over 20% acknowledgments.

Figure 19 Content types of entries that were categorized as 'Base Camp'

The 'Civil Affairs' category (all from the CMOC log) was almost exclusively used for sitreps and tracking.
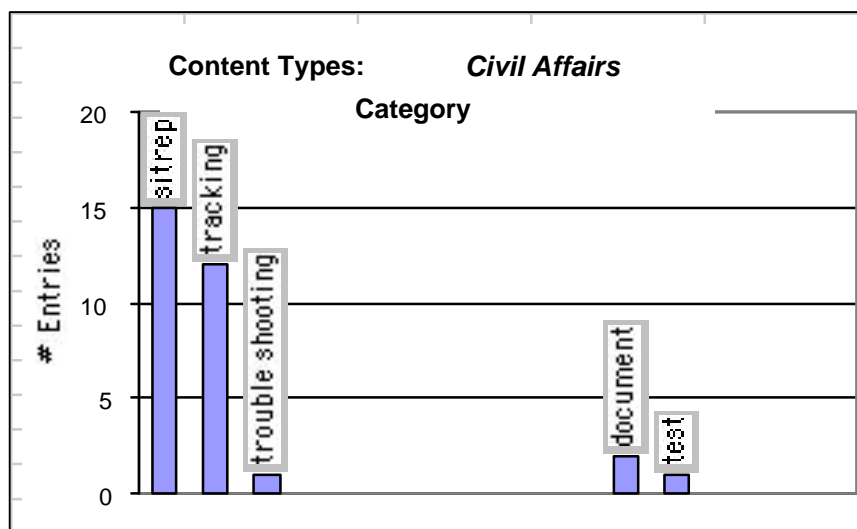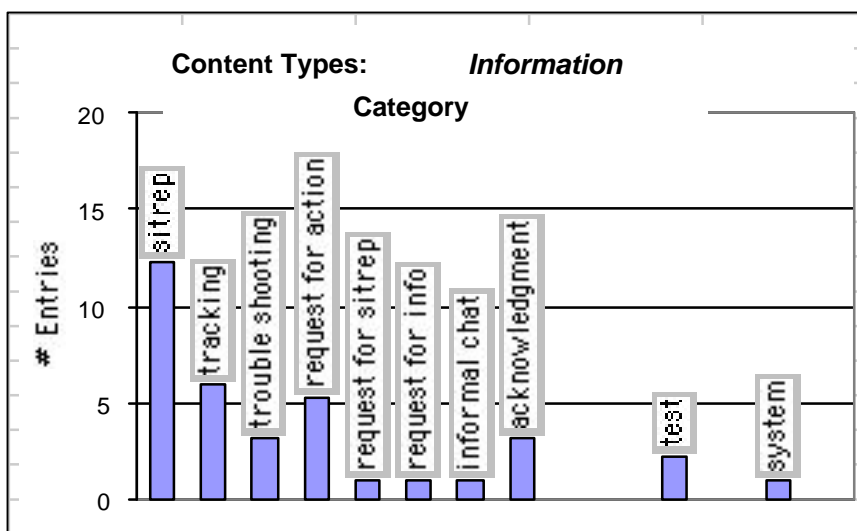

Figure 20 Content types of entries that were categorized as 'Civil Affairs'

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Content Types: *Information* **Category**

Entries

sitrep
tracking
trouble shooting
request for action
request for sitrep
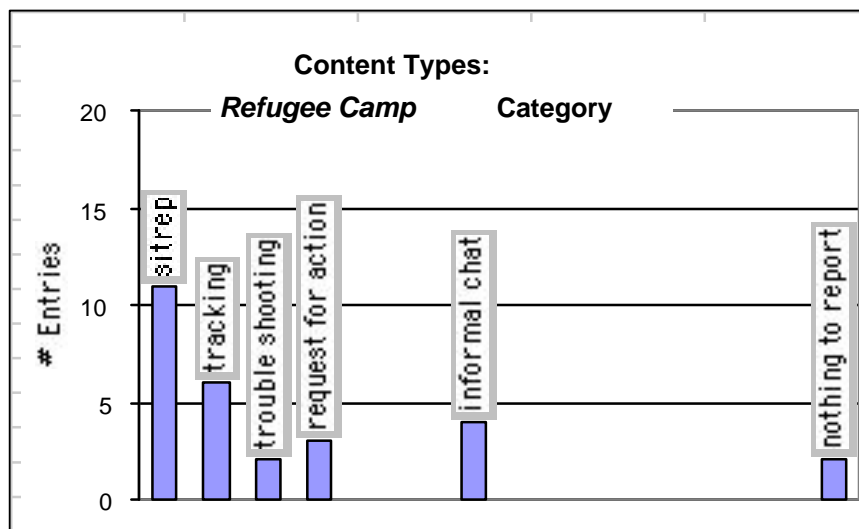request for info
informal chat
acknowledgment
test
system

The 'Information' category was used for almost all of our content types.

Figure 21 Content types of entries that were categorized as 'Information'

Content Types: *Lesson* **Category**

Entries

trouble shooting
informal chat
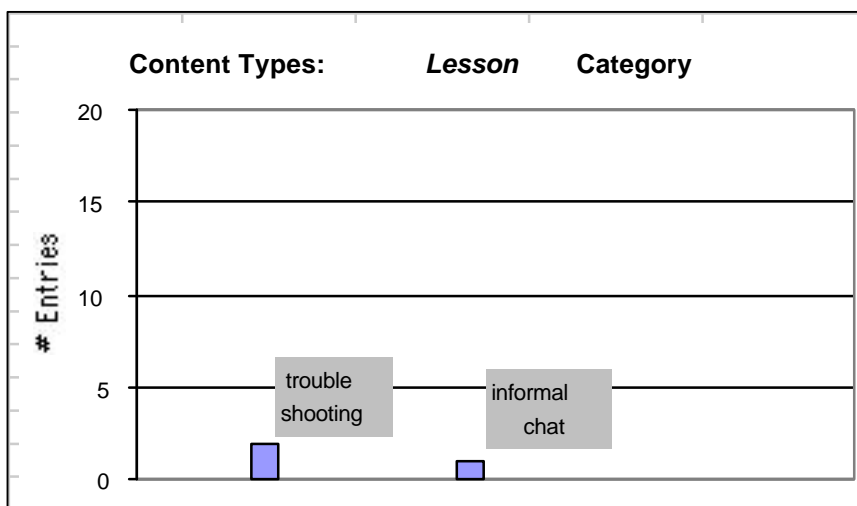
The 'Lesson' category was used mostly for troubleshooting (~65%) and for informal chat (~35%).

Figure 22 Content types of entries categorized as 'Lesson'

Content Types:
Refugee Camp **Category**

Entries

sitrep
tracking
trouble shooting
request for action
informal chat
nothing to report

The 'Refugee Camp' category was used in a similar pattern to the use of 'Civil Affairs': mostly sitreps and tracking in the Civil Affairs log.

Figure 23 Content types of entries categorized as 'Refugee Camp'

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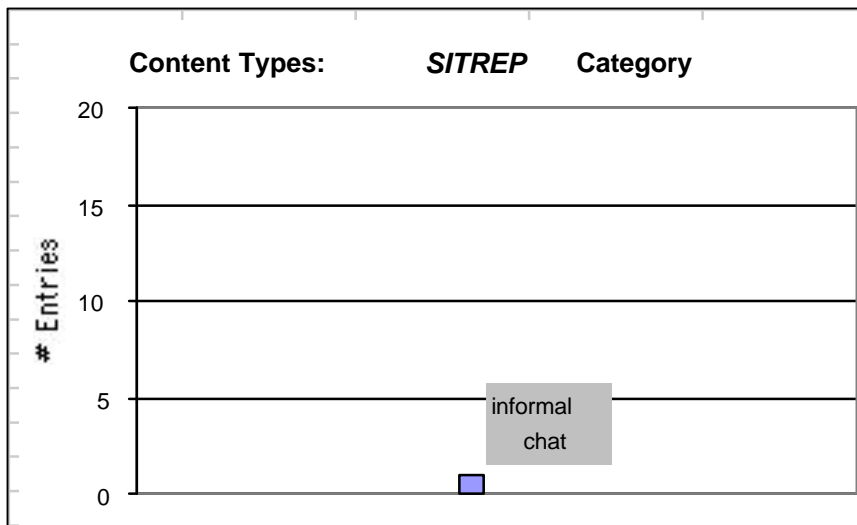
The 'SITREP' category was used for informal chat – in this one entry, it was a reference to the location of sitrep documents.

Content Types: *SITREP* **Category**

Figure 24 Content type of the single 'SITREP' category entry
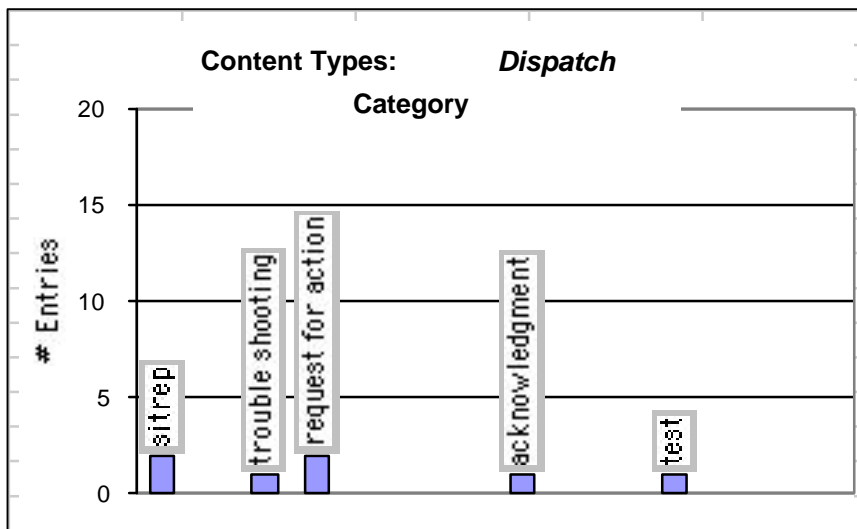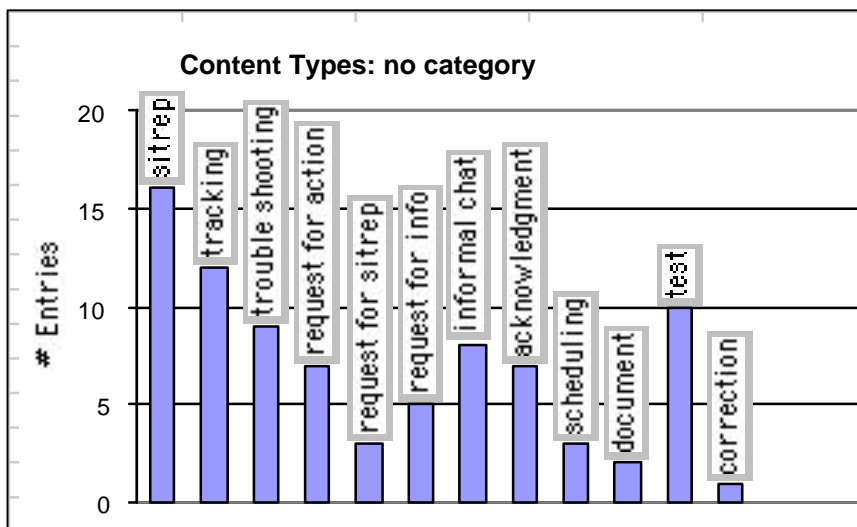
Content Types: *Dispatch* **Category**

Figure 25 Content types of entries categorized as 'Dispatch'

Entries that were not categorized fell into almost all of our content types.

Content Types: no category

Figure 26 Content types of entries with no category

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RIMPAC 2000

In RIMPAC logs, categories were used when creating entries almost exclusively in the Intel log. 77% of Intel entries used categories. There were 10 entries in the BWC log that used categories. No other logs had categories associated with entries.

RIMPAC Log	Category	# Entries
BWC	None	533
	SITREP	8
	MEDEVAC	1
	Medical Casualty	1
Intel	None	160
	Air Defense	146
	Air	121
	TBMD	85
	Naval-Surface	65
	Coastal Defense	57
	Naval-Subsurface	33
	Ground	31
	Targeting	1
	HADR	0 – not used

Table 8 Category Usage in RIMPAC 2000 Logs. The default is 'None' – no category.

Listed below are potential categories that were not used in CommandNet.
ETR   estimated time to repair
OPSUM   operational summary
SORTS   operational status of resources and training
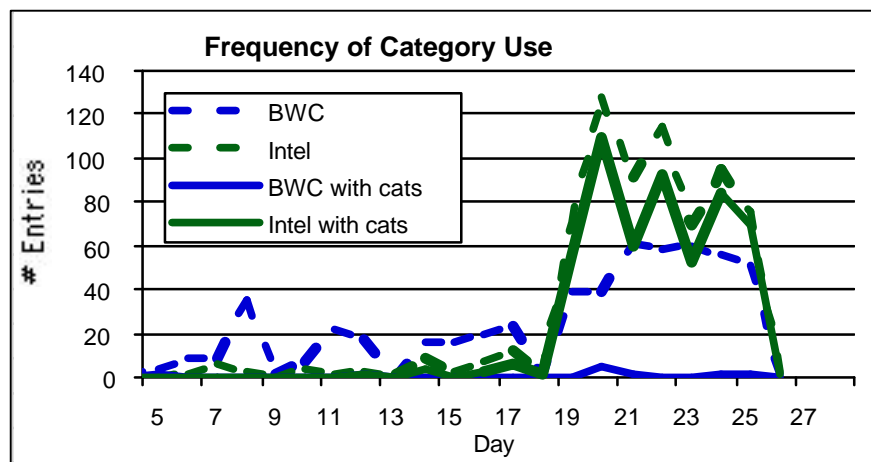CASREP   casualty report (broken equipment)

Figure 27 Frequency of category use in BWC and Intel logs

The graph at left contrasts the use of categories between the BWC log and the Intel log. Entries in the BWC log are shown by the broken blue line. Categories are used infrequently, at best, as shown by the solid blue line. By contrast, the use of categories (solid green line) in the Intel log remains proportional to the regular use of entries (broken green line).

Importance
The importance feature was another easily-accessible label to data entries. The default importance level was 'Routine.'

Importance	Display Code	Description	Associated Time
Routine	R	Routine	None
Priority	P	Priority	~ 6 hours
Immediate	O	Operational immediate	< 30 minutes
Flash	Z	Flash	< 10 minutes

Table 9 Importance levels and their display codes.

The drop down box for choosing importance listed the levels as words (see the first column in Table 9). However, the importance level associated with a created entry was displayed as a single-letter code. There were some comments, in the interviews and surveys. that people did not know what these letters meant -- one explanation as to why importance was little used.

One design recommendation is to include these importance levels in the help pages, together with the associated times.

Strong Angel

Importance was not used much during Strong Angel. Flash was never used at all. Priority was used for 5% of the CMOC Afloat entries (actually, it was just one entry) and 11% of the CMOC entries. Immediate was used only in the CMOC log, 6% of all entries.
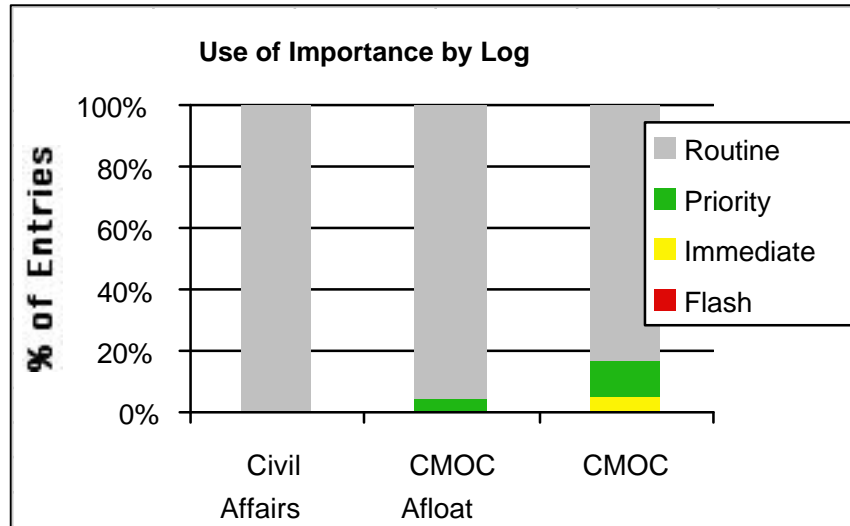

Figure 28 The Use of Importance in Strong Angel logs. Importance was not used in the Civil Affairs log. Flash was never used.

RIMPAC 2000

The importance feature was used more in the RIMPAC logs, but mostly in just the Intel and CFACC logs.

Log	Level of Importance Used in Entries			
	Routine	Priority	Immediate	Flash
BWC	96.6%	2%	1.1%	0.3%
JCCC	97%	0.1%	0.3%	0%
Intel	17%	30%	42%	11%
CFACC	66%	9%	5%	20%
CECG	99%	1%	0%	0%

Table 10 The use of the importance feature in RIMPAC 2000 logs

Users of the CFACC log commented that they did not think anyone was monitoring or reviewing the logs. If that was the case, why did they bother to add importance levels? Perhaps importance levels were used because of the precedence set in the first entries. In Figure 32 reveals that the first entries made were flash entries.

There were three levels of Intel users: those entering data coming in from various data streams, those monitoring the BWC and CFACC logs and entering data (anchor desks), and those making higher level analyses based on the entries of the other users. These three groups of users within the Intel community were aware of each other. This could be why the Intel logs used importance more than any other community of users.
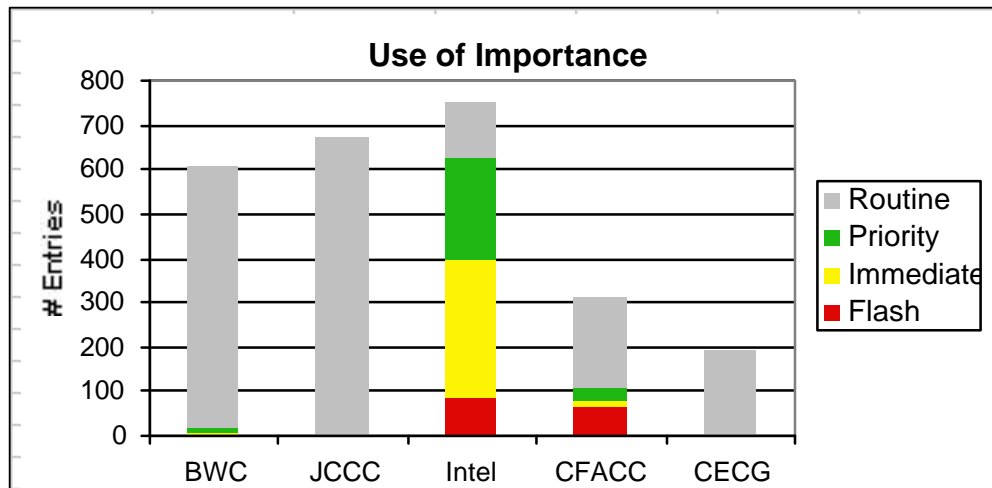
Use of Importance

Figure 29 Use of the Importance Feature by Log in RIMPAC 2000

The next graph, Figure 30, shows the use of importance by log as a percentage of all entries made. This shows that Intel users made a large percentage (~40%) of Immediate entries, and CFACC users made about 20% Flash entries.

Use of Importance by Log
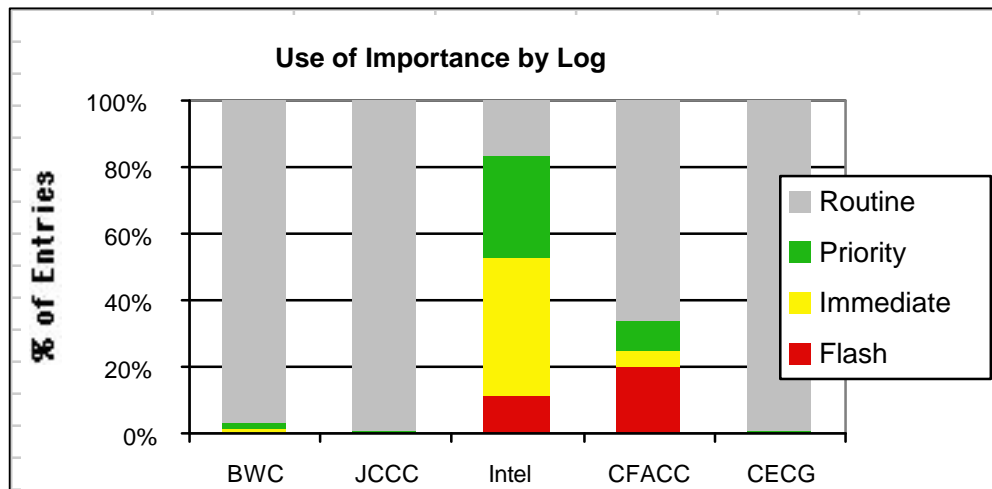
Figure 30 Percentage of Importance Use by Log in RIMPAC 2000

The following series of five graphs show the frequency of importance use per log. The most interesting graphs are the Intel log and the CFACC log.

Use of Importance in Intel Log

The pattern of usage of importance in the Intel log follows the Intel entry distribution. The percentages of priority, immediate, and flash entries increase as the number of entries increase.
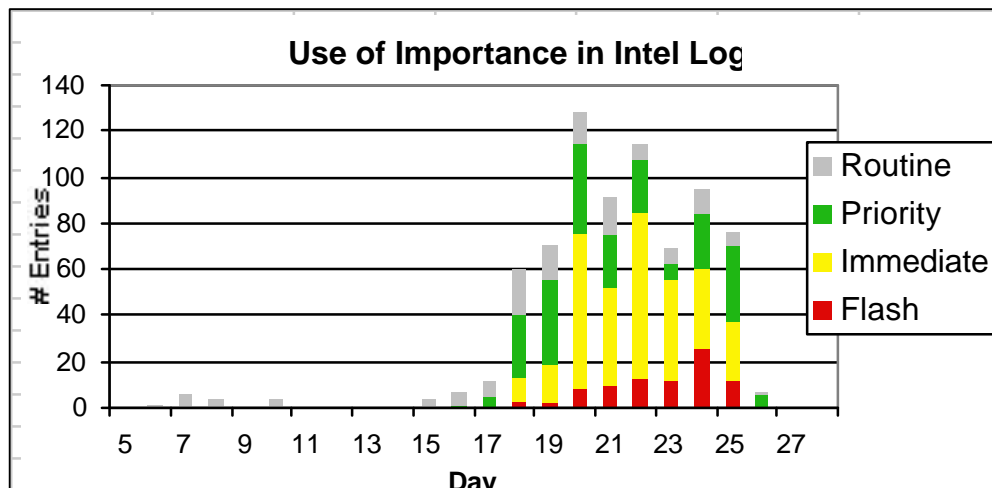
Figure 31 Frequency of Importance Use in the Intel Log

**Figure 32
Frequency of
Importance Use in
the CFACC Log**

Use of Importance in CFACC Log

**Figure 33
Frequency of
Importance Use in
the BWC Log**

Use of Importance in BWC Log

**Figure 34
Frequency of
Importance Use in
the JCCC Log**

Use of Importance in JCCC Log

Figure 35 Frequency of Importance Use in the CECG Log

Use of Importance in CECG Log

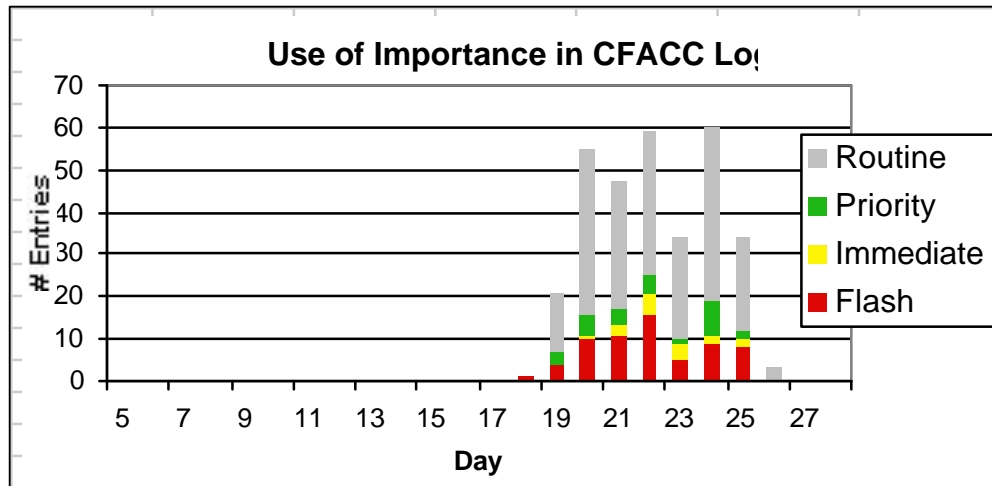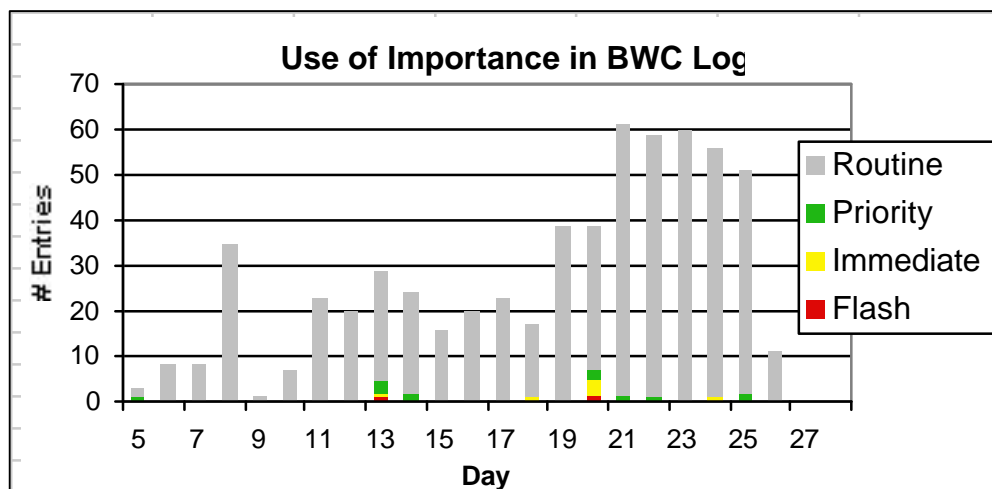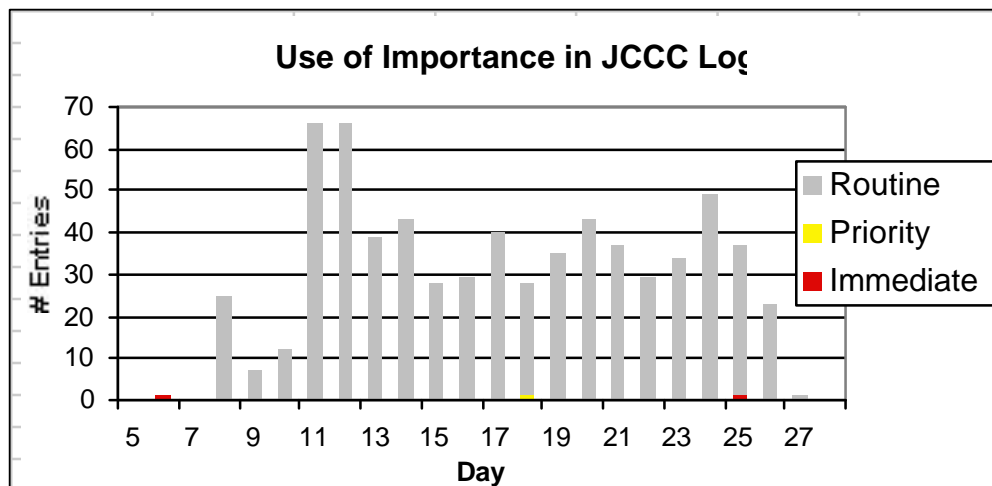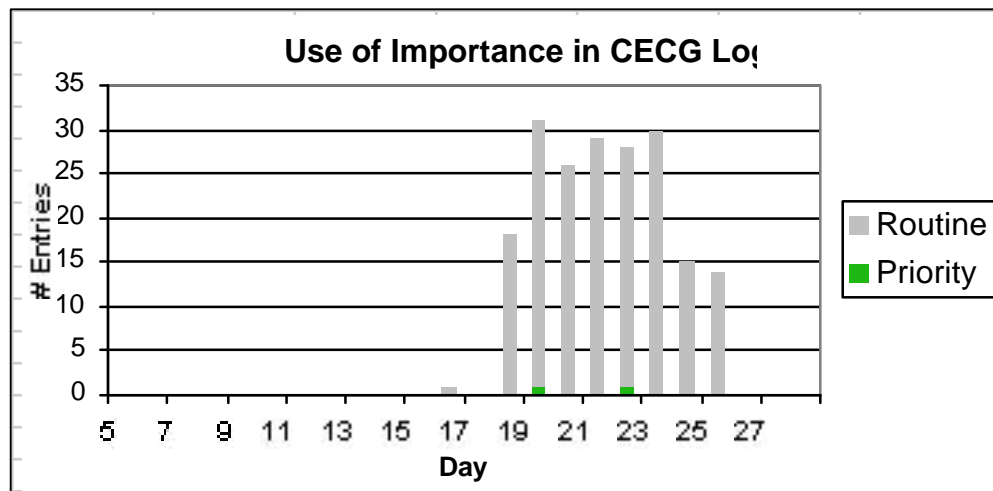*(Bar chart: X-axis labeled "Day" from 5 to 27; Y-axis labeled "# Entries" from 0 to 35. Legend: Routine (gray), Priority (green). Routine bars appear on days 17, 19, 20, 21, 22, 23, 25, 26 with values approximately 1, 18, 31, 26, 29, 28, 30, 15, 14. Small Priority bars appear near days 20 and 23.)*

Advanced Features

Search

We have thrown out all searches done by CMI or MITRE staff, and any searches performed on test logs.

Strong Angel

In the Strong Angel logs, only 2 users (1% of active users) navigated to the search screen. Both of these users performed a search. Only one of the users actually saved the search. That same user viewed the contents of the saved search. These two users were the same two Strong Angel users who also looked at headlines. (See below.)

RIMPAC 2000

In RIMPAC, 22% of the users looked at the search page. 80-90% of those users never went back to the search page. (2 were multi-user roles, and so probably represented more than one user.)

30% of those users made a search, mostly the first time they looked at the search page. 2 users searched once, 2 searched twice, one searched 4 times, and one searched 11 times on 2 different days.

Just one user saved a search. No one viewed the saved search (search was saved on the 26th, late in the exercise).

Profile of two Intel users who went to the search page more than once:

* u321 went to the search page 3 times on one day and did 11 searches, three times two days later without searching.
* u49 went to the search page on one day and did nothing. The next day, u49 went back to the search page and made a search. Later that day, u49 went back to the search page and made three more searches. The last search was saved. It was never viewed.

Headlines

This study excludes all activity done by CMI or MITRE staff and any activity done on the test logs.

Strong Angel

2 Strong Angel users (1% of active users) navigated to the headlines screen. One of those two looked at headlines in two different logs. Both users tried to create new headlines, both added entries to the headlines. Neither user saved the headline. These are the same two Strong Angel users who did searches. (See above.)

RIMPAC 2000

28 RIMPAC users (30% of active users) looked at the headlines page at least once. Of those 28, only 5 (5.5% of all users) looked more than once on, at most, two separate occasions.

5 of those 28 tried to create a new headline. Only one of those 5 tried twice. 2 of those 5 added entries to the headline.

Not a single user submitted a headline. No users viewed any headlines (there was none to view).

Refresh

CommandNet was set to refresh every 60 seconds, by default. Refreshing updated the window with the latest entries, searches, and headlines. When a refresh occurred, the list (of entries, searches, and headlines) would automatically reset to the most recent addition. If a user were scrolling back through a list of entries to monitor previous activity, he would suddenly find himself looking at the end of the list after a refresh. Also, system response time was so slow that, when the system refreshed, the visible screen would be blank for a period of time.

CommandNet provided ways to alleviate these problems. The refresh rate could be set through the user Preferences. Alternatively, a more immediate method was provided by a Disable Refresh button located in the menu at the top of each screen. When a user clicked on the Disable button, refresh was disabled until the user clicked on the Enable Refresh button. The status of disabled refresh was indicated by red text across the top of the list. While refresh was disabled, no updates would appear.

Strong Angel

In Strong Angel logs, the use of the enabling/disabling refresh and changing refresh rate feature was minimal. Refresh was disabled only 5 times (via the Disable Refresh button), and refresh was enabled a total of 11 times (via the Enable Refresh button). The refresh rate was changed 5 times (2 of those times by a CMI person). 76% of the refresh activity occurred in the CMOC Log, 24% in CMOC Afloat, and none in the CA Log. It is curious to note that the Enable Refresh button was ued more than the Disable Refresh button. Since these two buttons essentially act as toggles between states, it appears that users may have thought that the Enable Refresh button acted as a forced refresh.

RIMPAC 2000

The Enable Refresh button was used much more often than the Disable Refresh button. Again, users must have thought that the Enable Refresh acted as a forced refresh. Most of the refresh activity occurred between the during the war exercises; 92% of the refresh enabling and 82% of refresh rate changing occurred during that period. Activity over other days was minimal.

One user, in particular, made 74% of all the Enable Refresh actions. This user was also responsible for 35% of all refresh rate changes. The user was a monitor the Intel log (he did not make any entries). There were periods of time when the user clicked on the Enable Refresh button every couple of minutes. Since he never disabled the refresh, he must have assumed that the Enable Refresh button would activate immediate screen refresh. This user's activity contributed to the Enable Refresh peak in the Intel log in the figure below.
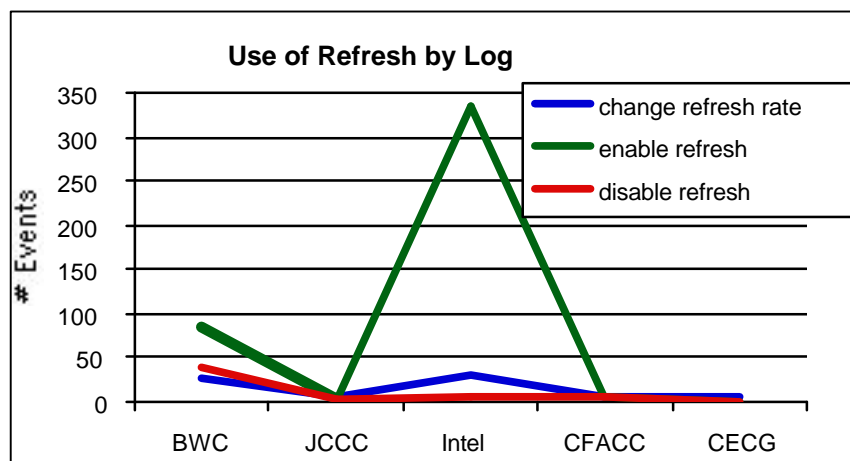
About one fourth of all RIMPAC 2000 users changed the refresh rate through the user preferences. However, only 9% of the user population changed the rate more than once. Yet, each time a user logged in, the refresh rate was reset to the default of 60 seconds.

The most popular setting for the refresh rate were 60 seconds (22%), 180 seconds (21%), and 120 seconds (13%).

Figure 36 Comparing use of refresh features across logs

Preferences

Strong Angel

In the Strong Angel logs, once the preferences screen was opened, there was a 64% chance the preferences would be changed.
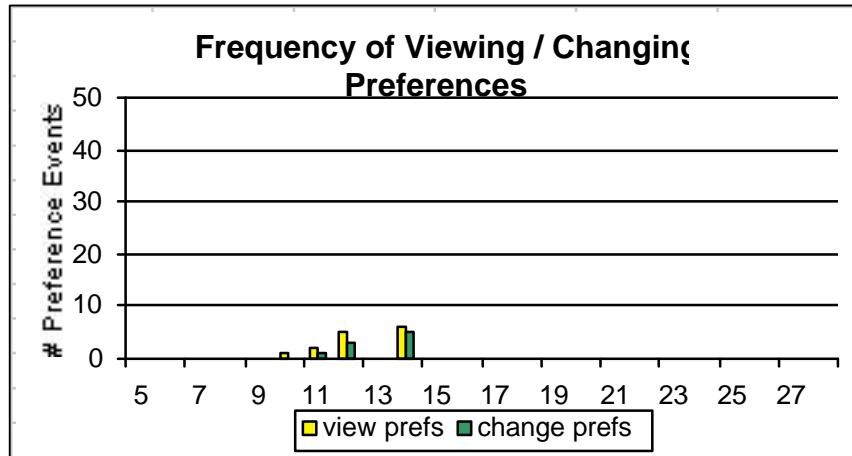

Figure 37 Frequency of Viewing and Changing Preferences in Strong Angel Logs

Log	# times preferences were viewed	# times preferences were changed	Likelihood that preferences would be changed after viewing
CMOC	10	5	50%
CMOC Afloat	4	4	100%
Civil Affairs	0	0	
Overall	14	9	64%

Table 11 Likelihood that preferences would be changed after viewing in Strong Angel Logs

Log	% Users who viewed preferences	% Users who changed prefererences
CMOC	20%	15%
CMOC Afloat	5%	5%
Civil Affairs	0%	0%
Overall	25%	20%

Table 12 Percentage of users viewing and changing preferences in Strong Angel logs

Use of Preferences by Log
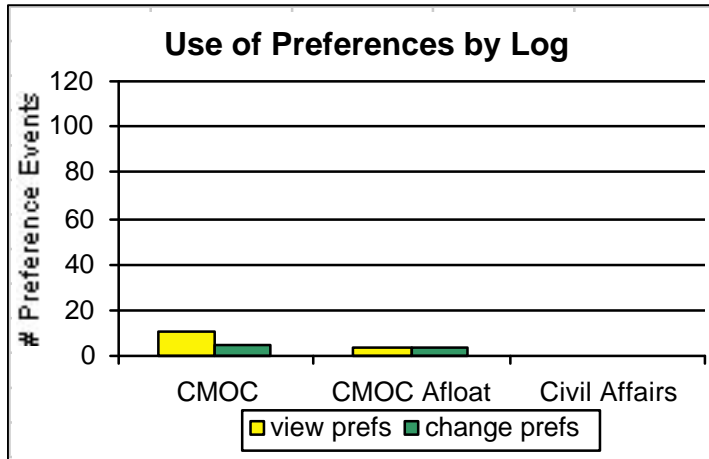

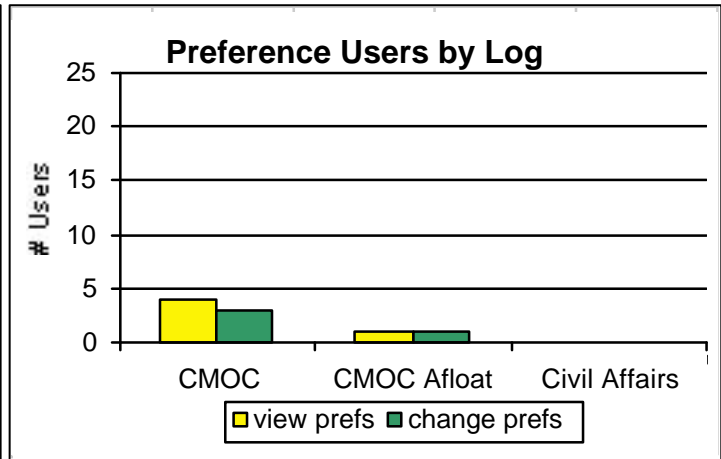**Figure 38 Preference Events by Log**

Preference Users by Log

Figure 39 Users' Preference Activity by Log

Preference Settings

CommandNet provided the option of changing the order entries were displayed. By default, entries were displayed most recent entry first, least recent entry last. No users changed the entry display order.

Users of Strong Angel logs never changed whether or not importance, date, time, or category were visible. The only person to change the number of days displayed was a CMI user. He changed it from the default of 2 days to show all the entries.

CommandNet also allowed the user to select how the time was displayed. The user could select various time offsets such as Zulu, Kilo, and Whiskey. By default, the offset was Zulu. The time offset was changed 10 times by 5 different users. 70% of these changes were to Whiskey time, and 20% to Zulu time. There was just one change was to Tango time (Tucson or San Diego), but that was probably a user error since the time offset was changed to Whiskey time one minute later.

RIMPAC 2000

The pattern of viewing the preferences screen and changing preferences follows the pattern of usage during RIMPAC exercises. (See Figure 40, below.)

Frequency of Viewing / Changing Preferences
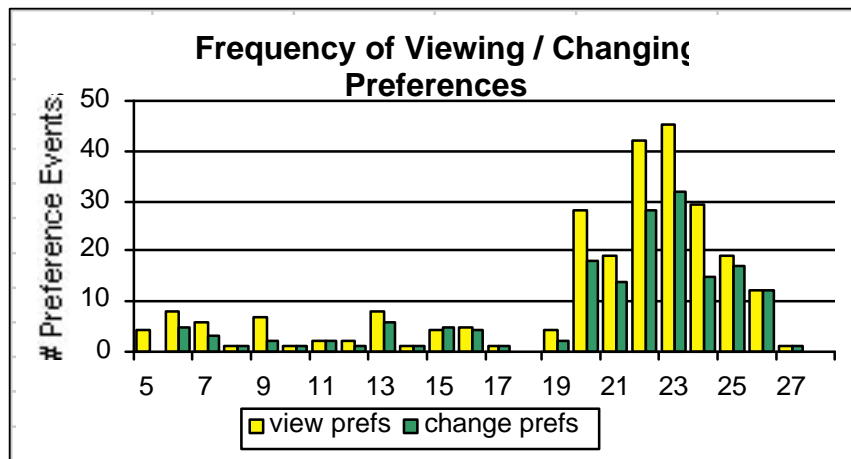

Figure 40 Frequency of Viewing / Changing Preferences in RIMPAC 2000 Logs

Once the preferences screen was opened, there was about a 70% chance that the user would make a change to the preferences.

About half the users (55%) changed preferences at least once.   Half of those users were using the BWC log, and just over a quarter were using the Intel log. (See Table 13, below.)

Log	% of all users who viewed preferences	% of all users who changed preferences
BWC	49%	22%
JCCC	8%	4%
Intel	27%	13%
CFACC	14%	5%
CECG	2%	1%
Overall	55%	46%

Table 13 Percentage of users viewing and changing preferences in RIMPAC 2000 logs

Most of the changes in preferences occurred in the BWC log and the Intel log, but users of the other logs were more likely to make a change once they opened the preferences screen.

Log	# times preferences were viewed	# times preferences were changed	Likelihood that preferences would be changed after viewing
BWC	99	63	64%
JCCC	16	15	94%
Intel	108	73	68%
CFACC	17	15	88%
CECG	7	6	86%
Overall	247	183	70%

Table 14 Likelihood that preferences would be changed after viewing in RIMPAC 2000 logs
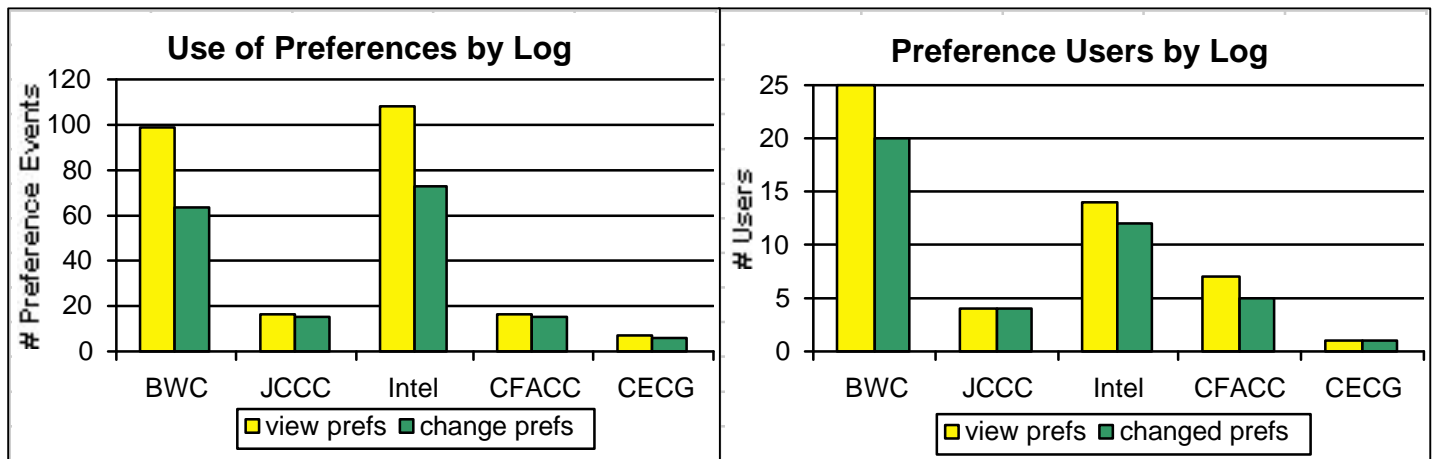

Figure 41 Preference Events by RIMPAC 2000 Log Figure 42 Users' Preference Activity by Log

Preference Settings

The preference feature allowed users to change the order the entries were displayed. By default, entries were displayed most recent entry first, least recent entry last. No users changed the entry display order.

The user could also select how the time was displayed. Available time offsets included Zulu, Kilo, and Whiskey. By default, the offset was Zulu. Users changed the offset to Whiskey (Hawaii time) 81% of the time, Zulu 13%, and Kilo 6%.

The time offset was changed a total of 32 times by 17 users. Most of those users set the time offset only once or twice, except for U238, who set it 6 times in the CFACC log. This particular user did the following:
- changed time offset from Zulu to Whiskey
- changed time offset from Whiskey to Kilo 5 days later
- reset the offset from Kilo to Whiskey about an hour later
- changed time offset from Whiskey to Zulu the next day
- reset the offset from Zulu to Whiskey immediately afterwards
- reset the offset from Whiskey to Zulu 2 hours later

Help

We have no data on the help feature. Help pages were added after the automated data logging was implemented. No data was collected on help.

Hyperlinks

Strong Angel

In the Strong Angel logs, there were six hyperlinks added to entries. 4 of those links were tests. The other two were the same link (duplicated across two logs) to a news report.

RIMPAC 2000

In the RIMPAC logs, the hyperlink feature was used just three times, all occurring before the war exercises began. One user was probably exploring the feature when he made a test entry and added a URL. The second instance was another test entry by a CMI user. This may have been done for training or demonstrative purposes. The third use of the hyperlink feature was the only "real" use. A link was added to an FBIS (Federal Bureau of Information Services) report.

Miscellaneous Observations

Log Content and Style

Use of the logs differed between the civil-military Strong Angel HA/DR exercise and the exclusively military RIMPAC 2000 exercises. Use also differed among user communities within each exercise. The differences included:

- usage consistency
- content
- style (all capitals versus lower case and milspeak versus natural English)

Usage consistency was addressed partly in the subsection on Entries (frequency of entries) and addressed again, below, in the subsection on shift changes. We recap these findings here.

Content was partly addressed in the Categories subsection.

Here we summarize the differences between exercise groups and among user groups within each exercise group.

Strong Angel

Usage Consistency

CommandNet was in use for not more than several days during Strong Angel. The CMOC Afloat log and the Civil Affairs log were not available for more than a day or two, and the Civil Affairs log suffered from intermittent connections.

Content

Strong Angel participants used CommandNet to record mostly situation reports (47%) and tracking events, both people and resources (35%). There was also significant use for troubleshooting, chat, request for action, acknowledgment, and testing (all > 10%).

Style

All Strong Angel logs were written in natural English, in lower case letters.

RIMPAC 2000

Usage Consistency

The BWC, JCCC, and Intel logs were used throughout the entire month. The CFACC and CECG logs were used only during the war exercises.

The JCCC log was used most consistently; about 35 entries were made per day at about 16 words per entry. Shift changes were logged fairly consistently.

Both the BWC and Intel logs had marked increase during the war exercises. Activity in the BWC log increased from about 20 entries a day to about 60 a day, with no significant change in the average number of words per entry. Activity in the Intel log changed drastically from fewer than 10 entries a day to a range between 65 and 125 a day. There was no significant change in the average number or words per entry. Shift changes in the BWC log were mostly consistent at three a day. There were more shift changes logged in Intel during increased activity.

Usage of the CFACC log during its short period of existence was fairly consistent. No shift changes were logged.

Activity consistency in the CECG log was similar to that of the CFACC log but for one exception; exactly two shift changes were logged per day.

Overall, the Intel log was used the heaviest for making entries, and the BWC entries were the wordiest.

Content

The BWC log contained admiral activity and was an operational log. The log can be grouped into three content periods: before, during, and after the exercises. Before the exercises, entries were mainly about trouble shooting, personnel, tasking, and scheduling. During the exercises, entries shifted towards sitreps, tracking of forces, reports, and casualties. A portion of these entries contained information from other logs (CFACC, Intel, and CECG) and also notification that information had been forwarded to other logs. The after-exercises entries were mostly situation reports.

The Intel log can also be grouped into the same three content periods. Before the exercises, entries were reports (often introduced by "Sources indicate that…"), general information, and information on the enemy forces. During the exercises, entries were sitreps and tracking information. Some of the entries were Intel messages pasted into CommandNet. (This was apparent by the style and capitalization of the messages.) The after-exercises entries were mostly tracking information from messages.

The JCCC log included maintenance entries, trouble shooting, and system and network reports.

CFACC entries during the exercises logged exercise events and tactical details: sitreps, aircraft tracking, enemy reports, and battle reports. At the end of the exercises, entries were sitreps, tasking, and about enemy forces.

CECG entries during the exercises were specific to specific exercise events, damage reports, munitions, and targeting. Entries also contained information on the enemy, warnings and advisories, and commands. Towards the end of the exercises, entry contents dealt more with tracking of both friendly and enemy forces.

Style

Almost all log entries were in lower case with capitalized abbreviations denoting operations, teams, and logs. Language was mostly natural. The JCCC log used some "tech speak."

The one exception was Intel messages pasted into the Intel log in capital letters. Reports and manually-typed information were in lower case and natural language.

There were considerable typographic errors in the logs. A spell-checking tool was requested on numerous occasions.

Shifts

Strong Angel

There were no shift changes logged in the Strong Angel logs.

RIMPAC 2000

In the RIMPAC 2000 logs, entries reporting shift changes were not made consistently. Sometimes shift changes were reported by the user leaving the watch, and some were reported by the user assuming the watch. There was

often some overlap, and both events were recorded. 62 "stand down" entries were reported and 164 "stand up" entries.
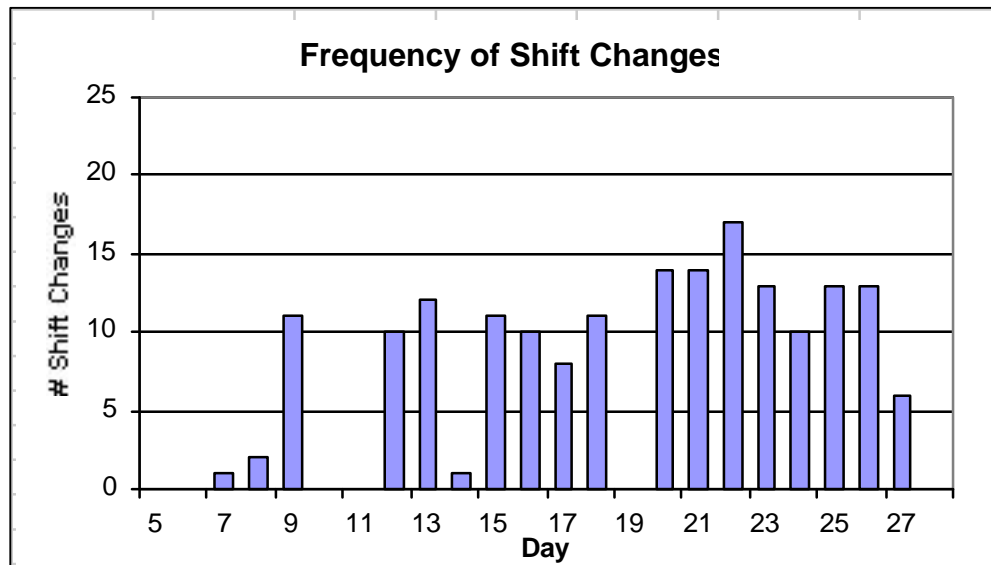

Figure 43 Frequency of Shift Changes in RIMPAC 2000 Logs

For purposes of keeping a searchable permanent record, the category feature would have leant itself well to labeling shift changes. However, categories were never used for shift changes. In addition, since the language varied in each entry ("x assumed the position of", "x relieved", "y was relieved by x", etc), there was no easy way to search and locate entries with shift changes. Why were categories not used to label shift changes? Perhaps, since no category was initially created for shift changes, users had nothing appropriate to choose.

"Routine" importance was used for shift changes in all cases except one use of "Immediate" for an unexceptional entry.

All BWC shift entries were "stand ups" (made by the person assuming the watch). All shift entries were made by bwc (battle watch officer) or abwc (assistant battle watch officer). There were, on average, 3 shift entries per day. BWC shifts were every 6 hours, or 4 per day, so shift changes were not logged consistently.

Figure 44 shows the frequency of logged shift changes, broken out by log.
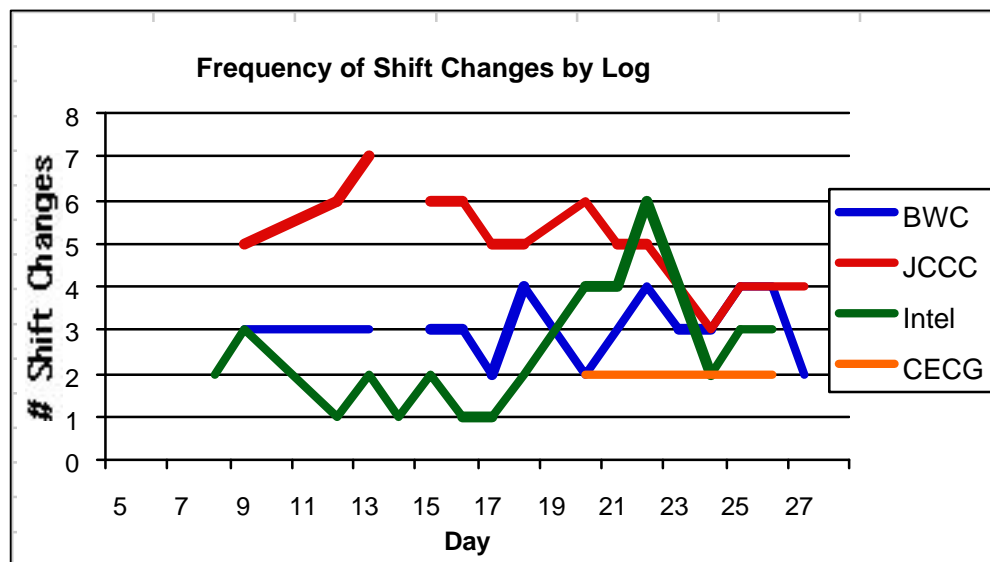
All CECG shift entries were "stand ups." All shift entries were made by cecgwo (CECG watch officer). There were exactly 2 shifts per day in this log. This coincides with the 12-hour shifts.

The JCCC log contained the highest frequency of shift changes, about 5 a day.

Figure 44 Frequency of Shift Changes by Log in RIMPAC 2000

The Intel log averaged 3 shift change entries per day. The frequency of shift changes appears to be consistent with the frequency of entries in this log. In other words, as activity increased, so did the number of shift changes.

Shift changes were not entered in the CFACC log. There should have been 2 entries per day for the 12-hour shifts.

There were about 12 shift change entries per day except for on days 6, 8, 10, 11, 14, and 19. (Day 19 had only three entries total.)

Replicating Entries Across Logs

We found several instances of replicated entries in multiple logs. There are two different cases where this happened. In one instance, a user decided to submit the same entry to more than one log. In the second situation, someone monitoring a particular log wanted to pass on a specific entry to those monitoring another log.

In order to replicate an entry and post it to multiple logs, a user would either have to copy and paste the text or type it in more than once. A potential new feature of CommandNet would facilitate cross posting to multiple logs. Perhaps the display could reflect from which log the replicated entry was initially posted. Just as useful, something in the original log could indicate that the entry had been copied, for reasons of security.

Strong Angel

After the CMOC Afloat log was created on June 12th, 12 entries, dated June 11th, were copied and pasted from the CMOC log. A built-in feature would have made the task considerably easier. In addition, it might have been useful for the users of the CMOC Afloat log to know the origin and date of the copied entries.

RIMPAC 2000

The RIMPAC 2000 logs have numerous examples of entries proceeded by "Got info from Intel" or appended by "BWC notified" or "Tech Control informed." Again, these would be good arguments for a cross posting capability that indicated where an entry was copied to and also where the copied entry had been taken from.

Profiles of User Groups

Strong Angel

	CMOC	CMOC Afloat	Civil Affairs
# Days in use	6	3	1
% of entries made	62%	18%	20%
# Users	12	2	4
# Users making entries	12	2	4
# Main users	4 (64% entries)	2 (100% entries)	3 (96% entries)
Average # entries per day	12	7	22
Average # entries per day per user	4	8	7
% duplicate entries	0	0	0
Training	yes		
Likes	ease of use		
Requests	chat, ability to include attachments		
Complaints	refresh, categories not used properly		
used categories	yes (53%)	no	yes (91%)
used importance	yes	very little	no
looked at headlines	yes, a little	no	yes
looked at searches	yes, a little	no	yes
changed preferences	yes	yes	yes
enabled or disabled refresh	yes	yes	yes

Table 15 Overview of Strong Angel logs, their usage, and user feedback

Strong Angel participants that responded to our survey all had experience using computers. All were familiar with some type of collaborative software, ranging from email and shared directories to audio and video. Half the participants had used GroupSystems before.

Other methods of recording observations and accessing information included local logs (greenbook), email, and the "collaborative logbook", an older version of CommandNet.

Strong Angel participants differed from participants in RIMPAC 2000 exercises in that Strong Angel users received more training from CMI staff. Overall, they were pleased with the training they received and found the tool easy to use.

> *"Very straightforward, easy to understand."*

> *"It was good. They showed me the basics, and if I had any questions, I knew who was around to ask. I mean if I was in my office by myself, I could probably figure it out on my own. I think it's very simple so you don't need a lot of training which is what I like about it."*

> *"We are learning as we go."*

Strong Angel participants used CommandNet to record mostly situation reports (47%) and tracking events, both people and resources (35%). There was also significant use for troubleshooting, chat, request for action, acknowledgment, and testing (all >10%).

The category feature was used consistently (91%) in the Civil Affairs log, about half the time in the CMOC log, and not at all in the CMOC Afloat log. Surveyed participants had mixed reactions to the use of categories.

> *"Could be useful if we used it. Problem is we don't use it well. "*

Someone else stated, *"not much use for it."*

On the use of the importance features, users noted that there was little need to prioritize entries higher than 'Routine.'

> *"I haven't had to change it; (everything is routine so far)."*

> *"I just kept it as routine, did not really notice it."*

The search feature was little used. Some of the participants thought it was a good idea to have, but either had no reason to use it or felt there was not enough material to warrant a search.

> *"Reusability of saved searches is an important feature."*

> *"I heard from x there is a search. Thought that was a good idea, but never used it yet."*

The headline feature was not used much either. For some it was a matter of training, others were not even aware the feature existed.

Overall, Strong Angel participants surveyed said that CommandNet was easier to use than other comparable systems. They found it useful, appropriate for the exercise, and easy to use.

When asked what they found easiest about CommandNet, one user said "*ease of getting a large group of people to log on without a lot of training and get usefulness out of it*." Another user found it difficult to find information in the logs.

> *"I had the most trouble with the ability to go back and review things. Reviewing multiple days is hard to make sense. Operators are trained on key words but it depends on what you are logged into. There is no degree of assurance that you would find what you are looking for."*

Most commonly requested features included chat or a log reserved for side conversations, and the ability to add attachments.

Below are two graphs representing typical usage of a single participant during Strong Angel. Activiy was minimal as the logs were in use for not more than six days.
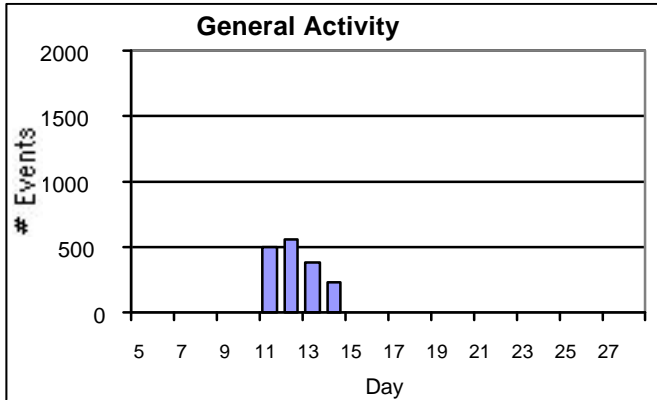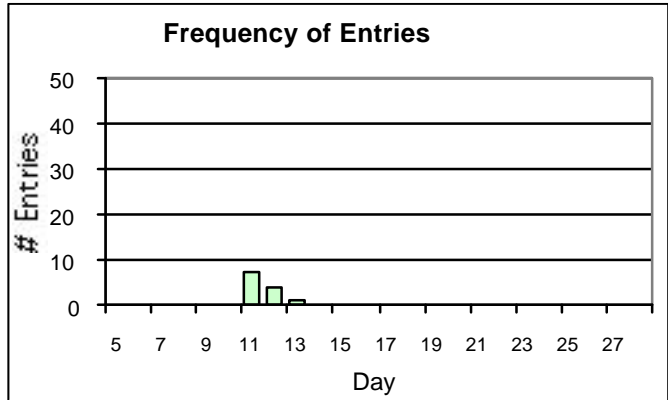
Figure 45 General activity of typical user

Figure 46 Frequency of Entries for typical user

RIMPAC 2000

	BWC	JCCC	Intel	CFACC	CECG
# Days in use	21	19	11	7	8
% of entries made	24%	26%	29%	12%	8%
# Users	68	19	28	18	5
# Users making entries	8	14	13	6	1
# Main users	2 (94 entries)	7 (96% entries)	6 (97% entries)	4 (99%)	1 (100% entries)
Average # entries per day	29	35	67	44	24
Average # entries per day per user	25	7	16	14	24
% duplicate entries	3%	3%	2%	3%	2%
typical user	data entry, monitor	data entry	43% monitor, 57% data entry, used BWC	data entry	data entry
training	on the job	on the job	on the job	on the job	on the job
log review	yes	at beginning of watch, sometimes at end	yes	yes	2-3 times per watch
likes	scrollback feature, persistent history	timestamps, #'d entries	timestamps, importance, user id associated wit entry, history	timestamps, viewing other entries, viewing other logs	timestamps, #'d entries, viewing other logs
requests	chat, ability to edit or delete entries	ability to edit	chat, multiple logs open simultaneously		ability to edit entries
complaints		slow	slow, not enough training	no one looked at logs	slow, refresh problem
used categories	2%	no	77%	no	no
used importance	no	no	yes	yes	no
looked at headlines	no	no	50% users looked, 6% did something	no	no
looked at searches	no	no	44 % looked, 31% did something	no	no
changed preferences	yes	no	yes (44% users)	no	yes
enabled or disabled refresh	yes	no	yes (31%)	no	no

Table 16 Overview of RIMPAC 2000 logs, their usage, and user feedback

BWC

The Battle Watch Captain's log was used as an operational log. The log could be grouped into three content periods: before, during, and after the exercises. Before the exercises, entries were mainly about trouble shooting, personnel, tasking, and scheduling. During the exercises, entries shifted towards sitreps, tracking of forces, reports, and casualties. A portion of these entries contained information from other logs (CFACC, Intel, and CECG) and also notification that information had been forwarded to other logs. The after-exercises entries were mostly situation reports.

The BWC log was used throughout the entire month, during both Strong Angel and RIMPAC exercises. There were typically about 22 entries a day, but activity increased from about 20 entries a day to 60 during the exercises. 50% of all entries were made by bwc, and 44% were made by abwc. These roles were used by potentially 16 different people. The graphs below show activity and entry patterns for both bwc and abwc users. Note the shift in entry activity from the bwc to abwc during RIMPAC.

(Note that graphs in the Log Profile subsection use the same scales for visual comparison. In other words, all "Overall Activity" graphs are scaled to 2000 events per day, and all "Frequency of Entries" graphs are scaled to 50 events per day.)
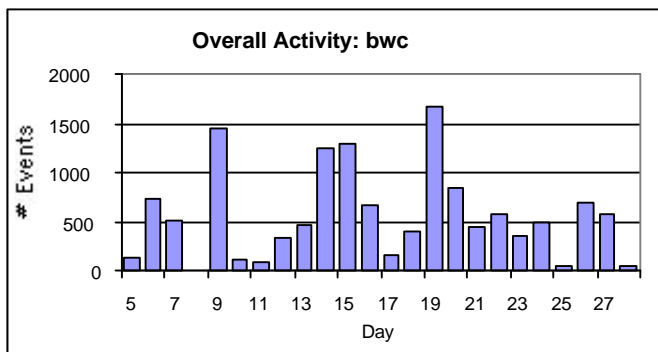

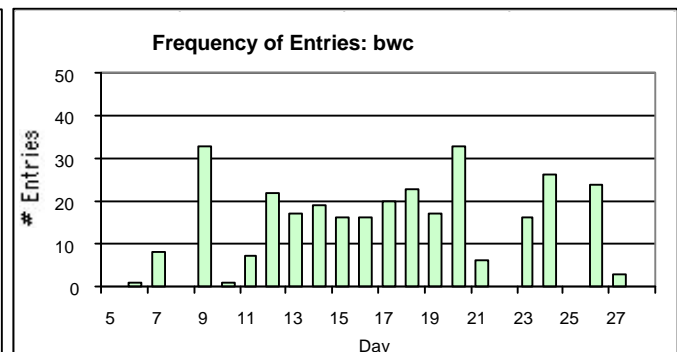Figure 47 Overall activity of the 'bwc' user
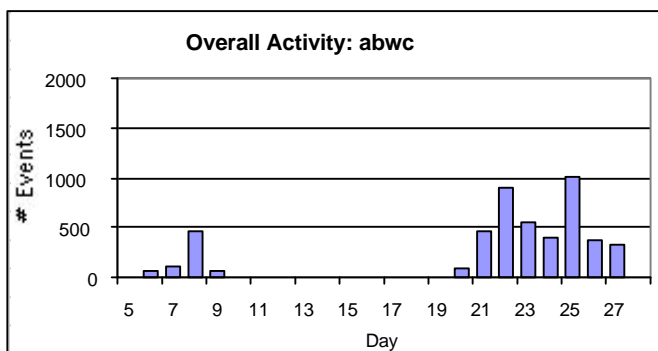

Figure 48 Frequency of entries made by 'bwc'

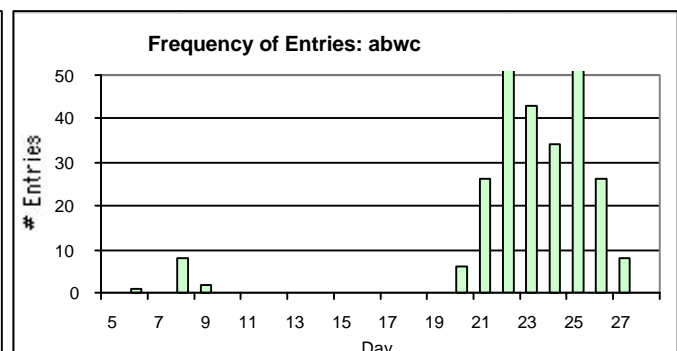Figure 49 Overall activity of the 'abwc' user

Figure 50 Frequency of activity of 'abwc'

All BWC users surveyed were regular computer users. All had used email and shared directories, 80% had used chat, and 60% were familiar with GroupSystems. Before using CommandNet as a means of reporting observations and accessing information, participants had used a local log (the greenbook), email, and a previous version of CommandNet referred to as "the collaborative logbook."

They thought the category feature was useful enough and easy to use, but it was used an insignificant number of times. The importance feature was used minimally as well. No one surveyed used search or headlines.

Training was rated as neither adequate nor inadequate. Most everyone learned basic features from watching someone else. One participant complained that he had received some training – well after he had begun to use the tool.

All thought CommandNet was relatively easier to use than past methods (2 on a scale of 5, with 1 being the easiest). Most rated CommandNet as somewhat slower than other systems.

Overall, BWC users surveyed judged CommandNet to be somewhat useful, somewhat easy to use, and very appropriate to their job.

What users liked most about CommandNet were ease of use and its value as a permanent record of events. They commented on how easy it was to add entries and how easy and useful the scroll back feature was.

Users also wanted the ability to delete or edit entries.

JCCC

The JCCC log was created for use in the Joint Command Control Center. The JCCC log was used for technical support: logging troubleshooting events, maintenance, and system and network status. The users in the JCCC community were all regulars and were accustomed to logging entries in other tools like an Excel spreadsheet, Word document, or local logs (greenbook). All had used email, and 75% had used chat, shared directories, and audio. None of the users interviewed had received any training; they learned to login and make entries from someone on the previous watch.

The log was in use for 16 days. Figure 51 displays the overall activity for a typical user in the JCCC Log. Overall activity includes entries made, use of the advanced features, screen refreshes, navigational activity, etc. The activity level is fairly constant throughout its use. Figure 51 shows the frequency of entries logged for a typical user. A typical user also averaged about seven entries a day.
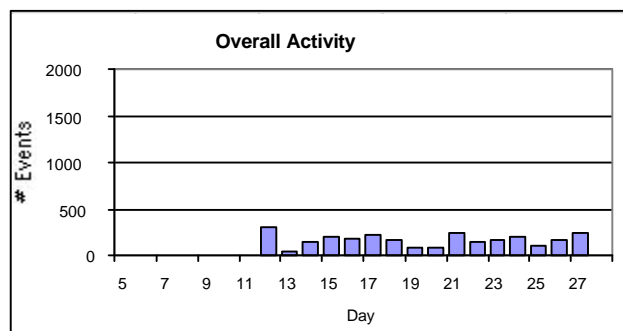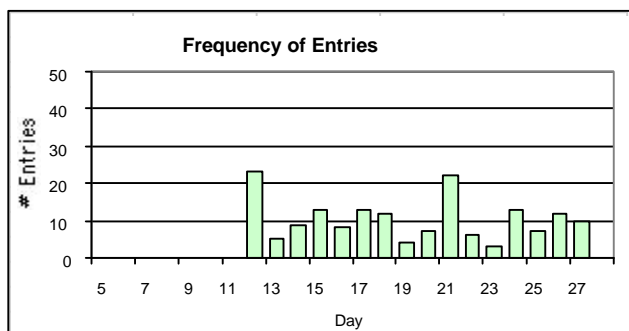

Figure 51 Overall activity for a typical user

Figure 52 Typical frequency of entries

Compared to methods utilized in the past, JCCC users found CommandNet "*easy to use*" and, according to one person, "*about the best I've seen*." They liked the fact that the entries were numbered because they could refer to them by the number. Indeed, about 3% of the entries contained references to other entries. Interviewed users also liked the automatic time stamps associated with each entry.

Another well-liked feature was the ability to scroll back through the history of logged events. Users reportedly reviewed the log at the beginning of their shift and sometimes also at the end.

Not one user complained, during our interviews, about the slowness of the system. That was surprising considering that 5% of the entries were duplicates resulting from hitting the submit button more than once before the system had time to update the logs. The JCCC log had a higher percentage of duplicate entries than any other log.

More than one user requested the ability to edit entries; there were lots of typographical errors. One user did not understand the symbols that represented the level of importance (i.e., R, P, O, and Z. See the Importance subsection). That user would like to see help on the symbols or a visible legend.

Other than for simple data entry, the JCCC user community did not use CommandNet for anything else. The easy-to-use category and importance features were not used to annotate entries, and none of the more advanced features (search, headlines) were used at all. A few users viewed and changed the user preference settings, but the refresh feature was not used.

They found it somewhat easier than other tools. Overall, it was rated as somewhat useful, somewhat appropriate, and somewhat easy to use.

Intel

The Intel log contained more entries than any other log. It was used heavily during the RIMPAC exercises. In fact, activity increased drastically from fewer than 10 entries a day to a range between 65 and 125 a day. The graphs below show typical patterns of a single Intel log user. In addition to making entries in the Intel log, the typical Intel user monitored the BWC log.
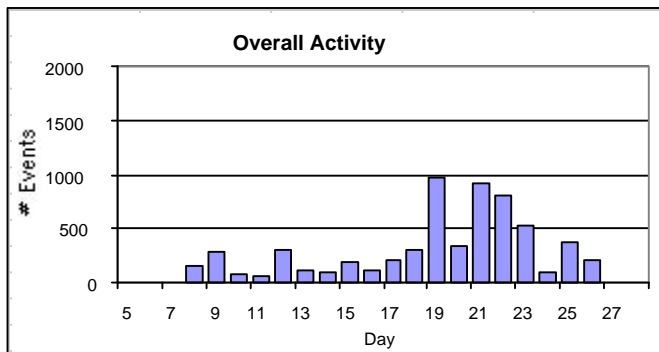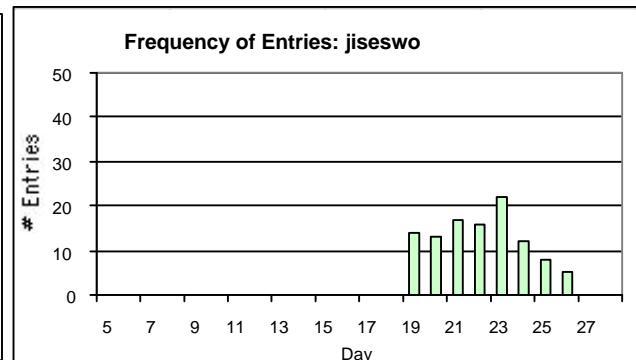

Figure 53 Overall activity of an Intel user

Figure 54 Frequency of entries made by 'jiseswo'

Before the RIMPAC exercises, entries were reports (often introduced by "Sources indicate that…"), general information, and information on the enemy forces. During the exercises, entries were sitreps and tracking information. Some of the entries were clearly Intel messages pasted into CommandNet. (This was apparent by the style and capitalization of the messages.) The after-exercise entries were mostly tracking information copied from messages.

At least one third of the surveyed population was reservist. All were computer users and familiar with email and shared directories. Other comparable methods for making observations and accessing information were Microsoft Excel spreadsheet, Microsoft Word, local logs (greenbook), and older versions of CommandNet.

No one received training; two users said they figured things out on their own, but one complained that he needed more.

Unlike other logs, the category feature was used heavily, and most (67%) found it both useful and easy to use. Out of nine categories created, seven were used frequently. The importance feature was used regularly in the Intel logs, too, but was rated as less than useful.

> *"I don't prioritize reading based on that since I read them as they come in. I don't do this often enough to remember what 'O' and 'P' mean."*

A couple of users made several searches more than once. Searches were rated useful, helpful, and easy but were considered slow and not so intuitive. One person suggested that it might be easier to use the 'Find' feature of the browser.

Headlines were not used, but a few people looked at them.

Most users said CommandNet was somewhat easier than other systems and not any faster.   Everyone interviewed thought it provided better analysis. Overall, they unanimously found it useful, appropriate, and easy.

Below are some comments about what the Intel community liked.

> *"auto log entry time, precedence level, originator, as much space as needed to write whatever"*

> *"The fact that it's quick, easy to use, research tool for current events. It's a log. Recap events go back and figure out what's going on. Keeps key nodes on ship apprised of what's going on."*

> *"Very intuitive ui. It gives me access to real time info."*

Common complaints were about the frustrating refresh and slowness of the system.

Requested features included the ability to force refresh, chat, and the capability of adding attachments. Since CommandNet could ultimately be used as a chat tool, we infer from user comments that chat was discouraged.

> *"I would like more info. It would be nice to have a way to ask questions. If I am unclear, I send out email. The log is not meant to be interactive."*

CFACC

The Coalition Forces Air Command Control Log was used for just six days during the RIMPAC exercises. There was little activity in the log, about 44 entries a day (14 per user).

Two thirds of survey participants were regulars, one third were reservist. All were users of email, chat, shared directories, and document management software. Tools used in the past to record observations and access information included Microsoft Word and local logs, or the greenbook.

Two thirds of the surveyed population received no training on the use of CommandNet. The others said that training had been adequate.

Categories were not used. Two respondents said that there were no categories from which to choose.
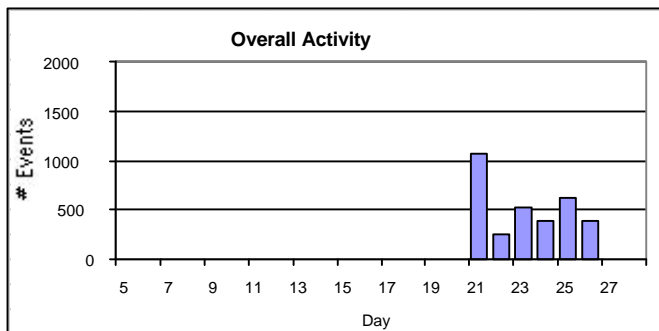

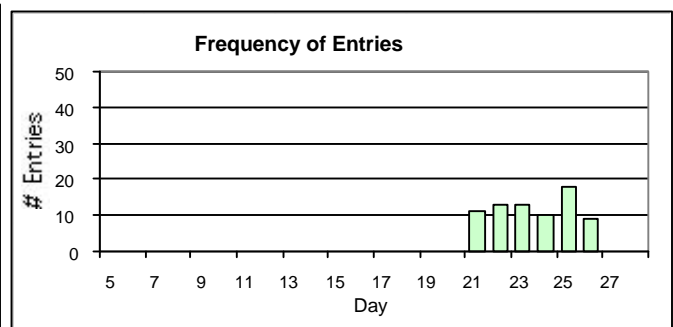**Figure 55 Overall activity of typical user**

Figure 56 Frequency of entries of typical user

Those who used the importance feature said it was easy to use, but one did not know what the purpose was. One user remarked that there were no defined criteria for using the importance feature. Another user indicated that the importance feature was not used because the exercise was "*not really a war.*" About one quarter of entries were labeled as 'Flash.' When asked if CommandNet would be useful as an analysis tool, one user said it would be if categories and importance were used properly.

Search and headlines were not used. One person tried to use the search feature but could not get it to "*come up.*" Another user thought that search would be more useful during a real war.

No shift changes were recorded in CFACC logs.

Compared to other systems, all CFACC users surveyed found CommandNet easier to use. Overall, CFACC users thought CommandNet was somewhat useful, somewhat appropriate, and somewhat easy.

Users liked the automatic timestamp associated with each entry. They liked being able to see other people's entries and other logs (BWC).

Most users commented on the slowness of the system and how it would not be used during a war if it were that slow.

> *"Updates are too slow. Data entry needs to be a lot quicker but updating is too slow and I
> end up writing on paper. It's no better than a notebook."*

3% of the entries were duplicates resulting from repeated submitting.

CECG

The CECG log was created for the Coalition Exercise Control Group. The purpose of the log was for recording significant exercise events and operational activities. Everyone surveyed was a regular. All were experienced computer users and had used email, chat, and shared directories. Most had used Microsoft Word in the past for similar event logging. At least two people had used a precursor to CommandNet, the "collaborative log." According to our survey, no one interviewed received any training on the use of CommandNet.

The log was in use for eight main days. All entries were made by 'cecgwo', a role created for the CECG watch officer. Based on information extracted from logged shift changes, the cecgwo role was potentially used by five different people. Figure 57 shows the overall activity of this role. Use is constant during the eight days. The frequency of entries made by cecgwo, shown in Figure 57, follows a bell-shaped pattern; more entries were made during the exercises. About 24 entries were made a day, possibly by at least two different people or shifts per day (there were two shift changes logged per day).
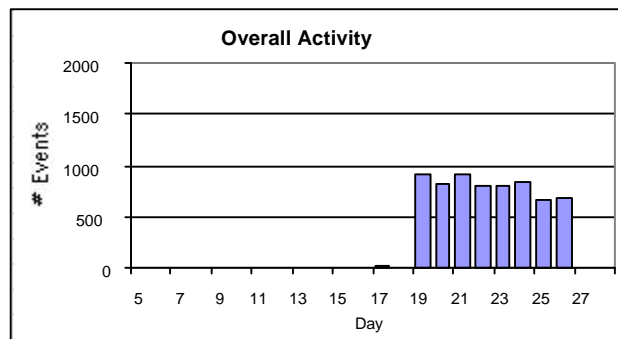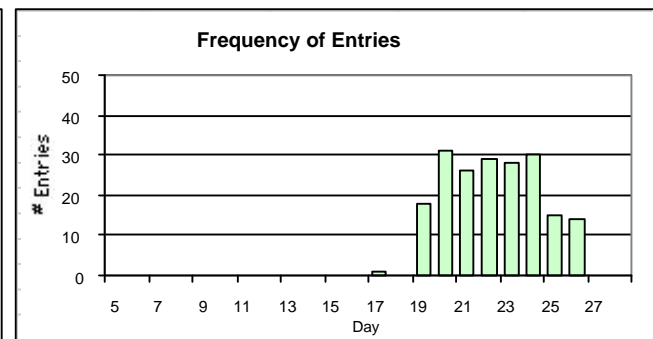

Figure 57 Overall activity for user 'cecgwo'   **Figure 58 Frequency of entries for user 'cecgwo'**

CommandNet was used by the CECG user community mainly to log entries. People interviewed said they used the scroll back feature at the beginning of their watch to review previous entries. There was a belief expressed by two users that no one was looking at the logs, although there was some evidence that there were people who logged in just to monitor the logs.

No features were used other than change in user preferences. The lack of feature use could be attributed to the lack of training or to the urgency of the situation.

> *"When it gets busy, I only want to make entries."*

Most popular positive comments about CommandNet were regarding numbered entries and automatic timestamps. One person particularly liked the ability to see other logs.

One user complained about the refresh problem during review of entries. It was unclear from the data if the user knew how to disable the refresh. Slowness of the system was another common complaint. According to one participant, the slowness made CommandNet unreliable as a means of communication: "*when you need it most, you're unable to use it.*"

Two participants surveyed wanted the ability to edit entries and to make corrections. Someone else commented that it was good to have a permanent record – Microsoft Word files could be changed.

Someone complained about the lack of instructions that accompanied the tool – was the help feature not available or just too unobtrusive? They all said it was somewhat harder (4 out of a scale of 5, with 5 being harder) to use than other systems, and somewhat slower.

CommandNet Usability Report

Introduction

This report discusses the usability aspects of CommandNet, a system developed by the University of Arizona's Center for Management of Information. The report is based on our observation of the users participating in Strong Angel and RIMPAC 2000 and on their feedback as reflected in interviews and their responses to the survey questionnaire. As we identify usability problems, we make design suggestions on how to fix them. First we cover the usability issues essential to the basic use of CommandNet: speed, space constraints, menu, navigation, preferences, look and feel. Then we address the usability of the more advanced features that were used by only a small subset of users: search, headlines, and administration.

Speed

Although we had positive feedback from the users about CommandNet, a major and very serious area of complaints was the speed of the system. Sometimes it took the system several minutes to refresh the screen. The people making entries were very concerned that they might get a call and have to give a situation update while their screen was blank. We also noticed a significant amount of duplicate entries resulting from impatient users clicking on the Submit button multiple times. Improving the speed of the system will make a tremendous difference on the acceptance of CommandNet.

Space constraints

During RIMPAC 2000, participants often used CommandNet while having several other applications opened at the same time. Due to this constraint, the screen real estate available to CommandNet was not sufficient to fit the entire user interface. Vital parts like the frame to create new entries and the menu would often be partially hidden from the user. Many users did not use the menu often, but a good part of their CommandNet window was occupied by it, and there was no way to control this layout. We suggest the following redesign of CommandNet's layout.
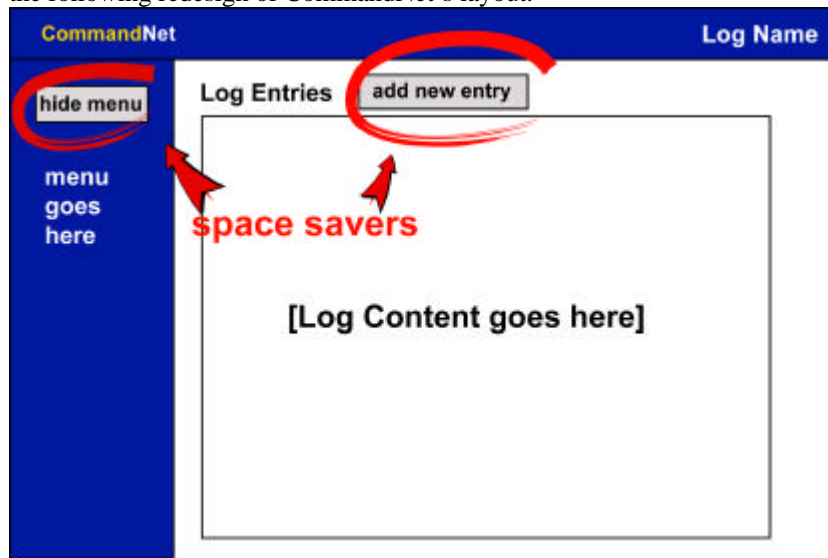

Figure 1: Proposed CommandNet Screen with menu exposed

Figure 2: Proposed CommandNet screen with menu hidden

Figure 1 displays the screen the users would see when they chose a log. The menu that is now on top has been moved to the left. This will help users scan the menu options. Usability studies show that users can locate the menus better on the left than on top of the window (Nygren, 1996). It is also easier to scan the menu options since there is only one option per line. The "Hide Menu" button allows users to hide the menu, thus creating more room for the content (Figure 2).

In the current interface, it is not possible to see the bottom frame in its entirety when the window is shrunk to less than half the screen size, which happened quite often during CommandNet's use during the exercises. We suggest adding the "Add New Entry" button to the top of the screen, which brings up a pop up window where the user can make a new entry. Since the pop up window is temporary, it can be made an appropriate size to display the entire entry form without interfering with other windows on the user's screen. A pop up window also allows the user to refer to the other entries while making the new one.

This suggested new design does not use frames. The benefits of this will become clear when we discuss the navigation.

Menu

We define two types of links: navigation links and action links. Navigation links take the user to a different page, while the action links perform a function. Differentiating between these two types of links graphically helps the users to find them in the interface and to infer the behavior of a link. In CommandNet's menu, both types of links are present. **Log, Headlines, Search, Preferences, Admin, Logout,** and **Help** are the navigational links because they take the user to a different page. Refresh **Enable, Disable** are functional links because they perform a function of enabling or disabling refresh without going to any other page. Making the navigation links look different from the action links can help the user find the functionality they need much more quickly and easily.

Refresh

Traditionally, actions in interfaces are shown with a button. Users are very accustomed to this convention and quickly locate the buttons on the screen. We suggest making a refresh button that says "Enable Refresh" if it is disabled, and changes to "Disable Refresh" if it is enabled. This is a toggle button. It performs two functions depending on the current state of the system (like a light switch). Such buttons are usually very intuitive to use, and they save space on the screen.

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It is very important for this button to be visible to the users because the refreshing of the screen while users were scrolling to review the logs caused a lot of frustration. *Visible* here does not only mean that this button is in the user's field of vision, but also that it is easily noticeable. To help the user notice it, it is important to put it in a place where the user's attention is already focused – near the log entries (Figure 3).

Figure 3: Proposed CommandNet screen with refresh enable/disable toggle button

Navigation

The navigation links are now the ones left in the menu. They perform four important functions:
- Provide current orientation
- Tell the user how to get back
- Expose the functionality to the user
- Provide a way to get to other pages

Provide current orientation

Users sometimes felt disoriented because the menu options that corresponded to where they were in the interface were not highlighted consistently. After choosing a log, and entering the main log screen displaying the entries, users would see none of the menu options highlighted. If a user then clicked **Search**, it was not clear how to get back to the screen of entries. It was not obvious that **Log** took one back to entries because it was not highlighted while the user was displaying entries. If the user then hit the "Back" button on the browser, it would take her back to the Log Entries, but the **Search** menu option would still be highlighted because the upper frame was not refreshed.

There are several design improvements to avoid such situations. A general principle is to always show the menu option corresponding to the content of the page as highlighted (even when the user just chose a log and did not click on any menu options yet). If the user hits the Back button, the highlighted menu option should be changed as appropriate. Using the frames often causes the problem of the navigation links not refreshing when the Back button is clicked. The new interface we are proposing does not use frames, making the navigation much easier to implement correctly. Clear terminology of the menu options can help the users understand where the options can take them. While most of the menu options used very clear terminology, we suggest changing names of two menu options: **Log** to **Log Entries,** and **Close** to **Choose Log**. This tells the user more explicitly what they will see if they choose these options. Many users expressed a desire to open multiple logs without closing the log they are looking at. To meet this requirement we recommend the **Choose Log** menu option popping up a window where the users can choose a log. This easily allows the user to open multiple log windows.

Using the titles for the content pages that are consistent with the highlighted menu option also helps the users to check that they are in the right place. This was done on all the pages except for the Log Entries page. We suggest adding a title to this page as well.

Tell the user how to get back

The same design suggestions that orient users will also help them go back. However, if there is a sequence of screens that the user has to navigate through to perform a function (like creating a new search or headline), the Back links have to be provided on each page. In general such long chains of screen should be avoided since they are hard to navigate, and hide the functionality from the users.

Expose the functionality to the user

There were many comments from users about not being able to find different functions of CommandNet, like editing entries, creating a category, etc. These users knew they had access to this functionality, but it was not exposed to them in the interface and they had to navigate through many pages before they could find what they needed. To address this problem, it is necessary to expose as much of functionality as possible to the user in the menu and in the content of the page.

A lot of functionality is concealed in the **Admin** menu option. We suggest revealing that functionality directly in the main menu, or in the content of the page as appropriate. For example, **Change Password**, **New Log**, **Manage Users**, **Add Category**, etc. can all be menu options for those users who have permissions to use these functions. However, the editing entries functionality would be best exposed as "edit" buttons to the left of each entry because the users usually try to edit entries while reading them. Please note that only the users who have the editing permissions should see these "edit" buttons. When the edit button is clicked, a new window should pop up with the form where the users can make their changes. A window pop up will allow for more space for the edit form, so that a multi-line text field can be used to display the entries. In the current editing interface, the entry text is displayed in a one-line text field, and users commented that the large entries did not fit and could not be edited properly. Also, the entries are displayed in 'oldest first--newest last' order, which is inconsistent with the order of entries on the Log Entries Screen, and made it harder for users to find the entry they wanted to edit.

Provide a way to get to other pages

One of a menu's functions is to provide a way to get to other pages and show the users which pages they can reach. As discussed in the previous section, if the menu options are not explicit, the users are not aware they can do certain functions. The inverse of this principle is also true. If the menu options are visible, users assume that they can perform all those functions and will be confused if they cannot click on them. In the screen where the user chooses a log, **Log, Headlines, Search, Preferences, Close, and Refresh Enable/Disable** are not available to the user, but they show up in the menu. When users cannot click on them, they may not only be confused, but may also assume that these menu options are not functional in general, and thus will not try to click on them in other pages. It is important to present the users with all and only the options available to them at each point during navigation.
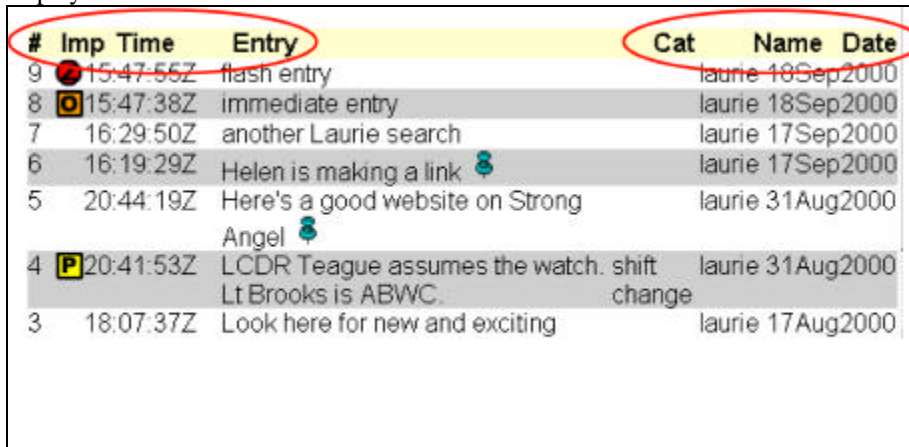
Preferences

The preferences interface was very straightforward and easy to use. The problem was not in setting preferences, but in keeping them. We had comments from users that if they used the refresh button on their browser, their preferences would be reset back to default. We recommend that the user's preferences should never be changed to default without the user explicitly resetting them. Even if the user logs out and then logs back in, preferences should stay the way they were set.

Look and Feel

Overall, the look and feel of CommandNet was very good, and users commented on what a nice application it was. We have some minor suggestions that can improve the look and feel of CommandNet. On the Log
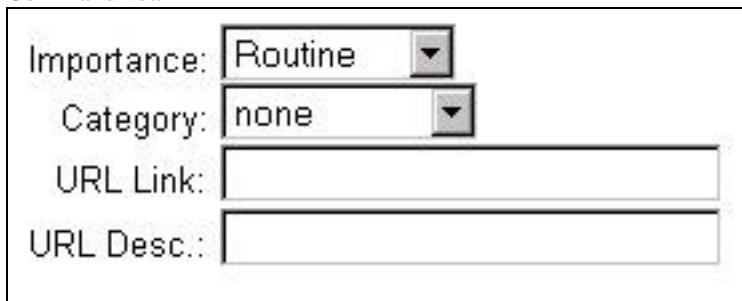
Entries page, the headings in the table that contains the entries should align with the content, and there should be space between the headings. In the current interface it looks like there are two columns, "# Imp Time Entry" and "Cat Name Date" (Figure 4). This made it hard for users to figure out which data is displayed in which column.

Figure 4: Current CommandNet view of Log Entries page. Suggestion: Align headings of the table with the content, and add some space between columns

The entry forms should have all the fields aligned on the left and their text labels aligned on the right as shown in Figure 5. This applies not only to the creating new entry form, but to all the forms in CommandNet.

Figure 5: Suggested form alignment

Many HTML forms in CommandNet (Login form, new search form, etc.) could benefit from the cursor being in the first field where the user should be typing. All the form elements should be labeled. We suggest putting the "New Entry:" label above the multi-line text field where the user makes a new entry. All of the other form fields were labeled very clearly.

Search and Headlines

Search and headlines are what we consider the advanced features of CommandNet. Few users took advantage of them in our study, but that does not mean that these features will not be of interest to the users when CommandNet is used over a longer period of time. We have the following design suggestions on how to improve the interface for search and headlines to help users get more value out of them.

Put new search and saved searches on the same screen to avoid unnecessary navigation (Figure 6). The same applies to new headline and saved headlines. Add the title "Saved Searches" or "Saved Headlines" above the saved searches or headlines to explain them to the user (Figure 6). Search the headlines as well as entries, or specify that only the entries can be searched.

When saving searches, ask only for the title (because the description is usually just a repetition of the title). Save the search terms and display them in the table where saved searches are displayed, instead of

"Description" column, so that the users know exactly the basis of the search. It would also be very beneficial to allow users to edit and delete their searches.

Figure 6: Proposed layout of search that avoids unnecessary navigation

In the current headlines interface, adding an entry to a headline after entering the title and description will erase the title and description. We suggest a "wizard" approach to this interface. Wizards are interfaces that take the user through a process step by step providing a "back" button and a "next" button. In this case, the first step is to select the entries to add to the headline. The second step is to enter the title and description. If this process is broken down into its steps, it will help the user create new headlines. Another issue with the current headline interface is not being able to remove entries while creating a headline (before the headline is submitted). If an entry is added in error, the only way to correct this mistake is to start all over and create a new headline. There is also a need for editing the searches and headlines after they are created. Only some users should have permissions to do so.

We believe that combining the search and headline interfaces can be very beneficial. During the usability tests users commented how they would like to create a headline out of the search results. We suggest that after getting search results, users should have an option to create a new headline out of resulting entries. When the user creates a new headline by going to the **Headline** option on the menu, she should be able to search for the entries to add to the headline.

Links

Adding links to entries was a very well designed feature. It is very useful and easy to use, and we have very positive feedback about it from the users.

Security and the Admin interface

In CommandNet users have *User* permissions or *Admin* permissions. Having only *User* permissions allows the user to create other users with *Admin* permissions. This is a security vulnerability because it allows any user to get complete access to the system. In addition to enabling and enforcing a more secure permissions policy, we also recommend creating admin levels such that a user can be an administrator of one log, but not all. In the current version of CommandNet, an admin user has full rights to everything within CommandNet.

There are navigation issues with the current Admin interface as well. When the user enters the system she can choose a log or can choose to do admin functions. If she chooses to do the admin functions, there is no navigation provided to get back to **Choose Log** screen. As suggested before, the **Close** link on the menu should be renamed **Choose Log**. It should be highlighted when the user is in the Choose Log screen, and the user should be able to click on it to get back to Choose Log screen. This is consistent with the point made in the Navigation section of this report, that functionality should not be buried in the menu. Instead of having a single admin link, there should be distinct links to manage users, change password, etc.

Editing the Access Control List is available in the Choose Log screen only before any log is chosen. We observed several users not being able to find how to add others to the ACL because they had already chosen a log. This functionality should be available once the log is chosen as well as in the Choose Log screen.

When users clicks on the **Admin** menu option, they are presented with a variety of possible functions, each with an icon and descriptive text. Only the icon is a link, the text is not. This suggests to users that the option might not be available to them because they cannot click on it. We recommend making both the icon and the text into a link.

Chat

There were many requests from users for Chat functionality. CommandNet lends itself to chat, and it came to the rescue during the Strong Angel exercise when other lines of communication were not available. During RIMPAC, the Chief of Staff made a policy decision to use CommandNet only for significant events and lessons learned. Many users commented that although they should not use the logs for chat, a chat feature would be very useful. To meet the need for chat we recommend installing a chat application for people to use in conjunction with CommandNet.

Name

The ship's radio network was also called CommandNet. This made the reference to CommandNet ambiguous, since one could be referring either to the radio network or collaborative log.

References

Nygren, E., & Allard, A. (1996). Between the Clicks" Skilled Users Scanning of Pages. Designing for the Web: Empirical Studies. Human Factors and the Web/HTML Conference. Sandia National Laboratories, Albuquerque, NM.

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