Reflections on Strong Angel III: Some Lessons Learned

Murray E. Jennex
San Diego State University
mjennex@mail.sdsu.edu

ABSTRACT

Strong Angel III was a civilian military disaster response demonstration held in San Diego in /August, 2006. This demonstration resulted in the generation of a great deal of knowledge that can potentially benefit disaster response efforts world wide. This paper attempts to capture this knowledge and to reflect on the demonstration for its value to the community.

Keywords

Training, Strong Angel.

INTRODUCTION

This paper summarizes the significant lessons learned from Strong Angel III, SA3, as observed by the author. SA3 was a demonstration of technologies and civilian-military cooperation for disaster response held in San Diego, California, USA August 21-26, 2006. Over 800 individuals and 200 organizations participated in the demonstration. The purpose of the demonstration was to create a laboratory for experimenting with cutting-edge processes and technologies that can be used to facilitate cooperation, communication, and information flow between civilian and military organizations in a post disaster or conflict situation (Strong Angel III, 2006).

To create the laboratory participants signed up to perform specific tasks (see Appendix A for a listing and description of these tasks) and were then directed to show up with their equipment to a location chosen because it had little to no infrastructure. The first two days of the demonstration were spent establishing basic infrastructure such as power, water, communications, and living accommodations (unlike a real disaster response only a few participants actually lived on the site for the duration of the demonstration). After establishment of the infrastructure, participants began to respond to the disaster scenario of a bird flu epidemic coupled with terrorists launches a wave of successful cyber attacks that bring down grid power, Internet access, and land and cellular telephone service. The scenario, coupled with the barrenness of the demonstration site forced participants to work together to get technologies to work and to accomplish tasks in an environment that was a reasonable facsimile of a disaster site.

SA3 is the third such demonstration in the Strong Angel series with previous demonstrations being held in 2000 and 2004. Each of the previous Strong Angel demonstrations has altered some aspect of corporate or governmental behavior over and it is expected that the same will occur for SA3 (Strong Angel III, 2006). To facilitate this, the SA3 executive committee held a post demonstration review (this author was a participant in this review) to solicit lessons learned and prepared a post action report to discuss and publicly promulgate lessons learned, knowledge gained, and areas needing further research (Mikawa, 2006).

METHODOLOGY

The methodology used in this paper is action research; the author was an active participant assigned the task of determining the economic impact of the exercise (task 29, Appendix A). Data collection is from direct observation, review of results from the SA3 executive team, and a review of posted observations from other SA3 participants. Reflections on the demonstration are from the author. These reflections are theoretically based using the Jennex (2007) model of a crisis response system. This model summarizes the literature and the author's experiences with Year 2000, Y2K, and Katrina crisis response and with crisis response drills. Evaluations of SA3 drill/task effectiveness are based on self reported data from the task performers and observations from the SA3 executive board and exercise participants as recorded by the author and the SA3 executive team. Finally, given that all reflections are from the author, only those issues, lessons learned and things that did not work well, that the author personally observed are discussed. While this means that the paper is not an inclusive list of lessons learned and things that did not work well, it is based on primary data.

The limitation of this research is that it is primarily qualitative and subjective research. It relies on the perceptions of the author, a trained observer familiar with the crisis response literature and theory, and is not validated using quantitative methods. The author has used this experience to attempt to overcome the self-reporting bias of the participants. However, this is still a major limitation and thus this research should be considered as exploratory that can be used to help develop theory, but not to validate theory.

STRONG ANGEL III LESSONS LEARNED

The SA3 executive team did not specifically list "lessons learned" but did evaluate what went well and what didn't and identified areas worthy of further research and/or development. This listing of lessons learned is culled from Mikawa (2006), from other posted reflections on SA3, and from the author's notes taken during the post action review meeting and throughout the demonstration. Also, lessons learned are viewed from the concept of being able to respond to a disaster in a developing country where infrastructure, social, and financial resources may be in very limited supply. This tends to eliminate elegant solutions that require extensive bandwidth and/or constant clear power and instead focuses on the simple, reliable, easy to use solutions. Lessons learned are listed and discussed based on the perceived importance of the author.

The major lesson learned was that disparate data and computing sources can be integrated (in this case integration is viewed as being able to share and use data from different sources). Jennex (2007) discusses how a crisis response system needs to facilitate communication between responders and how knowledge management, KM, can be used to encourage knowledge sharing between responders. Jennex and Olfman (2005) identified as a critical success factors, CSFs, for KM having a common knowledge and data structure. 7. Nisha de Silva (2001) discusses the difficulty of integrating disparate data sources including lack of standards for data formats. Unfortunately, no standards have been established for data storage and transmission and communities will use what they have available. This makes the ability to integrate disparate data and computing sources critical. SA3 used SSE, Simple Sharing Extension, technology to synchronize data from differing sources. The greatest demonstration of this capability was the mash up of GIS, Geographical Information System, solutions that allowed several different solutions to share and use data through the creation of an interoperable data store. While SSE is a Microsoft product, it is offered as an open source technology making it useful to anyone needing to use it. This is significant as there are no standard GIS or data solutions in use in emergency response (although ESRI Commercial off the Shelf, COTS, products are becoming a de facto standard due to their widespread use). Organizations and countries use what they have. The identification of a technology that will allow organizations and countries to continue to use what they have and not require them to migrate to a standard solution is of great benefit and was the most significant discovery observed.

A major lesson previously learned and reaffirmed at SA3 was the danger of relying on Internet and phone based communications. This infrastructure fails fairly rapidly following a major disaster (9/11, the 2004 Tsunami and Hurricane Katrina resulted in loss of communications in the affected areas (Murphy and Jennex, 2006)) either due to loss of the physical infrastructure or to the loss of power and subsequent draining of emergency backup batteries. Establishing communications in a "dark" structure and site was not an easy task. Two days were needed to establish basic Internet service with this task ultimately requiring the SA3 executive team to appoint a communications czar to oversee coordination and conflicts between various providers. Also, the Internet access established was satellite based and did not have the large amount of bandwidth many expected. This led to the failure in the use of Groove as a demonstration coordination, communication, and management tool due to its extensive bandwidth requirements. Other applications also suffered due to bandwidth limitations. Ultimately, the lesson learned is that emergency response systems need to utilize low bandwidth software. Two examples of small footprint software were demonstrated successfully at SA3. The Sahana web based system and Toozl (an emergency response system that comes on a 4 GB flash drive) both provided good functionality at low cost and with minimal infrastructure requirements. Sahana has been modified following SA3 to incorporate SSE and to make it even more durable and smaller in footprint (Sahana, 2006)

The use of GIS and remote sensor and communication networks is important and can become critical for decision makers. The ability to visualize data in ways to support decision making is critical (Gheorghe and Vamanu, 2001, Jennex, 2007; Nisha de Silva, 2001) for emergency response systems. SA3 demonstrated the value of visual and other data collection from remote locations and its transfer to the home control location. Technologies were demonstrated that facilitated situational analysis by transmitting live data (video, voice, text) from a variety of locations. Additionally, GIS sensors in cell phones, PDAs, and other responder equipment made it possible for decision makers to know where all responders were at any given time. Additionally, the integration of data into a interoperable data store for all GIS solutions to use (as discussed above) provided for exceptional data displays (Hattotuwa, 2006). However, as impressive as this is, Mikawa (2006) points out that the colorful maps and displays provided, while nice, were not practical in a large scale disaster where infrastructure for displaying and printing this displays may not exist. The need for the ability to generate simple black and white maps and displays on regular sized paper is reiterated (Mikawa, 2006).

Another lesson reaffirmed was that technology is an enabler of disaster response, but not the key. Disaster response is still a human intensive activity. Humans need to assimilate data, assess it, and make decisions. Technology can assist in this but not replace humans. Also, humans can function and operate in environments devoid of electricity or that are too hot or too cold for technology to work well. Of course, humans tire and need food and water and rest and technology can help humans perform longer and better while processes can standardize responses and decisions, making it easier for humans under stress.

A lesson learned with respect to training and preparation is that there is too much technical effort needed to setup critical infrastructure. Disaster volunteers tend to be people who are there or are available and they may not have the technical skills needed to accomplish setting up critical infrastructure. This suggests the need for a small but dedicated and trained cadre of technical savvy volunteers. However, this also raises the issue of who will pay for them. This may not be a major issue in developed countries such as the United States where emergency response units are routinely trained and maintained but it is an issue in under developed countries that have a shortage of technically trained people to begin with.

Another key learning was the development of the interaction model between the various disaster response organizations. There are many of these organizations with very complex interrelationships that are not understood by many disaster responders. This is important knowledge that should be captured and taught to all responding to disasters.

THINGS THAT DIDN'T WORK SO WELL

Critical infrastructure risk analysis and management was not detailed enough. A system was provided that generated a critical infrastructure risk monitor. The system was generated using publicly available information sources but did not include input from the local utility companies. While interesting, the system would have failed to provide much insight or valuable data should a real disaster have occurred. The system illustrated the need for detailed critical infrastructure information that only the utility companies possess. This author was a Y2K manager for a large electric utility in the western United States, and as such, actually performed this analysis for the Y2K scenario for southern California and the countries of Ukraine and Armenia so was familiar with the interrelationships that exist in critical infrastructure and the data that is available. The lesson reaffirmed is that which was generated during Y2K, utility companies need to work together to understand critical infrastructure relationships and then be able to communicate this knowledge to emergency response decision makers. This also means that emergency response teams should include local utility experts and if possible generate procedures for issues in critical infrastructure. Training should also include these personnel.

Social network mapping could not keep up with the dynamic nature of the Strong Angel III participants. Hattotuwa (2006) and Mikawa (2006) wanted the ability to map and understand the dynamic communications that occurred during the demonstration. This is useful for a real emergency also as it helps emergency managers understand communication and knowledge flow paths and identify key individuals. The individuals attempting to map the SA3 social networks used pictures and paper to attempt to create a publicly available map of the social network. This proved very time consuming and the effort was abandoned after about day 4. While a good idea, this is difficult to implement. Current knowledge management research uses social network analysis, SNA, to study knowledge flows in an organization. Software tools exist to facilitate mapping. However, given the highly dynamic nature of an emergency response team it may not be feasible to even use these tools. Automated SNA is difficult in these situations as communications use multiple media. Automated tools are good for mapping social networks based on email, instant messages, or phone. These media have log records that can be used to generate SNA. However, SA3 showed that much key interaction occurred using face to face and informal communication media that can only be mapped by someone observing the interactions or by involving participants in lengthy interviews and survey responses. This is an area needing further research and may depend upon the creation of personal monitoring devices utilizing GPS and RFID (radio frequency identification) that can monitor all personal communications before SNA can be fully effective.

Determining the economic impact of SA3 was much more difficult than expected. The economic impact of having 800 participants spend a week in San Diego can be assessed fairly easily using models from analysis of the Super Bowl or World Series on their respective communities, but is this really the economic impact of SA3? Also, the value of material left behind for emergency response agencies can be readily determined using a inventory. However, given the short effective life cycles of technical equipment this value doesn't really reflect the economic impact of SA3 on the community. It was determined that using visitor impact and left behind materials does not reflect the real economic impact on the community. Reflection on SA3 shows that its real value is in the knowledge generated and disseminated to those directly or potentially involved in disaster response and/or disaster response planning. This is a very difficult value to capture. Jennex, Smolnik, and Croasdell (2007) explore how to assess success for knowledge management, KM. KM is about the capturing and reuse of knowledge in an organization or group. SA3 is a KM activity focused on the generation, capture, and dissemination of knowledge associated with disaster response. Jennex, Smolnik, and Croasdell (2007) found the definition of KM success to be:

> "KM success is a multidimensional concept. It is defined by capturing the right knowledge, getting the right knowledge to the right user, and using this knowledge to improve organizational and/or individual performance. KM success is measured using the dimensions of impact on business processes, strategy, leadership, efficiency and effectiveness of KM processes, efficiency and effectiveness of the KM system, organizational culture, and knowledge content."

The key to this definition are the areas of measurement as they suggest that the value of SA3 is in its impact on disaster response processes, strategy, leadership, disaster KM processes, organizational culture, and the knowledge generated itself. Assessment of these areas can be accomplished once the knowledge is recognized and used. However, this does create the issue of determining the impact of the knowledge use. Additionally, there is the complementary issue of determining the value if the knowledge is never used due to there not being a disaster (not likely). As stated earlier, the first two Strong Angels did result in changes in disaster response behavior, for SA3 to be assessed will require identifying critical areas where SA3 is expected to have an impact and then waiting until the knowledge created is used to make the expected changes in disaster response. It is expected that SA3 will have an impact on the continued development and adoption of the Sahana emergency management software. Once these changes are made to the Sahana software and other areas where knowledge from SA3 can be applied then the economic assessment of the value of SA3 can be accomplished.

Another area that did not work well is the improvement of the disaster organizational culture by improving communication and cooperation between civilian and military personnel. While much good was done and understanding generated through several very frank meetings between military and civilian personnel, an observation is that there are very severe and entrenched cultural differences between civilians, civilian NGOs, non-government organizations, and the military. Each group has its own culture and view of emergency response. Additionally, there are the usual veteran-rookie issues between those that have deployed in disaster response and those that have not. Finally, Hattotuwa (2006) and Mikawa (2006) observed that in many disaster or conflict reconstruction responses the majority of the affected population are women and children (approximately 70%) and that the large majority of SA3 participants were male raising concerns that there are potential cultural issues that are not being addressed. Unfortunately, while these cultural issues can be identified, correcting or changing them takes time. Many organizations find it impossible to change their organizational culture and so fail in their attempts at innovation or change. This is real danger for SA3, that without continued attention and effort, no real cultural changes will occur. This is an area needing considerable further research and effort that will need to come from all participating organizations and it is not certain this attention will be given.

CONCLUSIONS

SA3 is a unique disaster response laboratory and demonstration. Participants got an opportunity to observe their technologies and processes in a near real disaster scenario. This resulted in the discovery and potential resolution of issues that would surely cause these technologies and processes to fail in a real disaster deployment.

The potential value of the SA3 demonstration is in the lessons learned. This paper has addressed those lessons learned observed and considered by the author to be significant. The implementation of these lessons learned in the technologies and processes demonstrated at SA3 and in future developments will be the realization of this value. This is a conclusion that all exercise and training designers need to remember, that value is only realized in changed and improved behavior. The key lessons learned (and subsequent recommendations) are summarized as follows:

- Integration of disparate data and computing sources using SSE, Simple Sharing Extension, technology works. Recommendation: incorporate SSE into crisis response software tool sets and design systems to utilize SSE.
- Limitations on reliance on cell phone, land line, and Internet public infrastructure. Recommendation is that disaster response plans must take into account that these systems will be unavailable within about 9 hours of a disaster as their backup power supplies fail. Alternative communication methods such as satellite phones and ham radios (equipped with long term backup power supplies) should be considered.
- Use of GIS and remote sensor and communication networks to help decision makers gather and visualize critical data, information, and knowledge is very effective. Crisis/disaster response system designers need to incorporate GIS functions into these systems.
- Technology enables disaster response but disaster response is still a human intensive activity. Recommendation is to not purchase technology at the expense of training people. Communities need to have broad based participation in disaster response training as it is impossible to predict who will be left to respond after a disaster. Technology investments should continue, but only to support human actions.
- Setting up critical infrastructure requires too much technical skill that first responders may not have. Recommendation is for designers to continue to explore the development of low tech infrastructure components and for communities to increase training in this area.
- Establishment of communication protocols and models between disaster response organizations. Recommendation is for disaster response agencies to continue to work together to develop these protocols and for communities to work with agencies to learn how these protocols work.

This author was tasked with determining the value of SA3. The conclusion after reflecting on this task is that SA3 has significant value but that this value cannot be determined until knowledge created during SA3 is captured, disseminated, and used to improve disaster or conflict reconstruction response. This paper points out several major areas where this knowledge will have an impact and is an attempt to disseminate these findings to those involved in disaster response and planning. It is also recommended that the SA3 executive team complete its lesson learned final report and develop and include in that report specific measures in the identified areas so that the value of SA3 can be measured. This report will be posted on the SA3 web site but there should also be active attempts to disseminate the reports findings to those involved in disaster response and planning.

ACKNOWLEDGMENTS

I would like to thank the SA3 executive team for their hard work in making SA3 a reality. I would also like to thank all those participants who spent the week in San Diego making SA3 an exciting and engaging demonstration.

REFERENCES

1. Gheorghe, A.V., and Vamanu, D.V., (2001). Adapting to New Challenges: IDSS for Emergency Preparedness and Management. International Journal of Risk Assessment and Management, 2(3/4), 211-223.
2. Hattotuwa, S.Y., (2006). ICT for Peace Building: Strong Angel III, Final Observations. Retrieved from http://ict4peace.wordpress.com/2006/08/30/strong-angel-iii-final-observations on January 15, 20076.
3. Jennex, M.E., (2007). Modeling Emergency Response Systems. 40th Hawaii International Conference on System Sciences, HICSS40, IEEE Computer Society, January 2007.
4. Jennex, M.E. and Olfman, L., (2005). Assessing Knowledge Management Success. International Journal of Knowledge Management, 1(2), pp. 33-49.
5. Jennex, M.E., Smolnik, S., and Croasdell, D., (2007). Towards Defining Knowledge Management Success. 40th Hawaii International Conference on System Sciences, HICSS40, IEEE Computer Society, January 2007.

6. Mikawa, S., (2006). Strong Angel III: Integrated Disaster Response Demonstration. Retrieved March 15, 2007 from http://www.strongangel3.net/files/SAIII_working_report_20061106.pdf. This link can be accessed from http://www.strongangel3.net/ (see the SA III executive report link on the site home page).

7. Murphy, T. and Jennex, M.E., (2006). Knowledge Management and Hurricane Katrina Response. International Journal of Knowledge Management, 2(4), pp. 52-66.

8. Nisha de Silva, F., (2001). Providing Spatial Decision Support for Evacuation Planning: a Challenge in Integrating Technologies. Disaster Prevention and Management, 10(1), 11-20.

9. Sahana, (2006). Strong Angel III Update. Retrieved from http://www.linux.lk/~chamindra/docs/StrongAngel3-Sahana.pdf on January 20, 2007.

10. Strong Angel III (2006). Official Website. Available at http://www.strongangel3.net.

APPENDIX A – STRONG ANGEL III TASKS (STRONG ANGEL III, 2006)

1. Mapping and developing necessary relationships - determine the reasonable nodes of effective community management during a time of self-reliance; determine the power and communications support requirements at key sites for a period of disrupted infrastructure; and understand the development of a social-network contact list of key members and organizations within a typical community.
2. Deployment kits customized for task member responsibility - define current requirements for field-expedient habitability, power, communications, and safety.
3. Resurrection – figure out how to work and bring back civil coordination following loss of all infrastructure.
4. Creating the urgent work environment with a foundation of existing tools - deploy effective tools that allow responders to develop sector responsibilities quickly and effectively despite having unfamiliar colleagues present, and then develop processes appropriate to the response that incorporate all those who must take part in reconstruction.
5. Urgently reach out to the civilian-military network for continuing conversation - establish a rapid and effective link to each of the sector agencies likely to be useful in SA3. Link through as many modes as can be devised on open networks and confirm the communication took place with time-date-person stamps.
6. Hook up the city's key infrastructure with urgent power and communications. - establish a rapid and effective link to each of the local resources likely to be useful in SA3. Link through as many modes as can be devised and confirm the communication took place with time-date-person stamps.
7. Examine how work-efficiency metrics can be used within urgent environments - incorporate the research performed at Ohio State University in the evaluation of effort required to respond within a disaster.
8. Establish effective multi-modal trans-boundary communications - identify critical community nodes through other tasks, then determine by how many methods those nodes can be reached each day to exchange a piece of information .
9. Explore failure modes for power and communications - provide communications systems through non-grid power methods, improving resiliency and self-sufficiency.
10. Broad area WiFi cloud development - deploy sustainable high-performance wireless clouds to support a wide area network in austere conditions. Develop quantitative assessment of WiFi networks in austere and urban environments.
11. Network distribution and traffic modeling - measure the efficiency of wireless communications in remote, austere conditions and model traffic flows through a series of network traffic simulations.
12. Search and Rescue capabilities integration - integrate all sensor modalities for Search and Rescue operations into remote visualization, evaluations, and reporting.
13. Multi-modal sensor integration and visualization - broaden the scope of methods for information retrieval in order to capture the most comprehensive information possible from the field, and distribute that information to both the internal and external daily briefings.
14. Discovering rich messaging - enhance public safety and group situational awareness through rich text messaging and first response alerts.

15. Interoperability competition - enhance communication and coordination among agencies working in a common response using a broad range of communications devices and information sharing systems designed to interoperate gracefully.
16. Figure Eight Decision Assessments - develop an effective decision making and assessment methodology for decision makers and field teams.
17. Day Zero Cyber Threat Mitigation - provide Day Zero protection to local workstations and network by blocking unknown application execution and unknown files.
18. Inform everyone of everything important - enable multiple groups in SA3 to accomplish common goals of information sharing, planning, and coordination across multiple agencies and organizations.
19. Sustainable and independent power - generate sustainable power without dependence on the grid.
20. Map the provisioning of stadium power -provide a description of large-scale power provisioning for single and multiple locations in an affected region.
21. Sustainable and efficient lighting - use the most efficient, robust, and reliable lighting that can be supported by the limited power supply onsite.
22. Embracing diversity - demonstrate shared situational awareness in a heterogeneous collection of disaster management tools.
23. Civil-Military radio management by protocol - monitor and maintain radio management for five days, including call sign assignment, frequency allocation, back-up frequency allocation, and battery charge management.
24. VOIP management - maintain voice communications with core operations team during disaster response via WiFi on Windows Mobile Smartphone Voice-over-IP.
25. Rapid epidemiological assessment, analysis, and reporting - rapid collection and dissemination of medical reporting and GIS mapping via highly-mobile just-in-time wireless clouds.
26. HAM radio integration and management - establish Amateur Radio links to ten global HAM radio operator sites on four continents from the SA3 site.
27. Video-VOIP for interviews and secure reporting - use encrypted Video-VOIP to report from a remote site to a local Emergency Operations Center. Record and playback selected video content upon request for urgent relief operations and improved shared situational awareness.
28. Secure tele-microscopy - support knowledge sharing by establishing a secure means of transmitting patient information and microscopic specimens to improve medical services and emergency response.
29. Civil-Military response economics - determine the monetary value, economic impact, and cost of replication of SA3.
30. Propose reporting systems for wireless communications in quarantine zones - develop small-device reporting methods for information flow during quarantine.
31. Effective volunteer integration - work pre-event with all agencies that use volunteers and find an acceptable means for them to welcome and use walk-up volunteers; design, implement and deploy a method of registering all walk-up volunteers, including their skills, languages spoken and interests; match those volunteers with an appropriate agency that is willing to accept and integrate them into their volunteer community.
32. Network security with minimal compromise - establish mesh networks that demonstrate principals of inclusiveness while protecting the information shared.
33. Machine translation assessment trials - facilitate shared situational awareness and regional-based multi-lingual communications through real-time language translation.
34. Crisis Management Assessment and Facilitation - Using Swift-Trust principles, develop systems to help urgently form reliable and effective Virtual Teams during a crisis.
35. Simple Sharing feeds for information flow - Demonstrate a neutral, open source, platform-independent, standards-based data replication method capable of achieving bi-directional, asynchronous information flow. Test again.
36. Ethical oversight to ensure a consistent focus - Consult a professional ethics advisor on-site for evaluation of the SA3.
37. Comprehensive remote risk analysis - Analyze the linkages, overlaps, and cascade effect for risk factors and vulnerabilities within San Diego County to prepare for "mitigation during failure".
38. Team Tracking - Maintain GPS tracker identification of SA3 core operations participants. Map GIS locations with video-VOIP capabilities.
39. Situational Awareness and Visualization - Maintain a visual GIS understanding of the demonstration area.
40. GIS medical resource reporting - Integrate GIS tools with data monitoring and alert programs to support comprehensive medical resource reporting.

41. Fust Fragility Indicators - Social Vulnerability Index - Using a social vulnerability index, propose assessment methods and tools to address those indicators.
42. Ghani-Lockhart Framework and Standards for Failed State Reconstruction - Use the Ghani-Lockhart Framework to map the existing resources and assets, design frameworks for use of assets, sequencing and prioritization of tasks and assignment of responsibilities, design a process to strengthen relationships and accountabilities between communities and those in authority; advise communicators on appropriate messages to enhance citizen trust; and advise on the design of a process for orderly leadership including succession in the event of further disruption.
43. MOEs and analysis for each of the tasks - assess completion of tasks after SA3.
44. Community involvement – make SA3 inclusive and open for community acceptance.
45. The public face of Strong Angel III - optimize public SA3 informatics 24x7 for the duration, including knowledge networking, mashups, information mobility, and trans-appliance interoperability with a public able to interact with SA3.
46. Complex System Monitoring - build a system level model to understand and evaluate the SA3 challenges and objectives.
47. Remote Medical Reachback - demonstrate civil-military support from SA3 to humanitarian operations in Southeast Asia by linking information flow aboard the USNS MERCY to SA3.
48. Virtual Team Management - evaluate 3 systems capable of facilitating user discovery, virtual teaming, presence, multi-modal communications, and information sharing among mobile users working over intermittent local area networks.
49. Experiment Emergency Operation Plan - implement a procedurally-based effort at emergency response.