Abstract

To make sense of the situation requires that we are able to quickly bring to bear (1) information from many sources, including new sources, (2) a wide variety of expertise and perspectives (to understand, filter, and integrate the available information and knowledge), and (3) synchronized effects over multiple domains\textsuperscript{1}. While organizations have been working towards changing attitudes, behaviors, and processes, InfoValley has been actively engaged in the research and development, greatly enhancing the information-sharing and team collaboration capabilities for network centric operations, to support (1) and (2), and making them available to those who are seeking new technologies with the greatest potential to provide dramatic increases in warfighting command and control capability, for experimentation at their BattleLabs.

This paper describes key aspects of research and development funded by the Missile Defense Agency, Office of Naval Research and the Air Force Research Lab to develop the technology. Application access, information exchange, annotated discussions and collaboration with networked staff are some of the capabilities provided to the commanders while empowering them to use their voice and laser pointers for interaction with situational display. Cognitively augmented interfaces and interactions enable networked team to combine available information in new ways and discuss to deal with uncertainty and unfamiliarity. Interactive InfoWall\textsuperscript{TM} technology works with existing applications without creating new burden on them.

Introduction

C2 community appears to be agile, and ready and willing to adopt Network Centric Enterprise Solutions to reap the InfoAge benefits. It is encouraging for researchers to note that C2 Policy is taking up the challenges of “\textit{Shaping behavior}” by compressing decision loops, \textit{collaboration across new levels, and distributed yet interdependent}\textsuperscript{2} among others to get C2 right for the 21\textsuperscript{st} century.

\textsuperscript{1} Dr. Albert and Dr. Hayes: Power to the Edge, page 74
\textsuperscript{2} Mr. Don Diggs, Director C2 Policy, OASD (NII), Plenary Address, 10\textsuperscript{th} ICCRTS 2005.
Today’s military is in the midst of Information Age transformation moving towards achieving critical speed and access in battlefield awareness and decision making for effective planning and execution of its missions. Following excerpts from Network Centric Warfare\(^3\) and Power to the Edge\(^4\) provide the context and relevance of the work presented in this paper.

The very essence of command and control (C2) lies in the ability of a commander, at any level, to make the most out of the situation. In order to do so, commanders come equipped with the education, training, and experience that they bring to the situation, the assets and supplies they are assigned, and with access to information and decision support.

The output of a C2 process consists of the decisions a commander makes, the degree to which the commander’s perception of the situation and the commander’s intent is shared among the forces, and manifestations of command decisions (e.g., plans, orders, and information). In the final analysis, none of these C2 products will make any difference unless they are translated into effective actions in the battlespace\(^5\).

Interactive technology development at InfoValley leverages the strengths of C2 personnel, focuses on their cognitive abilities, designs and develops capabilities for information sharing and collaboration, and empowers them to harvest the benefits offered by the NCW. During the development attention is given to usability of NCW resources effectively, allowing the users to focus on their specific tasks to accomplish the mission.

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This simply cannot be done without changing attitudes, behaviors, and processes, as well as greatly enhancing the information-related capabilities made available to those throughout an organization\(^6\).

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\(^3\) David S. Alberts, John J. Garstka, Frederick P. Stein: Newwork Centric Warfare, 2\(^{nd}\) Edition, 2000, CCRP Publication

\(^4\) David Alberts and Richard Hayes, Power to the Edge, 2003, CCRP Publication

\(^5\) Page 157 - Newwork Centric Warfare

\(^6\) Page 74 - Power to the Edge
networked staff are some of the capabilities provided to the commanders while empowering them to use their voice and laser pointers for interaction with situational display. Cognitively augmented interfaces and interactions enable networked team to combine available information in new ways and discuss to deal with uncertainty and unfamiliarity. Interactive InfoWall™ technology works with existing applications without creating new burden on them.

Interactive InfoWall™ is developed as an enabling technology for multiple users to simultaneously interact with a Multipanel (contiguous) display wall, using Multimodal (voice commands, laser pointers, keyboards and mice) interface, and working with Multimedia (video, audio, graphics and text) information as a team to accomplish a common goal in a networked computing environment. It enables users to access their applications, display using a window on the wall and interact with them. Team leaders and commanders can directly interact with applications, discuss or clarify, while looking at the displayed information and becoming aware of the situation during the decision making process. In other words, it has the potential to encourage interactions that can take place between and among the entities in a distributed and collaborative C2.

**Background**

In the nineties AFRL recognized the need to display and manipulate real-time multimedia data in a battlefield operations control center as critical to the Joint Commander directing air, land, naval and space assets. They developed Interactive DataWall for solving the information management problems facing the 21st century military commander [1]. InfoValley received an SBIR Phase I in 1999 and II in 2000 from AFRL for Developing Multiple Simultaneous User Interface Technology (MSUIT) for C4I Systems. Research and development effort resulted in innovative interaction technology that has been patented. Technology for coordinated laser pointers and voice commands for multiple users to interact simultaneously with a display wall was developed.

In most problem solving scenarios, people generally spread out the relevant pieces of information and visually observe them to perceive interrelationships. Observation of information from the task environment by all possible means is the first step in the OODA loop. Each team member has some task-related information to share with the team, and some information must be presented simultaneously to all of the participants. To facilitate this capability, InfoValley proposed to investigate and develop Team Computer Interaction (TCI) Technology leveraging its Multiple Simultaneous User Interface Technologies (MSUIT). MDA funded SBIR Phase I and II to develop TCI Technology for BMC2.

Knowledge Wall developed at SSC San Diego uses Knowledge Web (multiple summary pages authored by different people using templates and relies on common “business” processes across command) [7] and [8]. The goals for the Knowledge Wall were to support shared situation awareness in distributed / asynchronous environment, facilitate group interaction / collaboration and increase the “speed of command” / efficiency. The results were amazing and it was reported that there was a 600% increase in information exchange efficiency. InfoValley believes that interactions with the displayed information would produce more effective results. However, the company does not have access to experimentation data as of now and hope to get feedback from the user community soon.
Interactive InfoWall™ Capabilities and Architecture

Organizations are changing to take advantage of ubiquitous networked computing to achieve better performance. Connected teams are working together and hierarchies are disappearing. Every member of the team needs access to the information and rest of the team to share and collaborate. Interactive InfoWall™ has been developed to display several applications on a display wall and facilitate interactions with these applications using laser pointer and voice commands. These untethered interactions support users to do things in a more natural way than using tethered interactions.

Using the capabilities, users can use their laser pointers and/or voice commands to interact with the displayed applications. They can sketch or draw to relate various information objects displayed on the wall and discuss to clarify, if needed. This information can be shared with remotely located team members. Training required to use the technology is less than ten minutes. Writing with the light and speaking to the computer makes the interactions simple and productive.

Prototype system has been designed for simple integration into existing networked computing environments. All it needs is a node on the network to get connected and communicate with the rest of the systems. Following is an example scenario where InfoValley’s untethered interaction technology is made available to the networked team.
Technology Demonstration and Response

Demonstrations of technology started in 2001 to various military personnel at every stage of the development. These demonstrations took place at the company’s InfoLab and various outside locations including trade shows in Hampton VA, Washington DC and Huntsville AL; and at military facilities including SBBL (Sea Based Battle Lab) on USS Coronado, GMD (Ground Based Missile Systems) at Huntsville and DISA (Defense Information Systems Agency) in Fairfax VA. InfoValley is pleased to report that there is a tremendous interest and almost everyone understands the benefits of this new technology and wants to use it in their work. Now the efforts are underway to make the capability available to everyone who wants to use it.

InfoValley had the opportunity to demonstrate and discuss with several DoD Prime contractors including several divisions of SAIC (Science Applications International Corporation) Valley Forge PA, Hampton VA and McClean VA; Raytheon in Reston VA, Northrop Grumman in Reston VA and Lockheed Martin in Colorado Springs. All of them showed interest and are checking with their IRAD (Independent Research and Development) teams to assess the technology. Company is exploring experimentation opportunities with NPS and JHU/PPL. Initial response is encouraging.

Transition for Experimentation

Office Naval Research and Command Third Fleet wanted to use InfoValley technology and provided funding for the task of transitioning new technology from a research lab into a training facility for experimentation. This effort was to investigate technical integration issues for incorporating InfoValley’s innovative interaction technology called Interactive InfoWall™, design, develop and deliver Interactive CORTEX solution for a flexible and adaptable collaborative environment. Steps were taken to incubate Interactive InfoWall™ technology and rapidly develop a working prototype for fleet experimentation at the CORTEX Space. The resulting system facilitates two commanders to simultaneously interact with the display wall while working with multiple staff members at a single location by sharing their multimedia information on a large display wall, each staff member using a window on the wall.

Interactive CORTEX is a tool for supporting multidisciplinary experts who must collaborate in order to solve complex problems. It is a practical and enabling tool for experimentation at a command center. Participants can use the display wall to present and share their applications, and the commanders can interact with these applications during the analysis of current situation and decision making process as well as planning sessions.

Current Status

The development of TCI technology is in the final stage of Phase II and InfoValley is actively seeking sources of support for Phase III commercialization. Several interested DoD organizations are studying the capabilities for possible use.
Conclusion

InfoValley is pleased to note that there is a great deal of synergy in its work and C2 community. The company is pleasantly surprised to observe that DoD is not just looking for new ideas and usable technologies but they are ready for using as soon as they find useful ones, and they are doing everything in their power to cut the bureaucracy in the acquisition process.

References


