Working Together Virtually:
The Care and Feeding of Global Virtual Teams

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Abstract

Since the demise of the Cold War, the U.S. and other countries have increased their involvement in non-warfighting conflicts. Non-warfighting conflicts include complex contingencies, peacekeeping and humanitarian assistance operations and other crises with security, political, economic, environmental and humanitarian dimensions. This "new world order," combined with advances in information technologies, dramatically has increased the creation and significance of virtual teams – teams of people working across geographical, cultural, organizational and time zone boundaries. This paper will present current research in the area of virtual teams, focusing on how to improve global virtual teams' effectiveness. In addition, the paper will highlight the author's on-going research in how virtual teams develop shared situational awareness.

1. Introduction

Virtual teams, small groups of geographically separated people working together, are an integral part of today's society. In the commercial world, virtual teams routinely provide nearly continuous coverage on projects, most notably in automobile and airplane design and development. The U.S. and its allies work together in virtual teams to put out small "fires" around the world. Such multi-national "fires" are known by many monikers, including small-scale operations, Operations Other Than War (OOTW), or complex emergencies, depending on the background and culture of the organizations involved. The U.S. military is particularly interested in the successful implementation of virtual teams to support its participation in an increasing number of joint and coalition operations, to provide alternatives for a downsized force and to serve as a testbed for exploring alternative techniques for command and control (C2), particularly in the area of network-centric warfare.

This rapid increase in cross-cultural, geographically dispersed teams results not only from a new global economy and changing political-military situations, but also from the rapid and substantial growth of information and communication technologies. Traditional communication tools -- telephone, fax and traditional postal correspondence – retain their usefulness in certain applications; even so, they have been eclipsed by today's networked information technologies, including video teleconferencing (VTC), text chat and application sharing, to web sites, packaged groupware programs and information downloaded to wireless devices.

Virtual teams offer many benefits over collocated teams. Because members of a virtual team can work from anywhere at anytime, the team's reach and redundancy are expanded [Klein, 2000].

Teams grow "richer" because they can be assembled based on the respective team members' skills as opposed to their physical location. Virtual teams also reduce travel expenses and other costs associated with face-to-face meetings. On the flip side, virtual teams have some serious drawbacks. Studies indicate that virtual teams have less overlap in their representation of the (shared) task and are less cohesive than co-located teams [Hinds, 1999]. In addition, virtual team members often have cultural differences and their lack of a shared history can negatively affect the team's ability to develop a sense of trust, impacting the team's ability to accomplish its mission [Jarvenpaa et al., 1998].

Despite the drawbacks, in practical terms, virtual teams are all but inescapable today. To live and work in today's world is to face the certainty of working, sooner or later, as a member of a virtual team. This modern-day reality demands that we evaluate and adapt traditional ways of working together, focusing on new processes and techniques to overcome known obstacles.

This paper will review the various types of virtual teams, discuss the significant obstacles facing global virtual teams and share lessons learned in how to best address these obstacles. It also will address current research into how virtual teams build shared situational awareness (SSA) and detail an experiment that uses games to explore the effects different modes of communication and visualizations have on virtual teams' SSA.

2. **Definitions: Global Virtual Teams and Shared Situational Awareness (SSA)**

"Virtual teams" are groups of distributed people working together to achieve a common goal or solve a shared problem through the use of computer-mediated communication technologies, linking them across time, space and cultural barriers.

Virtual teams come in many different shapes and styles with team members from the:

1. Same organization; same department;
2. Same organization; different departments;
3. Different organizations; similar cultures (e.g., US military – Joint Operations);
4. Different organizations; different cultures (e.g., US government agencies supporting Presidential Decision Directive (PDD 56), and
5. Different organizations; different cultures; different nationalities (e.g., Coalition Operations).

We will refer to the virtual team outlined in item 5, above, as a "global virtual team," otherwise defined as "a temporary, culturally diverse, geographically dispersed, electronically communicating work group" (Figure 1) [Jarvenpaa et al., 1998] whose members may have never worked together before and who may not expect to work together again as a group" [Jarvenpaa et al., 1998; Lipnack and Stamps, 1997]. A multi-national, political-military coalition would be one example of a global virtual team.

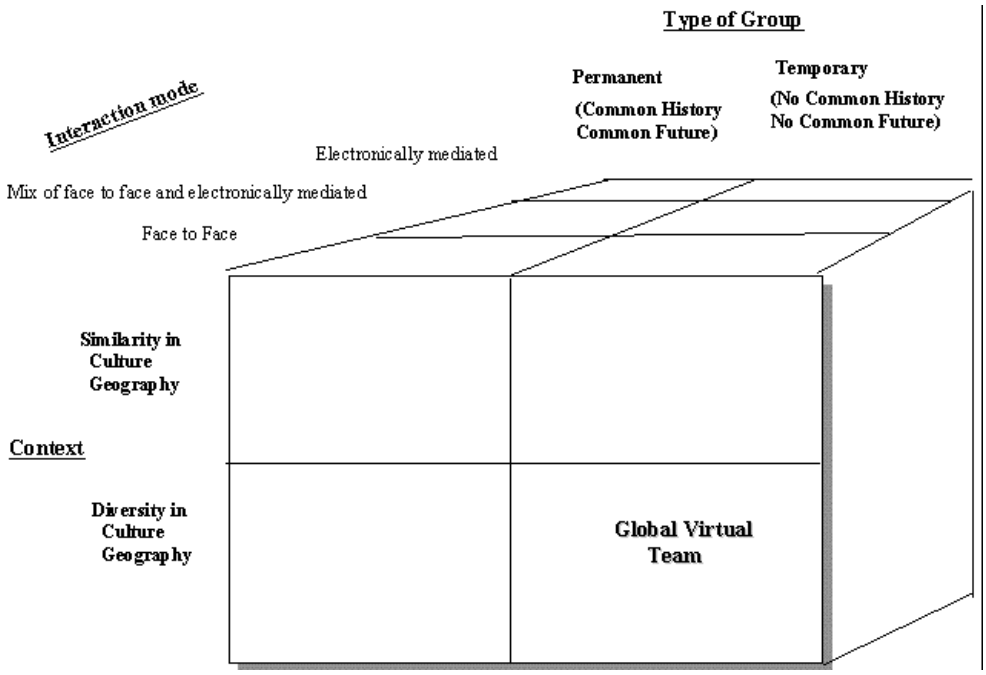

Figure 1. Definition: Global Virtual Team [Jarvenpaa et al., 1998]

At each level of separation (e.g., differences in geography, histories, culture, etc.), team members face greater challenges attaining – and maintaining - team cohesiveness. Teams that share more collective experiences/common ground are more likely to achieve more cohesive team mental models [Klein, 2000]. Team literature suggests that teams are more likely to succeed in their missions when team members have similar mental models or SSA. SSA constitute "the degree of overlap in individual team members' situational awareness (SA) at any given point in time," [Loughran, 2000] wherein SA is "the perception of the elements in the environment within a volume of space and time, the comprehension of their meaning, the projection of their status into the near future and the prediction of how various actions will affect the fulfillment of one's goals." [Endsley, 1995]. Put more simply, SA involves "knowing what's going on so you can figure out what to do." [McGuiness, 1995]

We will consider obstacles faced by global virtual teams, examine ways to overcome those obstacles and discuss how teams build SSA.

3. **Global Virtual Team Obstacles**

Virtual team research and case studies indicate that it is more difficult for virtual teams to achieve success than teams that meet face-to-face. The more common problems affecting global virtual teams are discussed below.

3.1 ***Cultural Differences***

Perhaps the greatest obstacle facing virtual teams is an inadequate understanding of team members' cultural differences; this is an extreme problem for global virtual teams whose

members hail from different parts of the world, with different backgrounds, histories and cultures.

Caroline Ziemke, of the Institute for Defense Analyses (a U.S. federally-funded research and development center), has researched countries' cultural differences extensively and recently completed a yet-to-be-published book profiling the "personalities" of countries. Starting with Isabel Myers and Katharine Briggs' Myers Briggs Type Indicator (MBTI) personality test, Ziemke modified the personality categories so that she might apply them to nations rather than individuals. She has categorized a number of countries in great detail by type, including Israel, North Korea and India after exhaustively reviewing their respective histories, "creation myths," and cultures. This approach may have particular relevance in understanding the differences arising in the multi-national cultures of global virtual teams.

The MBTI also has been used to compare and contrast various U.S. government agencies. Two anonymous authors illustrated the cultural differences between the Department of Defense (military) and the Department of State (diplomacy) in a paper coined "*Defense is from Mars, State is from Venus*," while illustrating how the two Departments' MBTI personality differences impacts their respective cultural differences. Defense Department personnel are predominantly practical, factual, step-by-step and goal-oriented (ISTJs in the Myers-Briggs lexicon[1]). State Department personnel, on the other hand, typically are more intuitive, theoretical and future oriented (in short, Myers-Briggs INTJs). Such personality differences hinder the ability of personnel from the two departments to work together effectively even as the current state of the world demands that they do work together effectively by "develop(ing) an understanding and appreciation for the other that includes their respective approaches to problem solving, capabilities and limitations, organizational structure, training programs and the external considerations that impact on each." [Anonymous, year unknown] The *Defense is from Mars* paper illustrates how an organization's culture is affected by the personality make-up of the majority of its individual members.

Individualism-collectivism is a major dimension of nationalistic cultural variability [Hofstede, 1980]. The degree to which a culture is individualistic or collectivistic effect how team members share information amongst themselves. Individualistic cultures favor the needs and values of individual, while collectivistic societies favors goals and needs of the group. [Jarvenpaa, 1998] The research indicates that this cultural dimension affects teams' expectations about how rewards and praise are handled. Members from collective cultures may prefer team-based rewards to individual recognition [Duarte et al., 1999].

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[1] **E-I Extroversion vs. Introversion:** **E** 's: are interested in people and events, external, blurt out thoughts, interactive, do-think-do. **I** 's: internal, reflection, think-do-think, depth, concentration, ideas. **N-S Intuition vs. Sensation; N** 's: are innovative, theoretical; brainstorm alternatives, consider the future, hunches, insights, look at trends and patterns S 's: practical, factual, resist radical approaches, step-by-step, the five senses, implement ideas, determine realistic constraints. **T-F Thinking vs. Feeling;** T 's: justice, logical, critical, reasonable, firm but fair, principles, objective. **F** 's: heart, subjective, mercy, empathy, compassion, mercy, harmony, compliment, empathy. **J-P Judging vs. Perceiving;** J 's: regulate, control, goal-oriented, decisive, organized. **P** 's: spontaneous, flow, adapt, tentative, open, flexible, let life happen. Sandra Krebs Hirsh and Jean M. Kusnsnerow, *Introduction to Type in Organizations- Individual Interpretive Guide*, (Palo Alto: Consulting Psychologists Press, 1990), p. 14

The challenge remains: to find ways in which culturally different groups can understand each other better by optimizing the use of technologies and techniques both in training programs and real-world operations. (See Section 4.)

3.2 ***Lack of a Shared Goal***

Most team literature stresses that a clear definition of the team's goal or mission is a critical element for any successful team, global or otherwise. The higher the degree of agreement among team members, the greater the likelihood that they share a common definition of the mission. Stanford's Pamela Hinds' has established in her research that distributed workers experience less overlap in their representation of the (shared) task and thus are less cohesive than collocated workers.

It is difficult for global virtual teams to develop common goals. . Most often, team members bring different goals and agendas to their team's efforts from the start. Reasons for participating may vary widely – some members may be supporting personal or national political agendas, while others participate for humanitarian reasons, or merely because it is a job they are being paid to do. The lack of a shared goal might also be the result of a communication problem. In Hinds' study, team members often were unaware they had different situational perspectives from other members.

Social psychologist Morton Deutch directly linked a team's success to whether or not team members had cooperative goals, [Lipnack and Stamps, 1997] He outlined three specific types of goals:

> Cooperative: People have compatible goals and realize "when you succeed, I succeed";
> Independent: Goals are perceived as being separate with no linkage between individuals' successes, and
> Competitive: People have incompatible goals and realize "if you win, I will lose."

Success in global virtual teams relies not only on having cooperative goals, but also sharing an understanding for what those goals are. Robert E. Neilson, a professor at National Defense University and author of "Collaboration Technologies & Organizational Learning" cites the biggest obstacle to the successful implementation of collaborative projects is the lack of incentive for sharing intellectual capital across boundaries. He feels most virtual team participants are listening to the same radio station, WIIFM, "What's In It For Me." For any type of virtual team to achieve success, there must be "something in it" for each and every team member, whether the rewards are individual or collective in nature.

3.3 ***Communication Problems***

Virtual teams experience communication failures face-to-face teams routinely avoid, in large part because virtual teams lack the visual and auditory cues that can be transmitted by face-to-face teams. Body language and audible voice intonations play an important role in human beings' situation awareness. While some physical cues can be conveyed via video teleconferencing

(VTC), slow graphical refresh rates and "face shot" limitations of perspective hinder proper and complete interpretation of critical cues, including body positioning.

Distributed team members also suffer from communication problems because they fail to communicate such contextual information as workload, personal perspectives, outside factors affecting their tasks and so forth. For example, different people interpret other team members' silences very differently. When one member sends another a question and receives no response, that originator might interpret silence as agreement, lack of interest or something else entirely. In fact, the silence might reflect the fact that the recipient of the question is out of town or did not receive the message due to technical difficulties.

Even as communications obstacles lead to differing perspectives, virtual team members often are completely unaware of the manner in which these conflicting perspectives arise. Pamela Hinds' study showed that overall conflict was lower in distributed groups than collocated ones but Hinds concluded that distributed groups often don't realize they have differences. Collocated groups, on the other hand, more easily identify differences and argue them out to achieve shared conclusions.

The uneven distribution of information is yet another communication problem commonly experienced by virtual teams. Team members might share information with only certain members of the team and then forget that they have failed to share such information team-wide. It is difficult enough for team members to monitor their own personal information picture and "reception," let alone that of their fellow team members – and their role in coordinating the picture. Tools and techniques have been developed to address this type of problem. (See Visualization Tools in Section 4.1.)

3.4 *Lack of Trust*

It takes time for teams to build trust. Furthermore, studies show that people build trust faster in face-to-face environments than in distributed situations. This is in large part because team members build trust by identifying with each other. Identifying with each other is far more difficult for distributed team members joining global virtual teams from vastly different cultures. Other factors in the building of trust include: performing competently, displaying concern for the well being of others and acting with integrity [Duarte and Snyder, 1999]. Collocated teams that work together over long periods generally build trust. Even when something damages that trust, it can be repaired. Virtual teams, particularly global virtual teams, do not have that luxury. If a team member or team leader diminishes trust early on in a project, chances are trust will never be re-established.

A team member's efforts to maintain or enhance her reputation can play a role in building trust. This may provide the impetus members need to be "team" players. However, in global teams, where professional networks have less effect, members may be less likely to act a certain way to protect their reputation. (See Reputation Managers in Section 4.1.)

4. **Overcoming Obstacles**

Global virtual teams are more susceptible to the obstacles facing virtual teams because of cultural, communication and trust issues, to name a few. Even so, applying the "Three Ts" increases the team's likelihood of success: technology, training and techniques.

4.1 ***Technologies***

Advances in information and collaboration technologies have facilitated the increase in virtual teams. Twenty years ago, virtual teams may have existed, but the lack of communication and collaboration tools would have made participation on such teams a frustrating and tedious experience. The telephone would have linked the virtual team of 20 years ago, allowing members to talk and strategize about their shared goals. To collaboratively develop a product, however, team members would have been forced to use the regular postal service to send documents or write comments they might later review over the phone. This process was excessively time consuming and inefficient.

Collaboration Tools

Phones, and to a lesser extent fax machines, are still used today, but there are a variety of low-cost and readily available tools that have greatly enhanced the collaboration of global virtual teams. These collaboration tools are either – synchronous (real-time) or asynchronous (not real-time). Microsoft's NetMeeting is one of the more popular synchronous collaboration tools[2]. It allows groups of up to 8 people to share documents or applications, write or draw on a shared white board, and type text chat to the whole group or only to one person. NetMeeting's latest version 3.01 also facilitates video teleconferencing (VTC) and/or the dissemination of audio on a 1-to-1 basis. Future NetMeeting releases will support many-to-many video and audio conferencing for small work groups. One of NetMeeting's most appealing features is its price: it is free to those running the Microsoft Windows operating system on their computers.

Asynchronous tools support non real-time collaboration. E-mail is the most popular asynchronous collaboration tool, supporting the dissemination of timely messages as well as attachments to allow team members to review documents such as plans schedules or timelines. Sharing relevant project data helps the team build a common picture.

Web Sites for Information-Sharing

Another way to build a shared information picture is to create a shared web site for the global virtual team's project. Such web sites can include functionalities allowing team members to post relevant information and to encourage team members to share more personal information about themselves. Research indicates that when team members share personal information, they increase their trust in each other. ReliefWeb is a popular web site used to share global information about international disasters, http://www.reliefweb.int/w/rwb.nsf/. A project of the

[2] A web site called NetMeeting Zone offers information on frequently asked questions about NetMeeting. You can find this FAQ at: http://www.netmeeting-zone.com

United Nations Office for the Coordination of Humanitarian Affairs (OCHA), it primarily provides an information source and has not been designed specifically for teams.

Portals

Some web sites are developed specifically for a particular team or project. A fairly new web site concept entails fostering customized information sites that focus on specific communities. Such information "portals" constitute low-cost, ubiquitous environments for combining content, collaboration tools and occasionally training curricula. Web portals provide a single point of access to information from a number of different web sites while offering information filters that help collect information resources for a specific topic or project and provide ubiquitous access to that information. Users in turn can customize such portals to generate the information is most relevant to their particular needs. My Yahoo, http://my.yahoo.com, and My Netscape, http://my.netscape.com are among the more popular general-purpose commercial web portals.

Although portals can be developed for a variety of domains, one particularly relevant domain would be a portal designed for crisis planning and response (CPR) combining domain-specific information related to complex contingency operations and other crises, support collaboration among multiple distributed users, provide just-in-time training, and support passive, active and experiential education modes. Such a portal would incorporate academic resources from various military and non-military sources, create a knowledge base for the educated construction of virtual teams and act as an information-sharing conduit to open the doors of communication among civilian and military agencies and the international community. It also could be used to share lessons learned, a powerful tool for virtual teams. Seeing what other teams with similar goals have achieved provides a richer mental model of what it means to be a team member.

Reputation Managers

Reputation Manager software is a technology application that can facilitate the building and establishing of trust in global virtual teams. Popular on-line auction site Ebay, http://www.ebay.com, uses reputation managers to ensure its on-line auction buyers and sellers play fairly. Ebay's "Feedback Forum" allows buyers and sellers to rate the quality of each individual transaction undertaken with other Ebay buyers and sellers. Ebay investigates individuals receiving a given number of negative comments; if Ebay finds the complaints to be legitimate, it will revoke the user's privileges.

Epinions, http://www.epinions.com, also uses reputation managers to collect user reviews and ratings for a wide range of products and services. Would be consumers can visit the Epinions site to determine how popular or effective given products or services may be before making a purchase. Reputation managers may prove difficult to implement across global virtual teams given the difficulty team members may have posting honest opinions of people they may have to work with again. Nevertheless, reputation managers do have their appeal in building a reputation history and as a trust-building tool. Reputations play an important role in the decisions we make. We often rely on friends' and co-workers' opinions of others when deciding how to work with them.

Visualization tools

Distributed teams find it very difficult to convey complex concepts. Shared visualizations – and shared annotations - are a way such concepts can be disseminated. Using whiteboard technologies, visualizations can be shared synchronously, allowing users to add their comments as annotations. In addition, most office product software allows team members to make their own changes in different colors or add the electronic equivalent of "post-its."

A team may create a visualization that encompasses all project information to display to various team members how much of the project info landscape had been accessed (viewed, read) by other members. This would help team members develop pictures of other team member's mental models.

Group Decision Support Systems

In addition to collaboration tools, group decision support systems (GDSS) offer great benefits to distributed teams. Virtual team members are repeatedly called upon to contribute to group decisions. GDSS tools have been designed to facilitate the process of developing a shared understanding of the issues that face the team and then providing tools for acting on decisions made by the team.

Although technology is an enabler – it also may lead to virtual team failures. It is important to remember that people are more critical to a virtual team's success than technology. In "The Luck and Loneliness of the Long-Distance Worker," [Salisbury, 1999] the author writes, "the quality of the equipment is important … but it is equally important that the individuals involved realize that they must communicate clearly and explicitly with managers and fellow workers." These barriers must be addressed through training and applying techniques to foster the team.

4.2 ***Training***

Training is an important component for the successful implementation of virtual teams. Klein and Associates' Gary Klein contends that practicing or "over learning" individual skills will reduce team performance. He hypothesizes that once we know how to do our individual part well, it is hard to adapt to teamwork. To succeed as a team we need to train as a team. Training team members to function as a team is beneficial (even if the team makeup may not be exactly the same), because it gives them opportunities to be introduced to different backgrounds, cultures, etc. while learning more about their respective roles as members of the virtual team.

Training as a team generally is viewed as being difficult, time-consuming and expensive. Making training and rehearsal systems easier to use and less expensive, very likely will increase the frequency with which virtual teams will practice teamwork. In Joint/coalition operation environments, teamwork practices are infrequent due to high costs, planning requirements and travel expenses. In addition, the people comprising actual teams typically are not well represented. These operations involve non-governmental organizations and international organizations and these team members often do not participate because they lack the time and

financial resources. If they could participate virtually, from their home stations, the likelihood that they could participate would increase.

The training of virtual teams can be undertaken in either a traditional face-to-face manner (which many virtual team advocates recommend – at least initially), or via the same tools and environment that the virtual team will encounter in working together. In 1999, ThoughtLink, Inc., of Vienna, Virginia, evaluated the effectiveness of using a low-cost, web-based environment that would allow distributed team members to collaboratively train together. This U.S. Department of Defense-sponsored research focused on U.S. government inter-agency personnel planning for a hypothetical complex contingency. The training audience included 21 people from 7 different U.S. government agencies. In the real world, the participants would work as members of a virtual team when required to develop this plan.

A portion of the training audience used a web-based template ThoughtLink developed for the experiment. The template, called the Distributed Interactive Collaboration Environment (DICE), was a web site with training resources and integrated collaboration tools. ThoughtLink evaluated the effectiveness of this new training environment by dividing the training audience into two groups: one group trained face-to-face in a traditional seminar wargaming event, the second group trained using DICE. The results showed that DICE was equally effective as a learning environment as face-to-face training, though some obstacles were identified. For instance, the DICE-trained audience was less satisfied with its experience and its members required more facilitation than the face-to-face group to remain on track. All results from this experiment are available in an annotated briefing on ThoughtLink's web site at http://www.thoughtlink.com/publications/TLI-DICE99Abstract.htm. It should be noted that DICE is not limited to training applications. It also can provide an operational environment for planning and overall information sharing.

Virtual teams must be well versed in the domain in which they will be working, but the fact that they will be working virtually requires special training. This includes training to provide an understanding of the technology they will be using as well as group decision making and negotiation skills. In addition, members of a virtual team should be trained to work in an information-sharing environment. This is difficult because it requires that team members accept the cultural changes inherent in distributed teams (e.g., moving towards a flatter, less hierarchical organization in terms of information sharing and responsibility.)

4.3 **Techniques**

Technology and training alone cannot ensure an effective virtual team – or an effective non-virtual team for that matter. By successfully implementing time-proven techniques, a virtual team's ability to achieve its objective can be improved significantly. Some such techniques can be gleaned from the research community, such as Stanford's Pamela Hinds' study on how distance affects the development of shared mental models among distributed workers.[Hinds, 1999]. In the commercial sector, literally hundreds of organizations have used virtual teams and developed techniques for their success. Some of the more relevant lessons-learned for global virtual teams are shared below.

Developing a Common Goal

Since the lack of a shared goal is one of the most daunting obstacles facing virtual teams, it's important that teams clearly communicate their goals, define a team charter and work plan to avoid potential pitfalls down the road. If team members disagree on shared goals they can attempt to air and reconcile their differences.

Dr. Lane Hurley of the Federal Executive Institute in Charlottesville, VA, provides training for the U.S. government's Senior Executive Service and other high-level government officials. He suggests that the development of team charters and work plans early on in a team's lifecycle is critical to the success of virtual teams.. Dr. Hurley defines the team charter as a written document detailing the team's objective, the process by which it will accomplish the objective and who will be accountable for what efforts. The work plan spells out what work will be done and by whom. The work plan can represent variable lengths of time depending on the team and its objectives. Hurley also suggests that each team member describe his or her own vision of the future and how the team's goals can be implemented. Differences among visions will identify potential trouble spots. Once the team charter has been written, a purpose statement, a problem statement and a process map are drafted. When these are checked periodically, the team will be more likely to stay on track, share the same SSA and experience fewer conflicts overall.

Meeting Face-to-Face

Most virtual team experts recommend an initial meeting (if possible) to allow team members to meet socialize and thereby establish a better understanding and trust of one another. The ability to meet face-to-face periodically throughout a given project will further solidify ties and relationships among team members.

Sharing Contextual Information

Creating a persistent, shared space for the team (e.g., a web site) is one means of increasing team-wide cohesion and insuring that contextual information is being shared. This shared space can capture information important to the team, including project deadlines, team member data, personal bios and contact information. The web site can also have separate areas where individual team members can manage their own information or brainstorm with other team members.

Appoint a Team Facilitator

A team leader/facilitator can help overcome some communication problems facing virtual teams. The facilitator oversees team members' virtual interactions while watching for signs of coordination and communication failures. Since virtual team participation may not be the primary obligation of any one team member, most often need encouragement to participate. Team facilitators must foster broad participation while keeping all team members in the information loop. Facilitators can promote collaboration and communication by scheduling opportunities for all team members to meet virtually to discuss the current state of the project, its schedule and share their respective SSAs. The team facilitator should also be responsible for

alerting team members as to project progress and status. Team members need to see the "big picture" as well as what role they play in achieving the big picture. The team leader also must interact with all team players to alert them when information is needed.

Among global virtual teams it may not always be clear who should serve as team leader/facilitator; as a result, occasional power struggles may arise. Global teams may have more than one leader: for instance, there may be a team leader coordinating the U.S. military interests and another team member coordinating the activities of members from another country team. The bottom line is that it is important for all teams to have a leader – someone who coordinates all of the many pieces of the puzzle. Since the problem is more complex in virtual teams, this role is more important.

5. **Using Gaming to Explore Factors Affecting SSA in Virtual Teams**

Although substantial research has been undertaken (particularly by the US Air Force), into how individuals develop situational awareness (SA), there is relatively little formal experimentation in team-based, shared SA (SSA). By understanding the key factors and variables in how teams build shared situational awareness, we can improve our own teams' SSA – and potentially hinder the SSAs of our enemies.

ThoughtLink, Inc. and the Center for Naval Analyses (CNA) currently are conducting a series of experiments focused on using games to evaluate how a virtual team's SSA is affected when team members use different modes of communication and shared visualizations. This research will result in the drafting of recommendations regarding how to improve (or systematically degrade) a virtual team's SSA using the tools/processes of communication and visualization. ThoughtLink and CNA are using games for this experiment because games have proven particularly effective in exploring questions related to strategy, human behavior and warfighting trends while providing a controlled test bed to focus theories and generate data to support claims.

The first phase of this effort will study different communication and visualization factors as applied to a relatively simple game called SCUDHunt. SCUDHunt - developed collaboratively by CNA and ThoughtLink for this experiment - is a simple, short, abstract game of command, control, communications, intelligence, surveillance and reconnaissance (C3ISR). Four-person teams play a game in which the objective is to find 3 hidden scuds on a 5X5 square game board. Teams build a picture of where the scuds might be by sharing asset reports from the different sensors they control: one team member might control the satellite asset while another controls the special operations team. Each asset has a distinct set of capabilities and level of accuracy. Initial results from this experiment may be available in time for the conference for which this paper has been written. A web site further detailing this project is available at: http://www.scudhunt.com.

6. **Conclusion**

The Information Age has had a powerful influence in how we work, removing boundaries, opening doors to the world and redefining the scope of who can participate on a virtual team. To

fully leverage this potential, however, we must realize that this new world order requires us to adopt new tools and methodologies for communicating and sharing information. We must find new ways to train – both to learn the new technologies and to become more aware of what it means to be part of a virtual team.

Cultural differences, lack of a shared goal, communication problems and lack of trust are just a few of the obstacles facing global virtual teams. These obstacles, although affected by the technology and the tools, are influenced primarily by human factors. There are techniques for effectively employing the information and collaboration technologies to address some of these obstacles. These techniques include using the same tools and technologies for training environments, creating project web sites or web-portals for sharing information and fostering a sense of community. Other techniques include the use of team leaders, structuring communications to build common pictures of teams' shared goals and objectives and finally, attempting to occasionally meet face-to-face to build trust and reconvene on the team's objectives.

Virtual teams are not a passing trend but rather will become the workday norm in years to come. We owe it to ourselves to improve our ability to foster virtual teams by sharing success stories and mentally noting those techniques and methodologies that have proved successful and those that have failed. If we work together towards the future of virtual teams it will truly be an effort in teamwork and we will all benefit.

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