**U.S. Army Research Institute
for the Behavioral and Social Sciences**

Research Report 1944

**Behavioral, Attitudinal, and Cultural Factors
Influencing Interagency Information Sharing**

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U.S. Army Research Institute

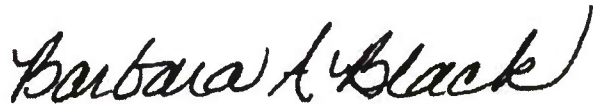**CDR Chadwick Hixson**
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14. ABSTRACT (Maximum 200 words):

This research examined factors influencing information sharing between distributed organizations. Participating in a U.S. Joint Forces Command sponsored experiment, interagency partners conducted planning for simulated crises, with each organization working from their own location, utilizing their own information sharing technology to exchange information. Participants completed a pre- and post-experiment questionnaire, which examined factors influencing interagency information sharing. Findings suggest that organizational culture, attitudes toward information sharing, perceived interdependence, and trust are likely to influence information sharing behaviors and collaboration. Experiences throughout interagency experiments/exercises can shape future collaboration attitudes, so simply coming together to interact in an event will not necessarily result in better collaboration in the future. Suggestions for enhancing interagency collaboration based on questionnaire results and observations are presented.

15. SUBJECT TERMS

Distributed information sharing, trust, perceived interdependence, interagency collaboration

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Research Report 1944

Behavioral, Attitudinal, and Cultural Factors Influencing Interagency Information Sharing

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BEHAVIORAL, ATTITUDINAL, AND CULTURAL FACTORS INFLUENCING INTERAGENCY INFORMATION SHARING

EXECUTIVE SUMMARY

Research Requirement:

Coordination between government, non-government, and multinational partners is critical for successful Stability, Security, Transition, and Reconstruction (SSTR) operations. As part of a United States Joint Forces Command (USJFCOM) exploration into policies, standards, and procedures to improve information sharing between the military, interagency, local, and multinational (MN) partners, the U.S. Army Research Institute (USARI) examined attitudinal, behavioral, and organization-based cultural factors related to information sharing and collaboration between distributed organizations. The goal of the research was to provide awareness of human-based factors (e.g. attitudes and behaviors) that influence success in distributed collaboration between interagency partners.

Procedure:

Questionnaires were completed by participants in a week-long USJFCOM experiment centered on interagency collaboration in response to a series of natural and man-made disasters. Participants came from multiple organizations that regularly need to collaborate with other interagency partners. Questionnaires were administered prior to the start of the experiment and toward the end of the experiment to assess changes over time on factors relating to interagency information sharing such as trust, perceived interdependence, and organizational culture. Observations of participants were used to supplement questionnaire data.

Findings:

Findings suggested that interagency information sharing could be enhanced by improving individuals' attitudes toward interagency information sharing, enhancing understanding of the interdependencies that exist between agencies, and appropriately calibrating trust in the capabilities of interagency partners. Experiences throughout interagency experiments/exercises are likely to shape future collaboration attitudes, so simply coming together to interact in an event will not necessarily result in better collaboration in the future. Focus should be placed on facilitating the success of interagency collaborative activities in order to foster positive attitudes toward information sharing.

Utilization and Dissemination of Findings:

These findings have been summarized in a USJFCOM report on the Interagency Shared Situational Awareness Project (2009). Findings will be utilized to shape future collaborative experiments/exercises and as guidance for interagency partners vested in improving collaboration between organizations.

BEHAVIORAL, ATTITUDINAL, AND CULTURAL FACTORS INFLUENCING
INTERAGENCY INFORMATION SHARING

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BEHAVIORAL, ATTITUDINAL, AND CULTURAL FACTORS INFLUENCING INTERAGENCY INFORMATION SHARING

"The coordination that occurs between agencies of the U.S. Government, including the Department of Defense, for the purpose of accomplishing an objective." – Interagency Coordination defined (Joint Publication 3-08, p. GL-9)

INTRODUCTION

Leaders recognize the need for changing the way the United States (U.S.) plans and conducts Stability, Security, Transition, and Reconstruction (SSTR) operations to ensure a common U.S. strategy between all U.S. government assets. Two founding documents provide guidance that reinforces the need for a whole of government approach in SSTR. On the civilian side, the National Security Presidential Directive 44 (NSPD-44) presents general guidelines for development of interagency processes for SSTR operations. Department of Defense (DoD) Directive 3000.05 (September 16, 2009) modifies the way our military forces plan, prepare, and execute SSTR operations. The need to improve planning and implementation of SSTR across the government was reiterated by the Combatant Commanders' annual list of Critical Warfighter Challenges (WFC-2009). Specifically, WFC 3 addresses information sharing and interagency coordination. It states, "The Joint Force and Interagency community conducting homeland defense and civil support operations require integrated, layered, all-domain strategic communications, and the capability to create, visualize, and share decision-focused views of the operational situation in a distributed net-centric environment in order to support accurate situational awareness and timely decision-making" (IA SSA Final Planning Conference, 2009).

The catastrophic magnitude 7.0 M_w earthquake that struck Haiti on 12 January 2010 provides a striking example of the challenges for successful interagency harmonization. The U.S. response was led by the U.S. Agency for International Development (USAID) with the Department of Defense (DoD) supporting. In addition, the United Nations, through the World Food Program, played a leadership role for coordinating responses from over 140 countries and 1000 non-governmental organizations (NGOs) from all over the world. Because the U.S. and others were in Haiti at the invitation of the Haitian government, they ultimately were in charge. Yet, much of the infrastructure of the government was destroyed and government officials were simultaneously dealing with their own personnel tragedies while trying to govern. Amidst this upheaval responders struggled to gain an understanding of the situation to support decision making.

Gathering and sharing information was particularly challenging. For the first 72-96 hours, there was limited information available for decision makers. U.S. Southern Command (USSOUTHCOM) noted, "*Initially, much of the information gathering had to be accomplished the old fashioned way—with boots on the ground*" (Ryan, Goehring, & Hulslander, 2010, p. 6). USSOUTHCOM used human intelligence teams to gather information from social network sites, blogs, clergy, NGOs and the Haitian Diaspora. Communications needed to be open or unclassified to allow coordination with the broad range of stakeholders participating. Therefore, commercial communication infrastructure, mainly cell phones and email, was used as an

alternative to military communications. Most communication was verbal for the first two weeks which allowed a rapid response, but it also caused information sharing inefficiencies resulting in a lack of understanding on what supplies were on hand, where they were located, and what additional supplies were coming (Ryan, Goehring, & Hulslander, 2010).

Because of the challenges inherent in interagency harmonization, U.S. Joint Forces Command (USJFCOM) conducted a series of experiments examining potential solutions for interagency information sharing. Initial findings, along with stakeholder conferences in 2008 and 2009, suggested that lack of appreciation of interdependencies, different organizational cultures, and distrust between organizations could interfere with information sharing and collaboration. The U.S. Army Research Institute for the Behavioral and Social Sciences (USARI) collaborated with USJFCOM to investigate factors influencing interagency information sharing including attitudes, behaviors, and organizational culture.

Research Concepts

Previous Research

USJFCOM-Joint Concept Development and Experimentation examined distributed information sharing over the past three years in several experiments and exercises. Multinational Experiment 5 (MNE5; 2008) focused on technologies, processes, and openness in a distributed experiment looking at information sharing across agencies during a variety of manmade crises and natural disasters. During MNE5, Sweden hosted an open network where information was freely shared and available. The network was established at the lowest level and self-regulated. Self regulation took place by having users' rate information provided to identify erroneous or misleading content. Information was exchanged via a Wikipedia style repository to encourage developing a shared understanding among participants. At the conclusion of the experiment, a change of mindset was recommended from a command and control system to a collaborative system. The MNE5 Swedish Technology Team concluded that "current governmental policies do not seem to encourage individuals to take risks in information sharing even if the potential benefit may seem obvious" (Swedish Technology Team Final Report, 2008, p. 6).

This change of mindset was reiterated by GEN James Mattis, (then Commander, USJFCOM, currently Commander, U. S. Central Command), when he stated at the Joint Warfighting 2010 conference:

> *If you cannot create harmony, even vicious harmony on the battlefield, based on trust, across service lines, across coalition-national lines and across civilian-military lines to include non-governmental organizations. If you cannot do that, even if you are brilliant operationally, you really need to go home because your leadership in today's age is obsolete* (Germanotta, 2010, p. 12).

At the same conference, General David H. Petraeus, (then Commander of U.S. Central Command, currently U.S. military Commander in Afghanistan) agreed stating, "The question shouldn't be need to know. It should be need to share. You literally change the way you

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approach the whole process. Working with coalition partners and non-governmental organizations on the ground is key to success" (Germanotta, 2010, p. 6).

Other past JFCOM research includes a series of 3 experiments, called Noble Resolve (2007 - 2008), which focused on technology to facilitate information sharing, and centered on the problem of distributed information sharing for homeland defense. Information sharing and shared situational awareness were examined when participants used similar advanced technologies to share information and to develop a Common Operating Picture (COP). A COP is a single identical display of relevant information shared by more than one Command. Findings concluded that solutions for successful information sharing extend beyond a common technology or a common view. Rather than a single system for all users, information sharing may be aided by available technology that connects organizations irrespective of their preferred systems. In addition, the research suggested that instead of a COP, a user-defined view may be more beneficial, where each organization or user compiles a picture of what they need to see to develop situational awareness.

Lessons learned from these experiments suggest that: (1) information sharing is an area of key concern for effective collaboration between agencies, and (2) technology alone will not solve the multiple issues surrounding information sharing between agencies. Key stakeholders in interagency collaboration[1] attributed roadblocks to information sharing as both formal polices (including the classified environment), standards, and procedures as well as informal understandings such as organizational culture, attitudes, and existing behaviors. During an initial planning conference for IA SSA (2009), cultural roadblocks to information sharing were described as follows:

> *Cultural change is critical to organizational transformation and is the most difficult challenge. People must be educated and trained to understand the value of sharing information.*

USARI Research in the Interagency Shared Situational Awareness Project

The Interagency Shared Situational Awareness Limited Objective Experiment (IA SSA LOE) built on findings from MNE5 and the Noble Resolve campaign. As part of this USJFCOM investigation into the changes to policies, standards, and procedures that could improve information sharing between the military, interagency, local, and multinational (MN) partners, USARI examined attitudinal, behavioral, and organization-based cultural factors related to information sharing and collaboration between distributed organizations. This report focuses on the research and findings of USARI. Findings from the USJFCOM effort can be found in a separate report (see Interagency Shared Situational Awareness Project, 2009).

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[1] Stakeholders included representatives from Department of Homeland Security (DHS), Office of Secretary of Defense (OSD), Joint Chiefs of Staff (JCS), U.S. Northern Command (USNORTHCOM), U.S. Southern Command (USSOUTHCOM), U.S. Pacific Command (USPACOM), U.S. European Command (USEUCOM), U.S. Strategic Command (USSTRATCOM), U.S. Special Operations Command (USSOCOM), all four services, National Guard Bureau (NGB), the states of Virginia and Alabama, Department of State (DoS), Allied Command Transformation (ACT), Finland, Spain, Portugal, and InRelief, a non-governmental organization (NGO).

Understanding Performance of Complex Teams

Research on teams, multi-team systems, and organizational effectiveness was utilized as basis for understanding critical factors influencing interagency information sharing and effectiveness within this exercise. Interagency coordination requires organizational structures that are not well explained by more traditional views of organizations, which describe individuals nested within teams, who are in turn nested within units, ultimately nested within a single organization. Instead, interagency teams cross multiple boundaries including organizational, cultural, political, and spatial. While traditional theory on both teams and organizations can provide a basis for the study of interagency coordination, multi-team systems constitute a more appropriate level of focus, where attention is placed on loosely coupled teams that are working towards a common goal, but maintain internal coherence within a sub-team of the larger system. In other words, interagency partners perform collectively toward a common goal, but simultaneously work within the structure of their own organizations with different goals, policies, culture, etc. Because multi-team systems theory is still in its infancy, existing team and organizational theory were heavily relied upon to develop a model of effectiveness in complex teams that is most appropriately applied at the multi-team system level for the current research.

Specifically, a model of effectiveness in complex teams was adapted for use in the current research to assist in identifying the critical factors influencing interagency information sharing and collaboration, which should ultimately result in enhanced performance in complex, distributed environments. The Performance Requirements and Information Sharing Model (PRISM) was modified from existing team models and organizational theory (Marks, Mathieu, & Zaccaro, 2001; Salas, Sims, & Burke, 2005; Schein, 1992; Staples & Webster, 2008) by researchers at USARI to represent a subset of inputs and processes affecting the relationship between information sharing (i.e. communication) and performance (see Figure 1; Hunter & Pierce, 2010). Past research has shown support for some of these relationships (e.g. interdependence moderates the relationship between trust and information sharing; Hunter & Pierce, 2010).
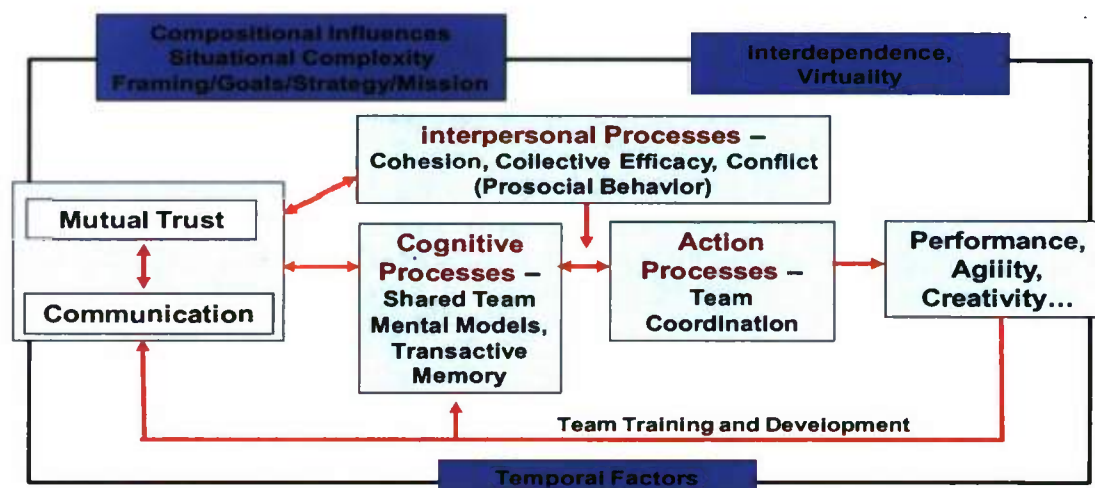

Figure 1. The Performance Requirements and Information Sharing Model (PRISM)

The model suggests that individual attitudes and organizational culture (compositional influences) impact trust and information sharing. Additionally, perceptions of trustworthiness within the system are key influencers of information sharing between interagency partners, and vice-versa (where information sharing affects trust). This reciprocal relationship affects team processes such as cohesion, which ultimately impacts performance. Additionally, the actual and perceived interdependence among interagency partners is likely to change the nature and importance of some of these relationships, modifying the criticality of information sharing and collaboration for individual members of the interagency team. The propositions of this model led to the selection of scales used in the current research, in an attempt to measure key constructs inherent in the reciprocal process described above, with the goal of better understanding the critical aspects of information sharing and interagency collaboration.

The PRISM model focuses more on what unfolds as the multi-team system is formed and continuously evolves. Identifying the specific factors that individuals and organizations bring to the multi-team system (compositional influences) that impact information sharing and collaboration is also important to this research. Lyons, Wolf, & Vincent (2007) suggest that some organizations may be more prepared for collaboration based on need for collaboration, technology, training, individual readiness, etc. To address these factors, we explore the affect of attitudes toward information sharing, readiness to collaborate, and aspects of organizational culture expected to relate to information sharing and effective collaboration with interagency partners. We explore individuals' perceptions of the advantages of sharing information with other agencies, focusing on participants' beliefs regarding whether or not information sharing between agencies can help achieve their organizations' goals (Saviak, 2007). Higher perceived advantages of information sharing and readiness to collaborate are expected to relate to greater sharing of information with interagency partners. We also examine organizational practices that promote a climate of information sharing (Ibragimova, 2006 and Nita, 2008), with positive attitudes and climate of information sharing expected to be associated with higher perceived advantages to information sharing, higher perceptions of interdependence between agencies involved in the experiment, and ultimately greater sharing of information between agencies.

Method

IA SSA LOE was conducted in July 2009 at the USJFCOM Joint Futures Lab (JFL) in Suffolk, VA and at distributed sites throughout the United States. Realistic scenarios were used to set the conditions for information sharing and collaboration between various federal, state, local, multinational government organizations, and international organizations.

The experiment took place in a distributed environment, using fielded capabilities, allowing participants to operate from their home stations with existing tools. Scenarios were developed to stimulate information sharing between participants. Scenarios included the following conditions: a hurricane passing through the Caribbean and then striking the East Coast of the U.S.; a major power outage in Virginia; a pandemic outbreak, originating in Africa and spreading to the Caribbean, Europe, and Pacific areas; and tracking of a ship originating from Africa that is suspected of human trafficking and possible infection, and which ceased reporting its location. All scenarios were run concurrently and in real time, with subsequent experimental trials building upon previous trials' developments.

Prior to the start of each trial, the control cell provided participants with a mission update that established conditions for that trial. During the experiment, participants coordinated simulated responses and planning actions as scenarios and information sharing tasks were introduced. Scenarios were designed to provide information to specific organizations, which would then need to share that information and send queries for clarification. Participants were able to communicate using telephone, email, text chat, and global-information systems. Unique to this experiment was a central collaborative environment called the Virtual Exchange Information Center (VEIC). The VEIC facilitated information sharing by replicating the seamless exchange of information that would be provided if the participants' systems were all truly federated or linked together. Participants were granted access to all exposed data sources. They could use this collective shared data to improve their own user-defined Situational Awareness (SA) or update a previously published product.

The experiment lasted five days, with the first day used for training and to obtain a baseline trial where participants used their current polices, standards, and procedures to share information. The fifth and final day was used to present initial findings. Eight additional two-hour trials occurred with three on days 2 and 3, and two on day 4. USARI questionnaires were administered to participants on the first day, prior to the baseline trial (pre-experiment questionnaire), and on the fourth day, following trial 7 (post-experiment questionnaire). The final survey was administered after trial 7 instead of trial 8 because participants had another lengthy survey to complete following trial 8.

Research was conducted in compliance with the Human Use Committee at USARI and at USJFCOM. Participants were provided an overview of the research and its purpose at the Final Planning Conference and again prior to administering the initial questionnaire. Participants were provided a paper copy of the Privacy Act Statement along with a verbal explanation prior to beginning the questionnaire. The pre- and post-experiment questionnaires were administered electronically via Vovici, a commercially available software tool for administering and scoring surveys on-line. Once at the survey site, participants were asked to read the Informed Consent and to check the appropriate boxes noting that they were 18 years old or older and that they agreed to participate. Only then were participants able to proceed to the survey.

Participants were told to be representatives of their own organization; therefore, they were to respond as they supposed that their organization as a whole would respond to the questionnaire items. They responded to a series of items that asked about factors relating to information sharing with interagency partners. The individual responses were utilized to capture the specific sub-team attitudes, behaviors, and organization-based cultural influences that impact performance in the multi-team system. On the post-experiment questionnaire, participants were asked to respond to an item asking if their organization's information sharing practices were similar to their own. On a range from one to seven, with one being similar and seven being dissimilar, the mean score was 2.87 (standard deviation = 1.4) indicating a leaning towards agreement that they shared their organizations perceptions towards information sharing.

Additional questionnaire items not reported in this research were administered to solicit subjective opinions from the participants on interagency information sharing. These items were

used to determine differences between trial conditions for USJFCOM's research (Interagency Shared Situational Awareness Project, 2009). Some of these data were used to supplement findings in this report when they add to our understanding of the topic.

Finally, observers at each of the interagency sites were colocated with participants and recorded observations in an online data collection system using laptops throughout the course of the experiment. Observers were comprised of personnel from USJFCOM, MN military officers, USARI, and the Institute for Defense Analysis. Information entered into the online system could be seen and commented on by observers from the distributed sites, creating the potential for dialogue between observers when particular behaviors relating to information sharing, collaboration, and shared situational awareness were noted. Observers were directed to document activities that hindered or enhanced information sharing. USARI used these observations to provide additional information and insights from the experiment in relation to interagency collaboration.

Participants

Twelve agencies participated, allowing employees to act as role-players in actual agency positions, responding to a series of natural and man-made disasters. However, several agencies participated only intermittently in the experiment, and their data were not used in the analyses, resulting in usable data from seven participating agencies. After ensuring that questionnaires were completed by the actual role-players and eliminating data from those who participated only intermittently, usable data were available for 16 participants on the pre-experiment questionnaire and 17 participants on the post-experiment questionnaire. Additionally, one participant's data was removed from analyses because every item had a response of '1', resulting in a score that was more than 3 standard deviations from the mean on all measures. The number of participants from a single organization ranged from one-to-four and responses within an organization were consistent.

Measures

Numerous validated instruments measuring factors that could influence information sharing between distributed organizations were reviewed for their relevance to behavioral factors of interest. Selected items from these measures were used to develop a pre-experiment and post-experiment questionnaire administered on the first and fourth days of the experiment. Participants responded using a Likert-type scale ranging from 1 = strongly disagree, 2 = disagree, 3 = moderately disagree, 4 = neither agree nor disagree, 5 = moderately agree, 6 = agree, and 7 = strongly agree. This response format was used for all measures with the exception of Readiness for Collaboration / Collaborative Outcomes, which used a behaviorally-anchored rating scale with anchors on either end of a 9-point scale (see Appendix). Some items were administered once during either the pre-experiment or the post-experiment questionnaire period and other items were administered during both the pre- and post-experiment questionnaires periods. A summary of the measures follows.

Organizational climate of information sharing. Assesses organizational-level attitudes toward information sharing and organizational practices fostering information sharing and

promoting a climate of information sharing (see Ibragimova, 2006 & Nita, 2008). Higher scores indicate a higher degree of practices within the organization that promote information sharing. The resulting scale was administered on the pre-experiment questionnaire only and consists of 13 items with an acceptable alpha reliability level of .95.

Perceived advantages of information sharing. Assesses the extent to which respondents feel that information sharing between agencies will help them achieve their organization's goals (adapted from Saviak, 2007). Higher scores indicated greater perceived advantages in sharing information with interagency partners. The measure was administered on the pre-experiment questionnaire only and consists of three items with an acceptable alpha reliability of .86.

Readiness for collaboration. Assesses perceptions of the effectiveness of collaborating with interagency partners. Lyons, Wolf, and Vincent (2007) developed a longer measure of readiness to collaborate, from which these items were adapted. The adapted items focused on the 'collaboration effectiveness and attitudes' dimension of readiness for collaboration in the Lyons et al. measure. Higher scores indicate a greater readiness for collaboration. The measure was administered on the pre-experiment questionnaire and adapted for use as an outcome measure on the post-experiment questionnaire. The readiness for collaboration measure consists of 10 items, with an acceptable alpha reliability of .83.

Trust. Assesses the trustee as perceived by the trustor. Focus is placed on the predictability dimension of trust (i.e., judgment of the trustee's consistency of work and action). Higher scores indicate trustors' judgments that interagency partners are more trustworthy. The measure was adapted from Staples & Webster (2008) and Adams & Sartori (2006). The trust scale was included on both the pre- and post-experiment questionnaire to examine changes in trust over the course of the experiment. The scale consists of six items, with an acceptable pre-experiment alpha reliability of .94 and an acceptable post-experiment alpha reliability of .79.

Perceived interdependence. Assesses the degree of reciprocal interdependence required to successfully complete tasks, including perceptions of the degree that the responder needed to depend on interagency partners for information and vice versa (adapted from Rossi, 2009). Higher scores reflect a greater degree of perceived interdependence between interagency partners. The perceived interdependence scale was administered only on the post-experiment questionnaire. The scale consisted of nine items with an acceptable alpha-reliability of .81.

Information sharing behavior. Self-reported rating of information sharing behaviors occurring between interagency partners throughout the experiment (adapted from Staples & Webster, 2008). Higher scores reflect the perceptions that more information sharing occurred between interagency partners[2]. The information sharing behavior scale was administered only on the post-experiment questionnaire. The scale consisted of two items with an acceptable alpha-reliability of 78.

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[2] It was anticipated that objective measures of information sharing would be available for comparison with subjective questionnaire measures. Unfortunately, these objective performance measures were not able to be produced.

Collaboration outcomes. The readiness for collaboration scale previously described was adapted for use as an outcome measure assessing perceptions of the effectiveness of collaborating with interagency partners throughout the experiment (Lyons et al., 2007). Higher scores indicate a higher perceived effectiveness of collaboration between interagency partners. This ten-item measure was administered on the post-experiment questionnaire and had an acceptable alpha reliability level of .91.

Results

The means, standard deviations, and the intercorrelations between all scales included on both the pre- and post-experiment questionnaires are reported in Table 1. All scale means were slightly positive (greater than 4 on a 7 point scale), except the Readiness for Collaboration and Collaborative Outcomes scales, which were 9-point behaviorally anchored rating scales.

Descriptives

The descriptive statistics (i.e., means and standard deviations) reported in Table 1 indicate several characteristics of collaboration between the interagency partners. First, respondents reported a neutral, to slightly positive attitude toward collaboration between organizations. This suggests the potential for improvement in the attitudes that exist regarding this collaboration in organizations voluntarily coming together for an interagency collaborative experiment. Moreover, the perceived interdependence between organizations is only slightly above the midpoint. Respondents may not fully see the benefits of sharing information with interagency partners, or value the information that they are receiving from interagency partners. A potential means for improving collaboration between agencies could be training members on interdependencies that exist, including an understanding of what information others may need. In this research, all participants agreed to share information with other participants. Despite this agreement to share information, findings from this sample do not show that this agreement resulted in overly positive attitudes toward information sharing or the perception that an organization's culture is particularly supportive of information sharing. No significant pre- to post-experiment differences were found for trust, suggesting that participation in the information sharing experiment did not increase trust, as might be expected based on PRISM.

Correlations

All scales were correlated in the positive direction except for the Readiness for Collaboration and Collaborative Outcomes scale. The majority of the significant correlations followed the expected pattern, where information sharing climate and perceived advantages of information sharing related to greater trust in interagency partners, higher perceived interdependence between partners, and greater reported information sharing behaviors throughout the experiment.

A particularly high correlation of .90 in the positive direction was found between Perceived Advantages of Information Sharing and Organizational Climate of Information Sharing (see Table 1). Correlations do not show cause and effect, but rather the strength of a relationship between measures. This finding implies that organizations that understand the

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advantages of information sharing have practices in place to enhance information sharing. The reverse could also be stated; where organizations that have practices in place to share information have a better understanding of the advantages of information sharing.

Table 1.

Scale Descriptives and Intercorrelations.

Scale	Mean	SD	1	2	3	4	5	6	7	8
IS Climate	5.00	1.24	(.95)							
IS Advantages	5.27	1.33	.90*	(.86)						
Readiness for Collab.	4.83	.84	-.38	-.41	(.83)					
Trust (Pre-exp.)	4.87	1.17	.89*	.78*	-.29	(.94)				
Trust (Post-exp.)	5.02	1.08	.70*	.78*	-.80*	.65*	(.79)			
Interdependence	4.65	1.00	.65*	.66*	-.67*	.61*	.81*	(.81)		
IS Behavior	5.78	1.42	.81*	.82*	-.61*	.77*	.76*	.64*	(.78)	
Collab. Outcomes	4.74	1.27	-.48	-.35	-.10	-.48	.13	.09	-.15	(.91)

Note: Alpha reliabilities are reported in italicized parentheses on the diagonal. * indicates correlation is significant at $\rho < .05$ level; IS = information sharing; Collab. = collaboration; exp. = experiment.

The correlations also show that Trust (pre-experiment and post-experiment) was significantly correlated with Organizational Climate of Information Sharing, Perceived Advantages of Information Sharing, Interdependencies between Agencies, and Information Sharing Behaviors. This suggests that positive perceptions of trust between organizations are strongly associated with positive information sharing attitudes and behaviors. This also reinforces the perceptions of subject matter experts who participated in conferences prior to the experiment when they concluded that trust or lack of trust impacts information sharing (Information Summary, 2009).

Unexpected results were found in regards to the Readiness to Collaborate and Collaboration Outcomes scales. Readiness to Collaborate correlated negatively with the majority of the post-experiment measures, including Trust, Perceived Interdependence, and Information Sharing Behavior. This might be explained according to unmet expectations, where respondents who perceived a high readiness to collaborate within their respective organizations at the start of the experiment were disappointed when collaboration was difficult. Alternatively, individuals who did not come into the experiment with high readiness to collaborate, could have developed greater trust in their interagency partners, perceived more interdependence, and reported more information sharing behaviors after the experiment unfolded. To explore this further, an independent sample t-test was conducted, where the difference in scores between pre-experiment and post-experiment Trust was examined according to high vs. low (median split) Readiness to Collaborate. Significant mean differences were found, where Trust increased over the course of the experiment when Readiness to Collaborate was low, but Trust decreased over time when Readiness to Collaborate was high at the beginning of the experiment ($t = 2.39$; $\rho < .05$).

Based on the preceding findings on Readiness to Collaborate scale and the Collaborative Outcomes scale, further exploratory analysis was conducted by comparing responses by organization. As can be seen in Figure 2, a significant interaction was found between organizations by time (pre vs. post; $F (6, 12) = 4.30$, $p<.05$). Organizations with higher pre-experiment Readiness to Collaborate seem to report lower post-experiment Collaborative Outcomes. Conversely, organizations with low Readiness to Collaborate scores at the beginning of the experiment tended to report more positive Collaborative Outcomes at the end of the experiment. These findings imply that coming together to participate in a collaborative experiment can result in positive, negative, or no change in attitude towards collaboration, and these results may depend on attitudes or expectations regarding the effectiveness of collaboration at the start of the experiment.
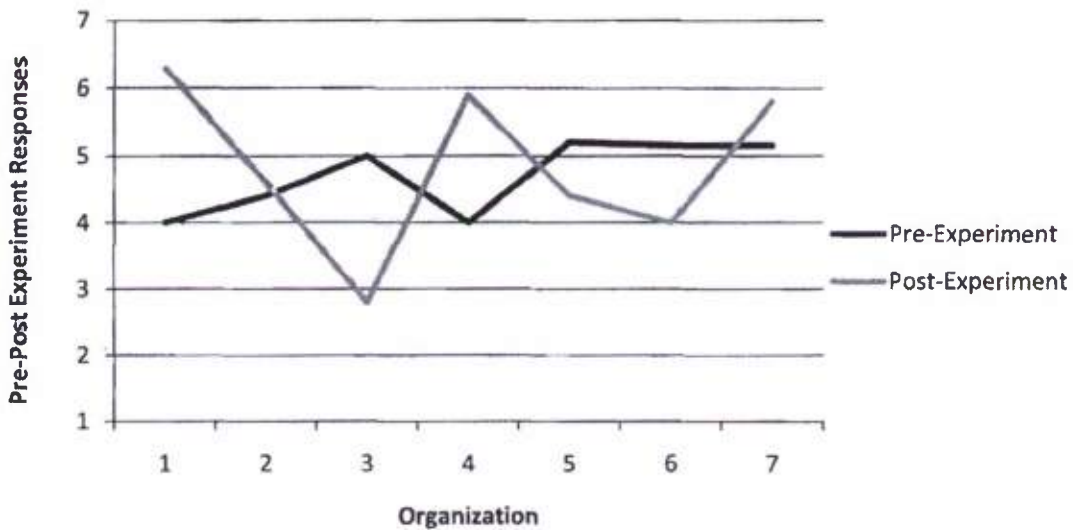

Figure 2. Readiness to Collaborate (Pre-Experiment) and Collaborative Outcomes (Post-Experiment) by Organization

Observations Focused on Enhancing Information Sharing

Throughout the exercise, additional factors influencing information sharing were observed. As mentioned in the method section, observers were located at each of the distributed locations, recording observations related to information sharing, collaboration, and shared situation awareness throughout the experiment. Selected observations are summarized here to provide further information on ways to enhance interagency collaboration.

Ensure Intelligibility of Information Shared

Problems with information sharing between interagency partners were observed in relation to the language that different agencies use. Consider the following message: "Request your assessment of the impact the power outage and associated problems will have on potential hurricane evacuation efforts and identify any alternate destinations if required NLT 1430Z 21 July." The use of Zulu time caused great confusion, particularly between military and civilian

authorities attempting to exchange information. Among participants, there was disagreement over the local time equivalent of Zulu. Time reporting continued to be inconsistent in the experiment with participants using EST, Eastern Daylight Time, Zulu, etc. In reality, literal reading of time information may lead to misaligned coordination and synchronization of operational activities.

Similarly, problems were observed in relation to the use of acronyms that were not understood by all interagency partners, and lack of specificity in reporting. One message sent during the experiment read, "The NOC will pass this info to IP-NICC via CWIN Comms." The response received was, "Pass what info? Who is IP-NICC? What is CWIN Comms?" While this is an experiment, in a real-life disaster, critical information may be needed immediately for response. Delays are inherent in multiple rounds of discussion regarding the same message. Additionally, as described above in the questionnaire results section, the interactions that interagency partners have may negatively impact future collaborative efforts, particularly when interactions are frustrating and are perceived as less useful.

Ineffective communication can take place when information is missing or ambiguous. For example, "Connectivity has been made from HF Radio locally to outside telephone lines." The response was, "Connectivity among what parties? Locality = what?"

These observations highlight the need to be aware of difficulties that agencies may have in understanding each others' communications. Attention to the clarity of information shared will reduce the amount of time needed to share information, as well as enhance the experience of collaboration between interagency partners.

Improve human-machine interoperability

Basic human-machine interoperability issues that hindered information sharing were identified by multiple observers. Examples of these issues included:

- Some screens needed to be refreshed, while others did not. To maximize information sharing, they should auto refresh.
- Some agencies were NOT receiving the information and were unaware that information had been sent because of variability in the technology. There should be a way to confirm that information is received.
- At times programs were inoperative but players did not know. For example, chat had disconnected but participants were not aware of it.

Observers noted that it's difficult to get beyond these issues in order to collaborate to the degree required for advancing performance in disaster relief environments. While trying to enhance trust, communication, and collaboration, the tools used in this experiment may actually hinder them.
It was concluded that systems should ALWAYS have a Human Factors specialist as part of their design and development team. This seemed to be missing in some of these systems.

Foster successful interactions between interagency partners

One organization did not share any information with others until trial 7 of the 8 trial experiment. At the end of the experiment participants were asked, "*More information from (organization) would most improve your organization's situation awareness?*" Six of the 7 other organizations selected this organization as the one that they would have liked to receive more information from. Observers at this location noted that the culture of this organization was to rigorously validate any information before it was distributed. This validation process resulted in delayed information sharing and frustration from other agencies.

Observations of interagency partners who had never participated in a similar experiment, compared to agencies with more experience working together on these types of experiments, suggested that prior experience working with interagency partners may be beneficial to perceptions of collaboration effectiveness. As an example, observations of an agency who had never participated in the past demonstrated that these individuals were left out of information exchange, to the extent that emails from this organization directed toward members of the other organizations remained unanswered. The team resorted to sending out information on what expertise they could provide relevant to the different storylines and still, nobody ever recognized or responded to their offers. Conversely, observations of some of the agencies that collaborate regularly, where team members may actually know each other personally had very different outcomes, suggesting that information sharing between these agencies was much more successful. These observations are supported by responses to a question administered by USJFCOM, asking participants "to what extent information from other mission partners was relevant, useful, usable, and sufficient." Significant differences were found, where organizations that had experience participating in these experiments rated the information received from other organizations throughout the course of the experiment higher than those who had no previous experience. Particular attention should be placed on making sure that these interactions are perceived as somewhat successful or at least increasingly successful over time. The results of the questionnaires suggest that negative experiences within these experiments may also serve to foster more negativity in the attitudes regarding interagency collaboration, which could ultimately impact interagency collaboration in an unconstructive way.

Summary

This report describes research conducted by USARI, examining attitudinal, behavioral, and organization-based cultural factors related to information sharing and collaboration between distributed organizations in a USJFCOM experiment on interagency collaboration (Interagency Shared Situational Awareness Project, 2009). The PRISM model (Hunter & Pierce, 2010) was used as a guide to identify critical factors influencing information sharing and collaboration, including perceived interdependence, trust, and organizational culture, which should ultimately result in enhanced team performance in complex, distributed environments. Additionally, other factors that individuals and organizations bring to the team were explored, including attitudes toward information sharing and organizational practices promoting a climate of information sharing.

Significant pre-post questionnaire comparisons were found, even with this small sample size. Although the small sample size limits generalization of findings, the pre-experiment, post-experiment design supplemented with observer notes provides information useful to future information sharing between interagency partners. Findings suggested that interagency information sharing could be enhanced by improving individuals' attitudes toward interagency information sharing and enhancing understanding of the interdependencies (e.g., complimentary or supporting roles and capabilities) that exist between agencies.

Results from the Readiness to Collaborate and Collaboration Outcomes scales were unexpected. Readiness to Collaborate correlated negatively with the majority of the post-experiment measures, including Trust, Perceived Interdependence, and Information Sharing Behavior. The Readiness to Collaborate measure was limited to items assessing the expected effectiveness of interagency collaboration. The questions used to assess readiness to collaborate are likely to actually have measured expectations regarding the outcomes of the experiment, and therefore differences between pre-experiment and post-experiment responses tapped into unmet expectations for interagency information sharing. These results are informative because they highlight the potential for negative consequences of interagency experiments/exercises, when information sharing and collaboration is perceived as unsuccessful. When pre-experiment expectations for collaboration were low, trust between interagency partners actually increased, but when pre-experiment expectations were high, trust decreased over the course of the experiment. This suggests that attention should be placed on increasing effectiveness of interactions and minimizing frustrations (e.g., interoperability issues).

An illustration of positive interactions that can occur and the benefits that can be derived from these types of interactions with interagency partners was seen when an extended text-chat exchange was captured between two interagency participants, one military and one civilian, previously unknown to each other. The exchange began with descriptions of each organization's roles and responsibilities followed by participants noting they had been involved in the same humanitarian relief mission but from very different perspectives. This led to a sharing of ideas on how they could have been more successful if their organizations had worked together and supported each other. This interaction culminated with a sharing of contact information because they recognized that there could be opportunities to collaborate in the future. Both organizations reported this episode as an important example of building relationships across organizations and they presented this interaction as a noteworthy event in the final After Action Review. A significant improvement on measures of collaboration was seen between these organizations who took the time to establish a deeper understanding of their interdependencies.

Conversely, negative interactions that should be avoided were also observed. One organization spent about thirty minutes explaining their capabilities and authorities to others when it was evident that other organizations lacked this understanding. Even after the exchange, other organizations were hesitant to collaborate with this organization and ignored their message traffic. The occurrence seemed to relate to perceived interdependence (where other agencies may not have understood how sharing information with this organization would be beneficial). The result was more negative attitudes and lower perceptions of collaborative outcomes by individuals from this organization.

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Past research is supported by the current findings, suggesting that factors such as organizational climate fostering information sharing, individual attitudes toward information sharing, trust, and perceived interdependence are likely to enhance information sharing between organizations. Future research needs to continue to explore these topics using more objective measures, as well as explore relationships with more teams-related outcomes such as situation awareness and team effectiveness or adaptability.

Transition

These findings were incorporated into the final report published by USJFCOM titled Interagency Shared Situational Awareness Project. Specifically, one of the four recommendations of the publication was as follows:

> *Leaders must instill an information sharing culture by actively supporting the sharing of information as the rule and the withholding of information as the exception (Information Assurance). This includes educating organizational members on interdependencies and many direct and indirect benefits of information sharing. Furthermore, leaders can support changes in information sharing culture through:*
> - *Supporting incentives to promote information sharing practices and procedures;*
> - *Reviewing lessons learned on the benefits of information sharing to operations;*
> - *Providing training to develop understanding of interdependencies such as the capabilities, roles, and missions of all Community of Interest (COI) partners;*
> - *Increasing participation in exercises and experiments designed to improve information sharing; and*
> - *Training with COI members to develop expertise.*

<div align="right">Interagency Shared Situational Awareness Project, 2009, p. 14</div>

Results from the experiment produced a set of recommendations, written in DOTMLPF-P format for DoD partners and in White Paper format for interagency organizations. These documents have been provided to participating organizations, Joint Staff J6 (for refinement of CJCSM 3115.01B), USJFCOM J9 and to USJFCOM J7 in support of the C2 Capability Portfolio Management Joint Task Force Headquarters Focus Integration Team.

In addition, a Guide / Concept of Operations describing the creation and process for use of the collaborative environment employed in the LOE, was requested for transition to organizations that did not currently have a means of sharing unclassified information. The document is being familiarized with U.S. Forces - Afghanistan, the International Security Assistance Force, and the U.S. Embassy in Kabul, Afghanistan, in conjunction with USJFCOM J6 efforts to expand the capabilities of HARMONIEWeb, a DoD-developed system, to deployed forces in theater.

The USJFCOM report concluded:

It is important that lessons learned and insights gained be implemented in future exercises so that collaboration can be made more routine. This will build meaningful trust relationships between organizations and foster an information sharing culture, which will dramatically improve the effectiveness of information sharing should a crisis response so dictate.

<div align="right">Interagency Shared Situational Awareness Project, 2009, p. 16</div>

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Items using Likert Scale

Organizational Climate of Information Sharing
1) My organization's senior leaders think that our organization should share information with other mission partners.
2) Supervisors in my organization think that our organization should share information with other mission partners.
3) Colleagues from my organization think our organization should share information with other mission partners.
4) Managing organizational knowledge is central to my organization's strategy.
5) My organization has effective policies and procedures for information sharing in place.
6) In my organization, senior leaders instill a sharing culture.
7) My organization provides the time and resources to share information with other mission partners.
8) My supervisor(s) encourage sharing information with other mission partners.
9) My organization has training that focuses around sharing information.
10) My organization provides incentives to share information with other mission partners.
11) In my organization, senior leaders model the information sharing behaviors they want to see.
12) It is valuable to share knowledge with individuals from other mission partner organizations.
13) It is disadvantageous to share knowledge with individuals from other mission partner organizations.

Perceived Advantages of Information Sharing
1) An information-sharing network improves my organization's ability to accomplish mission tasks.
2) My organization saves time in accessing information provided by other mission partner organizations.
3) Access to an information-sharing network improves my organization's ability to complete mission tasks.

Trust
1) Overall my organization can trust mission partners from outside of my organization.
2) My organization can depend on other mission partners for information.
3) My organization knows what to expect from other mission partners.
4) My organization usually knows how other mission partners are going to react.

5) My organization is confident that other mission partners will use information provided by my organization in appropriate ways.
6) My organization is confident that other mission partners will not misuse any information that is given to them.

Perceived Interdependence
1) My organization's role was designed in such a way that we needed to interact with other mission partners in order to perform mission tasks effectively.
2) My organization was required to work together with other mission partners to complete mission tasks.
3) If my organization did not engage in task-related interactions with mission partners, it would have been difficult to adequately perform mission tasks.
4) My organization's performance on mission tasks depended on receiving accurate information from other mission partners.
5) My organization rarely obtained information from other mission partners to complete mission tasks.
6) My organization depended on other mission partners for inputs required to complete mission tasks.
7) The other mission partners could not successfully complete their mission tasks unless they received information from my organization.
8) Task performance of other mission partners depended on receiving accurate information from my organization.
9) Other mission partners rarely had to obtain information from my organization to complete their mission tasks.

Information Sharing Behavior
1) When interacting with other mission partners, my organization kept the best ideas to ourselves.
2) My organization was willing to share knowledge/ideas with other mission partners.

Items using Behaviorally Anchored Rating Scale

Readiness for Collaboration
Directions: When answering these items, consider past experiences when your organization has needed to interact with other organizations (mission partners) in order to accomplish a mission:

Left Anchor	Right Anchor
1) My organization has to wait to get information needed to accomplish mission tasks.	The information my organization needs to accomplish mission tasks is readily available.
2) It is difficult for my organization to share information that is needed with other mission partners.	My organization can share information that is needed with other mission partners.
3) In general, other mission partners don't give my organization the information needed to accomplish mission tasks	In general, other mission partners give my organization the information needed to accomplish mission tasks.
4) My organization tends to use internal resources in order to get a better understanding of new situations.	My organization tends to communicate with other mission partners in order to get a better understanding of new situations.
5) My organization can't always tell what information other mission partners need.	My organization usually gives other mission partners the information they need before it is asked for.
6) My organization often receives information from other mission partners that is not needed.	My organization gets just the right amount of information from other mission partners.
7) The information my organization receives from other mission partners is often incorrect.	The information my organization receives from other mission partners is often correct.
8) My organization's policies often prevent us from communicating with the mission partners whom we need to accomplish mission tasks.	My organization's policies give the flexibility to communicate with the mission partners we need to accomplish mission tasks.
9) The types of mission tasks that my organization accomplishes rarely require input from other mission partners.	My organization engages with other mission partners frequently to accomplish mission tasks.
10) My organization doesn't get useful information from other mission partners.	Interacting with other mission partners helps my organization accomplish mission tasks.

Collaboration Outcomes

Directions: These questions focus on your interactions throughout the experiment with mission partners who were outside your own organization. When answering these questions, consider your role within the experiment as a mission partner.

Left Anchor	Right Anchor
1) My organization had to wait to get information needed to accomplish mission tasks.	The information my organization needed to accomplish mission tasks was readily available.
2) It was difficult for my organization to share information that was needed with other mission partners.	My organization could share information that was needed with other mission partners.
3) In general, mission partners didn't give my organization the information needed to accomplish mission tasks.	In general, other mission partners gave my organization the information needed to accomplish mission tasks.
4) My organization tended to use internal resources in order to get a better understanding of new situations.	My organization tended to communicate with other mission partners in order to get a better understanding of new situations.
5) My organization couldn't always tell what information other mission partners needed.	My organization usually gave other mission partners the information they needed before it was asked for.
6) My organization often received information from other mission partners that was not needed.	My organization got just the right amount of information from other mission partners.
7) The information my organization received from other mission partners was often incorrect.	The information my organization received from other mission partners was often correct.
8) My organization's policies often prevented us from communicating with the mission partners whom we needed to accomplish mission tasks.	My organization's policies gave us the flexibility to communicate with the mission partners whom we needed to accomplish mission tasks.
9) The types of mission tasks that my organization accomplished rarely required input from other mission partners	My organization engaged with other mission partners frequently to accomplish mission tasks.
10) My organization didn't get useful information from other mission partners.	Interacting with other mission partners helped my organization accomplish mission tasks.

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