SANDIA REPORT

Understanding Communication in Counterterrorism Crisis Management

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Abstract

This report describes the purpose and results of the two-year, Sandia-sponsored
Laboratory Directed Research and Development (LDRD) project entitled *Understanding
Communication in Counterterrorism Crisis Management*. The purpose of this project
was to facilitate the capture of key communications among team members in simulated
training exercises, and to learn how to improve communication in that domain. The first
section of this document details the scenario development aspects of the simulation. The
second section covers the new communication technologies that were developed and
incorporated into the Weapons of Mass Destruction Decision Analysis Center (WMD-
DAC) suite of decision support tools. The third section provides an overview of the
features of the simulation and highlights its communication aspects. The fourth section
describes the Team Communication Study processes and methodologies. The fifth
section discusses future directions and areas in which to apply the new technologies and
study results obtained as a result of this LDRD.

Contributors

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Introduction

In response to terrorist attacks, joint decisions must be made by multiple agencies under conditions of high stress. Teams with diverse membership face issues such as short time cycles, high stakes, incomplete data, and conflicting interests. Previous Weapons of Mass Destruction (WMD) terrorism exercises have pointed out that communication barriers between organizations impede an effective response. For example, participant-participant and participant-machine interactions between participants playing distinct roles have a large impact on the outcome of decisions.

In the WMD Decision Analysis Center (WMD-DAC), we use distributed computer simulation and visualization tools to investigate issues surrounding terrorist attacks. Our simulations provide a means to explore WMD terrorism defense through interactive, dynamic, "what-if" computerized "war-gaming."

Traditional Department of Defense distributed simulations are based on Distributed Interactive Simulation (DIS) or High Level Architecture (HLA) protocols. These simulations rely primarily on two communication paths, [1] electronic exchange through DIS/HLA interconnected machines running loosely coupled, federated computer models, and [2] participant-participant and participant-machine interactions between participants playing distinct roles. This second category of communication has a large impact on the outcome of decisions made as part of the simulation. Sandia's Enterprise Modeling Architecture (EMA) supports distributed, multi-participant simulations using HLA and provides a unique distributed architecture with need-to-know (NTK) controls. The EMA allows control of information flow, and control of what is revealed and known to multiple, geographically dispersed participants. Participants are allowed to see a controlled view of the simulation based on their or their agency's role.
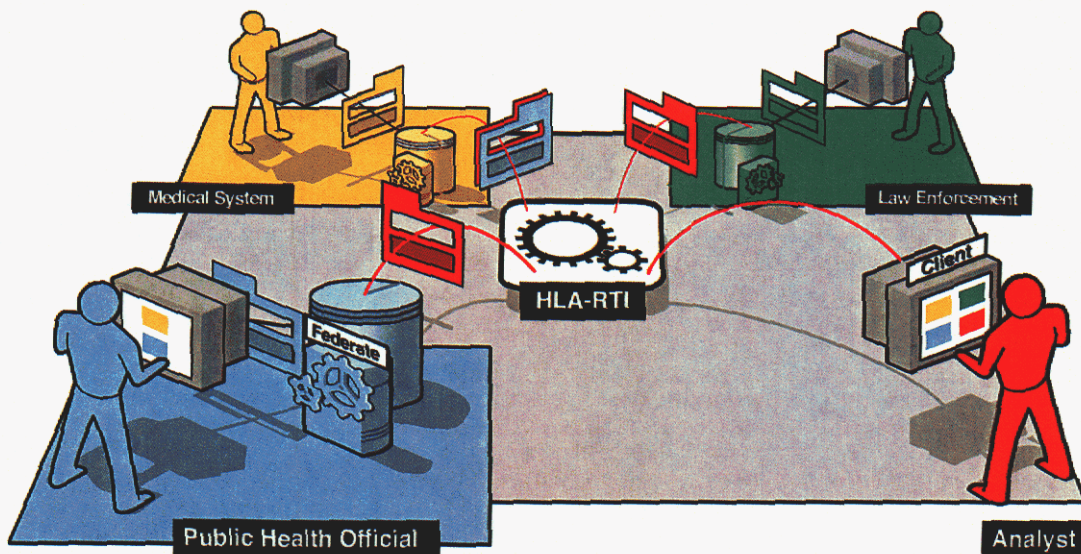
Figure 1. Enterprise Modeling Architecture (EMA) Supports Multi-Participant Simulations using HLA.

Prior to this LDRD, participant-participant and most participant-machine interactions were not captured in these exercises. This project created the capability to capture these interactions as part of the simulation data stream and to incorporate communication measurements into our simulations. This project also developed the capability to monitor the quantity and quality of interagency, participant communication during interactive simulations in WMD-DAC, thus increasing its value for WMD terrorism preparedness.

The data gathered from these communication portals is analyzed by automated and human simulation referees using established human and computer-mediated communication research methodologies to categorize individual and team interactions and behaviors and perform sensitivity analyses. This allows researchers to observe, study, and increase their understanding of the relationships between interagency communication and the effectiveness of joint decisions in a high-stress environment.

This two-year LDRD had two distinct phases. The focus for the first year (FY03) was to participate in WMD terrorism and facility protection exercises with first responders and to incorporate lessons learned into a conceptual interagency communication network simulation (ICNS) that would be the basis for monitoring communication traffic in a WMD-DAC distributed interactive simulation. The first year also focused on exploring new communication technologies and defining scenario requirements. The focus for the second year (FY04) was fourfold: first, to create a storyboard scenario capturing the full response process; second, to implement the scenario and new communication technologies into the WMD-DAC environment; third, to conduct tabletop exercises using the new WMD-DAC simulation and communication technologies; and fourth, to analyze the communication output from the exercises to determine how electronic forms of communication can affect team productivity.

1 Scenario Development

One of the objectives of this project was to develop a scenario within the WMD-DAC environment that would include multiple team member interactions and decisions. This scenario identified mandatory joint decision points to force team members playing specific roles to communicate and act, thereby feeding the team performance assessment and metric process. The scenario also identified individual decision points, or actions, to encourage players to use and share their unique knowledge. Team members were required to utilize only the communication portals provided by the WMD-DAC environment.

1.1 Scenario Content

In order to achieve realism in the scenario, we collaborated with external agencies and existing Sandia projects to validate the technology, research process, and scenario content. We interviewed domain experts including California and New Mexico public health officials, FBI agents, emergency operations center operators, managers for several international airports in the San Francisco Bay Area, and bioterrorism attack first responders. We supported hosting two external simulation-driven tabletop exercises that employed facility and urban area response strategies for the San Francisco International Airport (Yang et al., 2004) and the Alameda County Public Health Department (Lipkin et al., 2003). These tabletop exercises were well attended with multi-agency representation.

Based on these efforts and the recommendations of the first responders, we implemented a new scenario called Facility Communications that models a possible anthrax release within a west coast international airport. Figure 2 shows all the models that comprise the Facility Communication simulation. There are three agency role players in the simulation: the Airport Decision Maker (or Airport Duty Manager (ADM)), the FBI Agent (FBI), and the Public Health Officer (PHO). These three players effectively represent the roles of major first responders in the targeted scenario. The Airport Decision Maker is responsible for the smooth flow of operations at the airport as well as the safety of the passengers; the FBI Agent is responsible for the intelligence gathering and law enforcement aspects of the scenario; and the Public Health Officer is responsible for insuring that adequate medical treatment is available to the public after an anthrax attack has occurred. The player models interact with other models, including threat, sensor, and population, that together support the evolution of the scenario.
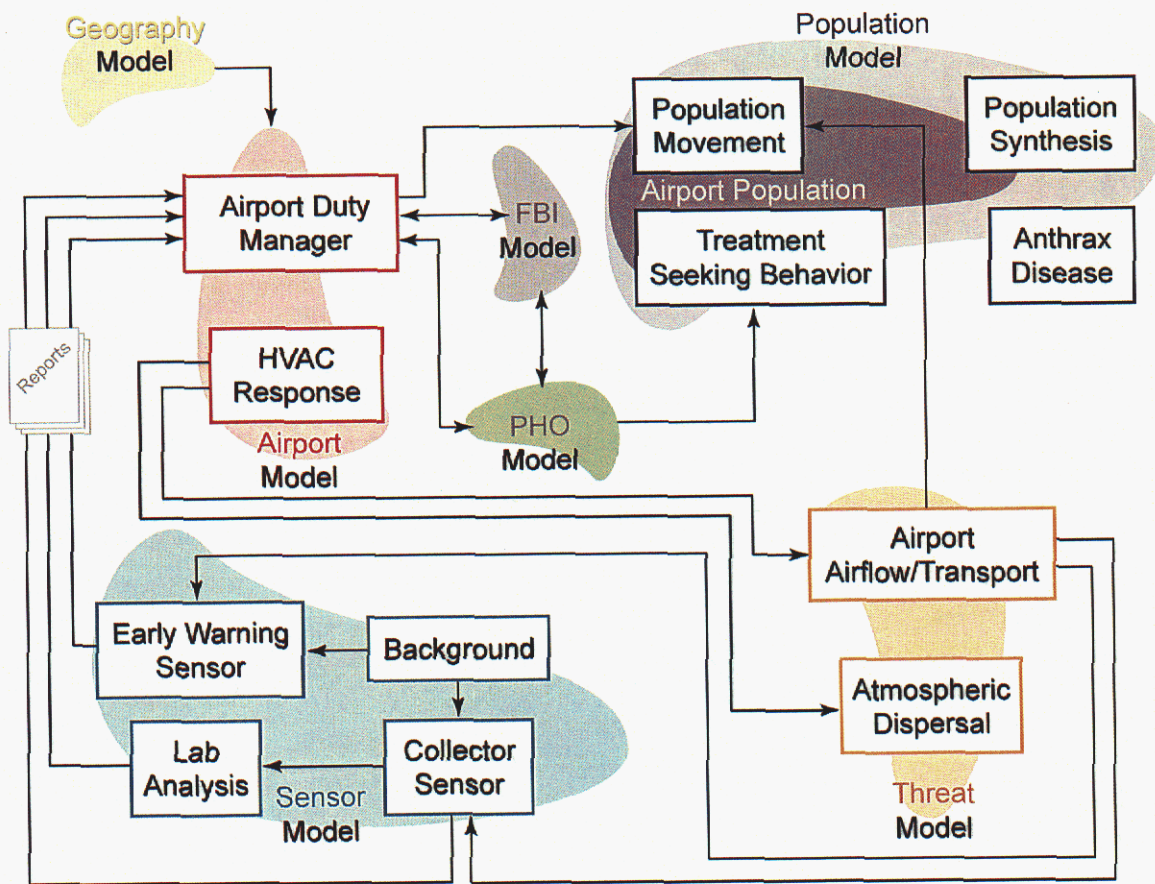
Figure 2. Facility Communications Simulation Model Interaction Diagram.

Scenario events are tracked through the FBI player's bulletins. We acquired examples of real FBI bulletins and designed our simulated bulletins in the same format. FBI bulletins serve to inform the FBI agent of current worldwide events. By monitoring the bulletins closely, an FBI agent can link together otherwise separate and seemingly disjoint events to gain a broader perspective of the world situation. We initially wrote the critical and relevant information that defined the progression of the scenario using this bulletin format. We then created irrelevant bulletins that ranged from easily identifiable as background noise to some that could be misleading to the FBI player.

1.2 Scenario Timeline

Figure 3 shows a diagram of the scenario timeline. Through his FBI bulletins, the FBI Agent role player learns that two terrorist cells appear to be planning on individually launching a biological attack within a major west coast city. Further bulletins reveal that one terrorist cell is captured in Honolulu as its members attempt to board a plane for the Bay Area International Airport. They confess only that the target is a California international airport. Another cell in Vancouver, Canada eludes capture by police and is later determined to be traveling south on I5, possibly toward the Bay Area International

Airport. Each aspect of the scenario is uncovered piece by piece as the simulation progresses over a 36-hour period. If the FBI Agent determines the information is relevant, he may share it with his teammates in order to alert them. His actions in response to the bulletins, as well as his sharing of the information, affect whether or not the terrorists are captured.
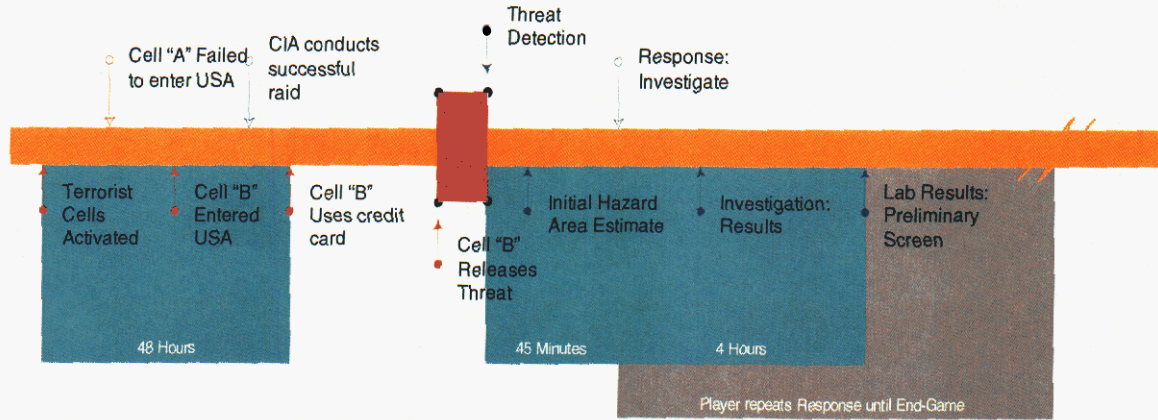
Figure 3. Scenario Timeline.

1.3   Joint Decision Points

We defined three joint decision points for inducing the high-stress environment targeted in this LDRD:

1. Request lab samples
   This is a low consequence, high value decision that impacts the accuracy and timeliness of the team's investigation as well as the scenario outcome. Lab results from collector sensor samples are the only way to positively confirm an anthrax attack.

2. Notify public of the attack / Shutdown airport HVAC system
   This is a high value, high consequence decision that could cause mass panic. On the other hand, waiting until the anthrax attack is confirmed to notify the public and shut down the airport's HVAC system in order to contain the spread of anthrax could result in the loss of many more lives.

3. Evacuate the airport
   This is a high value, high consequence decision, as canceling all flights and evacuating large numbers of people could have enormous monetary and emotional costs.

1.4   Multiple Scenario Outcomes

In addition to the three joint decisions, each player also makes individual decisions based on his role. These actions may simply notify and alert other agencies and first responders, or they may also initiate investigations that could affect the scenario

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outcome. It is important to note that the scenario outcome is not predetermined and does reflect the actions and decisions of the players. There are four possible outcomes:

1. The anthrax release is successful and the terrorists are captured at the airport. This outcome can only occur if the ADM, alerted by the FBI to increase security before the alarm sounds, takes certain key actions in a timely manner. The airport police then have a 50% chance of capturing the terrorists. This outcome would significantly reduce the time to determine if an anthrax attack has occurred as well as reduce the number of airport casualties.

2. The anthrax release is successful and the terrorists are captured later outside Bakersfield. This outcome can only occur if the FBI agent takes certain key actions from relevant bulletins. If the terrorists are captured before the lab results are returned, this outcome would also reduce the time to determine if an anthrax attack has occurred as well as reduce the number of airport casualties.

3. The anthrax release is successful and the terrorists leave the airport undetected and are never captured. Only lab results would determine if an anthrax attack has occurred.

4. There is no anthrax release (false alarm). Either the terrorists never enter the airport or they are unsuccessful due to heightened airport security.

The style of the communication as well as the communication itself affects how well players communicate with one another. Figure 4 shows a decision tree for a simulation. Different decisions that affect the final outcome are made based on the style of communication. Consistently negative (sad face) communications among the players may disrupt the communication flow, while positive (happy face) communications tend to increase communication among the players. This diagram portrays the communication types among the four role players (red, green, yellow and blue faces). The gray squares represent decision points, while the white squares indicate the type of communication (. = declaratory, ? = interrogative, and ! = exclamatory or imperative). The gray faces indicate the emotions of the players (neutral, happy, angry, sad, frustrated, etc.). The computers indicate the processing of the players' communications into the final outcome of the scenario. The better outcomes (the green bars on the bottom of the figure) are obtained when the players are more objective and willing to ask more questions, as this stimulates communication flow. The worse outcomes (the red bars) are obtained when the players are negative and emotional, asking fewer questions and thus discouraging communication flow. Better communication allows for more effective and prompt decision-making leading to a better outcome.
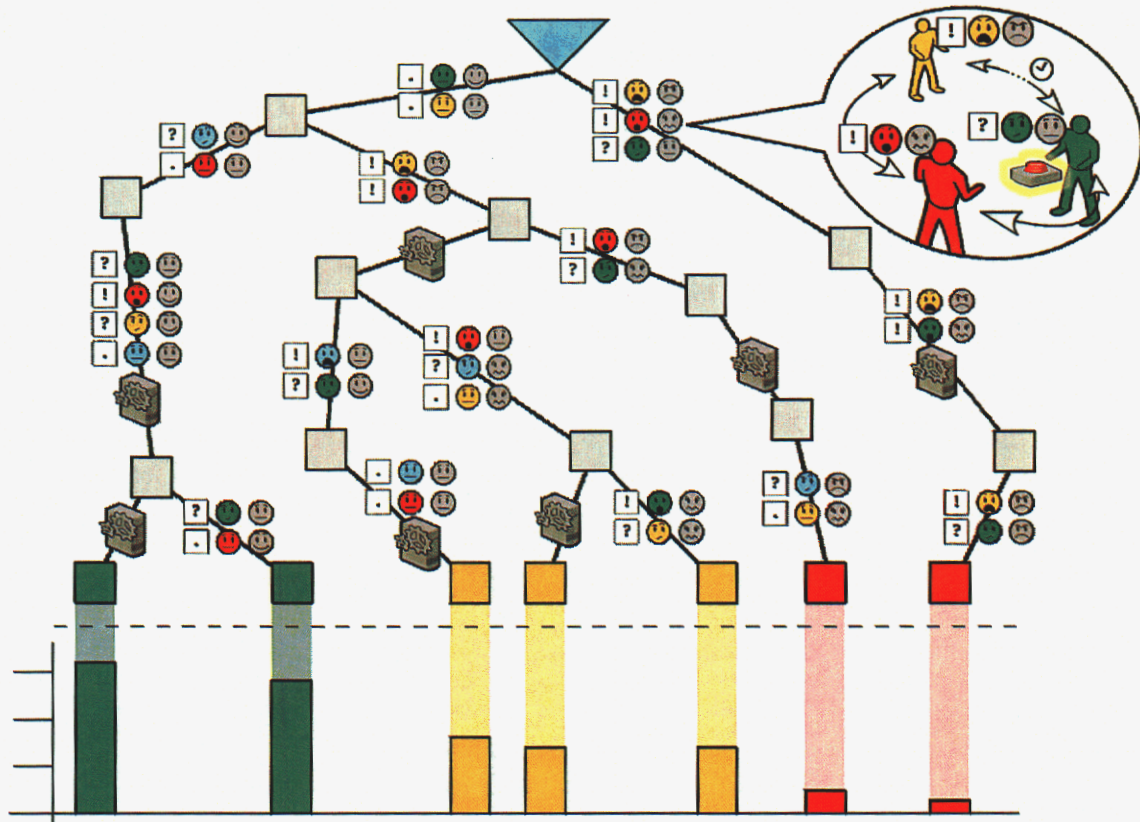
Figure 4. Multiple Scenario Outcomes Reflect Players' Actions.

1.5 The Airport Decision Maker Role

Figure 5 shows a program flow diagram for the Airport Decision Maker role. Note the different paths the simulation can take based on the ADM's actions.
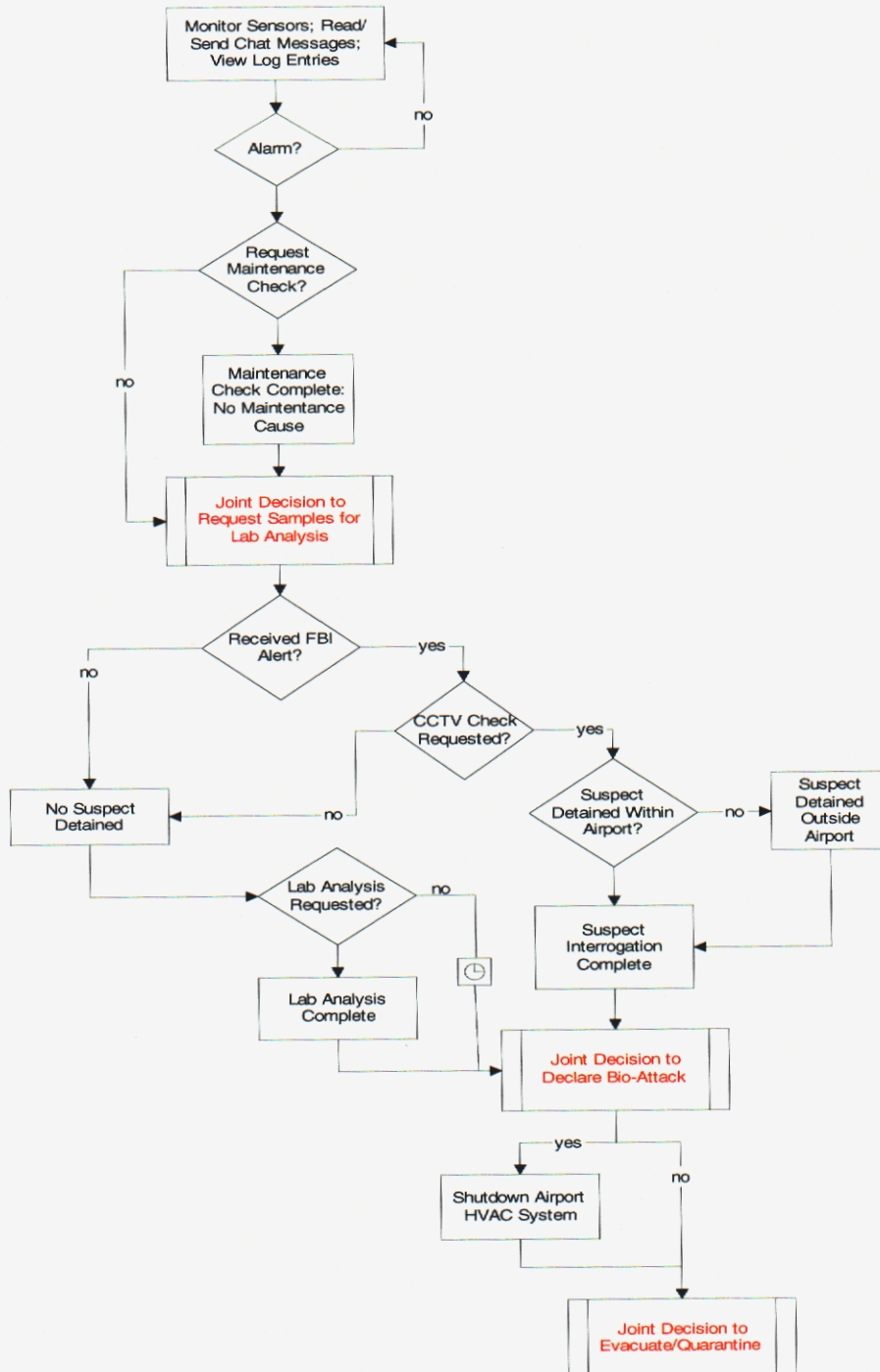
Figure 5. The Airport Decision Maker Role Program Flow Diagram.

1.6   The FBI Agent Role

Figure 6 shows a flow diagram for the FBI Agent role. The FBI's actions, similar to the ADM's, can affect the outcome by determining whether or not the terrorists are caught later outside the airport.
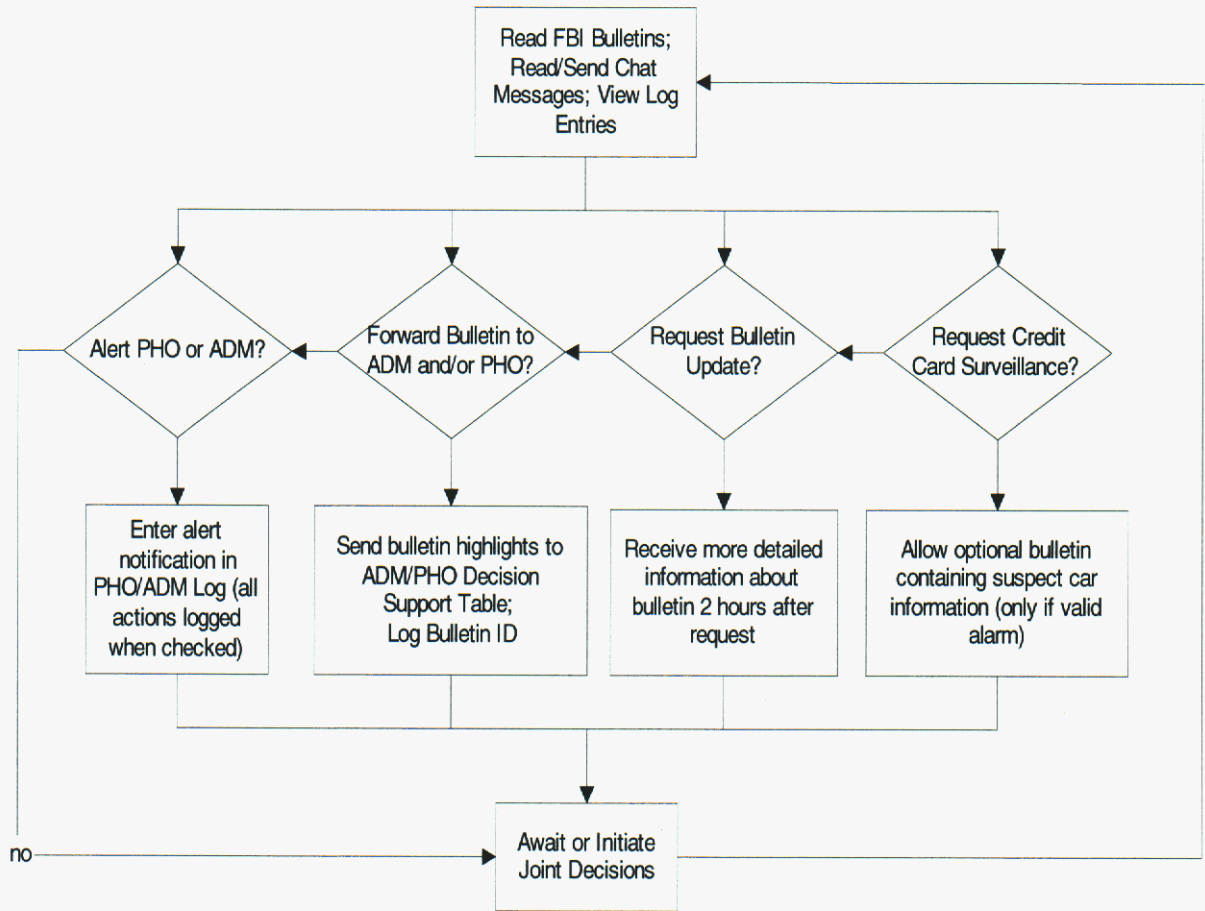
Figure 6. The FBI Agent Role Program Flow Diagram.

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1.7 The Public Health Officer Role

Figure 7 shows a flow diagram for the Public Health Officer role. Although the PHO's actions do not affect the law enforcement aspects of the scenario, his actions directly impact the preparedness of medical facilities to handle the large numbers of people that would be seeking antibiotic treatment after an anthrax attack.

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┌─────────────────────┐
│   Read/Send Chat    │ ◄───────────┐
│   Messages; View    │             │
│    Log Entries      │             │
└─────────────────────┘             │
           │                        │
           ▼                        │
┌─────────────────────┐             │
│  Await or Initiate  │             │
│   Joint Decisions   │             │
└─────────────────────┘             │
           │                        │
           ▼                        │
        ╱────────╲        no        │
       ╱ Received  ╲────────────────┘
       ╲ FBI or ADM ╱
        ╲  Alert?  ╱
           │
           ▼
┌─────────────────────────────┐
│ If ADM alerts PHO, enable   │
│ all response types except   │
│ Treatment; if FBI alerts    │
│ PHO, enable all response    │
│ types except Treatment and  │
│ Deliver Warning Notices to  │
│        Passengers           │
└─────────────────────────────┘
           │
           ▼
┌─────────────────────────────┐
│ All actions logged when     │
│ checked; if Alert FBI is    │
│ checked, send message to    │
│ FBI's Decision Support      │
│          Table;             │
│ if Alert Airport is checked,│
│ send message to ADM's       │
│ Decision Support Table      │
└─────────────────────────────┘
```

Figure 7. The Public Health Officer Role Program Flow Diagram.

2 Technology Development

A second objective of this LDRD was to create a conceptual Interagency Communication Network Simulation (ICNS) that would be the basis for monitoring communication traffic in a WMD-DAC distributed interactive simulation. The ICNS supports the capture, archive, and transmission of virtual email/faxes, chat room messages, and human voice data (see Figure 8). To this end, we have incorporated into our simulation both a pseudo-email capability using the HLA data stream and an Instant Messaging-like capability using Java's Remote Method Invocation (RMI) architecture. Players may automatically "email" specific information to their teammates through the actions available to them, and they may also "chat" with any one or all of their teammates in the three chat rooms provided in the simulation. We also created a prototype real time speech-to-text translation tool, but have not yet integrated it into the EMA due to the infancy of current speech recognition engine technology.

Machine-machine, human-machine, and human-human communication is captured.
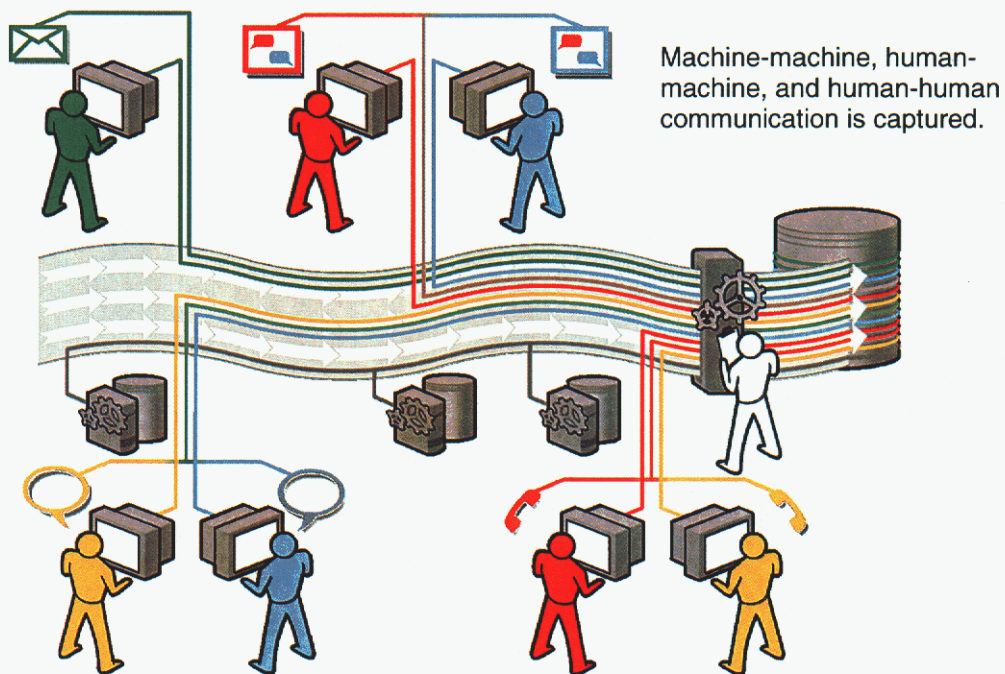
Figure 8. Complete Data Stream Capture.

All communication data, whether actions, events, or information flows between players, can be synthesized and categorized. Figure 9 shows the EMA's unique capability to synthesize events, actions, and information flows between entities, as well as human (role) communication content and categorization. The first column records the scenario events and actions, the second column breaks down the event into its communication type, and the third column contains the style of communication. For example, look at the purple chat information flow in the second column. This chat message was between the

blue and the red players (User 02 and User 03). User 02's message was declarative and happy (as indicated by the blue and gray faces in the third column), and User 03's message was exclamatory and ambivalent (as indicated by the red and gray faces).
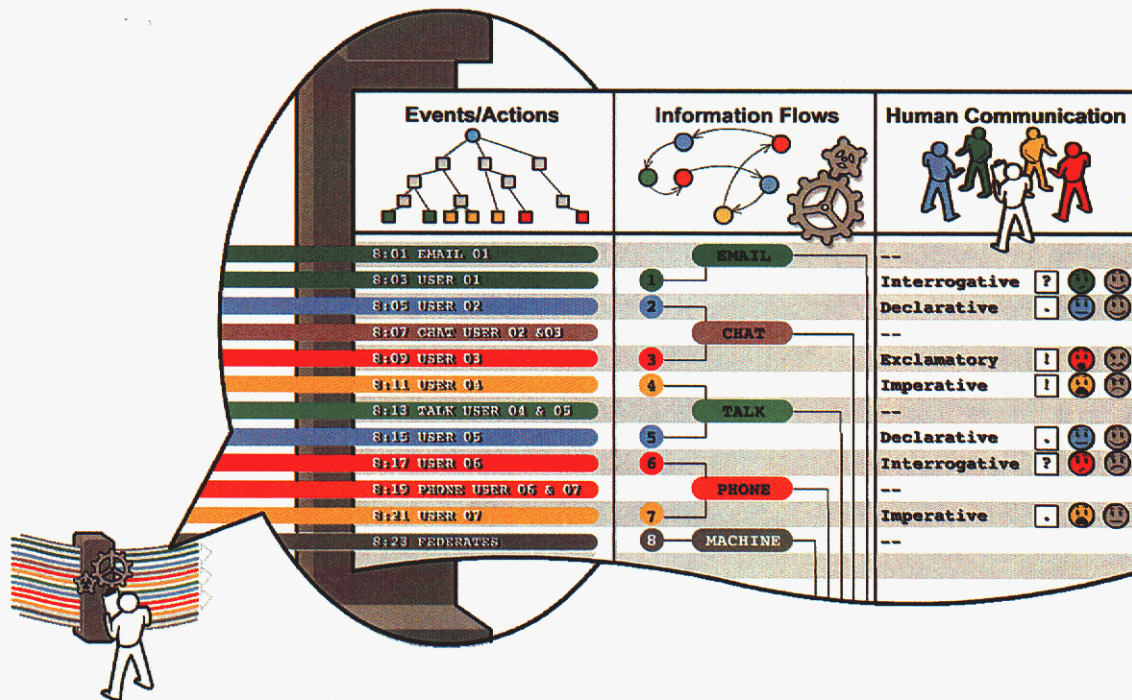
Figure 9. Information Synthesis & Categorization.

2.1 The Chat Interface

The Instant Messaging-like chat interface is shown below in the top left corner of Figure 10. The three available chat rooms for each player are listed in the tabs on the bottom left of the Chat dialog, and the names of the rooms correspond to the names of the players who may participate in those rooms. Players initiate a text message in the bottom left text field, and the message immediately appears in the corresponding chat rooms of the other players. Note that each message is time-stamped and indicates the initiator of the message. Messages may include requests for additional information, knowledge sharing among participants, opinions, or even stress relief. All chat messages, along with their metadata, are stored in an external SQL database for later retrieval and analysis.

2.2 The Chat Room Conversation Analyzer

The Chat Room Conversation Analyzer shown on the bottom right side of Figure 10 serves as a post-processing interactive tool to view and query the chat messages database. It sorts conversations within each simulation by individual or all chat rooms, color codes statements by role player, allows interactive updates of Interaction Process Analysis (IPA) numbers (see Section 4.2 below), and provides a statistical analysis of each message by both role player and IPA.
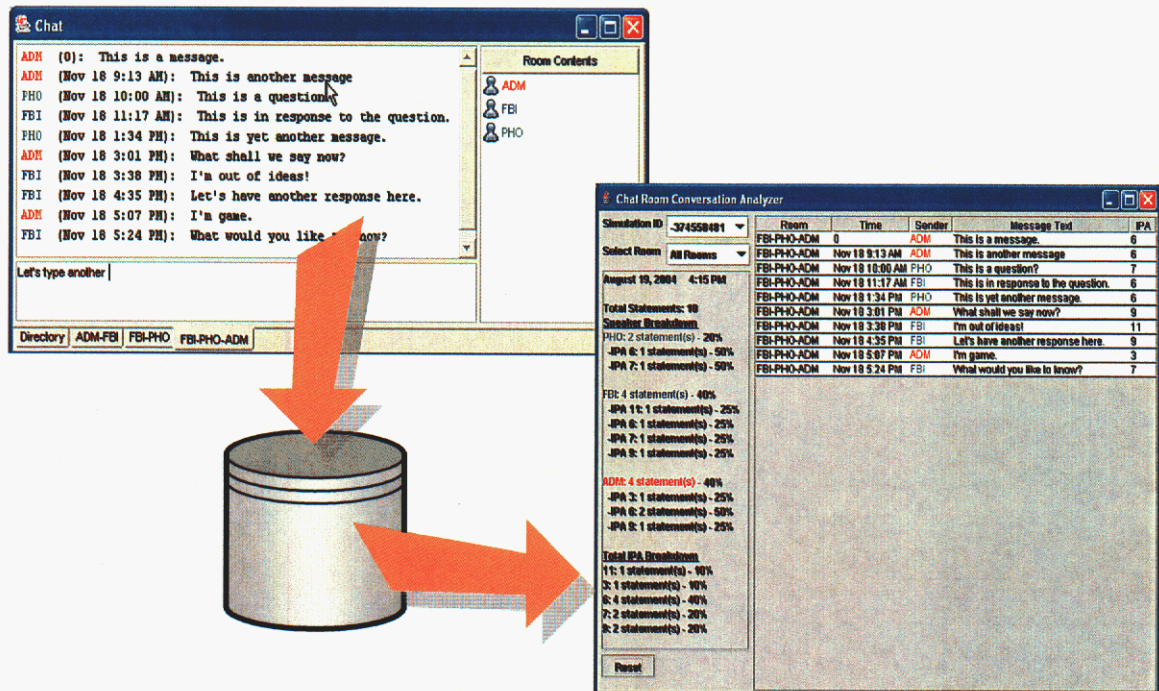
Figure 10. Chat Interface & Chat Room Conversation Analyzer Tool.

2.3 Speech-to-Text Prototype

The Conversation Model is a VOIP prototype that demonstrates speech-to-text translation in real time using a client-server architecture. It has two major components: 1) the VOIP application that manages the transfer of audio data between the server and multiple clients; and 2) the IBM Via Voice speech recognition engine that takes a stream of audio data as input and returns text as output to a client GUI. The Cloud Garden interface allows the Via Voice speech recognition engine to be programmed using the standard Java Speech API. Unfortunately, speech-to-text technology is not yet ready for large-scale use without significant time spent training the speech engine for each participant. Therefore, we are also providing a means to correlate the captured text with the corresponding audio clip. By capturing the audio as well as the text, post-exercise analysts can also hear the emotion associated with specific parts of the conversation. Figure 11 shows the client-server architecture of the Conversation Model.
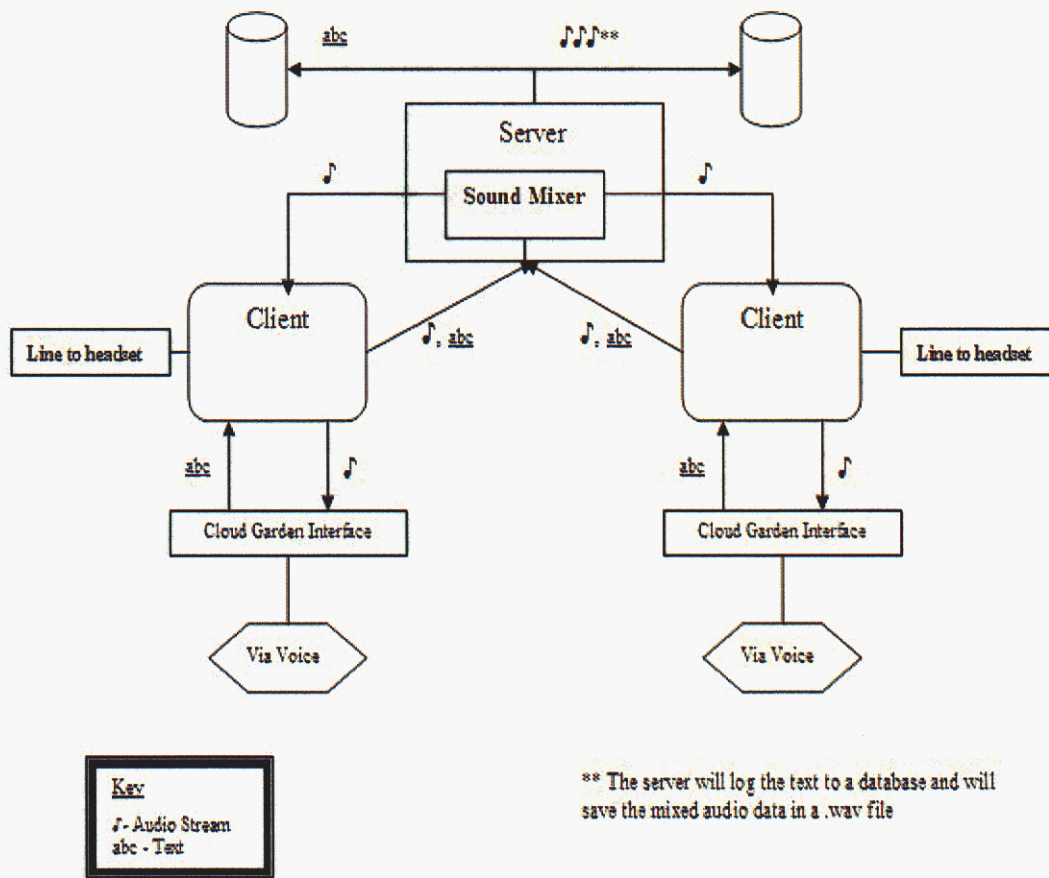
Figure 11. Speech-to-Text Capture & Translation via the Conversation Model.

The Conversation Model Interface is shown in Figure 12. After a user dons a headset, he connects to the server and can begin dictation. Note the mistakes made by the speech engine: "have just come back" was interpreted as "had just come back" and "positive for anthrax" was interpreted as "positive before and perhaps if."
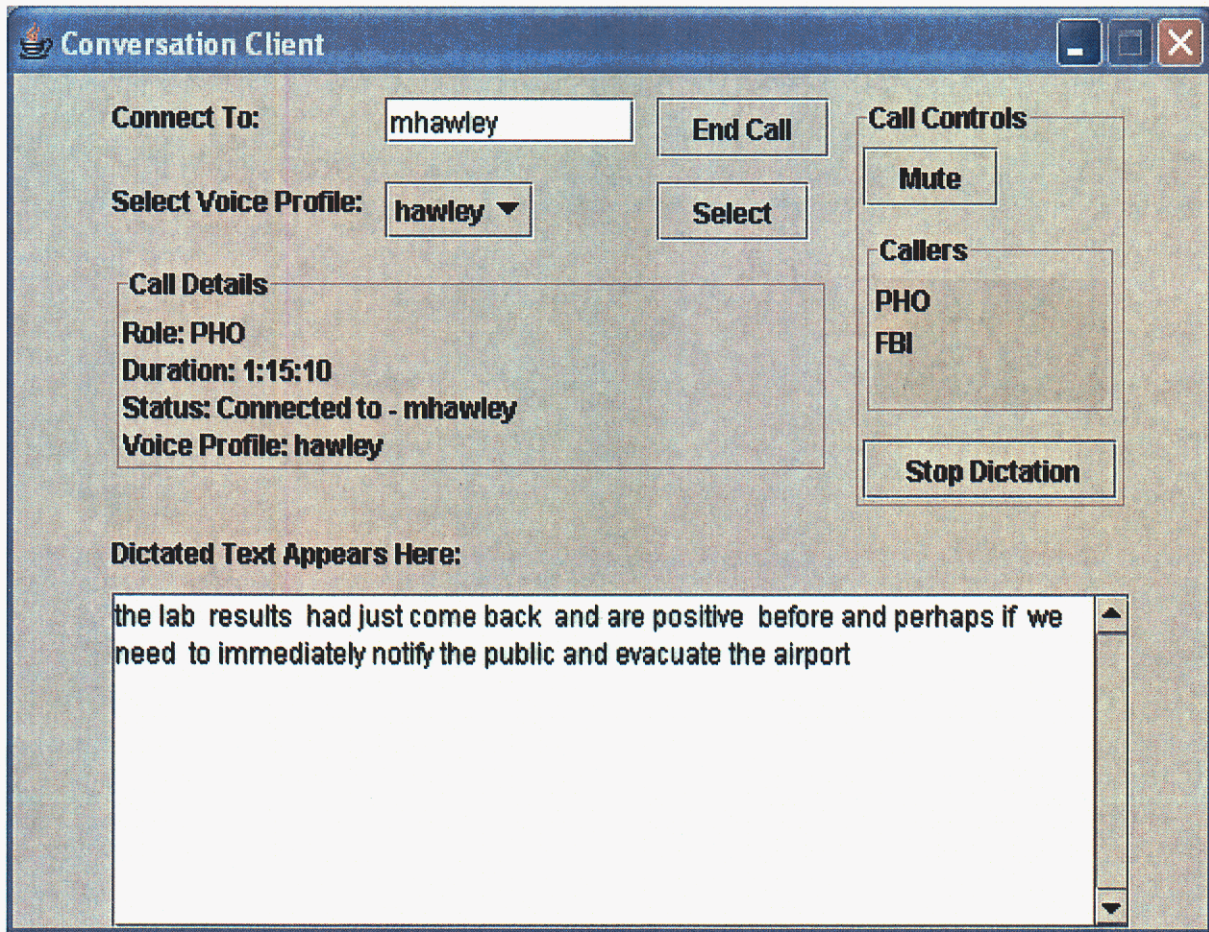
Figure 12. Conversation Model Interface. Note the speech recognition engine's mistakes in speech-to-text translation.

2.4 Text-to-Speech Prototype

We also explored a second category to processing speech: text-to-speech. Text-to-speech processing involves converting typed text into audio waveforms that are then played. There are two ways to realize the audio waveforms: (1) use software processing to attempt to produce a natural sounding text pattern, and (2) use a database of spoken words from a given person.

When software is used to produce text-to-speech with an artificial voice, the user of the system must be prepared to tolerate non-natural-sounding speech. This is because the written word cannot accurately reflect the intended prosody of the writer. Prosody is a term that refers to the basic elements of recognizing speech. It consists of pitch, the length or duration of a sound, and the loudness (intensity or volume). Prosody is used to determine what type of punctuation is to be used with the sentence. The human brain and ear often use this function to determine the feeling behind the words.

Figure 13 shows the text-to-speech prototype we developed. If you look at just the right half of the screenshot, under "Response from Bot," you see a typed line of text. Once you have selected a particular speech engine synthesizer and a personal pre-recorded profile (by clicking on the head icon), pressing the "Test TTS" button translates the typed message into speech. The synthesizer actually translates the text very accurately, but in a very artificial-sounding voice. This limitation restricted its implementation into the EMA at this time.
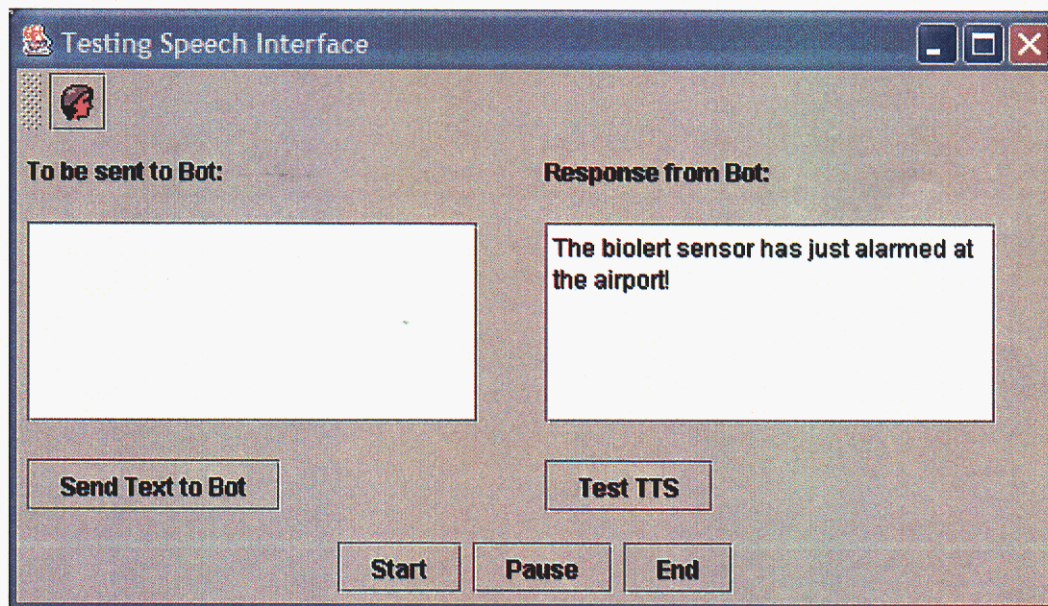
Figure 13. Prototype Text-to-Speech Interface.

3 Simulation Features

A detailed description of the simulation features can be found in the booklets created for each of the three role players and attached as Appendices A, B, and C. These booklets describe each character role and how the players interact within the simulation. They provide screenshots of the three user interfaces and describe each section in detail. An 18-minute narrated movie of the simulation is also available on CD upon request. This movie describes the features of the simulation and provides excerpts from an actual team exercise.

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4 Team Communication Study

4.1 Group Decision-Making Communication

The third objective of this study was to make quantifiable predictions as to how electronic forms of communication can affect team productivity by conducting tabletop exercises using the simulation and new communication technologies discussed above. The team communication study used established human- and computer-mediated communication research methodologies to categorize individual and team communicative behaviors and correlate these behaviors with performance measures. This study was designed to examine individuals' communication processes as they receive information pertaining to a crisis situation (an anthrax release in an airport) in order to understand how differences in communication patterns, quantity, and sharing influence the group decision process.

Group communication processes have a very powerful influence in determining both group outcomes and in mediating the effects of any given technology. As DeSanctis and Poole (1994) state, "the structure of the group is not to be thought of as a permanent, concrete set of relations, either among the members, or between members and their tasks; rather the structure is a patterning of group activities that result from a continuing process by which groups use the rules and resources available to them to produce and reproduce the apparently stable systems that are observed."

Group decision-making is often thwarted by several communication process outcomes that occur in meetings that limit decision effectiveness (DiSalvo, Nikkel, & Monroe, 1989). These are:

➢ Poor communication skills (10%)
➢ Egocentric behavior (8%)
➢ Nonparticipation (7%)
➢ Sidetracked (6.5%)
➢ Interruptions (6%)
➢ Negative leader behavior (6%)
➢ Attitudes and emotions (5%)

In the last several decades organizational groups have begun using electronic forms of communication as a means to help combat this outcome loss. Indeed, computer-mediated (CM) devices have been touted as potentially producing more effective communication by virtue of creating an environment that promotes certain communication gains (Dubrovsky, Kiesler, & Sethna, 1991). That is, under certain circumstances CM interactions are said to differ from face-to-face interactions through the production of greater and faster communication transfer, as well as greater accessibility and convenience for team members (Finholt, Sproull, Kiesler, 1990; Kiesler, Siegel, & McGuire, 1984; Straus, 1996). The use of CM communication can create many of the same forms of interaction that are typically found in face-to-face groups. However, CM groups may also produce effects that are quite different in many respects. For instance,

CM communication has been found in many experiments to produce differing arrays of process and performance outcomes that can be considered both favorable and unfavorable to organizational groups (see McGrath & Hollingshead, 1993; Straus, 1992).

CM interactions have been said to promote, among other things, greater task-focused and polarized communications. It has been suggested that task-focused behavior occurs more frequently in CM groups because CM team member are subjected to information processing limitations –caused by the structure of the electronic communication medium– which produce a narrowing of the communication bandwidth and, consequently, less informationally "rich" exchanges (Hiltz, Johnson, & Turoff, 1987). This narrowing of bandwidth occurs because CM groups normally exchange no social-physical cues at the time of interaction. Consequently, it is thought to be more difficult to interpret, and accordingly influence, other group members within the CM environment. In other words, one cannot monitor the facial expressions of others in order to observe their reactions and respond to them.

It can be argued this technology has benefited groups in many instances. However, the reduction of cues that are induced by this technology may pose a problem for organizational groups concerned with judgment or negotiating tasks. According to McGrath and Hollingshead (1993), a reduction of communicative cues will lead to poorer interaction for judgment and negotiating tasks because of a less "rich" communication transfer. It is maintained that the exchange of expressions and emotions are particularly valued here because they help determine the true intent of the communicators. Conversely, it has been contended that tasks requiring only the transmission of specific task ideas, such as brainstorming tasks, may only warrant communicating simple, "non-rich" information, which may be ideally suited for CM interactions (Dennis & Valacich, 1993). In this case, extensive non-verbal interactions may only serve to impede communication transfer by introducing non-essential interchanges as well as promoting production losses (Steiner, 1972).

What has not been empirically examined by any previous study is the efficacy associated with the group decision process within CM communication environments while managing a crisis situation. Crisis situations typically involve both brainstorming and negotiating tasks, which may promote certain types of communication patterns as well as affect the degree of communication and the amount of information-sharing that would take place among team members.

This study sought to better understand the communication process within CM teams during a crisis situation and its affect on team performance in order to help model, predict performance, and ultimately train first responder teams with this knowledge.

The research questions raised in this study include:

1. Does objective team performance vary as a function of their communication patterns?
2. Does objective team performance vary as a function of their communication content?
3. Does objective team performance vary as a function of their group across trial sessions?
4. Does subjective team performance vary as a function of their group across trial sessions?
5. Does subjective team performance correlate with objective team performance, team communication patterns, and/or team communication content?
6. Do specific team member roles correlate with certain communication patterns and/or communication content?
7. Do team communication patterns and/or communication content vary as a function of task?

4.2 Method

Dependent measures

The dependent measures include the communication process (frequency of communication, communication content, and degree of shared communication), the participants' time to decision, their objective team performance (decision accuracy in determining whether anthrax has been released or not) and subjective team performance (team satisfaction and perceived team performance/value).

Another aspect of group communication process is communication flow. The equality of communication, type of communication modality, and communication methods were examined, since research studies have found that they mediate the communication process, and thus group communication productivity. The time to decision was measured by assessing the total time it took to make the correct *group* decision. The decision was considered accurate if the group correctly determined if there was a crisis anthrax situation.

Moreover, since group dynamics evolve over time, the group processes' effect on the productivity, communication flow, and satisfaction will change as well. Therefore, each group worked as a team to develop a group decision twice. Each time, the group was confronted with a different scenario.

Subjects and Procedures

138 participants were recruited from Sandia National Laboratories during the summer of 2004. However, because of software problems, only data from 60 participants (20 groups of three participants each) were used. No personal compensation was given to the participants for participating in this study. All participants were over 18 years of age

(mean age range of 21-23). Of the participants, there was an equal split of males and females, with 71.5% of them having college senior-level education or above. Most (61%) did not regularly participate in electronic chat groups, but all did regularly use email.

Participants were randomly assigned to one of three role conditions – the FBI character role, the Airport Decision Maker character role, and the Public Health Officer character role. Participants' were assigned to conditions without considerations of their gender, age, or education level. Consideration was given, however, to the gender distribution within the groups, in that all male and all female groups were avoided if possible.

The experiment lasted approximately three hours. Participants were first required to read and sign an consent form (see Appendix D, *Research Participant Consent Form*), in which they agreed to be a participant. All participants then received a booklet describing their role in the study (see Appendices A, B, and C) that also contained a short background questionnaire. This questionnaire queried the participants about their computer experience and possible computer anxiety. The participants then read about the experiment in greater detail and became familiar with the communication environment.

The participants were assigned to groups of three. Each participant was individually taken to similar, but separate rooms. Each was told the nature of the experiment, the expected duration of the experiment, and that they needed only basic computer skills to participate in the experiment. The experimenter was to answer any questions the potential participants might have. The potential participants were told they could quit the experiment at any time, at their whim, with no ill effects to their status at Sandia National Laboratories. They were also told that no records would be kept of participants who quit before the experiment had finished. Those who elected not to participate would be thanked for their interest and asked to leave. Those who elected to participate would be asked to sign the consent form and their signature would be witnessed by the experimenter. Each participant was offered a copy of his or her signed and witnessed consent form.

Each participant was then handed the experiment booklet that guided them through the experiment. The experimenter reviewed the booklet with the participant by pointing out and reading the main points of the protocol. The booklet is divided into four parts: the background/computer attitudes questionnaire, the task scenario, instructions for the simulation interface, and the post-experiment questionnaire.

After answering the background/computer attitudes questionnaire, the participants were provided with one of three task scenarios. One task scenario had them take the role of an FBI agent, another take the role of a public health officer, and the third the role of an Airport Decision Maker. Each participant was randomly assigned a specific character role—FBI Agent, Public Health Officer, or Airport Decision Maker.

Each participant was asked to carefully read his or her task scenario. When they were finished, they were instructed how to use the chat interface to communicate with the other participants. When the participants indicated they were comfortable using the tool, they were instructed to type in the word "hello." When the test director received all three

hellos, the simulation started. In the booklet, participants were instructed not to reveal their name or gender, which may influence the interactions between participants.

The participants communicated in electronic groups twice. For both group sessions, each participant had the same character role. Each time the groups were faced with a new possibility that anthrax may or may not have been released. This was determined by modified Latin square design. The sessions were scheduled to take place in one day. Participants had one scheduled 15-minute break between the first and second session. The participants were placed in separate buildings. The first session lasted approximately 1-½ hours. The second session lasted less than one hour.

After the test director started the simulation, participants began to interact with the simulation and communicate according to their task scenario. Participants communicated with each other until the simulation was completed or the simulation time ended. During the simulation participants could slow the scenario time when more time was needed to formulate individual decisions.

At the conclusion of the simulation, participants answered a post-experiment questionnaire. They were then told they would be able to view the general results of the study when it was completed. The general results will be posted on a website six months after the conclusion of the study.

Task Type

As described previously, the task scenario involved the possible release of anthrax near a Bay Area city. This type of task falls under McGrath's (1984) task circumplex as an intellective-type of task that involves problem-solving tasks with correct answers. This type of task is considered to be appropriate for electronic group decision-making environments.

Coding of the Decision-Making Process

Content analysis of the group decision-making process was derived from verbatim transcripts of the electronic chat dialogue. Since the group decision-making process is mediated by several communication processes (DiSalvo et al., 1989), Bales' (1950) Interaction Process Analysis (IPA) was used to code the participants' communication patterns (see Appendix E, *Team Communication Study*). The IPA is based on Bales' Equilibrium Model. This model assumes that a group is continually trying to divide its efforts between instrumental (task related) needs and expressive (socio-emotional) needs. Therefore, the group is a system that seeks to maintain equilibrium between these two needs. Any disturbance upsets the balance temporarily until counteracting forces return the system to equilibrium. When a group meets more than once, it will go through three phases: orientation, evaluation, and control.

IPA can classify each bit of behavior performed by a group member into 1 of 12 categories. Six of these categories (socio-emotional positives and negatives) pertain to

socio-emotional activities that sustain or weaken interpersonal relationships within a group. Task questions and statements pertain to task activity, or behavior that focuses on the problem the group is trying to solve. Giving and asking for information, opinions, and suggestions related to the problem the group faces are all examples of task-oriented activity.

Using the method outlined by Bales (1950) and Hiltz, Johnson, and Turoff (1987), the transcripts were independently coded by two coders, who then met to review the entire transcript to resolve any inconsistencies. If they were unable to decide on a coding difference, the study director made the final coding decision.

In addition to the 12 IPA categories outlines by Bales (1950), it was decided to add five subcategories under IPA category 'gives information.' The additional subcategories, command statements, observation statements, statements of intent, acknowledgments, and replies, were derived from the coding categories used by Oser, Prince, Morgan, and Simpson (1991) to analyze patterns and content of aircrew communication.

4.3   Preliminary Results and Discussion

Preliminary analysis will include the examination of the time needed to develop a group decision for both sessions, the equality of communication among participants across sessions and character roles, and subjective team performance, such as team satisfaction and perceived team performance/value. Analysis of the communication content will be examined after the group transcript has been fully coded using the IPA method. This will be accomplished by the end of the 2004 calendar year.

Research examining group processes within electronic environments has suggested that the degree and richness of communication between group members will increase over time (McGrath, 1994; Walther, 1996). Using a series of t-tests in this experiment, significant differences were found in the amount of group communication between the first and second session across all three character roles, $t(59) = -8.60$, $p < .001$, $t(59) = -6.34$, $p < .001$, $t(59) = -8.01$, $p < .001$, for the FBI, PHO, and ADM character roles respectively. As shown in Figure 14, participants for all three character roles increased their amount of communication in the second session. This highlights the fact that even in crisis scenario environments, groups do go through the same orientating and maturing process that traditional groups encounter.

30
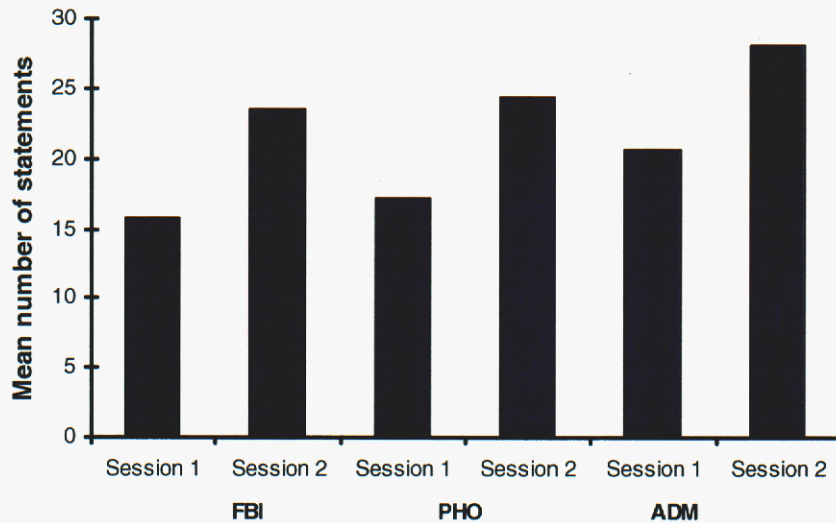
Figure 14. Differences in the Amount of Communication Between the Two Sessions.

Differences in the amount of communication between the two sessions apparently had no effect on the time required to reach a group decision as to whether anthrax had been released or not within the simulation. That is, no significant collective differences in decision time were found between the two sessions, $t(20) = -.398$, $p = .695$. It is possible that in the second session, more expressive communication was exhibited without benefiting the groups' decision analysis, therefore having no effect on the group decision time.

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5 Future Directions

A fourth objective of this LDRD was to incorporate the new communication technologies and study results into future WMD-DAC and other simulation-driven exercises and training events in which the four key issues of short time cycles, high stakes, incomplete data, and conflicting interests occur. The WMD-DAC application suite currently includes 4 additional decision-support and system evaluation applications:

- WMD-DAC Biological Defense Application
- WMD-DAC Nuclear Defense Application
- WMD-DAC Facility Defense Application
- WMD-DAC Borders Security Application

The technologies developed through this LDRD, as well as the analysis of the experiment results, will be applied in these applications as appropriate to support DHS, DOE, and DoD customers. In addition, we will extend the technologies to make use of or integrate with future extensions in simulation architecture and models, including the following areas:

5.1 Sensitivity Analysis
We are currently developing long-term partnerships with other Sandia departments to enhance sensitivity analysis and multi-center teaming around software development. One of the challenges facing system-of-systems modeling and simulation is in the area of multi-fidelity models and sensitivity analysis. Understanding the critical input parameters into sensor, entity movement, threat, public response, and other models is necessary before lower fidelity, higher speed representations of those entities can be created. Sensitivity analysis is one approach for identifying these parameters, their impact on application performance, and the sensitivity of the simulation to changes in their values.

5.2 Data Modeling
We are also establishing partnerships with other Sandia departments in the area of data modeling. Data modeling (or ontology mapping) maps data from multiple domains into common schemas that capture the relationships among data elements.

5.3 HLA "Rewind" Capability
We are exploring the development of an archive/retrieval capability for use in large-scale HLA simulations. This capability would allow the capture of simulation state and data and could eventually support a simulation "rewind" feature, including communication elements.

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Summary

By incorporating new communication technologies into the WMD-DAC environment, we were able to capture and analyze key communications among team members in a simulated high-stress training exercise. The information gleaned from this study and the partnerships discussed in Section 5 will be incorporated into future generation WMD-DAC exercises that will more accurately capture human-human and human-machine interactions. In this way, we hope to mitigate the communication barriers that exist between organizations that impede effective responses in WMD terrorism exercises.

Further analysis of the data obtained in the Team Communication Study is still underway and will be published in future reports.

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Communication Management Study
LDRD 03-0424
Booklet

Sandia National Laboratories

Role ID: ADM

Participant ID: _____

Group ID: _____

Date: _____

Time: _____

Location:_____

Facilitator:_____

Communication Management Study

INTRODUCTION

Welcome to the Communication Management Study! This study is divided into two sessions. The first session involves the following four steps. The second session involves all but the first step. In the first step, you will fill out the background computer-use and attitude pre-experiment questionnaire. In the second step, you will read the communication task scenario and familiarize yourself with your role in it. In the third step, you will interact with the other two study participants within a simulation. **It is very important that you interact with the other participants without revealing your name or gender**. In the fourth step, you will answer the questions in the post-experiment questionnaire. All information is provided in this booklet.

STEP 1.

Please turn the page and fill out the pre-experiment background computer use and attitudes questionnaire. **Stop when you are finished.**

PLEASE TURN PAGE

BACKGROUND QUESTIONNAIRE

Please answer these brief background questions regarding your computer usage and attitudes towards computer use.

1. How often do you usually use e-mail? (*Please Check One*)

   ____Daily ____ Weekly ____ Monthly ____ Rarely or Never

2. How often do you usually participate in chat groups? (*Please Check One*)

   ____Daily ____ Weekly ____Monthly ____Rarely or Never

Please indicate to what extent you agree with the following statements by circling the appropriate number.

	Not at All						Completely
3. *I hesitate to use a computer for fear of making mistakes that I cannot correct.*	1	2	3	4	5	6	7
4. *I feel insecure about my ability to interpret a computer printout.*	1	2	3	4	5	6	7
5. *I have avoided computers because they are unfamiliar and somewhat intimidating.*	1	2	3	4	5	6	7
6. *I have difficulty in understanding the technical aspects of computers.*	1	2	3	4	5	6	7
7. *The challenge of learning about computers is exciting.*	1	2	3	4	5	6	7
8. *I look forward to using a computer on my job.*	1	2	3	4	5	6	7
9. *Anyone can learn to use a computer if they are patient and motivated.*	1	2	3	4	5	6	7

Please provide the following information:

10. Age:

___18-20 ___21-23

___24-26 ___27-29

___30-33 ___34-36

___37-39 ___40-43

___44-46 ___47-49
___50-53 ___other

11. Gender:

___Male

___Female

12. Highest level of Education completed:

__High school __College freshman

__College sophomore __College junior

__College senior __Trade school

__Masters __Doctorate

PLEASE TURN PAGE

Communication Management Study

TASK SCENARIO

STEP 2.

Please read the scenario provided below. The scenario involves a possible bio-terrorism attack at a west coast airport in the United States. You are to imagine that you are in the situation described below. Each participant will receive a different view of the scenario, and will play the role of one of three organization representatives: FBI Agent (FBI), Public Health Official (PHO), or Airport Decision Maker (ADM). **The character you will play will be the ADM.** Please read the role description for all three organization representatives, paying particular attention to your own role. When you have finished reading the scenario, please inform the facilitator. The facilitator will then answer any questions you might have, and then familiarize you with the Graphical User Interface (GUI).

Communication with the other players is critical to influencing the outcome of the simulation. How well and with whom you share information will directly affect the number of people who will survive a bio-terrorism attack if it takes place, as well as your team performance score. On the other hand, consequences of a false alarm to the public are very high. You are encouraged to use the provided chat (Instant Messaging-like) interface frequently to communicate with the other players. Refer to the section on the Chat Interface below for a complete description of how this interface works.

You have the ability at any time to slow down the simulation to real time when sharing information, but overuse of this action may impact your team performance score.

The Situation

The United States is stepping up its efforts to capture key members of the al-Qaeda terrorist organization. This, however, has caused al-Qaeda and other terrorist organizations to respond towards the United States and its key allies by increasing both the number and lethality of its terrorism attempts. At the time of this study, there are no confirmed threats within the United States. The Homeland Security Advisory System condition is elevated (yellow), which means there is a significant risk of terrorist attacks.

It is the responsibility of the FBI role player to determine if a terrorist act is likely to occur in the scenario and to pass on relevant information to the other players to alert them. Remember that early detection and response are key elements to limiting loss of life in an actual bio-terrorism attack.

The goal of your team is to determine whether or not a bio-terrorism attack has occurred at the fictitious Bay Area International Airport in Bay Area, California. This airport has incorporated two different types of sensors as part of its bio-terrorism defense strategy: early warning sensors and collector sensors. There are five early warning sensors and 13

collector sensors placed within the airport's HVAC (heating, ventilation, and air conditioning) system, and the early warning sensors emit an alarm when they detect a biological agent (such as anthrax) in the air. **However, these sensors have a false alarm rate of about once per year, and it has been nearly a year since the last false alarm.** An early warning sensor will always alarm in your simulation, but you will not know if it is valid or false. The alarm will sound at a random time in the scenario, which is based on how the scenario progresses. Players should not assume the alarm has sounded until they get notification from the ADM player that the alarm has sounded. The only way to determine if the alarm is valid or false is by a group consensus to the joint decision to Request Lab Samples.

Although early warning sensors can detect an agent release within minutes by real-time examination of the agent particulates, collector sensors continuously gather air particulates onto a filter, which must be periodically retrieved and sent to a laboratory for analysis. This analysis takes several hours. Collector sensor results are almost 100% accurate in determining whether or not anthrax is present and are necessary to validate the alarm.

How well you share information with your team, and how carefully you make your decisions based on the information you have will determine the final outcome of the scenario as well as your team score.

There are three possible scenario outcomes:

1. The anthrax release is successful and the terrorists are captured at the airport. This outcome can only occur if the ADM, alerted by the FBI to increase security before the alarm sounds, takes the action to monitor the closed-circuit television videotapes within 30 minutes after the alarm sounds. The airport police then have a 50% chance of capturing the terrorists at the airport.

2. The anthrax release is successful and the terrorists leave the airport undetected. This outcome occurs if the terrorists are not captured at the airport.

3. There is no anthrax release (false alarm). Either the terrorists never enter the airport or they are unsuccessful due to heightened airport security.

Time is of the essence in determining whether anthrax has been released or not. You do not want to cause panic (one of the goals of the terrorists), falsely alarm the public (cause complacency), or disrupt business (could cost millions). However if anthrax has been released, thousands of people could die within weeks.

As the scenario unfolds, each team member will have access to separate, but limited, information sources. The quality and timeliness of your decisions will be determined by your group communication.

You will be participating in a computer simulation that involves interagency communication to determine **whether or not** a bio-terrorism attack has occurred at the Bay Area International Airport. The date of the simulation is November 18-19, 2004, a 36-hour time period that starts at 8:00 am the first day and ends at 8:00 pm the second day. Each member of your team has a different role in the simulation. As the simulation progresses, each member will receive different information associated with his or her role. You must determine what information to keep private or share. You and your interagency team are asked to monitor the environment, detect clues, and confirm or negate a potential attack correctly and quickly.

Your goal is to complete the three joint decisions that are listed at the top of each of your GUI screens. Any player may initiate a joint decision at any time during the scenario and detailed information about the pros and cons of making the decision are available during the simulation (see Joint decision Points, below). All players must unanimously vote "yes" in order for a decision to be implemented. These decisions will have a direct impact both on the outcome of the simulation and the team performance scores for speed and accuracy.

Note that the simulation may pause at certain points during the simulation to perform calculations. These pauses are usually on the hour, and last about 30 seconds. These are normal, and there is nothing wrong with your computer. Please be patient; the simulation will soon resume.

PLEASE TURN PAGE

PHO (Public Health Official)

Role and Responsibilities of PHO: The role of the PHO is to initiate medical and public health disaster preparedness, direct the integration of multidisciplinary agencies / professionals, assist in education, serve as a consultant to other agencies, and develop an internal state plan for emergencies. The responsibilities of the PHO are to direct radiological emergencies, public health, medical services, and mass fatalities.

Professional Profile: As an epidemiologist the PHO has been working in the public health industry for 26 years. The PHO has been assigned to work on Weapons of Mass Destruction (WMD) related issues for more than two years.

Organizational Culture: The PHO's primary mission is to protect the health and safety of the public. Therefore, it is very important that this person gives the public accurate and complete information during any kind of Weapons of Mass Destruction (WMD) attack. The PHO prefers not to confirm any attack until your laboratory has the time to conduct the necessary tests, or a terrorist has confessed to a biological attack. The PHO needs to be very careful not to falsely alarm the public; therefore, the other team members have to be patient while the PHO conducts the investigation and laboratory tests. One false alarm will end the PHO's professional career and hurt the reputation of the organization by causing unnecessary expenses and possible injuries due to mass panic.

During the Simulation: The PHO's informational sources include other members of the team and the laboratory. The PHO is the key player in determining if there has been an actual attack or not by monitoring the laboratory for the results of the anthrax tests and forwarding this information to the other players.

FBI (Federal Bureau of Investigation) Special Agent

Role and Responsibilities of FBI: The FBI has the responsibility as the "lead federal agency for crisis management." This does not mean the FBI takes over in crises situations.   Their role is to "identify, acquire, and plan use of resources needed to anticipate, prevent, and/or resolve a threat or act of terrorism" and to "…detect, prevent, preempt and disrupt terrorist attacks." The responsibilities of the FBI are to assess the threat, initiate criminal investigations, and engage in evidence collection.

Professional Profile: This FBI special agent has been working in the law enforcement field for 24 years. The agent has been assigned to work on Weapons of Mass Destruction (WMD) related duties for more than three years.

Organizational Culture: The agent's primary mission is to protect the safety of the public and to apprehend those who would cause public harm. Therefore, it is very important to insure that any arrests can be prosecuted in court. This can only be accomplished if the agent conducts timely investigations and collect relevant evidence before the information is lost. The agent needs to be very careful not to falsely alarm the public; therefore, the other team members have to be patient while the agent conducts the investigation and

understand why the agent may need to withhold sensitive information from them. Any accidental release of sensitive information can compromise the investigation and the reputation of the organization.

During the Simulation: The FBI agent's informational sources come from composite law enforcement bulletins and members of the team. The FBI agent is one of the key players in determining if there has been a bio-terrorism attack.

ADM (Airport Decision Maker) –YOUR CHARACTER ROLE

Role and Responsibilities of ADM: You as the ADM have the responsibility to insure the safety of the public in and near the airport, or from person(s) who use the airport as a mechanism to transport, conceal, or sell illegal or dangerous substances.

Professional Profile: You have been engaged in airport operations for 20 years and have been a member of the Airport Emergency Operations Center (EOC) at the Bay Area International Airport for the last 10 years. You have no actual experience with a WMD event, but have recently received training in that area.

Organizational Culture: Your primary mission is to protect the health and safety of the public while minimizing airport down time. **You need to be very careful not to falsely alarm the public or waste airport resources; therefore others have to be patient while you conduct your investigation to determine if a WMD attack has occurred.** You are also very concerned about the cost to the airport and passengers associated with shutting down an international airport. Consequences can be felt worldwide, as other airports' flights depend on your flights, and important business, political, and social meetings will be missed. Negative publicity could affect future flights from your facility, as well as your credibility and job.

Your Role: Please communicate with the other participants in a professional manner that is consistent with your character role, described above.

During the Simulation: Your informational sources come from your early warning and collector sensors, closed-circuit television (CCTV), and members of your team. As the ADM you are one of the key players responsible for deciding if there has been a bio-terrorism attack.

When the early warning sensor alarm sounds (only you will hear the alarm), your first responsibility is to determine what triggered the alarm (a cleaning agent, equipment malfunction, or anthrax). Useful actions at this point would be to "Interrogate maintenance personnel working near the sensors" to check for cleaning agent usage and to "Review closed-circuit television (CCTV) videotapes" to check for suspicious persons. Information from other role players that may or may not support an attack would be useful in making further decisions.
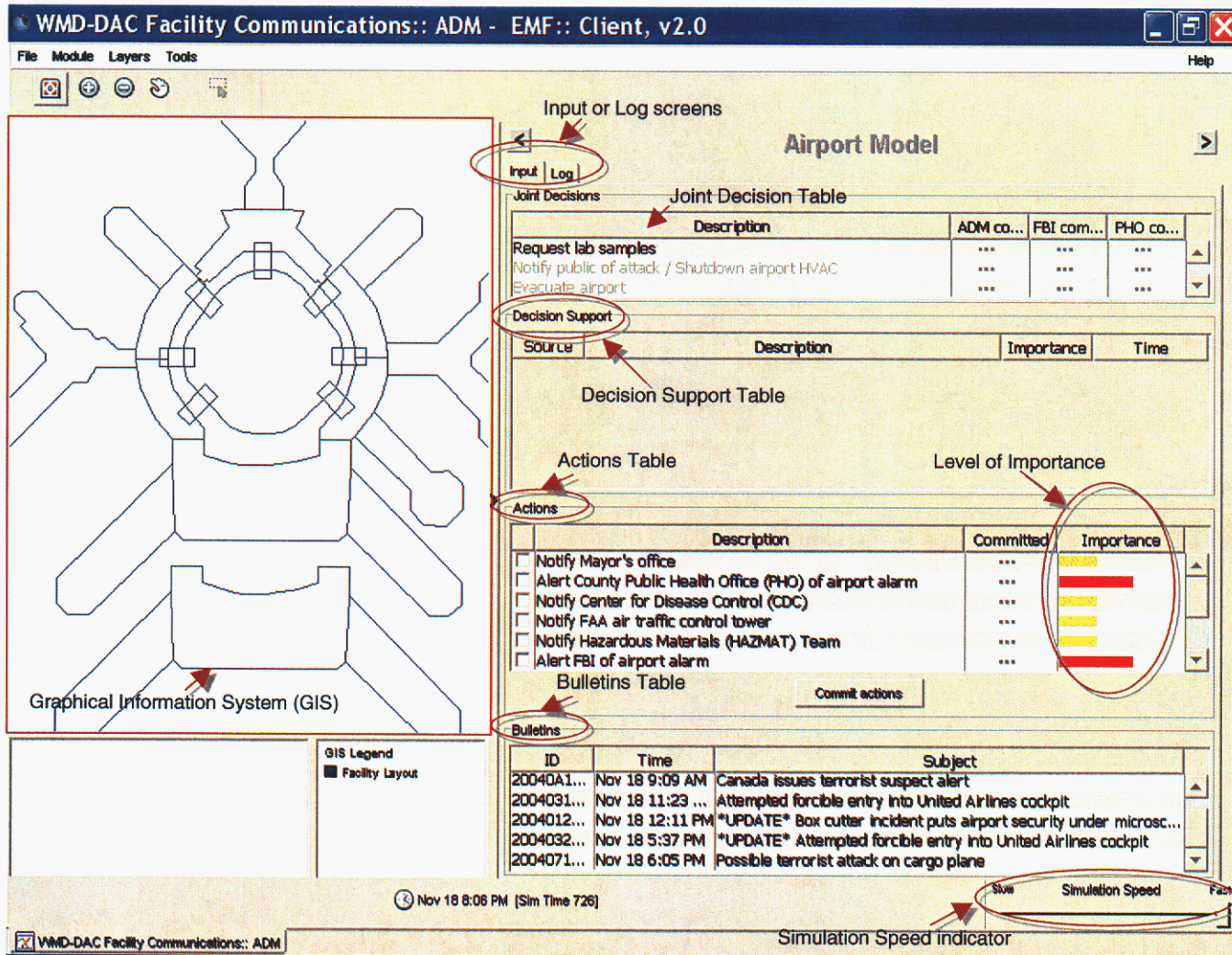
The GUI screen for the ADM

Interacting with the Computer: Your GUI consists of two screens: Input and Log. You can access each of these screens by clicking on the corresponding tab located at the top right-hand side of the GUI.

Your GUI Input screen is divided into four major areas. The Geographical Information System (GIS) on the left hand side of the screen displays the Bay Area International Airport facility layout. The right hand side of the screen contains three tables: Joint Decisions, Decision Support, and Actions.

The top table, Joint Decisions, lists the three decisions your team must unanimously agree upon in order to implement the decision. See Joint Decision Points, below, for a complete description of this table's functionality. All players have a Joint Decisions table.

The second table is the Decision Support table. This table keeps track of important information relative to the scenario that has been forwarded to you from your teammates. This table contains information for use in making decisions and no actions can be taken on the information that appears in this screen. To share or discuss any information that appears in this table the players must use the chat. See Decision Support Table, below, for a complete description of this table's functionality. All players have a Decision Support table.

The third table is the Actions table. This table lists a number of possible actions that you can take with regard to your role in the simulation. To learn more about an action, double-click in the "Description" column to pop up a dialog describing the action in more detail as well as its pros and cons. To initiate an action, check the box in the first column, then press the "Commit actions" button. The action is verified when the green check mark appears in the "Committed" column. The "Importance" column, similar to that in the Decision Support table, provides you with the relative importance level of the action. Once an action is committed, it is disabled and cannot be changed or viewed again.

Some actions are not enabled until a specific scenario event has occurred. For example, the action to "Review closed-circuit television (CCTV) videotapes" is not enabled until the alarm sounds. Prompt selection of this action after the alarm sounds can affect the course of the scenario by allowing you to capture the terrorists at the airport.

The Actions table can be sorted by any column by pressing the header bar of that column. For example, pressing the "Importance" header causes all actions to be sorted by their importance level (lowest to highest). Pressing a second time reverses the sort (highest to lowest).

The bottom table is the ADM Bulletins table. This table lists all the current event bulletins you receive during the simulation. Some bulletins appear at the simulation onset, while others appear as the scenario progresses. Some bulletins will have updates that will appear automatically at a later time in the scenario. There will be periods in the simulation where you will not receive any bulletins or updates, and this time can be used to review the information you have already received or to discuss any information that the other players have received. Bulletins feed the scenario story line and provide information on terrorist activities and locations as well as personal data. However, most of the bulletins do not contain information relevant to the scenario, and should be ignored. Your job is to determine which information is relevant, and which should be shared with your teammates to alert them without misleading them or compromising your investigation. The ADM does not have the option to forward the bulletin to the other players, so it is the responsibility of the ADM to communicate relevant information to the other two players using the chat. The ADM may want to share certain information with only one of the other players and may do so by using the designated chat room.

Note that you can slow down the simulation by moving the "Simulation Speed" scrollbar located at the bottom right hand side of the screen whenever you need to use the chat interface or initiate joint decisions.

Your GUI Log screen logs all your actions and airport events by time. This screen is useful to review what you have done at what time, but it is mainly used for post-simulation analysis. You can safely ignore this screen.

Interacting with the other players: Interaction between the three players is very important and will affect the final outcome of the simulation. As the ADM you are responsible for sharing appropriate information with the other two players. You are also responsible for using the chat interface to request information from the other players and to discuss events and information that occur during the simulation. The PHO has a list of actions that they can take during the simulation that will affect the final outcome, and the FBI has actions that they can take on the bulletins they receive. At times the other players may come to the ADM for assistance in making some of these decisions. It is your responsibility to provide them with appropriate information to make the decision and provide recommendations to them as to what actions they should take given the information you have been provided without compromising your investigation. If the other players take inappropriate actions or fail to take appropriate actions there will be adverse affects such as public panic or failure to commence antibiotics in a real alarm.

PLEASE TURN PAGE

Chat Interface

This simulation requires that you communicate with your teammates only via the computer. This is accomplished not only programmatically by forwarding information through tables and dialogs, but also by using the provided Instant Messaging-like chat interface. This interface is accessed via the Tools Menu at the top of your GUI screen. Selecting "Chat" will pop up the Chat dialog. If this dialog is not already up on your screen, please bring it up now so that you will be able to follow these directions more easily. This dialog should remain open on your screen throughout the simulation for easy accessibility.

The Chat Interface

Within its default Directory tab, the Chat dialog lists the four available chat rooms. For ease of use, the names of the rooms correspond to the permissions of the players to join that room. For example, only the ADM and the FBI role players can chat in the ADM-FBI room, and the PHO cannot see this information. It is recommended that players use the appropriate rooms to share information, as some information should only be shared with only one other player and not both players. All players can chat together in the FBI-PHO-ADM room. Please do not change any of the predefined settings, and simply use the rooms that have already been created for you.

You can enter a room by clicking on the tab associated with the desired room at the bottom of the Chat dialog. If you have permission to join this room, the left hand side of the screen will be colored white; if you do not have permission, it will be grayed out and disabled. **Please do not touch the Enter and Leave keys**, as the rooms are preset and we do not want you to accidentally remove a room or other participants from a room.

You initiate a chat message by typing in the text area on the bottom left-hand side of the dialog. The message is sent when you press the Enter key on the keyboard. A soft bell sound will indicate that the message has been sent, and the players who receive the message will also hear the bell. Additionally, an alert icon will appear on the tab of any room with unread messages.

Sent messages appear in the larger text area on the upper left-hand side of the dialog. All messages indicate the originator of the message as well as the simulation time it was sent. All messages are displayed in the order in which they are sent, and you can scroll back to review any previous correspondence.

The chat is one of the most important communication tools in the simulation and should be used frequently to discuss and validate information that is forwarded or shared from other players. Through use of the chat players may be able to obtain more information from the other players than they receive through forwards and will have more information to make decisions regarding the scenario. When communicating with the other teammates, **please do not use the copy/paste function.**

Joint Decision Points

Three predetermined joint decision points are listed in the Joint Decisions table for each role. Decision points serve to bring the team together to focus on a specific action and allow team members to communicate and make decisions according to their roles and responsibilities. Double-clicking in the "Description" column of the table pops up a dialog explaining the pros and cons of the decision as well as the voting options. You can cancel the dialog without initiating the decision if you just want more information about it, or you can vote either "yes" or "no" to broadcast the vote to the other players.

Any of the team players may initiate a decision at any time during the simulation. The decision points are sequential and can only be made in the specified order. Each player must vote either "yes" or "no" for each decision in order to progress to the next decision (players cannot change an earlier response if the vote is either "yes" or "no"). If a player is undecided at the time another player initiates a decision, he may abstain from voting by pressing "Postpone and Chat," regardless of the other players' responses. When he is ready to make a decision, after chatting with the other players and reviewing his Decision Support table, he can then re-initiate the same decision and all players will vote again. A joint decision is not implemented unless all players unanimously vote "yes." Please do not attempt to close a joint decision voting box by clicking on the "X" on the upper right hand corner of the box. In order to close the joint decision box please use only the yes, no, postpone and chat, or cancel buttons.

As each player responds to a decision request, his response is displayed in the "ADM commit," FBI commit" or "PHO commit" columns. A green check mark indicates a "yes" response; while a red circle with a line through it indicates a "no" response. The three dash marks indicate no decision has been made (a player may have decided to "Postpone and Chat," so watch for new chat messages).

You can also slow down the simulation at any time by moving the "Simulation Speed" scrollbar located at the bottom right hand side of the screen. Slowing the simulation to real time allows you the opportunity to review what information you already have (provided in your Decision Support tables) and to request more information from the

other players via the chat interface. **It is best to re-read the Joint Decision Point support information when the team is beginning each decision point.**

Joint Decision Point #1: Request lab samples
This decision should only be initiated after the Airport Alarm has sounded and is necessary in determining if the alarm is valid or false. After conferring with the other team members via the chat interface and reviewing their Decision Support tables, either the PHO or the ADM should take the lead on deciding if samples from the airport's collector sensors should be sent to a laboratory for analysis. This low consequence, high value decision will impact the accuracy and timeliness of the team's investigation as well as the scenario outcome. For example, the PHO may not commence antibiotic treatment until either lab results have been returned or terrorists have confessed to an anthrax attack. Please keep in mind it takes approximately 6 hours for the lab results to come back once this decision has been initiated.

Joint Decision Point #2: Notify public of attack / Shutdown airport HVAC
After conferring with the other team members via the chat interface and reviewing the Decision Support table, the PHO should take the lead on deciding if a biological attack declaration to the public is warranted. This action should not be taken until either positive lab results have been returned or the terrorists have confessed to an anthrax attack. This action also shuts down the airport's HVAC system in order to contain the spread of anthrax.

Additional PHO actions at this point, if not done already, should include mobilizing the local pharmaceutical stockpile and activating the Strategic National Stockpile (SNS). Note that antibiotic treatment of passengers and airport personnel may not commence earlier than one hour from the time the local pharmaceutical stockpile is notified, and the SNS cannot be ready to provide additional antibiotics until 24 hours from its notification time. The timing of the declaration and the quality of the information upon which the decision is based will impact the team's performance score. This is a high consequence decision that could cause mass panic.

Joint Decision Point #3: Evacuate airport
After conferring with the other team members via the chat interface and reviewing their Decision Support tables, either the PHO or the ADM should take the lead on deciding if the airport needs to be evacuated to tarmac or through terminal. Only the player that initiates the decision will be able to make the decision between the following two choices. All other players will be voting either yes, no, or postpone and chat to the decision the initiator makes. The 2 choices are:

1. *Evacuate to tarmac* (quarantine). This decision removes all passengers from the airport and quarantines them on the tarmac. All flights are cancelled, and no passengers are permitted to leave or enter the airport. The underlying population disease model is based on the assumption that 100% of those quarantined will receive antibiotic treatment immediately if the PHO has authorized it in his Actions table any time before the simulation ends.

2. *Evacuate through terminal* (leave airport). This decision routes all passengers through the terminals outside the airport without quarantining them. All flights are cancelled, and no passengers are permitted to enter the airport. The underlying population disease model is based on the assumption that 70% of those who left the airport before the evacuation will receive antibiotics after four days, while 90% of those who left after being evacuated will receive antibiotic treatment after one day.

The timing of the decision and the quality of the information upon which the decision was based will impact the team's performance score. This is a high consequence decision, as canceling all flights and evacuating large numbers of people will have enormous emotional and monetary costs.

Decision Support Table

The information in the Decision Support table, along with other information gained in the chat interface, should assist all players in making the joint decisions and determining the scenario outcome. This table is located on the middle right-hand side of each player's GUI Input screen, directly below the Joint Decisions table. Its purpose is to keep track of important information relative to the scenario that only you may know or that has been forwarded from teammates. No action can be taken on the information in this table. To share or discuss this information you must use the chat. It is very important to frequently check this table for new information and for updates to the actions you have taken. Since the information in your table may be different from the information in other players' tables, do not assume that they know everything that you know. There are four columns of data in this table:

1. *Source:* This column indicates who forwarded you the information (FBI, PHO, or ADM).

2. *Description:* Double-clicking on this column pops up a dialog containing the full message, as the field is not large enough to display the complete information.

3. *Importance:* This column provides you with the relative importance level of the information (high - red, medium -yellow, and low - green).

4. *Time:* This column displays the simulation time at which you received the information.

Tables can be sorted by any column by pressing the header bar of that column. For example, pressing the "Importance" header causes all information to be sorted by its importance level (lowest to highest). Pressing a second time reverses the sort (highest to lowest).

PLEASE SEE THE FACILITATOR NOW

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SIMULATION

STEP 3.

Now, you are ready to begin the simulation. You have approximately **60 minutes** to complete the simulation by coming to a collective decision regarding the possibility of anthrax being released or not. The simulation ends when the 36-hour scenario time frame has elapsed. A popup dialog will inform you when the simulation ends.

A time clock located at the bottom center of the GUI displays simulation time. This time clock does not appear until the simulation begins (it appears at the bottom of the window). Simulation time is normally 60 times real time (i.e., 1 second real time = 1 minute scenario time). Use the Simulation Speed scroll bar located to the right of the clock when you want to slow down simulation time.

Please **do not** reveal your name or gender. We would like this information to remain undisclosed as you converse with the other team members

When you are ready please type, **"I am ready to start"** in the FBI-PHO-ADM chat room. When all team members have responded, the facilitator will start the simulation. Once the simulation time appears in the time clock, the simulation has begun. Begin by examining your actions (ADM and PHO) or bulletins (FBI). Respond to any information either forwarded to you from other team members or available only to you. Begin chat discussions concerning unusual events and your ideas regarding the possible release of anthrax. **PLEASE INTERACT ACCORDING TO YOUR ROLE PROFILE IN THE SCENARIO**.

Please be ready to begin as soon as all players have indicated they are ready and the time clock appears.

PLEASE CONTINUE TO STEP 4 ONCE THE SIMULATION IS FINISHED

Communication Management Study

POST-EXPERIMENT QUESTIONNAIRE

STEP 4.

Please fill out the questionnaire on the next page according to YOUR perception of your team's performance.

PLEASE TURN PAGE

Post-Group Session Questionnaire
Session 1

Please take few minutes to fill out the following simple evaluation form. Your comments are critical to our continuous improvement process.

Please rank your group's problem-solving skills on the following scale:

1.   *Efficient*   *Inefficient*
         1   *2*   *3*   *4*   *5*

2.   *Coordinated*   *Uncoordinated*
         1   *2*   *3*   *4*   *5*

3.   *Fair*   *Unfair*
         1   *2*   *3*   *4*   *5*

4.   *Confusing*   *Understandable*
         1   *2*   *3*   *4*   *5*

5.   *Satisfying*   *Dissatisfying*
         1   *2*   *3*   *4*   *5*

To what extent did the following criteria meet or exceed your expectations?

	Below			**Exceed**	
6. *The pre-experiment instructions were precise, clear, and relevant.*	1	2	3	4	5
7. *The experiment objectives, processes, and procedures were communicated clearly.*	1	2	3	4	5
8. *All exercise support materials were clear, easy to follow, and relevant.*	1	2	3	4	5
9. *During the experiment, I felt safe, comfortable, and supported.*	1	2	3	4	5
10. *The computer scenario interfaces were easy to use.*	1	2	3	4	5
11. *The scenario story was realistic enough to promote meaningful human interactions.*	1	2	3	4	5

PLEASE TURN PAGE

12. *The three joint decision points (see Joint decision Points Attachment) were well placed and constructed.*   1   2   3   4   5

13. *Overall, I had a positive learning experience from participating in the experiment.*   1   2   3   4   5

To what extent are the following criteria important to you?

	Little				**Very**

14. *Having precise, clear, and relevant pre-experiment instructions.*   1   2   3   4   5

15. *Having the experiment objectives, processes, and procedures clearly communicated.*   1   2   3   4   5

16. *Having clear, easy to follow, and relevant exercise support materials.*   1   2   3   4   5

17. *Feeling safe, comfortable, and supported during the experiment.*   1   2   3   4   5

18. *Having easy to use computer scenario interfaces.*   1   2   3   4   5

19. *Having a scenario story that was realistic enough to promote meaningful human interactions.*   1   2   3   4   5

20. *Having well placed and constructed joint decision points.*   1   2   3   4   5

21. *Having a positive learning experience from participating in the experiment.*   1   2   3   4   5

PLEASE SEE THE FACILITATOR NOW

Post-Group Session Questionnaire
Session 2

Please take few minutes to fill out the following simple evaluation form. Your comments are critical to our continuous improvement process.

Please rank your group's problem-solving skills on the following scale:

1.   *Efficient*   *Inefficient*
        1   *2*   *3*   *4*   *5*

2.   *Coordinated*   *Uncoordinated*
        1   *2*   *3*   *4*   *5*

3.   *Fair*   *Unfair*
        1   *2*   *3*   *4*   *5*

4.   *Confusing*   *Understandable*
        1   *2*   *3*   *4*   *5*

5.   *Satisfying*   *Dissatisfying*
        1   *2*   *3*   *4*   *5*

To what extent did the following criteria meet or exceed your expectations?

		Below				Exceed
6.	*The pre-experiment instructions were precise, clear, and relevant.*	1	2	3	4	5
7.	*The experiment objectives, processes, and procedures were communicated clearly.*	1	2	3	4	5
8.	*All exercise support materials were clear, easy to follow, and relevant.*	1	2	3	4	5
9.	*During the experiment, I felt safe, comfortable, and supported.*	1	2	3	4	5
10.	*The computer scenario interfaces were easy to use.*	1	2	3	4	5
11.	*The scenario story was realistic enough to promote meaningful human interactions.*	1	2	3	4	5

PLEASE TURN PAGE

12. *The three joint decision points (see Joint decision Points Attachment) were well placed and constructed.*   1 2 3 4 5

13. *Overall, I had a positive learning experience from participating in the experiment.*   1 2 3 4 5

To what extent are the following criteria important to you?

	Little				**Very**

14. *Having precise, clear, and relevant pre-experiment instructions.*   1 2 3 4 5

15. *Having the experiment objectives, processes, and procedures clearly communicated.*   1 2 3 4 5

16. *Having clear, easy to follow, and relevant exercise support materials.*   1 2 3 4 5

17. *Feeling safe, comfortable, and supported during the experiment.*   1 2 3 4 5

18. *Having easy to use computer scenario interfaces.*   1 2 3 4 5

19. *Having a scenario story that was realistic enough to promote meaningful human interactions.*   1 2 3 4 5

20. *Having well placed and constructed joint decision points.*   1 2 3 4 5

21. *Having a positive learning experience from participating in the experiment.*   1 2 3 4 5

PLEASE SEE THE FACILITATOR NOW

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Communication Management Study
LDRD 03-0424
Booklet

Sandia National Laboratories

Role ID: FBI

Participant ID: _____

Group ID: _____

Date: _____

Time: _____

Location: _____

Facilitator: _____

Communication Management Study

INTRODUCTION

Welcome to the Communication Management Study! This study is divided into two sessions. The first session involves the following four steps. The second session involves all but the first step. In the first step, you will fill out the background computer-use and attitude pre-experiment questionnaire. In the second step, you will read the communication task scenario and familiarize yourself with your role in it. In the third step, you will interact with the other two study participants within a simulation. **It is very important that you interact with the other participants without revealing your name or gender**. In the fourth step, you will answer the questions in the post-experiment questionnaire. All information is provided in this booklet.

STEP 1.

Please turn the page and fill out the pre-experiment background computer use and attitudes questionnaire. **Stop when you are finished.**

PLEASE TURN PAGE

BACKGROUND QUESTIONNAIRE

Please answer these brief background questions regarding your computer usage and attitudes towards computer use.

1. How often do you usually use e-mail? *(Please Check One)*

   ____Daily ____ Weekly ____ Monthly ____ Rarely or Never

2. How often do you usually participate in chat groups? *(Please Check One)*

   ____Daily ____ Weekly ____Monthly ____Rarely or Never

Please indicate to what extent you agree with the following statements by circling the appropriate number.

	Not at All						*Completely*
3. *I hesitate to use a computer for fear of making mistakes that I cannot correct.*	1	2	3	4	5	6	7
4. *I feel insecure about my ability to interpret a computer printout.*	1	2	3	4	5	6	7
5. *I have avoided computers because they are unfamiliar and somewhat intimidating.*	1	2	3	4	5	6	7
6. *I have difficulty in understanding the technical aspects of computers.*	1	2	3	4	5	6	7
7. *The challenge of learning about computers is exciting.*	1	2	3	4	5	6	7
8. *I look forward to using a computer on my job.*	1	2	3	4	5	6	7
9. *Anyone can learn to use a computer if they are patient and motivated.*	1	2	3	4	5	6	7

Please provide the following information:

10. Age:

___*18-20*   ___*21-23*
___*24-26*   ___*27-29*
___*30-33*   ___*34-36*
___*37-39*   ___*40-43*
___*44-46*   ___*47-49*
___*50-53*   ___*other*

11. Gender:

___*Male*
___*Female*

12. Highest level of Education completed:

__*High school*   __*College freshman*
__*College sophomore* __*College junior*
__*College senior*   __*Trade school*
__*Masters*   __*Doctorate*

PLEASE TURN PAGE

Communication Management Study

TASK SCENARIO

STEP 2.

Please read the scenario provided below. The scenario involves a possible bio-terrorism attack at a west coast airport in the United States. You are to imagine that you are in the situation described below. Each participant will receive a different view of the scenario, and will play the role of one of three organization representatives: FBI Agent (FBI), Public Health Official (PHO), or Airport Decision Maker (ADM). **The character you will play will be the FBI agent**. Please read the role description for all three organization representatives, paying particular attention to your own role. When you have finished reading the scenario, please inform the facilitator. The facilitator will then answer any questions you might have, and then familiarize you with the Graphical User Interface (GUI).

Communication with the other players is critical to influencing the outcome of the simulation. How well and with whom you share information will directly affect the number of people who will survive a bio-terrorism attack if it takes place, as well as your team performance score. On the other hand, consequences of a false alarm to the public are very high. You are encouraged to use the provided chat (Instant Messaging-like) interface frequently to communicate with the other players. Refer to the section on the Chat Interface below for a complete description of how this interface works.

You have the ability at any time to slow down the simulation to real time when sharing information, but overuse of this action may impact your team performance score.

The Situation

The United States is stepping up its efforts to capture key members of the al-Qaeda terrorist organization. This, however, has caused al-Qaeda and other terrorist organizations to respond towards the United States and its key allies by increasing both the number and lethality of its terrorism attempts. At the time of this study, there are no confirmed threats within the United States. The Homeland Security Advisory System condition is elevated (yellow), which means there is a significant risk of terrorist attacks.

It is the responsibility of the FBI role player to determine if a terrorist act is likely to occur in the scenario and to pass on relevant information to the other players to alert them. Remember that early detection and response are key elements to limiting loss of life in an actual bio-terrorism attack.

The goal of your team is to determine whether or not a bio-terrorism attack has occurred at the fictitious Bay Area International Airport in Bay Area, California. This airport has incorporated two different types of sensors as part of its bio-terrorism defense strategy:

early warning sensors and collector sensors. There are five early warning sensors and 13 collector sensors placed within the airport's HVAC (heating, ventilation, and air conditioning) system, and the early warning sensors emit an alarm when they detect a biological agent (such as anthrax) in the air. **However, these sensors have a false alarm rate of about once per year, and it has been nearly a year since the last false alarm**. An early warning sensor will always alarm in your simulation, but you will not know if it is valid or false. The alarm will sound at a random time in the scenario, which is based on how the scenario progresses. Players should not assume the alarm has sounded until they get notification from the ADM player that the alarm has sounded. The only way to determine if the alarm is valid or false is by a group consensus to the joint decision to Request Lab Samples.

Although early warning sensors can detect an agent release within minutes by real-time examination of the agent particulates, collector sensors continuously gather air particulates onto a filter, which must be periodically retrieved and sent to a laboratory for analysis. This analysis takes several hours. Collector sensor results are almost 100% accurate in determining whether or not anthrax is present and are necessary to validate the alarm.

How well you share information with your team, and how carefully you make your decisions based on the information you have will determine the final outcome of the scenario as well as your team score.

There are three possible scenario outcomes:

1. The anthrax release is successful and the terrorists are captured at the airport. This outcome can only occur if the ADM, alerted by the FBI to increase security before the alarm sounds, takes the action to monitor the closed-circuit television videotapes within 30 minutes after the alarm sounds. The airport police then have a 50% chance of capturing the terrorists at the airport.

2. The anthrax release is successful and the terrorists leave the airport undetected. This outcome occurs if the terrorists are not captured at the airport.

3. There is no anthrax release (false alarm). Either the terrorists never enter the airport or they are unsuccessful due to heightened airport security.

Time is of the essence in determining whether anthrax has been released or not. You do not want to cause panic (one of the goals of the terrorists), falsely alarm the public (cause complacency), or disrupt business (could cost millions). However if anthrax has been released, thousands of people could die within weeks.

As the scenario unfolds, each team member will have access to separate, but limited, information sources. The quality and timeliness of your decisions will be determined by your group communication.

You will be participating in a computer simulation that involves interagency communication to determine **whether or not** a bio-terrorism attack has occurred at the Bay Area International Airport. The date of the simulation is November 18-19, 2004, a 36-hour time period that starts at 8:00 am the first day and ends at 8:00 pm the second day. Each member of your team has a different role in the simulation. As the simulation progresses, each member will receive different information associated with his or her role. You must determine what information to keep private or share. You and your interagency team are asked to monitor the environment, detect clues, and confirm or negate a potential attack correctly and quickly.

Your goal is to complete the three joint decisions that are listed at the top of each of your GUI screens. Any player may initiate a joint decision at any time during the scenario and detailed information about the pros and cons of making the decision are available during the simulation (see Joint decision Points, below). All players must unanimously vote "yes" in order for a decision to be implemented. These decisions will have a direct impact both on the outcome of the simulation and the team performance scores for speed and accuracy.

Note that the simulation may pause at certain points during the simulation to perform calculations. These pauses are usually on the hour, and last about 30 seconds. These are normal, and there is nothing wrong with your computer. Please be patient; the simulation will soon resume.

PLEASE TURN PAGE

PHO (Public Health Official)

Role and Responsibilities of PHO: The role of the PHO is to initiate medical and public health disaster preparedness, direct the integration of multidisciplinary agencies / professionals, assist in education, serve as a consultant to other agencies, and develop an internal state plan for emergencies. The responsibilities of the PHO are to direct radiological emergencies, public health, medical services, and mass fatalities.

Professional Profile: As an epidemiologist the PHO has been working in the public health industry for 26 years. The PHO has been assigned to work on Weapons of Mass Destruction (WMD) related issues for more than two years.

Organizational Culture: The PHO's primary mission is to protect the health and safety of the public. Therefore, it is very important that this person gives the public accurate and complete information during any kind of Weapons of Mass Destruction (WMD) attack. The PHO prefers not to confirm any attack until your laboratory has the time to conduct the necessary tests, or a terrorist has confessed to a biological attack. The PHO needs to be very careful not to falsely alarm the public; therefore, the other team members have to be patient while the PHO conducts the investigation and laboratory tests. One false alarm will end the PHO's professional career and hurt the reputation of the organization by causing unnecessary expenses and possible injuries due to mass panic.

During the Simulation: The PHO's informational sources include other members of the team and the laboratory. The PHO is the key player in determining if there has been an actual attack or not by monitoring the laboratory for the results of the anthrax tests and forwarding this information to the other players.

ADM (Airport Decision Maker)

Role and Responsibilities of ADM: The ADM has the responsibility to insure the safety of the public in and near the airport, or from person(s) who use the airport as a mechanism to transport, conceal, or sell illegal or dangerous substances.

Professional Profile: This ADM has been engaged in airport operations for 20 years and has been a member of the Airport Emergency Operations Center (EOC) at the Bay Area International Airport for the last 10 years. The ADM has no actual experience with a WMD event, but has recently received training in that area.

Organizational Culture: The ADM's primary mission is to protect the health and safety of the public while minimizing airport down time. This person needs to be very careful not to falsely alarm the public or waste airport resources; therefore others have to be patient while you conduct your investigation to determine if a WMD attack has occurred. The ADM is also very concerned about the cost to the airport and passengers associated with shutting down an international airport. Consequences can be felt worldwide, as other airports' flights depend on your flights, and important business, political, and social

meetings will be missed. Negative publicity could affect future flights from your facility, as well as the ADM's credibility and job.

During the Simulation: The ADM's informational sources come from your early warning and collector sensors, closed-circuit television (CCTV), and members of your team. The ADM is one of the key players responsible for deciding if there has been a bio-terrorism attack.

FBI (Federal Bureau of Investigation) Special Agent –YOUR CHARACTER ROLE

Role and Responsibilities of FBI: The FBI has the responsibility as the "lead federal agency for crisis management." This does not mean the FBI takes over in crises situations. Their role is to "identify, acquire, and plan use of resources needed to anticipate, prevent, and/or resolve a threat or act of terrorism" and to "…detect, prevent, preempt and disrupt terrorist attacks." The responsibilities of the FBI are to assess the threat, initiate criminal investigations, and engage in evidence collection.

Professional Profile: You have been working in the law enforcement field for 24 years, and have been assigned to work on Weapons of Mass Destruction (WMD) related duties for more than three years.

Organizational Culture: Your primary mission is to protect the safety of the public and to apprehend those who would cause public harm. Therefore, it is very important to insure that any arrests can be prosecuted in court. This can only be accomplished if the agent conducts timely investigations and collect relevant evidence before the information is lost. **You need to be very careful not to falsely alarm the public; therefore, the other team members have to be patient while the agent conducts the investigation and understand why the agent may need to withhold sensitive information from them.** Any accidental release of sensitive information can compromise the investigation and the reputation of the organization.

During the Simulation: Your informational sources come from composite law enforcement bulletins and members of the team. You are one of the key players in determining if there has been a bio-terrorism attack.

Your Role: Please communicate with the other participants in a professional manner that is consistent with your character role, described above.

WMD-DAC Facility Communications:: FBI - EMF:: Client, v2.0

File   Module   Layers   Tools   Help

Input or Log screens

Input | Log

FBI Model

Joint Decision Table

FEDERAL BUREAU INVESTIGATION

Joint Decisions

Description	ADM commit	FBI commit	PHO commit
Request lab samples	***	***	***
Notify public of attack / Shutdown airport HVAC	***	***	***
Evacuate airport	***	***	***

Decision Support

Source	Description	Importance	Time

Decision Support Table

Bulletins Table

Bulletins

ID	Time	Subject	Fwd to ADM	Fwd to PHO

Graphical Information System (GIS)

GIS Legend
- Canada
- United States
- Canada Roads
- US Interstate 5
- Cities

Simulation Speed

Simulation Speed indicator

WMD-DAC Facility Communications:: FBI

The GUI screen for the FBI Agent

Interacting with the Computer: Your GUI consists of two screens: Input and Log. You can access each of these screens by clicking on the corresponding tab located at the top right-hand side of the GUI.

Your GUI Input screen is divided into four major areas. The Geographical Information System (GIS) on the left hand side of the screen displays a map of the North American west coast and Hawaii. This is the area from which the terrorists originate their possible attack. You can follow the terrorists' route on the map toward the Bay Area International Airport, located approximately in the middle of California on the coast. The right hand side of the screen contains three tables: Joint Decisions, Decision Support, and Actions.

The top table, Joint Decisions, lists the three decisions your team must unanimously agree upon in order to implement the decision. See Joint Decision Points, below, for a complete description of this table's functionality. All players have a Joint Decisions table.

The middle table is the Decision Support table. This table keeps track of important information relative to the scenario that has been forwarded to you from your teammates. This table contains information for use in making decisions and no actions can be taken on the information that appears in this screen. To share or discuss any information that appears in this table the players must use the chat. See Decision Support Table, below, for a complete description of this table's functionality. All players have a Decision Support table.

The bottom table is the FBI Bulletins table. This table lists all the current event bulletins you receive during the simulation. Some bulletins appear at the simulation onset, while others appear as the scenario progresses. Some bulletins are optional, and are dependent upon actions taken on previous bulletins or other simulation events. There will be periods in the simulation where you will not receive any bulletins or updates, and this time can be used to review the information you have already received or to discuss any information that the other players have received. Bulletins feed the scenario story line and provide information on terrorist activities and locations as well as personal data. However, most of the bulletins do not contain information relevant to the scenario, and should be ignored. Your job is to determine which information is relevant, and which should be shared with your teammates to alert them without misleading them or compromising your investigation. All bulletins will look the same and will allow you to take the same five actions, it is your job to determine the relevance of the information you receive and to determine which actions are appropriate to take. Not all bulletins require action to be taken, and taking action on all bulletins will result in more irrelevant information coming through during the simulation.

The FBI Bulletins table has five columns. The first is the Bulletin ID, and the second is the time the bulletin is received. Double-clicking in the "Subject" column pops up a Bulletin Details dialog that displays the bulletin in its entirety as well as five actions that can be taken in response. The five actions are as follows:

Forward to ADM decision support:
This action forwards a brief synopsis of the highlights of the bulletin to the ADM's Decision Support table. Selecting this action puts a green check in the "Fwd to ADM" column as a reminder to you.

Forward to PHO decision support:
This action forwards a brief synopsis of the highlights of the bulletin to the PHO's Decision Support table. Selecting this action puts a green check in the "Fwd to PHO" column as a reminder to you.

Add to own decision support:
This action forwards a brief synopsis of the highlights of the bulletin to your own Decision Support table.

Take possible action:

A possible action you can take in response to the bulletin is listed at the bottom of the Bulletin Details dialog. Some desirable actions are to alert the PHO or the ADM of a possible bio-terrorism attack. Other actions, such as "Request credit card surveillance," can affect whether or not the suspects are apprehended later in the scenario. This action is disabled if there is no possible action listed. When you choose to take possible action the results of this action will appear in your decision support table a few hours after you request the action. Taking possible action for the appropriate bulletins is very important in determining if there has been a release of anthrax or not and getting confessions from the terrorist, however if you request too many actions to be taken you will receive more information that is irrelevant to the scenario which you will have to go through to find the relevant information. It is important to pay close attention to your decision support table for updates to the actions you have taken and for new information coming in from the other two players.

Request more information:

If this action is checked, any bulletin updates relating to the bulletin subject are dispatched two hours from the time you made the request, or the normal display time, whichever is earlier. This allows you to receive more timely information. Bulletin updates have the same subject line as the original bulletin, and are marked with the word **Update**. You will only receive the updates if you select the request more information action. Some updates are important in determining if there has been a release of anthrax or not and getting confessions from the terrorist, however if you request too many updates you will receive more information that is irrelevant to the scenario which you will have to go through to find the relevant information.

The FBI is the only player who can take possible actions on the bulletins they receive. The other two players are encouraged to share the information they receive with the other players but do not have the option of forwarding the bulletins or requesting more information. In order to find out information from the other two sources the FBI must rely on communication in the chat.

Note that you can slow down the simulation by moving the "Simulation Speed" scrollbar located at the bottom right hand side of the screen whenever you need to read bulletins, use the chat interface, or initiate joint decisions.

Your GUI Log screen logs all your actions and airport events by time. This screen is useful to review what you have done at what time, but it is mainly used for post-simulation analysis. You can safely ignore this screen.

Interacting with the other players: Interaction between the three players is very important and will affect the final outcome of the simulation. As the FBI agent you are

responsible for forwarding and sharing appropriate information with the other two players. You are also responsible for using the chat interface to request information from the other players and to discuss events and information that occur during the simulation. The other two players have a list of actions that they can take during the simulation that will affect the final outcome. At times the other players may come to the FBI for assistance in making some of these decisions. It is your responsibility to provide them with appropriate information to make the decision and provide recommendations to them as to what actions they should take given the information you have been provided without compromising your investigation. If the other players take inappropriate actions or fail to take appropriate actions there will be adverse affects such as public panic or failure to commence antibiotics in a real alarm.

PLEASE TURN PAGE

Chat Interface

This simulation requires that you communicate with your teammates only via the computer. This is accomplished not only programmatically by forwarding information through tables and dialogs, but also by using the provided Instant Messaging-like chat interface. This interface is accessed via the Tools Menu at the top of your GUI screen. Selecting "Chat" will pop up the Chat dialog. If this dialog is not already up on your screen, please bring it up now so that you will be able to follow these directions more easily. This dialog should remain open on your screen throughout the simulation for easy accessibility.

The Chat Interface

Within its default Directory tab, the Chat dialog lists the four available chat rooms. For ease of use, the names of the rooms correspond to the permissions of the players to join that room. For example, only the ADM and the FBI role players can chat in the ADM-FBI room, and the PHO cannot see this information. It is recommended that players use the appropriate rooms to share information, as some information should only be shared with only one other player and not both players. All players can chat together in the FBI-PHO-ADM room. Please do not change any of the predefined settings, and simply use the rooms that have already been created for you.

You can enter a room by clicking on the tab associated with the desired room at the bottom of the Chat dialog. If you have permission to join this room, the left hand side of the screen will be colored white; if you do not have permission, it will be grayed out and disabled. **Please do <u>not</u> touch the Enter and Leave keys**, as the rooms are preset and we do not want you to accidentally remove a room or other participants from a room.

You initiate a chat message by typing in the text area on the bottom left-hand side of the dialog. The message is sent when you press the Enter key on the keyboard. A soft bell sound will indicate that the message has been sent, and the players who receive the message will also hear the bell. Additionally, an alert icon will appear on the tab of any room with unread messages.

Sent messages appear in the larger text area on the upper left-hand side of the dialog. All messages indicate the originator of the message as well as the simulation time it was sent. All messages are displayed in the order in which they are sent, and you can scroll back to review any previous correspondence.

The chat is one of the most important communication tools in the simulation and should be used frequently to discuss and validate information that is forwarded or shared from other players. Through use of the chat players may be able to obtain more information from the other players than they receive through forwards and will have more information to make decisions regarding the scenario. When communicating with the other teammates, **please do not use the copy/paste function.**

Joint Decision Points

Three predetermined joint decision points are listed in the Joint Decisions table for each role. Decision points serve to bring the team together to focus on a specific action and allow team members to communicate and make decisions according to their roles and responsibilities. Double-clicking in the "Description" column of the table pops up a dialog explaining the pros and cons of the decision as well as the voting options. You can cancel the dialog without initiating the decision if you just want more information about it, or you can vote either "yes" or "no" to broadcast the vote to the other players.

Any of the team players may initiate a decision at any time during the simulation. The decision points are sequential and can only be made in the specified order. Each player must vote either "yes" or "no" for each decision in order to progress to the next decision (players cannot change an earlier response if the vote is either "yes" or "no"). If a player is undecided at the time another player initiates a decision, he may abstain from voting by pressing "Postpone and Chat," regardless of the other players' responses. When he is ready to make a decision, after chatting with the other players and reviewing his Decision Support table, he can then re-initiate the same decision and all players will vote again. A joint decision is not implemented unless all players unanimously vote "yes." Please do not attempt to close a joint decision voting box by clicking on the "X" on the upper right hand corner of the box. In order to close the joint decision box, please use only the yes, no, postpone and chat, or cancel buttons.

As each player responds to a decision request, his response is displayed in the "ADM commit," FBI commit" or "PHO commit" columns. A green check mark indicates a "yes" response; while a red circle with a line through it indicates a "no" response. The three dash marks indicate no decision has been made (a player may have decided to "Postpone and Chat," so watch for new chat messages).

You can also slow down the simulation at any time by moving the "Simulation Speed" scrollbar located at the bottom right hand side of the screen. Slowing the simulation to real time allows you the opportunity to review what information you already have (provided in your Decision Support tables) and to request more information from the

other players via the chat interface. **It is best to re-read the Joint Decision Point support information when the team is beginning each decision point.**

Joint Decision Point #1: Request lab samples
This decision should only be initiated after the Airport Alarm has sounded and is necessary in determining if the alarm is valid or false. After conferring with the other team members via the chat interface and reviewing their Decision Support tables, either the PHO or the ADM should take the lead on deciding if samples from the airport's collector sensors should be sent to a laboratory for analysis. This low consequence, high value decision will impact the accuracy and timeliness of the team's investigation as well as the scenario outcome. For example, the PHO may not commence antibiotic treatment until either lab results have been returned or terrorists have confessed to an anthrax attack. Please keep in mind it takes approximately 6 hours for the lab results to come back once this decision has been initiated.

Joint Decision Point #2: Notify public of attack / Shutdown airport HVAC
After conferring with the other team members via the chat interface and reviewing the Decision Support table, the PHO should take the lead on deciding if a biological attack declaration to the public is warranted. This action should not be taken until either positive lab results have been returned or the terrorists have confessed to an anthrax attack. This action also shuts down the airport's HVAC system in order to contain the spread of anthrax.

Additional PHO actions at this point, if not done already, should include mobilizing the local pharmaceutical stockpile and activating the Strategic National Stockpile (SNS). Note that antibiotic treatment of passengers and airport personnel may not commence earlier than one hour from the time the local pharmaceutical stockpile is notified, and the SNS cannot be ready to provide additional antibiotics until 24 hours from its notification time. The timing of the declaration and the quality of the information upon which the decision is based will impact the team's performance score. This is a high consequence decision that could cause mass panic.

Joint Decision Point #3: Evacuate airport
After conferring with the other team members via the chat interface and reviewing their Decision Support tables, either the PHO or the ADM should take the lead on deciding if the airport needs to be evacuated to tarmac or through terminal. Only the player that initiates the decision will be able to make the decision between the following two choices. All other players will be voting either yes, no, or postpone and chat to the decision the initiator makes. The 2 choices are:

1. *Evacuate to tarmac* (quarantine). This decision removes all passengers from the airport and quarantines them on the tarmac. All flights are cancelled, and no passengers are permitted to leave or enter the airport. The underlying population disease model is based on the assumption that 100% of those quarantined will receive antibiotic treatment immediately if the PHO has authorized it in his Actions table any time before the simulation ends.

2. *Evacuate through terminal* (leave airport). This decision routes all passengers through the terminals outside the airport without quarantining them. All flights are cancelled, and no passengers are permitted to enter the airport. The underlying population disease model is based on the assumption that 70% of those who left the airport before the evacuation will receive antibiotics after four days, while 90% of those who left after being evacuated will receive antibiotic treatment after one day.

The timing of the decision and the quality of the information upon which the decision was based will impact the team's performance score. This is a high consequence decision, as canceling all flights and evacuating large numbers of people will have enormous emotional and monetary costs.

Decision Support Table

The information in the Decision Support table, along with other information gained in the chat interface, should assist all players in making the joint decisions and determining the scenario outcome. This table is located on the middle right-hand side of each player's GUI Input screen, directly below the Joint Decisions table. Its purpose is to keep track of important information relative to the scenario that only you may know or that has been forwarded from teammates. Since the information in your table may be different from the information in other players' tables, do not assume that they know everything that you know. No action can be taken on the information in this table. To share or discuss this information you must use the chat. It is very important to frequently check this table for new information and for updates to the actions you have taken on previous bulletins. There are four columns of data in this table:

1. *Source:* This column indicates who forwarded you the information (FBI, PHO, or ADM).

2. *Description:* Double-clicking on this column pops up a dialog containing the full message, as the field is not large enough to display the complete information.

3. *Importance:* This column provides you with the relative importance level of the information (high - red, medium -yellow, and low - green).

4. *Time:* This column displays the simulation time at which you received the information.

Tables can be sorted by any column by pressing the header bar of that column. For example, pressing the "Importance" header causes all information to be sorted by its importance level (lowest to highest). Pressing a second time reverses the sort (highest to lowest).

PLEASE SEE THE FACILITATOR NOW

Communication Management Study

SIMULATION

STEP 3.

Now, you are ready to begin the simulation. You have approximately **60 minutes** to complete the simulation by coming to a collective decision regarding the possibility of anthrax being released or not. The simulation ends when the 36-hour scenario time frame has elapsed. A popup dialog will inform you when the simulation ends.

A time clock located at the bottom center of the GUI displays simulation time. This time clock does not appear until the simulation begins (it appears at the bottom of the window). Simulation time is normally 60 times real time (i.e., 1 second real time = 1 minute scenario time). Use the Simulation Speed scroll bar located to the right of the clock when you want to slow down simulation time.

Please **do not** reveal your name or gender. We would like this information to remain undisclosed as you converse with the other team members

When you are ready please type, **"I am ready to start"** in the FBI-PHO-ADM chat room. When all team members have responded, the facilitator will start the simulation. Once the simulation time appears in the time clock, the simulation has begun. Begin by examining your actions (ADM and PHO) or bulletins (FBI). Respond to any information either forwarded to you from other team members or available only to you. Begin chat discussions concerning unusual events and your ideas regarding the possible release of anthrax. **PLEASE INTERACT ACCORDING TO YOUR ROLE PROFILE IN THE SCENARIO.**

Please be ready to begin as soon as all players have indicated they are ready and the time clock appears.

PLEASE CONTINUE TO STEP 4 ONCE THE SIMULATION IS FINISHED

Communication Management Study

POST-EXPERIMENT QUESTIONNAIRE

STEP 4.

Please fill out the questionnaire on the next page according to YOUR perception of your team's performance.

PLEASE TURN PAGE

Post-Group Session Questionnaire
Session 1

Please take few minutes to fill out the following simple evaluation form. Your comments are critical to our continuous improvement process.

Please rank your group's problem-solving skills on the following scale:

1.	*Efficient*				*Inefficient*
	1	*2*	*3*	*4*	*5*
2.	*Coordinated*				*Uncoordinated*
	1	*2*	*3*	*4*	*5*
3.	*Fair*				*Unfair*
	1	*2*	*3*	*4*	*5*
4.	*Confusing*				*Understandable*
	1	*2*	*3*	*4*	*5*
5.	*Satisfying*				*Dissatisfying*
	1	*2*	*3*	*4*	*5*

To what extent did the following criteria meet or exceed your expectations?

		Below				Exceed
6.	*The pre-experiment instructions were precise, clear, and relevant.*	1	2	3	4	5
7.	*The experiment objectives, processes, and procedures were communicated clearly.*	1	2	3	4	5
8.	*All exercise support materials were clear, easy to follow, and relevant.*	1	2	3	4	5
9.	*During the experiment, I felt safe, comfortable, and supported.*	1	2	3	4	5
10.	*The computer scenario interfaces were easy to use.*	1	2	3	4	5
11.	*The scenario story was realistic enough to promote meaningful human interactions.*	1	2	3	4	5

PLEASE TURN PAGE

12. *The three joint decision points (see Joint decision Points Attachment) were well placed and constructed.*   1   2   3   4   5

13. *Overall, I had a positive learning experience from participating in the experiment.*   1   2   3   4   5

To what extent are the following criteria important to you?

	Little			**Very**	

14. *Having precise, clear, and relevant pre-experiment instructions.*   1   2   3   4   5

15. *Having the experiment objectives, processes, and procedures clearly communicated.*   1   2   3   4   5

16. *Having clear, easy to follow, and relevant exercise support materials.*   1   2   3   4   5

17. *Feeling safe, comfortable, and supported during the experiment.*   1   2   3   4   5

18. *Having easy to use computer scenario interfaces.*   1   2   3   4   5

19. *Having a scenario story that was realistic enough to promote meaningful human interactions.*   1   2   3   4   5

20. *Having well placed and constructed joint decision points.*   1   2   3   4   5

21. *Having a positive learning experience from participating in the experiment.*   1   2   3   4   5

PLEASE SEE THE FACILITATOR NOW

Post-Group Session Questionnaire
Session 2

Please take few minutes to fill out the following simple evaluation form. Your comments are critical to our continuous improvement process.

Please rank your group's problem-solving skills on the following scale:

1.   *Efficient*   *Inefficient*
            1   *2*   *3*   *4*   *5*

2.   *Coordinated*   *Uncoordinated*
            1   *2*   *3*   *4*   *5*

3.   *Fair*   *Unfair*
            1   *2*   *3*   *4*   *5*

4.   *Confusing*   *Understandable*
            1   *2*   *3*   *4*   *5*

5.   *Satisfying*   *Dissatisfying*
            1   *2*   *3*   *4*   *5*

To what extent did the following criteria meet or exceed your expectations?

		Below				**Exceed**
6.	*The pre-experiment instructions were precise, clear, and relevant.*	1	2	3	4	5
7.	*The experiment objectives, processes, and procedures were communicated clearly.*	1	2	3	4	5
8.	*All exercise support materials were clear, easy to follow, and relevant.*	1	2	3	4	5
9.	*During the experiment, I felt safe, comfortable, and supported.*	1	2	3	4	5
10.	*The computer scenario interfaces were easy to use.*	1	2	3	4	5
11.	*The scenario story was realistic enough to promote meaningful human interactions.*	1	2	3	4	5

PLEASE TURN PAGE

12. *The three joint decision points (see Joint decision Points Attachment) were well placed and constructed.*   1   2   3   4   5

13. *Overall, I had a positive learning experience from participating in the experiment.*   1   2   3   4   5

To what extent are the following criteria important to you?

	Little				Very

14. *Having precise, clear, and relevant pre-experiment instructions.*   1   2   3   4   5

15. *Having the experiment objectives, processes, and procedures clearly communicated.*   1   2   3   4   5

16. *Having clear, easy to follow, and relevant exercise support materials.*   1   2   3   4   5

17. *Feeling safe, comfortable, and supported during the experiment.*   1   2   3   4   5

18. *Having easy to use computer scenario interfaces.*   1   2   3   4   5

19. *Having a scenario story that was realistic enough to promote meaningful human interactions.*   1   2   3   4   5

20. *Having well placed and constructed joint decision points.*   1   2   3   4   5

21. *Having a positive learning experience from participating in the experiment.*   1   2   3   4   5

PLEASE SEE THE FACILITATOR NOW

Communication Management Study
LDRD 03-0424
Booklet

Sandia National Laboratories

Role ID: PHO

Participant ID: _____

Group ID: _____

Date: _____

Time: _____

Location:_____

Facilitator:_____

Communication Management Study

INTRODUCTION

Welcome to the Communication Management Study! This study is divided into three sessions. The first session involves the following four steps. The second session involves all but the first step. In the first step, you will fill out the background computer-use and attitude pre-experiment questionnaire. In the second step, you will read the communication task scenario and familiarize yourself with your role in it. In the third step, you will interact with the other two study participants within a simulation. **It is very important that you interact with the other participants without revealing your name or gender**. In the fourth step, you will answer the questions in the post-experiment questionnaire. All information is provided in this booklet.

STEP 1.

Please turn the page and fill out the pre-experiment background computer use and attitudes questionnaire. **Stop when you are finished.**

PLEASE TURN PAGE

BACKGROUND QUESTIONNAIRE

Please answer these brief background questions regarding your computer usage and attitudes towards computer use.

1. How often do you usually use e-mail? (*Please Check One*)

    ____Daily ____ Weekly ____ Monthly ____ Rarely or Never

2. How often do you usually participate in chat groups? (*Please Check One*)

    ____Daily ____ Weekly ____ Monthly ____Rarely or Never

Please indicate to what extent you agree with the following statements by circling the appropriate number.

	Not at All						*Completely*
3. *I hesitate to use a computer for fear of making mistakes that I cannot correct.*	1	2	3	4	5	6	7
4. *I feel insecure about my ability to interpret a computer printout.*	1	2	3	4	5	6	7
5. *I have avoided computers because they are unfamiliar and somewhat intimidating.*	1	2	3	4	5	6	7
6. *I have difficulty in understanding the technical aspects of computers.*	1	2	3	4	5	6	7
7. *The challenge of learning about computers is exciting.*	1	2	3	4	5	6	7
8. *I look forward to using a computer on my job.*	1	2	3	4	5	6	7
9. *Anyone can learn to use a computer if they are patient and motivated.*	1	2	3	4	5	6	7

Please provide the following information:

10. Age:

___*18-20* ___*21-23*
___*24-26* ___*27-29*
___*30-33* ___*34-36*
___*37-39* ___*40-43*
___*44-46* ___*47-49*
___*50-53* ___*other*

11. Gender:

___*Male*
___*Female*

12. Highest level of Education completed:

__*High school* __*College freshman*
__*College sophomore* __*College junior*
__*College senior* __*Trade school*
__*Masters* __*Doctorate*

PLEASE TURN PAGE

Communication Management Study

TASK SCENARIO

STEP 2.

Please read the scenario provided below. The scenario involves a possible bio-terrorism attack at a west coast airport in the United States. You are to imagine that you are in the situation described below. Each participant will receive a different view of the scenario, and will play the role of one of three organization representatives: FBI Agent (FBI), Public Health Official (PHO), or Airport Decision Maker (ADM). **The character you will play will be the PHO**. Please read the role description for all three organization representatives, paying particular attention to your own role. When you have finished reading the scenario, please inform the facilitator. The facilitator will then answer any questions you might have, and then familiarize you with the Graphical User Interface (GUI).

Communication with the other players is critical to influencing the outcome of the simulation. How well and with whom you share information will directly affect the number of people who will survive a bio-terrorism attack if it takes place, as well as your team performance score. On the other hand, consequences of a false alarm to the public are very high. You are encouraged to use the provided chat (Instant Messaging-like) interface frequently to communicate with the other players. Refer to the section on the Chat Interface below for a complete description of how this interface works.

You have the ability at any time to slow down the simulation to real time when sharing information, but overuse of this action may impact your team performance score.

The Situation

The United States is stepping up its efforts to capture key members of the al-Qaeda terrorist organization. This, however, has caused al-Qaeda and other terrorist organizations to respond towards the United States and its key allies by increasing both the number and lethality of its terrorism attempts. At the time of this study, there are no confirmed threats within the United States. The Homeland Security Advisory System condition is elevated (yellow), which means there is a significant risk of terrorist attacks.

It is the responsibility of the FBI role player to determine if a terrorist act is likely to occur in the scenario and to pass on relevant information to the other players to alert them. Remember that early detection and response are key elements to limiting loss of life in an actual bio-terrorism attack.

The goal of your team is to determine whether or not a bio-terrorism attack has occurred at the fictitious Bay Area International Airport in Bay Area, California. This airport has incorporated two different types of sensors as part of its bio-terrorism defense strategy: early warning sensors and collector sensors. There are five early warning sensors and 13

collector sensors placed within the airport's HVAC (heating, ventilation, and air conditioning) system, and the early warning sensors emit an alarm when they detect a biological agent (such as anthrax) in the air. **However, these sensors have a false alarm rate of about once per year, and it has been nearly a year since the last false alarm**. An early warning sensor will always alarm in your simulation, but you will not know if it is valid or false. The alarm will sound at a random time in the scenario, which is based on how the scenario progresses. Players should not assume the alarm has sounded until they get notification from the ADM player that the alarm has sounded. The only way to determine if the alarm is valid or false is by a group consensus to the joint decision to Request Lab Samples.

Although early warning sensors can detect an agent release within minutes by real-time examination of the agent particulates, collector sensors continuously gather air particulates onto a filter, which must be periodically retrieved and sent to a laboratory for analysis. This analysis takes several hours. Collector sensor results are almost 100% accurate in determining whether or not anthrax is present and are necessary to validate the alarm.

How well you share information with your team, and how carefully you make your decisions based on the information you have will determine the final outcome of the scenario as well as your team score.

There are three possible scenario outcomes:

1. The anthrax release is successful and the terrorists are captured at the airport. This outcome can only occur if the ADM, alerted by the FBI to increase security before the alarm sounds, takes the action to monitor the closed-circuit television videotapes within 30 minutes after the alarm sounds. The airport police then have a 50% chance of capturing the terrorists at the airport.

2. The anthrax release is successful and the terrorists leave the airport undetected. This outcome occurs if the terrorists are not captured at the airport.

3. There is no anthrax release (false alarm). Either the terrorists never enter the airport or they are unsuccessful due to heightened airport security.

Time is of the essence in determining whether anthrax has been released or not. You do not want to cause panic (one of the goals of the terrorists), falsely alarm the public (cause complacency), or disrupt business (could cost millions). However if anthrax has been released, thousands of people could die within weeks.

As the scenario unfolds, each team member will have access to separate, but limited, information sources. The quality and timeliness of your decisions will be determined by your group communication.

You will be participating in a computer simulation that involves interagency communication to determine **whether or not** a bio-terrorism attack has occurred at the Bay Area International Airport. The date of the simulation is November 18-19, 2004, a 36-hour time period that starts at 8:00 am the first day and ends at 8:00 pm the second day. Each member of your team has a different role in the simulation. As the simulation progresses, each member will receive different information associated with his or her role. You must determine what information to keep private or share. You and your interagency team are asked to monitor the environment, detect clues, and confirm or negate a potential attack correctly and quickly.

Your goal is to complete the three joint decisions that are listed at the top of each of your GUI screens. Any player may initiate a joint decision at any time during the scenario and detailed information about the pros and cons of making the decision are available during the simulation (see Joint decision Points, below). All players must unanimously vote "yes" in order for a decision to be implemented. These decisions will have a direct impact both on the outcome of the simulation and the team performance scores for speed and accuracy.

Note that the simulation may pause at certain points during the simulation to perform calculations. These pauses are usually on the hour, and last about 30 seconds. These are normal, and there is nothing wrong with your computer. Please be patient; the simulation will soon resume.

PLEASE TURN PAGE

FBI (Federal Bureau of Investigation) Special Agent

Role and Responsibilities of FBI: The FBI has the responsibility as the "lead federal agency for crisis management." This does not mean the FBI takes over in crises situations. Their role is to "identify, acquire, and plan use of resources needed to anticipate, prevent, and/or resolve a threat or act of terrorism" and to "…detect, prevent, preempt and disrupt terrorist attacks." The responsibilities of the FBI are to assess the threat, initiate criminal investigations, and engage in evidence collection.

Professional Profile: This FBI special agent has been working in the law enforcement field for 24 years. The agent has been assigned to work on Weapons of Mass Destruction (WMD) related duties for more than three years.

Organizational Culture: The agent's primary mission is to protect the safety of the public and to apprehend those who would cause public harm. Therefore, it is very important to insure that any arrests can be prosecuted in court. This can only be accomplished if the agent conducts timely investigations and collect relevant evidence before the information is lost. The agent needs to be very careful not to falsely alarm the public; therefore, the other team members have to be patient while the agent conducts the investigation and understand why the agent may need to withhold sensitive information from them. Any accidental release of sensitive information can compromise the investigation and the reputation of the organization.

During the Simulation: The FBI agent's informational sources come from composite law enforcement bulletins and members of the team. The FBI agent is one of the key players in determining if there has been a bio-terrorism attack.

ADM (Airport Decision Maker)

Role and Responsibilities of ADM: The ADM has the responsibility to insure the safety of the public in and near the airport, or from person(s) who use the airport as a mechanism to transport, conceal, or sell illegal or dangerous substances.

Professional Profile: This ADM has been engaged in airport operations for 20 years and has been a member of the Airport Emergency Operations Center (EOC) at the Bay Area International Airport for the last 10 years. The ADM has no actual experience with a WMD event, but has recently received training in that area.

Organizational Culture: The ADM's primary mission is to protect the health and safety of the public while minimizing airport down time. This person needs to be very careful not to falsely alarm the public or waste airport resources; therefore others have to be patient while you conduct your investigation to determine if a WMD attack has occurred. The ADM is also very concerned about the cost to the airport and passengers associated with shutting down an international airport. Consequences can be felt worldwide, as other airports' flights depend on your flights, and important business, political, and social

meetings will be missed. Negative publicity could affect future flights from your facility, as well as the ADM's credibility and job.

During the Simulation: The ADM's informational sources come from your early warning and collector sensors, closed-circuit television (CCTV), and members of your team. The ADM is one of the key players responsible for deciding if there has been a bio-terrorism attack.

## PHO (Public Health Official) –YOUR CHARACTER ROLE

Role and Responsibilities of PHO: The role of the PHO is to direct medical and public health disaster preparedness, direct the integration of multidisciplinary agencies/professionals, assist in education, serve as a consultant to other agencies, and to develop an internal state plan for emergencies. The responsibilities of the PHO are to direct radiological emergencies, public health, medical services, and mass fatalities.

Professional Profile: As an epidemiologist you have been working in the public health industry for 26 years. You have been assigned to work on Weapons of Mass Destruction (WMD) related issues for more than two years.

Organizational Culture: Your primary mission is to protect the health and safety of the public. Therefore, it is very important that you give the public accurate and complete information during any kind of WMD attack. You prefer not to confirm any attack until your laboratory has the time to conduct the all-necessary tests, or a terrorist has confessed to the act. **You need to be very careful not to falsely alarm the public; therefore, the other team members have to be patient while you conduct your investigation and laboratory testing**. One false alarm will end your professional career and hurt the reputation of your organization by causing unnecessary expenses and possible injuries due to the scare.

During the Simulation: Your informational sources include other members of your team. As the PHO, you are the key player in deciding if there is an actual attack or not. You can slow down the simulation when you need to read chat messages or communicate with others.

Your Role: Please communicate with the other participants in a professional manner that is consistent with your character role, described above.
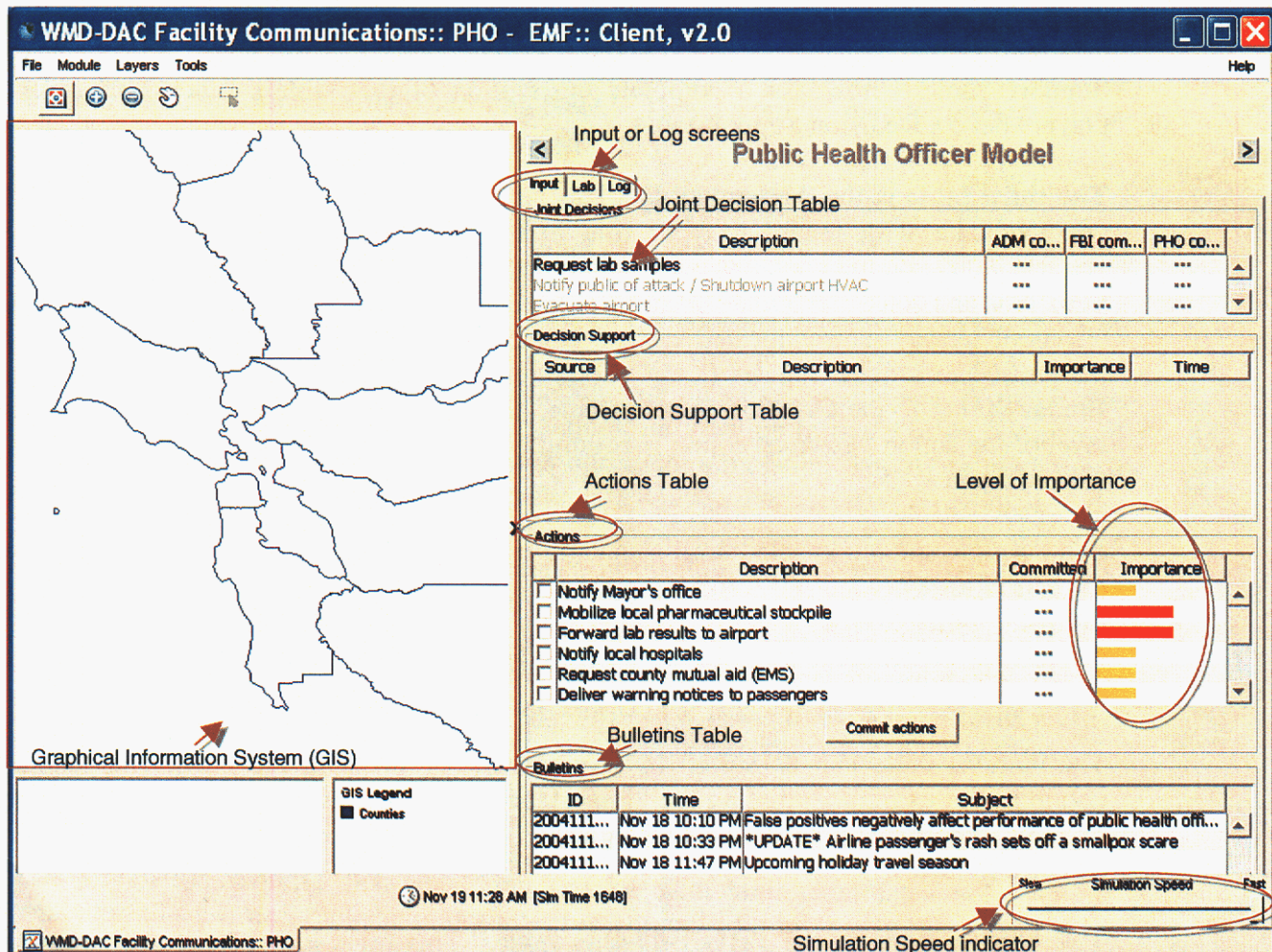
The GUI screen for the PHO

Interacting with the Computer: Your GUI consists of three screens: Input, Lab, and Log. You can access each of these screens by clicking on the corresponding tab located at the top right-hand side of the GUI.

Your GUI Input screen is divided into five major areas. The Geographical Information System (GIS) on the left hand side of the screen displays the Bay Area counties. The right hand side of the screen contains four tables: Joint Decisions, Decision Support, Actions, and Bulletins.

The top table, Joint Decisions, lists the three decisions your team must unanimously agree upon in order to implement the decision. See Joint decision Points, below, for a complete description of this table's functionality. All players have a Joint Decisions table.

The second table is the Decision Support table. This table keeps track of important information relative to the scenario that has been forwarded to you from your teammates. This table contains information for use in making decisions and no actions

can be taken on the information that appears in this screen. To share or discuss any information that appears in this table the players must use the chat. See Decision Support Table, below, for a complete description of this table's functionality. All players have a Decision Support table.

The third table is the Actions table. This table lists a number of possible actions that you can take with regard to your role in the simulation. Double-clicking in the "Description" column pops-ups a dialog box describing the action in more detail, as well as its pros and cons. To initiate an action, check its box in the first column, then press the "Commit actions" button located at the bottom of the table. The action is verified when the green check mark appears in the "Committed" column. The "Importance" column, similar to that in the Decision Support table, provides you with the relative importance level of the action. Once an action is committed, it is disabled and cannot be changed or viewed again.

Some actions are not enabled until a specific scenario event has occurred. For example, the action to "Forward lab results to airport" is not enabled until you have received lab results. Other actions can be enabled only if other actions have been previously committed. These dependencies are described in the details of the action, so be sure to read them carefully.

The Actions table can be sorted by any column by pressing the header bar of that column. For example, pressing the "Importance" header causes all actions to be sorted by their importance level (lowest to highest). Pressing a second time reverses the sort (highest to lowest).

The bottom table is the PHO Bulletins table. This table lists all the current event bulletins you receive during the simulation. Some bulletins appear at the simulation onset, while others appear as the scenario progresses. Some bulletins will have updates that will appear automatically at a later time in the scenario. There will be periods in the simulation where you will not receive any bulletins or updates. This time can be used to review the information you have already received or to discuss any information that the other players have received. Bulletins feed the scenario story line and provide information on terrorist activities and locations as well as personal data. However, most of the bulletins do not contain information relevant to the scenario and should be ignored. Your job is to determine which information is relevant, and which should be shared with your teammates to alert them without misleading them or compromising your investigation. The PHO does not have the option to forward the bulletin to the other players, so it is the responsibility of the PHO to communicate relevant information to the other two players using the chat. The PHO may want to share certain information with only one of the other players and may do so by using the designated chat room.

Note that you can slow down the simulation by moving the "Simulation Speed" scrollbar located at the bottom right hand side of the screen whenever you need to use the chat interface or initiate joint decisions.
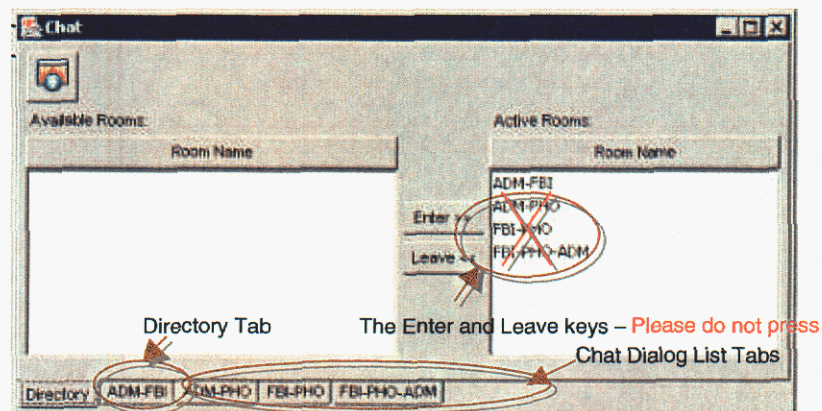
Your GUI Lab screen logs the time the collector sensor filters were received at the laboratory as well as the test results. The results will be forwarded to your decision support table as soon as they are complete. This screen is mainly used for post-simulation analysis and can be safely ignored.

Your GUI Log screen logs all your actions and airport events by time. This screen is useful to review your actions and their times, but it is mainly used for post-simulation analysis. You can safely ignore this screen.

Interacting with the other players: Interaction between the three players is very important and will affect the final outcome of the simulation. As the PHO you are responsible for sharing appropriate information with the other two players. You are also responsible for using the chat interface to request information from the other players and to discuss events and information that occur during the simulation. The ADM has a list of actions that can be taken during the simulation that will affect the final outcome, and the FBI has actions that can be taken on the bulletins that are received. At times the other players may come to the PHO for assistance in making some of these decisions. It is your responsibility to provide them with appropriate information to make the decision and provide recommendations to them as to what actions they should take given the information you have been provided without compromising your investigation. If the other players take inappropriate actions or fail to take appropriate actions there will be adverse affects such as public panic or failure to commence antibiotics in a real alarm.

Chat Interface

This simulation requires that you communicate with your teammates only via the computer. This is accomplished not only programmatically by forwarding information through tables and dialogs, but also by using the provided Instant Messaging-like chat interface. This interface is accessed via the Tools Menu at the top of your GUI screen. Selecting "Chat" will pop up the Chat dialog. If this dialog is not already up on your screen, please bring it up now so that you will be able to follow these directions more easily. This dialog should remain open on your screen throughout the simulation for easy accessibility.

The Chat Interface

Within its default Directory tab, the Chat dialog lists the four available chat rooms. For ease of use, the names of the rooms correspond to the permissions of the players to join that room. For example, only the ADM and the FBI role players can chat in the ADM-FBI room, and the PHO cannot see this information. It is recommended that players use the appropriate rooms to share information, as some information should only be shared with only one other player and not both players. All players can chat together in the FBI-PHO-ADM room. Please do not change any of the predefined settings, and simply use the rooms that have already been created for you.

You can enter a room by clicking on the tab associated with the desired room at the bottom of the Chat dialog. If you have permission to join this room, the left hand side of the screen will be colored white; if you do not have permission, it will be grayed out and disabled. **Please do <u>not</u> touch the Enter and Leave keys,** as the rooms are preset and we do not want you to accidentally remove a room or other participants from a room.

You initiate a chat message by typing in the text area on the bottom left-hand side of the dialog. The message is sent when you press the Enter key on the keyboard. A soft bell sound will indicate that the message has been sent, and the players who receive the message will also hear the bell. Additionally, an alert icon will appear on the tab of any room with unread messages.

Sent messages appear in the larger text area on the upper left-hand side of the dialog. All messages indicate the originator of the message as well as the simulation time it was sent. All messages are displayed in the order in which they are sent, and you can scroll back to review any previous correspondence.

The chat is one of the most important communication tools in the simulation and should be used frequently to discuss and validate information that is forwarded or shared from other players. Through use of the chat players may be able to obtain more information from the other players than they receive through forwards and will have more information to make decisions regarding the scenario. When communicating with the other teammates, **please do not use the copy/paste function.**

Joint Decision Points

Three predetermined joint decision points are listed in the Joint Decisions table for each role. Decision points serve to bring the team together to focus on a specific action and allow team members to communicate and make decisions according to their roles and responsibilities. Double-clicking in the "Description" column of the table pops up a dialog explaining the pros and cons of the decision as well as the voting options. You can cancel the dialog without initiating the decision if you just want more information about it, or you can vote either "yes" or "no" to broadcast the vote to the other players.

Any of the team players may initiate a decision at any time during the simulation. The decision points are sequential and can only be made in the specified order. Each player must vote either "yes" or "no" for each decision in order to progress to the next decision

(players cannot change an earlier response if the vote is either "yes" or "no"). If a player is undecided at the time another player initiates a decision, he may abstain from voting by pressing "Postpone and Chat," regardless of the other players' responses. When he is ready to make a decision, after chatting with the other players and reviewing his Decision Support table, he can then re-initiate the same decision and all players will vote again. A joint decision is not implemented unless all players unanimously vote "yes." Please do not attempt to close a joint decision voting box by clicking on the "X" on the upper right hand corner of the box. In order to close the joint decision box, please use only the yes, no, postpone and chat, or cancel buttons.

As each player responds to a decision request, his response is displayed in the "ADM commit," FBI commit" or "PHO commit" columns. A green check mark indicates a "yes" response; while a red circle with a line through it indicates a "no" response. The three dash marks indicate no decision has been made (a player may have decided to "Postpone and Chat," so watch for new chat messages).

You can also slow down the simulation at any time by moving the "Simulation Speed" scrollbar located at the bottom right hand side of the screen. Slowing the simulation to real time allows you the opportunity to review what information you already have (provided in your Decision Support tables) and to request more information from the other players via the chat interface. **It is best to re-read the Joint Decision Point support information when the team is beginning each decision point.**

Joint Decision Point #1: Request lab samples
This decision should only be initiated after the Airport Alarm has sounded and is necessary in determining if the alarm is valid or false. After conferring with the other team members via the chat interface and reviewing their Decision Support tables, either the PHO or the ADM should take the lead on deciding if samples from the airport's collector sensors should be sent to a laboratory for analysis. This low consequence, high value decision will impact the accuracy and timeliness of the team's investigation as well as the scenario outcome. For example, the PHO may not commence antibiotic treatment until either lab results have been returned or terrorists have confessed to an anthrax attack. Please keep in mind it takes approximately 6 hours for the lab results to come back once this decision has been initiated.

Joint Decision Point #2: Notify public of attack / Shutdown airport HVAC
After conferring with the other team members via the chat interface and reviewing the Decision Support table, the PHO should take the lead on deciding if a biological attack declaration to the public is warranted. This action should not be taken until either positive lab results have been returned or the terrorists have confessed to an anthrax attack. This action also shuts down the airport's HVAC system in order to contain the spread of anthrax.

Additional PHO actions at this point, if not done already, should include mobilizing the local pharmaceutical stockpile and activating the Strategic National Stockpile (SNS). Note that antibiotic treatment of passengers and airport personnel may not commence

earlier than one hour from the time the local pharmaceutical stockpile is notified, and the SNS cannot be ready to provide additional antibiotics until 24 hours from its notification time. The timing of the declaration and the quality of the information upon which the decision is based will impact the team's performance score. This is a high consequence decision that could cause mass panic.

Joint Decision Point #3: Evacuate airport

After conferring with the other team members via the chat interface and reviewing their Decision Support tables, either the PHO or the ADM should take the lead on deciding if the airport needs to be evacuated to tarmac or through terminal. Only the player that initiates the decision will be able to make the decision between the following two choices. All other players will be voting either yes, no, or postpone and chat to the decision the initiator makes. The 2 choices are:

1. *Evacuate to tarmac* (quarantine). This decision removes all passengers from the airport and quarantines them on the tarmac. All flights are cancelled, and no passengers are permitted to leave or enter the airport. The underlying population disease model is based on the assumption that 100% of those quarantined will receive antibiotic treatment immediately if the PHO has authorized it in his Actions table any time before the simulation ends.

2. *Evacuate through terminal* (leave airport). This decision routes all passengers through the terminals outside the airport without quarantining them. All flights are cancelled, and no passengers are permitted to enter the airport. The underlying population disease model is based on the assumption that 70% of those who left the airport before the evacuation will receive antibiotics after four days, while 90% of those who left after being evacuated will receive antibiotic treatment after one day.

The timing of the decision and the quality of the information upon which the decision was based will impact the team's performance score. This is a high consequence decision, as canceling all flights and evacuating large numbers of people will have enormous emotional and monetary costs.

Decision Support Table

The information in the Decision Support table, along with other information gained in the chat interface, should assist all players in making the joint decisions and determining the scenario outcome. This table is located on the middle right-hand side of each player's GUI Input screen, directly below the Joint Decisions table. Its purpose is to keep track of important information relative to the scenario that only you may know or that has been forwarded from teammates. No action can be taken on the information in this table. To share or discuss this information you must use the chat. It is very important to frequently check this table for new information and for updates to the actions you have taken. Since the information in your table may be different from the information in other players'

tables, do not assume that they know everything that you know. There are four columns of data in this table:

1. *Source:* This column indicates who forwarded you the information (FBI, PHO, or ADM).

2. *Description:* Double-clicking on this column pops up a dialog containing the full message, as the field is not large enough to display the complete information.

3. *Importance:* This column provides you with the relative importance level of the information (high - red, medium -yellow, and low - green).

4. *Time:* This column displays the simulation time at which you received the information.

Tables can be sorted by any column by pressing the header bar of that column. For example, pressing the "Importance" header causes all information to be sorted by its importance level (lowest to highest). Pressing a second time reverses the sort (highest to lowest).

PLEASE SEE THE FACILITATOR NOW

Communication Management Study

SIMULATION

STEP 3.

Now, you are ready to begin the simulation. You have approximately **60 minutes** to complete the simulation by coming to a collective decision regarding the possibility of anthrax being released or not. The simulation ends when the 36-hour scenario time frame has elapsed. A popup dialog will inform you when the simulation ends.

A time clock located at the bottom center of the GUI displays simulation time. This time clock does not appear until the simulation begins (it appears at the bottom of the window). Simulation time is normally 60 times real time (i.e., 1 second real time = 1 minute scenario time). Use the Simulation Speed scroll bar located to the right of the clock when you want to slow down simulation time.

Please do not reveal your name or gender. We would like this information to remain undisclosed as you converse with the other team members

When you are ready please type, **"I am ready to start"** in the FBI-PHO-ADM chat room. When all team members have responded, the facilitator will start the simulation. Once the simulation time appears in the time clock, the simulation has begun. Begin by examining your actions (ADM and PHO) or bulletins (FBI). Respond to any information either forwarded to you from other team members or available only to you. Begin chat discussions concerning unusual events and your ideas regarding the possible release of anthrax. **PLEASE INTERACT ACCORDING TO YOUR ROLE PROFILE IN THE SCENARIO**.

Please be ready to begin as soon as all players have indicated they are ready and the time clock appears.

PLEASE CONTINUE TO STEP 4 ONCE THE SIMULATION IS FINISHED

Communication Management Study

POST-EXPERIMENT QUESTIONNAIRE

STEP 4.

Please fill out the questionnaire on the next page according to YOUR perception of your team's performance.

PLEASE TURN PAGE

Post-Group Session Questionnaire
Session 1

Please take few minutes to fill out the following simple evaluation form. Your comments are critical to our continuous improvement process.

Please rank your group's problem-solving skills on the following scale:

1. *Efficient*   *Inefficient*
    1   *2*   *3*   *4*   *5*

2. *Coordinated*   *Uncoordinated*
    1   *2*   *3*   *4*   *5*

3. *Fair*   *Unfair*
    1   *2*   *3*   *4*   *5*

4. *Confusing*   *Understandable*
    1   *2*   *3*   *4*   *5*

5. *Satisfying*   *Dissatisfying*
    1   *2*   *3*   *4*   *5*

To what extent did the following criteria meet or exceed your expectations?

		Below				**Exceed**
6.	*The pre-experiment instructions were precise, clear, and relevant.*	1	2	3	4	5
7.	*The experiment objectives, processes, and procedures were communicated clearly.*	1	2	3	4	5
8.	*All exercise support materials were clear, easy to follow, and relevant.*	1	2	3	4	5
9.	*During the experiment, I felt safe, comfortable, and supported.*	1	2	3	4	5
10.	*The computer scenario interfaces were easy to use.*	1	2	3	4	5
11.	*The scenario story was realistic enough to promote meaningful human interactions.*	1	2	3	4	5

PLEASE TURN PAGE

12. *The three joint decision points (see Joint decision Points Attachment) were well placed and constructed.*   1   2   3   4   5

13. *Overall, I had a positive learning experience from participating in the experiment.*   1   2   3   4   5

To what extent are the following criteria important to you?

Little   **Very**

14. *Having precise, clear, and relevant pre-experiment instructions.*   1   2   3   4   5

15. *Having the experiment objectives, processes, and procedures clearly communicated.*   1   2   3   4   5

16. *Having clear, easy to follow, and relevant exercise support materials.*   1   2   3   4   5

17. *Feeling safe, comfortable, and supported during the experiment.*   1   2   3   4   5

18. *Having easy to use computer scenario interfaces.*   1   2   3   4   5

19. *Having a scenario story that was realistic enough to promote meaningful human interactions.*   1   2   3   4   5

20. *Having well placed and constructed joint decision points.*   1   2   3   4   5

21. *Having a positive learning experience from participating in the experiment.*   1   2   3   4   5

PLEASE SEE THE FACILITATOR NOW

Post-Group Session Questionnaire
Session 2

Please take few minutes to fill out the following simple evaluation form. Your comments are critical to our continuous improvement process.

Please rank your group's problem-solving skills on the following scale:

1. *Efficient*   *Inefficient*
   1   *2*   *3*   *4*   *5*

2. *Coordinated*   *Uncoordinated*
   1   *2*   *3*   *4*   *5*

3. *Fair*   *Unfair*
   1   *2*   *3*   *4*   *5*

4. *Confusing*   *Understandable*
   1   *2*   *3*   *4*   *5*

5. *Satisfying*   *Dissatisfying*
   1   *2*   *3*   *4*   *5*

To what extent did the following criteria meet or exceed your expectations?

	Below				**Exceed**
6. *The pre-experiment instructions were precise, clear, and relevant.*	1	2	3	4	5
7. *The experiment objectives, processes, and procedures were communicated clearly.*	1	2	3	4	5
8. *All exercise support materials were clear, easy to follow, and relevant.*	1	2	3	4	5
9. *During the experiment, I felt safe, comfortable, and supported.*	1	2	3	4	5
10. *The computer scenario interfaces were easy to use.*	1	2	3	4	5
11. *The scenario story was realistic enough to promote meaningful human interactions.*	1	2	3	4	5

PLEASE TURN PAGE

12. *The three joint decision points (see Joint decision Points Attachment) were well placed and constructed.*   1 2 3 4 5

13. *Overall, I had a positive learning experience from participating in the experiment.*   1 2 3 4 5

To what extent are the following criteria important to you?

	Little				**Very**
14. *Having precise, clear, and relevant pre-experiment instructions.*	1	2	3	4	5
15. *Having the experiment objectives, processes, and procedures clearly communicated.*	1	2	3	4	5
16. *Having clear, easy to follow, and relevant exercise support materials.*	1	2	3	4	5
17. *Feeling safe, comfortable, and supported during the experiment.*	1	2	3	4	5
18. *Having easy to use computer scenario interfaces.*	1	2	3	4	5
19. *Having a scenario story that was realistic enough to promote meaningful human interactions.*	1	2	3	4	5
20. *Having well placed and constructed joint decision points.*	1	2	3	4	5
21. *Having a positive learning experience from participating in the experiment.*	1	2	3	4	5

PLEASE SEE THE FACILITATOR NOW

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Appendix D
Research Participant Consent Form

[Prospective research participant -- Read this consent form carefully and ask as many questions as you like before you decide whether you want to take part in this research project].

Title: Understanding Communication in Counterterrorism Crisis Management

Sponsor: Sandia National Laboratories / Laboratory Directed Research & Development (LDRD)

Principal Investigator/Department: Marilyn Hawley / 08112

Other Investigator(s)/Department(s): Heidi Ammerlahn (08112)
James C. Forsythe (15311)
Jason Arnold (08114)
Patricia Hough (08950)
Pamela Barr (8114)
Tim Sa (8114)
Michael L Bernard (15311)
Ricky Tam (08947)
Donna Djordjevich (08114)
William B. Wilcox (8112)
Ann Yoshimura (08112)

Organization/Location: Sandia National Laboratories, MS-1188
Albuquerque, NM 87185

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1.   PURPOSE OF RESEARCH STUDY:

You are being invited to participate in a research study that may assist in the homeland defense effort by examining ways to reduce the time lag between the possible discovery of a Weapons of Mass Destruction (WMD) agent released in the environment and actions taken to protect citizens from this threat. Specifically, the study will investigate communication patterns among group members in a simulated environment that may represent a potential biological agent attack. You are free to choose whether or not to participate in this study, and there is no penalty or loss of benefits *or any adverse impact on your employment* if you decide not to participate.

2.   PROCEDURE:

Phase I – Background Information
Before the study begins, you will be asked to provide some basic background information (age range, gender, and how long have you been using a computer). No personally identifiable information will be collected, and you can view the questionnaire before deciding whether to participate in the experiment.

Phase II – Task Completion
After you have finished the background questionnaire, you will be asked to carefully read your task-story booklet. This booklet will contain a fictitious scenario that may or may not describe the release of a toxic substance. After reading the booklet, you will then communicate via an online chat service with two other participants regarding the task. Your group will try to decide the most appropriate group response to the task situation.

Phase III – Post-Task Questionnaire
After you have finished the task, you will be asked to individually indicate your experiences with the group and your perception of the final answer in a post-task questionnaire.

The total time required is about 3 hours and must be completed in a single session.

3.   POSSIBLE RISKS/DISCOMFORTS:

The risks associated with this study are considered minimal. Anticipated workload will be similar to that of moderate computer work. Any new information developed during the study that may affect your willingness to continue participation will be communicated to you.

4.   POSSIBLE BENEFITS AND COMPENSATION:

There is no financial or other tangible benefit for participating in this study. However, participants may benefit from helping in some small way with Sandia's Homeland Defense efforts, and from learning part of the experimental process first hand. When the study is finished, participants will be able to read a summary report provided on a website.

Potential benefits of this research to society include greater precision and accuracy in determining and predicting how different types of communication patterns can influence team-decision quality.

Potential benefits to SNL are funding for Sandia's Enterprise Modeling Architecture, a multi-participant computer simulation; and support of research in optimizing communalization patterns among group members in attention demanding environments. This study may also provide a research platform to study communication patterns in other domain environments such as aviation.

5. AVAILABLE MEDICAL TREATMENT FOR ADVERSE EXPERIENCES:

SNL Employees: If you are injured as a direct result of taking part in this research study, emergency medical care will be provided by Sandia's medical staff or by transporting you to your personal doctor or medical center. Normal benefits consistent with Sandia National Laboratories' policies and practices remain available to Sandia employees.

Non-SNL employees: If you are injured as a direct result of taking part in this research study, emergency medical care will be provided by Sandia's medical staff or by transporting you to your personal doctor or medical center. Neither Sandia National Laboratories nor the Federal government will be able to provide you with long-term medical treatment or financial compensation except as may be provided through whatever remedies are normally available at law.

6. CONFIDENTIALITY:

Your identity in this study will be treated as confidential. The results of the study, including laboratory or any other data, may be published for scientific purposes but will not give your name or any identifiable references to you. No records will be kept of subjects who quit before the experiment has finished.

However, any records or data obtained as a result of your participation in this study may be inspected by the sponsor, by any relevant governmental agency (e.g., U.S. Department of Energy), by the Sandia Human Studies Board or by the persons conducting this study, provided that such inspectors are legally obligated to protect any identifiable information from public disclosure, except as otherwise authorized or required by law.

All data will be maintained on computers with standard Sandia access protection and /or stored for three years in a locked filing cabinet in a secure building at SNL. If, after three years, it is determined there is no longer a need for retention in the current study, data will be stored or destroyed using standard Sandia protocol for the storage or destruction of sensitive materials. **Note:** All SNL records relating to human subject research are currently being retained for 75 years after completion of the study (see *SNL Record Retention and Disposition Schedule*, CPR400.2.13.14, Appendix A (Record Series # HR-102-212-000).

7. TERMINATION OF STUDY:

You are free to withdraw from the study at any time without penalty or loss of benefits. Your participation in this study may be ended by the test director at any time. The sponsor reserves the right to terminate the study at any time.

8. AVAILABLE SOURCES OF INFORMATION:

Any questions you may have about this study will be answered by the test director, Michael Bernard (505-845-0815).

Any concerns, questions or complaints about your participation in this study will be addressed by the Administrator of the Sandia Human Studies Board, Terry Reser, at 845-9171.

9.   AUTHORIZATION:

Your signature below signifies the following:

- You have read this consent form and had your questions about this study answered to your satisfaction.

- You voluntarily choose to participate in this study.

- Your consent does not take away any legal rights in the case of negligence or other legal fault of anyone who is involved in this study.

- Nothing in this consent form is intended to preempt any applicable federal, state or local laws regarding informed consent.

- You will receive a signed and witnessed copy of this form.

_____

Participant Name (Please Print)

_____   _____

Participant Signature   Date

_____

Witness Name (Please Print)

_____   _____

Witness Signature   Date

Appendix E
Team Communication Study

Interaction Process Analysis (IPA)—Robert Bales (1950, 1970, 1980).

Social-Emotional Positives
1. Shows solidarity *(gives help, raises other's status, wellbeing of group)*
2. Shows tension release *(shows satisfaction)*
3. Agrees *(shows passive acceptance, complies)*

Task—Attempted Answers
4. Gives suggestion *(implying autonomy for other)*
5. Gives opinion *(expresses feeling, wish)*
6. Gives information *(information, repeats, clarifies, confirms)*
   - a. Command statement *(specific assignments of responsibility)*
   - b. Observation statement *(orienting statements towards some aspect)*
   - c. Statement of intent *(announcements of intended actions)*
   - d. Acknowledgements *(recognition of a given communication)*
   - e. Replies *(statement used to respond to an inquiry, suggestion, etc.)*

Task –Questions
7. Asks for information *(information, repetition, confirmation)*
   - a. Dichotomous question
   - b. Open-ended question
8. Ask for opinion *(evaluation, analysis, expression of feeling)*
9. Ask for suggestion *(direction, possible way of action)*

Social-Emotional Negatives
10. Disagrees *(shows passive rejection, formality, withholds help)*
11. Shows tension *(asks for help, withdraws out of field)*
12. Shows antagonism *(deflates other's status, defends or asserts self)*

The system of categories used in observation and their relation to major frames of reference. The IPA system consists of categories 1 to 12 involving process analysis of communication patterns. Categories associated with letters were added for content analysis.

6 & 7 –problems of orientation *(deciding what the situation is like)*
5 & 8 –problems of evaluation *(deciding what attitudes taken towards the situation)*
4 & 9 –problems of control *(deciding who should be primarily responsible)*
3 & 10 –problems of decision *(deciding what to do about it)*
2 & 11 –problems of tension-management *(deciding how to control group affect)*

Acronyms

ADM – Airport Decision Maker (Airport Duty Manager)
BDI – Biological Defense Initiative
CM – Computer-mediated
DIS – Distributed Interactive Simulation
EMA – Enterprise Modeling Architecture
FBI – Federal Bureau of Investigation
HLA – High Level Architecture
ICNS – Interagency Communication Network Simulation
IPA – Interaction Process Analysis
NTK – need-to-know
PHO – Public Health Officer
PROACT – Protective Response Options to Airport Counter Terrorism
VOIP – Voice Over Internet Protocol
WMD-DAC – Weapons of Mass Destruction Decision Analysis Center

References

Bales, R. F. (1950). Interaction process analysis: A method for the study of small groups. Cambridge, MA: Addison-Wesley.

Dennis, A. R., & Vavacich, J. S. (1993). Computer brainstorms: More heads are better than one. *Journal of Applied Psychology, 78,* 531-537.

DeSanctis, G., & Poole, M. S. (1994). Capturing the complexity in advanced technology use: Adaptive structuration theory. *Organization Science, 5,* (2) 121-147.

Di Salvo, V. S., Nikkel, E., & Monroe, C. (1989). Theory and practice: A field investigation and identification of group members' perceptions of problems facing natural work groups. *Small Group Behavior, 20,* 551-567.

Dubrovsky, V., Kiesler, S., & Sethna, B. (1991). The equalization phenomenon: Status effects in computer-mediated and face-to-face decision making groups. *Human Computer Interaction, 6,* 119-146.

Finholt, T., Sproull, L., & Kiesler, S. "Communication and Performance in Ad Hoc Task Groups," in *Intellectual Teamwork - Social and Technological Foundations of Cooperative Work*, J. Galegher, R.E. Kraut, and C. Egido, (eds.), Erlbaum, Hillsdale, NJ, 1990.

Hiltz, S. R., Johnson, K., & Turoff, M. (1987). Experiments in group decision making: Communication process and outcome in face-to-face versus computerized conferences. *Human Communication Research, 13,* 225-252.

Kiesler, S., Siegel, J., & McGuire, T. (1984). Social psychological aspects of computer-mediated communication. *American Psychologist, 39,* 1123-1134.

Lipkin, Joel, Tam, Ricky, Ammerlahn, Heidi, Manley, Dawn, West, Todd, & Hirano, Howard (2003). Summary and Results of the Joint WMD-DAC/Alameda County Bioterrorism Response Plan Exercise. *SAND2003-8650*, Sandia National Laboratories.

McGrath, J.E. (1984). *Groups: Interaction and performance*, Englewood Cliffs, NJ: Prentice-Hall.

McGrath, J. E., & Hollingshead, A. B. (1993). Putting the "G" Back in GSS: Some theoretical issues about dynamic processes in groups with technological enhancements. In L. M. Jessup & J. Valacich (Eds.), *Group support systems: New perspectives* (pp. 78-96). New York: MacMillan.

Oser, R. L., Prince, C., Morgan, B. B., Jr., & Simpson, S. S. (1991). An analysis of aircrew communication patterns and content (Tech. Rep. No. 90-009). Orlando, FL: Naval Training Systems Center.

Steiner, I. D. (1972). *Group process and productivity.* San Diego, CA: Academic Press.

Straus, S. G. (1996). Getting a clue: The effects of communication media and information distribution on participation and performance in computer-mediated and face-to-face groups. *Small Groups Research, 1,* 115-142.

Walther, J. B., (1996). Computer-mediated communication: Impersonal, interpersonal, and hyperpersonal interaction. *Communication Research, 23,* 1-43.

Yang, Lynn I., Manley, Dawn K., Gordon, Susanna P., Ammerlahn, Heidi R., Djordjevich, Donna D., Edwards, Donna M., Goldsby, Mchael E., Hawley, Marilyn F., Tam, Ricky, Tsang, Rose P., & Yoshimura, Ann S. (2004). Summary of the 2003 San Francisco International Airport Bio-Defense Preparation Exercise. *SAND2004-2225,* Sandia National Laboratories.

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