In this presentation we describe the development of a distributed teamwork skills training program for co-located or distributed teams performing complex, highly interdependent tasks that require overlapping expertise and shared knowledge, flexibility, and the capability for rapid organization and deployment to respond quickly to a changing situation. Our goal is to develop and demonstrate a training approach that uses advanced distance learning technology to provide portable training to small, flexible, quickly reconfigured, rapidly deployed military teams. The program is a web-enabled, scenario-based teamwork skills training program comprised of: information about and examples of teamwork skills; scenario-based training exercises that provide practice in teamwork skills; guidelines for team-conducted exercise debriefings that do not require the presence of a training instructor; and a leader’s manual that helps team leaders to conduct web-based training sessions. The version we are currently developing is focused on physicians under training (fellows and residents) working in an academic trauma center.

**Training Teamwork in a Distributed Environment**

Over the past 15 years, there has been a significant research focus on team performance, resulting in the development of team-level models. At the core of these models is the identification of two sets of behaviors within a team. One set, *taskwork*, refers to the execution of mission tasks, while the second, *teamwork*, contains behaviors necessary to perform within a team (Salas, et al., 1992). Because team performance is comprised of both individual and team skills, team performance enhancement requires that team members be trained in teamwork skills (Salas, Cannon-Bowers, and Blickensderfer, 1997). Therefore, team training must encompass teamwork as well as taskwork skills.

In this presentation we describe the development of a distributed teamwork skills training program for co-located or distributed teams performing complex, highly interdependent tasks that require overlapping expertise and shared knowledge, flexibility, and the capability for rapid organization and deployment to respond quickly to a changing situation. Examples of teams of this type include Special Operations teams, crisis response teams within command and control organizations and operations centers, and medical teams. The distributed team training program we are developing applies to teams functioning in a range of operational conditions: collocated, distributed, and partially distributed.

Our goal is to develop and demonstrate a training approach that uses advanced distance learning technology to provide portable training to small, flexible, quickly reconfigured, rapidly deployed military teams. The training program we are developing, Teamwork Training in Remote and Networked Environment (T-TRANE), is a web-enabled, scenario-based teamwork skills training program comprised of: (1) information about and examples of teamwork skills; (2) scenario-based training exercises that provide practice in teamwork skills; (3) guidelines for team-conducted exercise debriefings that do not require the presence of a training instructor; and (4) a leader’s manual that helps team leaders to conduct web-based training sessions.

A major challenge in this project was to effectively employ web-enabled collaborative tools so that distributed teams can train as effectively as co-located teams, and in ways that compensate for advantages that may accrue to co-located teams that are training and/or working in face-to-face environments. As portrayed in Figure 1, T-TRANE uses a blend of synchronous and asynchronous technologies to enable teamwork skills training that takes advantage of the sense of community created by synchronous training, and at the same time affords the scheduling flexibility provided by asynchronous training. The collaborative tools offered by the technologies provide capabilities including shared artifacts, audio and text communication, discussion and chat groups, polling, whiteboards, and archiving.
Teamwork Skills in Emergency Medical Teams

Because emergency medical teams are highly interdependent, the need for effective teamwork skills is high. Mackenzie, Xiao and their colleagues in the Level One Trauma Anesthesia Simulation (LOTAS) Group have conducted extensive research on team coordination in emergency medical care (Mackenzie and Lippert, 1999; Mackenzie, Martin, and Xiao, 1996; Xiao, Hunter, Mackenzie, Jefferies, and Horst, 1996; Xiao, Mackenzie, Patey, and LOTAS Group, 1998). They have found that team performance depends on the team’s ability to coordinate its members’ capabilities and efforts (Mackenzie and Lippert 1999), and that effective coordination is especially important when task complexity is high (Xiao et al, 1998). They have found two factors that are strongly related to effective coordination, explicit communication and the availability of established work procedures. These two factors are interrelated in that explicit communication is necessary when an established protocol is not available or when a team member is about to violate the established procedure for one or more reasons.

Xiao et al (1996) have identified four components of task complexity for emergency medical teams that heighten the need for, and at the same time challenge, effective coordination: concurrent tasks, uncertainty, changing plans, and compressed work procedures and high workload. For example, Xiao et al (1996) found that when multiple tasks are attempted concurrently, the team is prone to team coordination problems such as goal conflicts among the individual team members, task interference, and competition for access to the patient. When the physiological status of the patient is uncertain, the appropriate next step becomes ambiguous, and as a result it becomes difficult for team members to anticipate other team members’ material and information needs. Achieving effective coordination in these situations requires high levels of teamwork skills such as effective leadership and explicit communication.

In their research, the University of Maryland group (Mackenzie et al., 1994, Xiao et al., 2002) have used video recording extensively in a real trauma setting. The video clips are a rich source of material for targeted performance review and awareness exercises (Townsend et al., 1993). With extensive effort to address the issues of confidentiality, several sample video clips were extracted from video recordings for use in this training program. The videotapes provide a cornerstone for our training program. We are using selected videotapes to exemplify correct and incorrect applications of teamwork skills and as the scenarios for the practice component of the training program. The use of video enables setting up of scenarios that are realistic, detailed, and rich in task complexity. The videos provide
stimulus material to facilitate a discourse on teamwork among participants and to make the experience of the course more engaging.

Initial Domain Application

Trauma resuscitation teams are comprised of an attending surgeon, fellows, residents, nurses, and technicians. The version of the teamwork skills program we are currently developing is focused on physicians under training (fellows and residents) working in an academic trauma center. We focus on this group because this portion of the team changes at least every other month, and therefore there is a need to develop effective teamwork skills as rapidly as possible. Because of the heavy work demands placed on the team, it is also necessary to make the training program as efficient as possible, with as much flexibility in scheduling as possible, so that team members can take advantage of the relatively rare time windows in their schedule.

Program Structure, Materials, and Delivery

T-TRANE is comprised of the materials and structures for a self-contained set of scenario-based training sessions, each of which is comprised of three components: (1) a structured pre-brief that explains the training goals for that session and set forth the initial parameters for a web-based problem-solving scenario; (2) a threaded scenario that provides an initial problem for the team to work through and includes a set of events that refine, complicate, or accelerate the tempo of the teamwork processes; and (3) the structure and resource materials for a post briefing that uses the threaded events as a framework that enables the team members to analyze their teamwork and problem-solving process and derive lessons learned and goals for improvement without the need for a real-time training instructor in the loop.

As illustrated in Figure 2, the training is comprised of four modules, and alternates between asynchronous and synchronous modules. Each of the synchronous modules will be scheduled at a fixed time while the asynchronous modules can be accomplished by trainees as their individual schedules permit, but within a fixed window of time. The synchronous modules allow students to ask questions or seek clarification and receive feedback from the leader on their understanding of concepts. The synchronous sessions are also valuable to build a sense of community and to reinforce what was learned in the asynchronous sessions (Neal, 1997).

The team leader will be responsible for overseeing each session. Training materials, including material related to the conduct of the practice sessions and key points to be covered in feedback and discussion segments of training, will be made accessible to the leader. In addition, the leaders will receive information about how to access and use the web-based technologies and training materials that provide guidance on how to conduct a synchronous session.

In synchronous sessions the leader will explain a problem situation that will be portrayed in a videotape, which all the team members will view on their computer screens. The team will then complete a teamwork exercise, which might, for example, involve role playing or assessing the workload distribution. After the practice exercise is completed, the team will engage in a debriefing, with the team leader, guided by T-TRANE supplied notes, serving as moderator. In asynchronous sessions, the team members will log onto a collaborative website, where they will read a description of a problem situation they must resolve. They will view a videotaped scenario, and then respond to the questions that were posed. Using T-TRANE materials, the team leader will integrate and comment on all the team members’ responses and post feedback to the website. Then the team members will log back on to view the integrated responses and the team leader’s feedback.

The first module (1) introduces and motivates the program, and then describes the structure and form of the training. It covers the initial presentation of the concept of teamwork, and explanations and examples of teamwork skills in both medical and other domains. The module includes both positive (correct) and negative (incorrect) examples of teamwork in order to support better generalization and transfer of modeled skills (Baldwin, 1992).

The second module (2) motivates participation in the program by providing an opportunity for the trainees to interact with one another, and provides the first opportunity for participants to practice teamwork.
skills. Each practice exercise in the training program focuses on particular skills, and includes a prebrief that reviews the teamwork concepts that the exercise is designed to train. This aspect of the prebrief is intended to orient the trainees to what they are expected to learn from the exercise, and in that sense is similar to the notion of an advanced organizer (Ausubel, 1968).

Practice on teamwork skills continues in Modules 3 and 4. The third module (3) is comprised of a series of three sequenced iterations that provide further opportunity for trainees to apply and practice teamwork skills and to receive feedback from other team members. Each iteration focuses on particular teamwork skills and has two phased segments: a practice phase in which the trainees apply the teamwork concepts they are learning and a feedback phase in which they receive feedback on their performance from their peers and/or the leader. In this asynchronous module, trainees will go through the practice phase individually, but will be able in the feedback phase to see how their teammates responded to the exercise and to enter their own reactions to the team’s performance.

The fourth module (4) provides an opportunity for trainees to practice in a dynamic environment (see Figure 3). It includes two practice segments, with each practice segment focusing on a combination of teamwork skills, rather than individual ones. Module 4 also provides a forum for discussing the application of the concepts and skills learned in the training program to the trauma resuscitation environment.

Applications to Other Domains

T-TRANE is applicable to teams that train and/or work in co-located or distributed locations. Trauma resuscitation teams represent an example of teams that work in a co-located situation but can train in a distributed fashion. The advantage of distributed training is that it could start, or be completely conducted, before the teams begin to work together. But even if the teams are already working together, a distributed training program allows the team members to train in locations other than where they work. Likewise, the skills that are trained can be applied in co-located or distributed team work environments. To apply this program in other domains, the problems portrayed in the videos would have to be replaced by relevant examples in the target domain, but the concepts and structure of the program, the delivery of the program using web-enabled collaborative tools, and the teamwork skills being trained would remain applicable.

Figure 3. Discussion of the scenario in Module 4 proof of concept demo instantiation
ACKNOWLEDGMENTS
This material is based upon work supported by the United States Air Force under Contract No. F33615-02-M-0008, conducted under the direction of Dr. Peter Crane. Part of the work was supported by the Army Research Institute under Contract No. DASW01-99-K-0003. The views expressed here are those of the authors and do not reflect the official position of the sponsors.

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