

PROJECT ACRP 04-04B2

**EMERGENCY MANAGEMENT TRAINING FOR AIRPORT
CRITICAL INCIDENTS**

Prepared for the Airport Cooperative Research Program
Transportation Research Board
of
The National Academies of Sciences, Engineering, and Medicine

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October 2017

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ACKNOWLEDGMENT OF SPONSORSHIP

This work was sponsored by one or more of the following as noted:

- American Association of State Highway and Transportation Officials, in cooperation with the Federal Highway Administration, and was conducted in the National Cooperative Highway Research Program,
- Federal Transit Administration and was conducted in the Transit Cooperative Research Program,
- ✓ Federal Aviation Administration and was conducted in the Airport Cooperative Research Program,
- Research and Innovative Technology Administration and was conducted in the National Cooperative Freight Research Program,
- Pipeline and Hazardous Materials Safety Administration and was conducted in the Hazardous Materials Cooperative Research Program,
- Federal Railroad Administration and was conducted in the National Cooperative Rail Research Program,

which is administered by the Transportation Research Board of the National Academies of Sciences, Engineering, and Medicine.

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Author Acknowledgments

The research reported herein was performed under ACRP Project 04-04B2 by Emergency Preparedness Solutions, LLC.

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Abstract

This project focused on the validation of legacy airport preparedness scenarios in the Transportation Emergency Response Application (TERA), established in ACRP 04-04A. Scenarios were revised extensively to meet standards of practice such as the DHS Homeland Security Exercise and Evaluation Program (HSEEP). Following initial revisions, these functional exercises were tested in the emergency operations centers (EOCs) of airports across the nation. Feedback from participants and subject matter experts was evaluated and applied, and final revisions were made across all exercises. A number of lessons were learned relative to the value of these exercises to airport EOCs, how the exercises can be independently delivered by airport personnel, and the viability of the TERA system.

Summary

All FAR Part 139 certified airports in the United States must be prepared to address multiple hazards which may impact their facilities, operations, personnel, and passengers. The foundation of that preparedness is an airport emergency plan (AEP), which is complimented by other measures, programs, and activities. Exercises are an essential component of preparedness for emergencies and disasters. Through well developed and evaluated exercises, organizations are able to assess the readiness of plans, policies, procedures, systems, and resources for a variety of disasters they may face.

The standard of practice for public safety exercises is DHS' Homeland Security Exercise and Evaluation Program (HSEEP). HSEEP provides a set of guiding principles for exercise programs and a common approach to exercise program management, design, development, conduct, evaluation, and improvement planning. HSEEP is derived from decades of best practices in public safety and military exercises. While the guidelines and training in their application are freely available from FEMA, the design, conduct, and evaluation of quality exercises requires experienced personnel and significant time available for these functions, which many airports don't have. This severely limits the accessibility of valuable exercises to many airports around the nation.

The Transportation Emergency Response Application (TERA), is a specific adaptation of the Emergency Management Staff Trainer (EMST) developed by Engineering and Computer Simulations, Inc. (ECS) under contract with the Transportation Research Board. TERA provides an interactive exercise experience with integrated audio, video, telephone, radio, and email features. Airport emergency operations center (EOC) exercises, developed under a previous Airport Cooperative Research Program (ACRP) project, were imported into TERA. The overall goal of ACRP 04-04B was to validate these exercises.

Key Findings

While there were a number of findings directly related to the goal of this project, there were others related to future implementations of TERA exercises across the airport community. Overall, these pre-developed TERA exercises are a great resource for airports seeking to conduct EOC exercises with minimal investment. These TERA exercises have our recommendation for use across the airport community, but that recommendation comes with several important qualifications:

- The exercises are developed to reach as broadly as possible, meaning they are applicable, with minimal customization, to most airports in most areas of the nation. Based on contextual details of the scenarios, certain vagueness or specifics may need to be excused for the sake of this flexibility. As such, exercise controllers may find need to provide clarifications to players.
- Some airports, particularly those owned by local or state governments or authorities may receive federal preparedness funds, which typically require exercises to be conducted in

accordance with the HSEEP methodology. To assist with this, the appendices of this ACRP report include customizable documents, such as an Exercise Plan and Exercise Evaluation Guides, which will assist with providing HSEEP-consistent exercises.

- TERA exercises require designers to pre-identify player roles for the assignment of injects, as such, an organization model which is likely to be used by most airport EOCs had to be adopted. These exercises utilize an organizational format consistent with the National Incident Management System (NIMS) Incident Command System (ICS). Airports who do not use a NIMS ICS-based, or similar, organizational model in their EOC may find difficulty in the application of these exercises.
- Airport personnel will require training in the setup, conduct, and evaluation of TERA exercises. Even if airport personnel are familiar with the conduct and evaluation of traditional exercises via HSEEP, the technical aspects of setting up and conducting an exercise in TERA requires training to help ensure a smoothly and efficiently run exercise. The TERA Trainer's Guide is provided on the TERA website, but we found this guide to be lacking in comprehensiveness as a tool. A Facilitator/Controller Handbook has been developed under this project and is provided as an appendix to the report. Understanding that some personnel may not have HSEEP training, we have also developed and provided an Evaluator Handbook, which compliments the aforementioned Exercise Evaluation Guides.
- TERA has the ability to facilitate team-based exercises as well as individual exercises. The exercises finalized under this project are idea for team-based functional emergency operations center exercises. Information from the scenarios can also be extrapolated by airport personnel to be used as the basis for effective tabletop exercises. Through our assessment of individual exercises, it was determined that the generic nature of these scenarios prevented meaningful outcomes from being accomplished, and, in some cases, the lack of greater customization and a proper feedback mechanism risks negative reinforcement of player actions.
- The enhanced threat of an active shooter and/or complex coordinated attack on the grounds of an airport indicates a need for an active shooter/complex coordinated attack scenario to be included in the TERA airport exercise series. As the scope of this project focused only on Part 139 required scenarios, this is not an exercise that was developed, but is highly recommended.
- The use of TERA exercises by general aviation (GA) airports is cautioned against. While the scenarios were developed for the broadest applicability possible covering a range of sizes and capabilities of certified airports, the fewer capabilities and resources of general aviation airports stretch the foundational assumptions of the exercise scenarios, which may be enough to negate the effectiveness of them for a GA. The leadership of individual GAs should assess the viability of each scenario for themselves.
- Players overwhelmingly liked TERA as an exercise facilitation tool. The multi-media content brings realism to the exercises and it is a means of providing a valuable exercise experience with less commitment than a traditional functional exercise, which requires extensive planning and design time, and a number of individuals to staff a simulation cell. However, the exercises included in this TERA airport series should not be considered a

replacement for an exercise designed for a specific airport and to test capabilities and plan elements of that airport.

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Background

In July 2006, the Airport Cooperative Research Program's oversight committee selected a project to develop software to train Emergency Operations Center (EOC) staff in their responsibilities. In 2010, the Transit Cooperative Research Program selected a project similar to the ACRP project to develop software to be used by transit operators, and later for the state departments of transportation through the National Cooperative Highway Research Program. The software produced is now known as the Transportation Emergency Response Application (TERA).

In ACRP Project 04-04, scenarios were developed for the airport community to assist in training personnel in their responsibilities in an EOC when responding to hazards identified in FAR Part 139.325. The ACRP identified a need for research to test these scenarios in TERA. This need became ACRP Project 04-04B.

There were several key references that guided the conduct of this research. The ACRP request for proposals identified Part 139.325, the research objectives, and the pre-established exercise learning objectives as being essential references. The research team also identified the Homeland Security Exercise and Evaluation Program (HSEEP) as a guiding reference.

Code of Federal Regulations Title 14, Part 139 (Certification of Airports), §139.325 (Airport Emergency Plan) requires certified airports to maintain an airport emergency plan which contains instructions for response to the incidents identified below. As such, the TERA exercises addressed each of these incidents.

- Aircraft incidents and accidents
- Bomb incidents
- Structural fires
- Fires at fuel farms or fuel storage areas
- Natural disasters
- Hazardous materials/dangerous goods incidents
- Sabotage, hijack incidents, and other unlawful interference with operations
- Failure of power
- Water rescue situations (as appropriate)

The objectives of this research, as identified by the panel, are:

1. Identify and assess existing scenarios in TERA that can be used for the airport community to exercise those hazards outlined in FAR Part 139.325;
2. Update the scenarios as needed; and
3. On-site field test the updated scenarios to validate with the airport community.

The learning objectives for each exercise were established in ACRP 04-04, and served as the foundation for accomplishing the objectives of this research. Those learning objectives require participants to:

- Apply NIMS/ICS response protocols in airport emergency situations
- Determine the correct degree of response, at the correct time, during an emergency
- Differentiate important from unimportant information during a crisis
- Describe the process for closing down the EOC
- State how incoming and outgoing information should flow during a crisis
- Define the roles and duties of the personnel around them
- Describe the actions that promote effective planning during an emergency

The US Department of Homeland Security (DHS), recognizing that exercises are a key component of national preparedness, established HSEEP, which provides a set of guiding principles for exercise programs, as well as a common approach to exercise program management, design and development, conduct, evaluation, and improvement planning. As HSEEP is a standard of practice in emergency management and homeland security, it was logical to apply this standard of practice to this research project.

Research Approach

The research approach was divided into three distinct phases, which were established in the ACRP’s request for proposals and followed the three research objectives:

1. Identify and assess existing scenarios in TERA that can be used for the airport community to exercise those hazards outlined in FAR Part 139.325;
2. Update the scenarios as needed; and
3. On-site field test the updated scenarios to validate with the airport community.

While the research team’s work generally followed the tasks in order as outlined in the amplified work plan, there were occasions where certain tasks were prolonged or re-visited based upon ongoing analysis of research findings which required some alteration of the expected work plan, or based upon scheduling with third parties. Outlined below are the three phases of the project and associated research-centered tasks for each.

Phase I

Project Objective 1:
Identify and assess existing scenarios in TERA that can be used for the airport community to exercise those hazards outlined in FAR Part 139.325

Our project team compared the existing scenarios to the identified hazards within FAR 139.325 and found a direct correlation for each. These are cross walked below in Table 1.

Table 1 Comparison of FAR Part 139 Preparedness Requirements with Legacy TERA Airport Scenarios

FAR Part 139.325 Requirements	TERA Scenarios
Fires at fuel farms or fuel storage areas	Airport fuel farm fire
Bomb incidents, including designation of parking areas for the aircraft involved	Bomb threat
Structural fires	Terminal Fire
Hazardous materials/dangerous goods incidents	HazMat
Aircraft incidents and accidents	Mass Casualty Accident
Natural disaster	November Storm
Failure of power for movement area lighting	Power failure
Sabotage, hijack incidents, and other unlawful interference with operations	Sabotage
Water rescue situations (as appropriate)	Water Rescue

The Panel requested early identification of potential candidate airports for participation in the project, which we accommodated in an amended amplified work plan. To that end, our TRB Program Officer secured an agenda item for the August 25 (2016) AAEE Emergency Management Working Group conference call. Our project manager was afforded time during this conference call to speak about the project and solicit participation. Our Program Officer sent a follow up email to working group members with a flyer created by EPS to solicit participation.

Following the conference call and circulation of the flyer, we received communications from several airports asking questions and expressing interest in the project. Our primary goal was to secure a slate of candidate airports with diversity in size and geographic location, with secondary goals of including a diversity in governance structure and joint use. Enough variety of airports was required to conduct a total of nine exercise validation events; with two events each for large, medium, small, and non-hub airports, and one general aviation airport.

Next, the project team reviewed and analyzed each of the nine scenarios with a blend of subjective and objective assessments covering the established ACRP 04-04 Learning Objectives (Table 2) as well as the ability of each scenario to facilitate either a tabletop or functional exercise experience, as either an individual or group effort, and the applicability to airports of all classes and sizes.

Table 2 ACRP 04-04 Exercise Learning Objectives

At the completion of this training, students will be able to:
<ul style="list-style-type: none">• Apply NIMS/ICS response protocols in airport emergency situations• Determine the correct degree of response, at the correct time, during an emergency• Differentiate important from unimportant information during a crisis• Describe the process for closing down the EOC• State how incoming and outgoing information should flow during a crisis• Define the roles and duties of the personnel around them• Describe the actions that promote effective planning during an emergency

Further, we examined each scenario referencing the standards of practice for exercise design as established by the Homeland Security Exercise and Evaluation Program (HSEEP). This review included the following benchmarks:

- Exercise objectives are clearly defined and reflected throughout the exercise;
- The exercise scenario supports the objectives of the exercise;
- Realistic scenarios and scenario details;
- Exercise documents are clear and professional, meet their intent, and free of conflict/contradictions;
- Inject origins, methodologies, and targets are realistic;
- All injects are associated with objectives;
- The exercise documents do not dictate or script actions of participants;
- The exercise provides meaningful engagement for all anticipated participants;
- Consistent and appropriate application of titles and terminology;

Based on our findings of this initial review and the higher than anticipated level of effort required to revise the scenarios adequately for validation, the decision was made to reduce the number of exercise validation events from 18 (two per scenario) to nine (one per scenario). Ongoing analysis and revisions continued throughout the project with each subsequent validation event. Initial scenario review findings are included in this report as Appendix A.

Phase II

Project Objective 2:
Update the scenarios as needed

Once we received an adequate list of candidate airports for the project, our team made an initial selection and began outreach to each, which was initiated by email to the individuals who contacted us to express interest in participating in the project. Generally, this outreach reiterated and expanded upon several of the points in our solicitation. The goal of this initial outreach was to reaffirm interest in the project and move toward

confirmation of participation. Through this communication, we also asked each airport to identify their top three scenarios of interest.

Once participation was confirmed, we coordinated with each airport individually to identify their scenario and schedule their exercise. Coordination with airports for the exercise validation events continued into Phase III.

Deficiencies within the exercises identified in our review from Phase I were then addressed by our team in Phase II. Most textual scenario data was able to be exported from TERA to spreadsheets, with scenarios delegated among our staff based on their specific range of subject matter expertise. Once initial edits were made, scenarios were exchanged with another staff member for peer review as a form of quality control. As scenario edits progressed, issues were identified which were applicable to most or all scenarios, with our subject matter experts providing input to the project manager to set standards for consistency, such as terminology or scenario timing.

A particular challenge was to ensure that each exercise was designed to reach as broad an audience as possible, meaning they must apply to most airports in most locations around the nation. We were able to reasonably accomplish this with minimal customization to each instance of exercise delivery, providing a grounded experience to a wide range of airports with the least amount of complexity to those running the exercises. This can result, however in some vagueness of detail for certain scenario elements, which may need to be clarified by exercise controllers.

While edits were extensive across most scenarios, the foundational premise and many injects were preserved. New injects and updated artifacts (documents, images, and audio) were developed to support the changes. Our project manager and technical specialist attended a week-long TERA Scenario Builder course conducted by ECS in November (2016). Information obtained from this course was extremely helpful in ensuring that properly written exercises were adapted for use within the TERA construct.

Although all nine scenarios had undergone a full narrative re-write by our project team prior to the TERA Scenario Builder Course, we revised each scenario a second time to incorporate TERA design requirements. Once this revision was complete, we transcribed the major events from a scenario outline into an import spreadsheet provided by ECS, the developers of TERA.

While scenarios can be edited within TERA, we learned during the TERA Scenario Builder course that the airport scenarios are considered “legacy” scenarios, being that they were imported into an earlier version of TERA. As such, they do not have the full functionality of current exercises within TERA. By re-building all scenarios through the ECS spreadsheet, we were able to bring the scenarios up to current professional standards, while making all exercise data fully transparent. Further, use of the spreadsheet allows us to get the majority of time-consuming data entry completed in a more efficient manner. This part of the process focuses primarily on the injects and the identification of supporting artifacts, such as documents and audio files.

Once completed, the spreadsheet is imported into TERA and parsed. As TERA parses the spreadsheet, it provides feedback on items that need revision or additional information (for

example, the spreadsheet does not accommodate certain complex tasks, so TERA provides a reminder to edit these further within the system post-import). After the import is complete and items are adjusted, we use the scenario builder within TERA to create additional, more complex injects, as well as add media-heavy items such as bulletins, resources used for in-scenario meetings, radio audio files, and more.

Once the data is entered and the initial scenario creation is complete, we play each scenario start-to-finish for quality assurance. We ensure injects are visible to the proper participating roles, that media items play or become available as intended, and that events are triggering at the proper times and at proper intervals. In addition to ensuring there are no technical issues, this provides an opportunity to ensure the proper flow of the scenario content, and to add or remove scenario content as needed.

Phase III

Project Objective 3: On-Site field test the updated scenarios to validate with the airport community.

The preparedness for each exercise was extensive, with responsibilities by both our project team as well as each host airport to ensure that exercises were successful. To maintain consistency in the identification and tracking of preparations for each exercise, we used EPS' Comprehensive Exercise Activities List (CEAL), which was regularly updated by our project manager.

In addition to ensuring that each exercise was complete and functional within TERA, our subject matter experts for each event ensured that all documentation was prepared, and reviewed airport emergency plans (AEPs) to become familiar with the airport prior to the exercise. Once the airport provided a roster of participants, we ensured that each participant had access to TERA and was granted access to the scenario within TERA.

We coordinated closely with each host airport to ensure that they were prepared for hosting this exercise. For consistency, we prepared the Host Preparedness document, which is included as Appendix B of this report. Key information and action items tasked to each airport included:

- Identification and readiness of the specific location of the exercise (typically the airport's EOC)
- Exercise start time and lunch arrangements
- A copy of the Airport Emergency Plan
- A roster of participants
- Internet connected computer work stations for each participant

The day prior to each exercise validation event, our project manager and other team members met with the airport point of contact to review the timeline for the day of the exercise, tour the exercise area, and review any last-minute details. The day of each exercise, the EPS team arrived early to set up the exercise area. This included setting up our own technology and often

assisting sites with setting up their technology, as well as establishing a sign-in area for participants and ensuring that participants received all relevant documents, which included:

- ACRP 04-04B Photo-Video Release Form
- Exercise Participation Evaluation Form
- TERA Player's Guide
- ACRP 04-04B Informed Consent Form

Note: Sample research documents are provided in Appendix C of this report.

In addition to these documents, a scenario-specific Exercise Plan (ExPlan) was developed for each exercise, with several copies provided to the airport point of contact. The ExPlan is a foundational document in HSEEP-consistent exercises, providing fundamental information on the exercise. A sample ExPlan is provided in Appendix E of this report.

Following HSEEP standards, each exercise began with a participant briefing, which served to introduce our team, provided information on the ACRP 04-04B project, the exercise objectives, and exercise rules and assumptions. This briefing was revised based upon feedback from previous exercises.

After the player briefing, all participants with TERA access were logged into their accounts and provided with a group orientation to TERA. Our team incorporated a brief TERA practice activity between the orientation and the start of the exercise to provide an opportunity for participants to gain familiarity with the tool prior to the exercise.

Throughout the conduct of the exercise, our team members took distinct roles to ensure proper facilitation and control, and to observe and evaluate the effectiveness of the exercise. Facilitation and control was necessary to operate TERA, respond to participant queries, and to guide participants as needed. Evaluators collected observational data on the flow of the exercise and the actions of participants, ensuring that the exercise supported participant ability to accomplish the objectives.

Immediately following exercise activity, our team led players through a multi-faceted hotwash. This began with a traditional post-exercise discussion to solicit feedback from participants on their performance relative to the exercise objectives. Following this traditional hotwash, we solicited feedback on the design and flow of the exercise as well as the functionality and value of TERA. All feedback was documented by our team and served to compliment written feedback provided on the participant evaluation forms which were collected at this time.

At the conclusion of these activities, our team collaboratively completed an Exercise Effectiveness Evaluation Guide. This sheet captured initial impressions from our team members on how well the exercise facilitated the ability of participants to accomplish the exercise objectives as well as the performance of TERA. The feedback obtained from our team members was important to tracking overall performance of each scenario and helped us to identify corrective actions which needed to be applied to this scenario, and potentially to other scenarios. A sample of this form is included in Appendix C of this report and a summary of the data obtained from these is provided in Chapter 3.

Table 3 provides a list of all participating airports in this project, the date of their exercise, and the scenario tested. Note that this list includes ten airports, as the power failure scenario was conducted twice, as detailed in Chapter 3.

Table 3 Final List of ACRP 04-04B Host Airports

<i>Airport</i>	<i>Class</i>	<i>Date</i>	<i>Scenario</i>
<i>Nantucket</i>	NH	1/30	Water Rescue
<i>King County</i>	NH	2/14	Sabotage
<i>Fairbanks</i>	SH	2/16	Terminal Fire
<i>Burlington</i>	SH	3/1	HazMat
<i>Boston/Logan</i>	LH	3/10	Bomb Threat
<i>MSP</i>	LH	3/14	Power Failure
<i>Memphis</i>	MH	3/17	Fuel Farm Fire
<i>San Antonio</i>	MH	3/20	MCI
<i>Atlanta Regional</i>	GA	3/28	Severe Storm
<i>San Francisco</i>	LH	6/21	Power Failure

Following each exercise, our subject matter experts reviewed data generated, allowing us to maximize our efforts and minimize the occurrence of repeat areas for improvement.

At the conclusion of the first nine validation events and prior to the tenth, members of our team convened for two days to conduct a detailed review and analysis of data on individual exercise validation events as well as trends that cut across all scenarios. We examined strengths and areas for improvement, identified benchmarks which should be applied consistently across all scenarios, and began making edits to address these areas. Changes included the introduction of new injects, adjustments to existing injects, and changes in exercise timing. With each exercise using the same set of objectives, we felt that timing of the exercise segments and the exercise overall should be similar across all exercises. These final scenario review findings are included in Appendix D.

The delay in the conduct of the tenth exercise allowed us time to incorporate early changes across all scenarios and to develop some new approaches to be tested in the tenth exercise.

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Findings and Applications

As indicated in Chapter 2, ongoing research analysis directly informed, and sometimes altered later tasks in the project. Detailed below are the findings of research conducted in each phase of the project.

Exercise Design

The most relevant research task in Phase I was Task 3: Assess Scenarios for Exercise Design Standards. The results of our review found a consistency of errors and exercise design flaws throughout each scenario; the scenarios, as written, to be inadequate in supporting most ACRP 04-04 objectives; incapable of supporting a tabletop exercise; and contain enough flaws and concerns which largely degrade the exercise experience for participants.

One of the most significant issues identified were the timeframes provided for participants to respond to injects. As an example, one exercise had an inject requesting a resource from the EOC. One minute of play time later, a follow up inject was sent requesting the status of that resource request. Not only are timeframes like this unrealistic, but they put undue stress on participants.

Another significant issue encountered consistently across exercises was the scripting of player actions, typically seen through non-player characters leading players intensively through actions instead of allowing participants to follow their own protocols. While most exercises provide a learning experience for participants, players must be allowed the latitude to make decisions based upon the information provided and in accordance with their own plans, policies, and procedures.

Lastly, scenarios incorrectly applied several National Incident Management System (NIMS) Incident Command System (ICS) concepts and principals. As the use of NIMS/ICS is a standard of practice and a requirement, the inappropriate use of these concepts in an exercise is a distraction and provides negative reinforcement. All scenarios should be consistent with NIMS/ICS, as well as adaptations of NIMS such as California's Standardized Emergency Management System (SEMS) and New York City's Citywide Incident Management System (CIMS). Based on these and other initial findings, we recommended to the Panel that full re-writes of each scenario be conducted.

TERA Integration

While TERA is a very powerful platform, there are some limitations and standards established within the construct of the system which influenced some design elements of the scenarios. The integration of the exercises into the TERA platform required consideration of how exercise elements would best function within the system.

Foundationally, TERA facilitates communication between various active participants (such as the Operations Section Chief, the Public Information Officer, etc.) and or non-player characters (NPCs), that simulate other personnel involved in an incident (such as local law enforcement, airline representatives, elected officials, etc.). Each participant is able to interact with the scenario through an interface that simulates phone calls, radio traffic, news reports, email, and more. Timed events called "injects" occur throughout the scenario and can be customized and tailor-fit to certain participating roles, and these injects can trigger customizable tasks those participants must complete. Design of scenarios within TERA must not only accommodate injects, but also the communications that players may have with NPCs.

Information derived from traditional exercise design must be integrated into TERA. An overview of this process was provided in Chapter 2. Integration with TERA is a highly detailed process, especially when multi-media is involved. This can include imagery, video, supporting documents and presentation slides, audio clips, and more. These artifacts must be strongly considered throughout the whole process of exercise design for proper placement and consistency, as well as time needed to develop them.

HSEEP Standard Documents

Certain documents which are standardized in the Homeland Security Exercise and Evaluation Program (HSEEP) must be developed for exercises which will be conducted through TERA, especially if state or federal grant funding programs require it. These documents serve specific functions in exercises by providing relevant information for exercise participants and exercise management staff. They also aid exercise management staff (controllers/facilitators and evaluators) in performing their jobs. For functional exercises, the standard documents prescribed through HSEEP are:

- Exercise Plan (ExPlan)
- Participant Briefing
- Controller/Facilitator and Evaluator Handbooks
- Exercise Evaluation Guides

These documents were not made available for the legacy TERA exercises. Sample documents are provided in Appendices E through H of this report.

NIMS/ICS

The importance of NIMS and ICS are emphasized in national preparedness and response standards as well as the exercise objectives of this project. It is important that the construct and context of the exercises support the implementation of NIMS and ICS by airports and other stakeholders.

Once TERA accounts are created and approved, our staff assigned roles for each individual within the exercise. This information was based on discussions with each airport's point of contact on their EOC organization. TERA exercises are built around a NIMS ICS structure for an EOC. This specific identification of positions is critical to TERA's ability to provide injects to specific roles. The positions used include:

- EOC Commander*
- Safety Officer
- Liaison Officer
- Public Information Officer
- Operations Section Chief
- Planning Section Chief
- Logistics Section Chief
- Finance/Administration Section Chief

*The term EOC Commander is a non-standard title in emergency management. We include in our recommendations a change of this title to EOC Manager.

Some scenarios also include a Law Enforcement Branch Director, which is organized within the Operations Section. While we found that AEPs generally indicate the use of NIMS ICS, their EOC may not reflect an ICS structured organization, in whole or in part. As such, we had to work with some host airports to modify the structure indicated in their AEP to fit an ICS structured organization. Note that some customization is available in the scheduling mode of exercises to customize titles, but the roles and responsibilities of the renamed positions must be the same.

If there were more participants than available roles, we identified and tested two options:

1. Assign more than one individual to a role. Organizationally, these individuals could be deputies to the principle or other subordinate positions, such as the Situation Unit Leader within the Planning Section.
 - We noted that this occasionally caused problems with TERA as not everyone assigned to one role would receive an inject.
2. Exclude subordinates of these principle positions from TERA access.
 - While this eliminates potential problems with TERA, we observed that some participants felt socially excluded from the exercise. There is also no way to directly provide injects to them, instead relying on communication and coordination practices which should be in place in the EOC.

We also found that the positions of Liaison Officer and Safety Officer could not be assigned until the exercise was actually started in TERA. We've brought this issue to the attention of ECS.

Not until the release of NIMS version 3.0 by the US Department of Homeland Security in October 2017 has there been any progress toward a standard organizational model within an EOC-type environment. Even with the release of this document, no firm standard has been established. While an ICS structured organization is the preference of the authors of this report, there are other models which have been successfully used. If other models are in use by airport EOCs, these TERA scenarios, as written, cannot be realistically applied to those airports.

Training Airport Staff

While TERA is a convenient platform from which to conduct an exercise with little effort in exercise design, there are significant logistical matters to be addressed to ensure a successful exercise. While the implied intent is to provide these TERA exercises to airports for their own

use, airport emergency managers will require training and guidance to conduct and evaluate these exercises. The processes associated with registering and managing users within TERA, scheduling an exercise, managing variable tokens, and assigning roles require a measure of guidance to do properly. Similarly, the use of the TERA interface as a controller, and the facilitation of exercise discussion requires training to perform properly. Exercise evaluation can generally be accomplished by anyone who has completed an HSEEP training course, but many airports do not have personnel who have done such. Regardless of the scenario or type of exercise, effective facilitation, control, and evaluation are imperative to a successful and meaningful exercise and measurable outcomes.

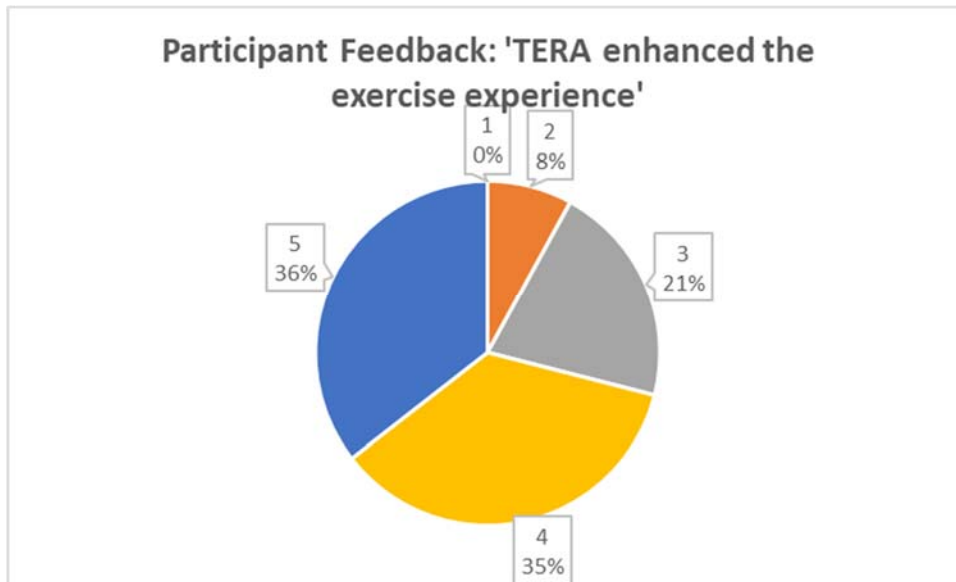
We provide a facilitator's guide and evaluator's guide, including exercise evaluation guides, as attachments to this report. These guides were developed based upon standards of practice in HSEEP, subject matter expert experience, and TERA documentation provided by ECS. These guides can support airport staff in their roles as facilitators and evaluators for exercises, but training is also highly recommended.

TERA Orientation

Time invested prior to the exercise to orient players to the TERA interface was valuable and reduced the in-exercise learning curve. In the first exercise validation event, the orientation we provided to participants was minimal. As a result, there were a number of difficulties and questions from participants about the interface, which distracted from the early minutes of the exercise. Learning from this, our team developed a more robust orientation as well as a brief hands-on tutorial for use in subsequent exercises. This provided a sharp decrease in TERA user questions during the exercises, allowing participants to focus on the exercise itself.

Based upon verbal feedback, as well as that from participant evaluation forms, participants felt that TERA provided an enhancement to the exercise experience. Figure 1 below shows cumulative results from the participant feedback form from all exercises. The graph displays data derived from a Likert scale, ranged 1 to 5, with one indicating strong disagreement and five indicating strong agreement.

Figure 1 Cumulative Participant Feedback: 'TERA enhanced the exercise experience'



Tasks and the TERA After Action Report

Early in the project we observed participants having a great amount of difficulty with TERA-driven tasks. Tasks in TERA are pre-scripted actions assigned to players that must be performed within very specific parameters to be completed. A task may call for a player to send an email to a certain role, with a specific subject line, within a certain time period. While tasks may be appropriate for a more traditional exercise based upon the plans, policies, and procedures of a specific airport or stakeholder, these generalized exercises do not lend well to the strict requirements of tasks. Where a task might require a player to send an email for a certain communication, the standard of practice at a certain airport may be to communicate this information by radio. This artificiality, along with the stress imposed on players to complete these tasks, often served to distract players from the exercise experience.

Tasks are a tracked metric within TERA. At the completion of an exercise, TERA generates an after-action report, which identifies the completion status of each task, organized by exercise objective. Since TERA tasks do not allow for any latitude in player decision-making, creative thinking, or application of their own plans, policies, or procedures; they provide little valuable information on how players accomplished exercise objectives. Further, the after-action report generated by TERA does not meet the expectations of an HSEEP-compliant after-action report.

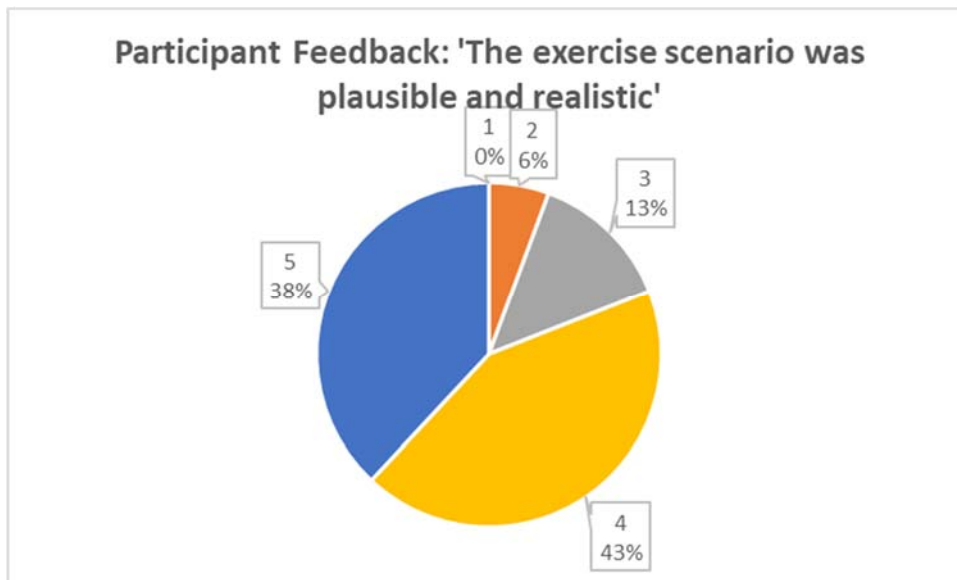
Our team concluded that the limited value of the TERA tracked tasks and the TERA after-action report gave reason to discontinue their use within these scenarios.

Developing Realistic Scenarios

While the ability to customize scenarios must remain limited to minimize complexity in setting up and executing an exercise, certain customizations allow for scenarios to be personalized to individual airports, making the exercises more relevant, meaningful, plausible, and realistic for participants. Customizations range from the name of the state, county, municipality, and airport; to identifying runway or gate numbers; and even adjusting the number of casualties or fatalities in a scenario. In TERA, these customized values are referred to as tokens, and must be integrated into design. While the original scenarios did include some tokens, our re-design of the exercises incorporated the ability to customize the most meaningful and relevant values. An inherent challenge of this project was developing exercises which could be used by airports of varying size, capability, and location across the nation. The customizations integrated into the scenarios were a key part of ensuring that the exercises were plausible and realistic for this variety of airports.

Based upon verbal feedback, as well as that from participant evaluation forms, participants felt that the exercise scenarios presented to them were plausible and realistic. Figure 2 below shows cumulative results from the participant feedback form from all exercises. The graph displays data derived from a Likert scale, ranged 1 to 5, with one indicating strong disagreement and five indicating strong agreement.

Figure 2 Cumulative Participant Feedback: 'The exercise scenario was plausible and realistic'



Exercise Objectives

Data suggested that the prescribed exercise objective of 'Describe the process for closing down the EOC' was generally impractical and ineffective given the duration and scope of the TERA exercises. As a standard of practice, most exercises are best conducted in 'real time', with alterations to time, such as time jumps, being generally avoided as participants have difficulty transitioning to the altered situation of a scenario. The implications of the scenarios exercised in

TERA generally have medium to long-term impacts, which would require airport EOCs to remain active for some time beyond the real-time duration of the exercise.

Early in the series of exercise validation events, we identified that this was an awkward objective for participants to accomplish. Data suggested the following two factors as key: 1) Most participants were generally not aware of demobilization activities for the airport's EOC; and 2) Participants wanted to discuss key activities and concerns beyond the timeline of the exercise.

To address this issue, we proposed a replacement objective along with a different approach to accomplishing it. This new objective, 'Determine short-term and long-term recovery and restoration needs for the airport', was piloted in our final exercise validation event with a facilitated discussion methodology to close out the exercise. Discussion points encompassed recovery, business continuity, and demobilization issues across the airport. This was received well by participants and rated highly by our team.

Exercise Deployment

As part of the research, our team examined the viability of TERA exercises to be deployed not only as functional exercises, but also as tabletop exercises, and individual exercises. The manner in which our research approach validated each exercise was in the most complex environment, the functional exercise. It was observed that in-exercise meetings conducted by players often evolved into what could be considered a tabletop exercise. While the discussions taking place during these sessions were valuable, to keep things on time and on task, exercise controllers were often required to step in and facilitate. Overall, the exercise material could be referenced to be used for tabletop exercises, but generally not facilitated through the TERA system.

The TERA platform supports the flexibility of individuals signing into TERA and participating in an exercise on their own, as one would take an online training course. We found the legacy exercises to be challenged to accomplish this well, and in consideration of it through our re-development of the exercises, we ascertained that the depth of design required to do this properly is incredibly complex, with a multitude of ‘if, then’-type logic statements to account for the unfacilitated actions of one player interacting only with non-player characters. This, effectively, requires the development of an exercise for each role within the exercise, independent of any other roles. Further, while this gamification approach is tempting, the lack of a proper feedback mechanism risks negative reinforcement of player actions. As indicated in an earlier finding, the design of exercises for specific airports, accounting for their own plans, policies, and procedures, may lend better to this type of exercise where tasks can be utilized and tracked.

TERA supports functional exercises extremely well through the integration of automated and multi-modal inject delivery. Functional exercises also promote a great deal of interaction among airport departments and agencies, as well as external stakeholders, should the airport opt to invite them.

Definitions

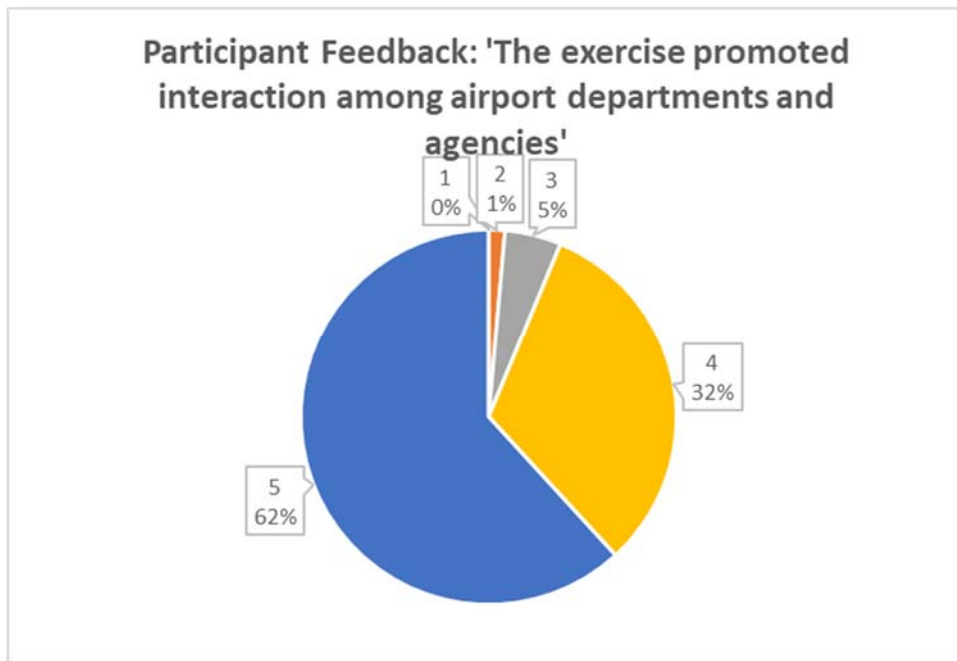
Functional Exercise (FE) – Functional exercises are designed to validate and evaluate capabilities, multiple functions, and/or sub-functions, or interdepartmental groups of functions. FEs are typically focused on exercising plans, policies, procedures, and staff members involved in management, direction, command, and control functions. In FEs, events are projected through an exercise scenario with event updates that drive activity at the management level. An FE is conducted in a realistic, real-time environment; however, movement of personnel and equipment is usually simulated.

Tabletop Exercise (TTX) – A TTX is typically held in an informal setting intended to generate discussion of various issues regarding a hypothetical, simulated emergency. TTXs can be used to enhance general awareness, validate plans and procedures, rehearse concepts, and/or assess the types of systems needed to guide the prevention of, protection from, mitigation of, response to, and recovery from a defined incident. Generally, TTXs are aimed at facilitating conceptual understanding, identifying strengths and areas for improvement, and/or achieving changes in attitudes.

(Source: Homeland Security Exercise and Evaluation Program. US Department of Homeland Security. 2013.)

Feedback received from participants, through both verbal means as well as participant evaluation forms, was very favorable in regard to the interaction promoted through these exercises. Figure 3 below shows cumulative results from the participant feedback form from all exercises. The graph displays data derived from a Likert scale, ranged 1 to 5, with one indicating strong disagreement and five indicating strong agreement.

Figure 3 Cumulative Participant Feedback: 'The exercise promoted interaction among airport departments and agencies'



Active Shooter and Complex Coordinated Attack

The enhanced threat of an active shooter and/or complex coordinated attack on the grounds of an airport indicates a need for an active shooter and/or complex coordinated attack scenario to be included in the TERA airport exercise series. Although active shooter or complex coordinated attack are not included in Part 139, these incidents are at the forefront for many airports around the nation. From the shooting at Los Angeles International Airport in 2013, to the shooting at Orlando International Airport earlier this year, and attacks at airports around the world involving firearms, explosives, and other deadly weapons, the threat is real. While there is no direct mandate for airports to prepare for such an incident, the Gerardo Hernandez Airport Security Act of 2014 (HR 4802) gives an indirect requirement to airports with a TSA presence to have preparedness measures in place for security incidents. We also received inquiries about these types of scenarios from participants at various exercise validation events. We discuss recommendations related to this finding in the following chapter.

Airports Used TERA Exercises to Further Preparedness Initiatives

Airport emergency managers were excited to host exercise validation events for this project. Many remarked that while full-scale exercises are required, they rarely have opportunity to exercise their EOC. Across the ten exercises conducted, we saw some airports engage only airport employees, while others invited external stakeholders. Some exercises had over forty participants, while others had less than ten. While all airport emergency managers used the exercise as an opportunity to engage with airport personnel, some also included external stakeholders. Some airport emergency managers used the exercise as a catalyst for other preparedness efforts. Typically, those included a review of their AEP or a test of technology, while others did even more.

King County International Airport/Boeing Field prepared for the exercise by:

- Ensuring all staff involved in the exercise had at least ICS 100 level training
- Provided an ICS/EOC overview to staff involved
- Upgraded alternative EOC facilities including adding landlines, TV/news access
- Acquired additional computers to support the EOC
- Drafted an alternative EOC SOP
- Reviewed AEP, revisions to follow

(Source: Charity Catalfomo, Safety and Security Program Manager. King County International Airport/Boeing Field)

General Aviation Airports

Our study included an exercise validation event at one general aviation (GA) airport. While participants successfully completed the exercise, there were several occasions in which the facilitator had to alter the scenario information during the exercise to make the information suitable to the airport, even though the host airport was likely better prepared than most GA airports might be. While their emergency operations plan doesn't meet the requirements of Part 139 and AC 150/5200-31C, the collaborative nature of assembling this plan with area fire and police departments had elevated their capabilities higher than would be expected of most GA airports. Additionally, the nature of their airport operations, with a number of film industry VIPs and prominent business executives using the facilities, heightened their need for preparedness. However, we do not feel that most GA airports will be able to readily use these scenarios as they are based on fundamental Part 139 requirements and the resources that correspond to these requirements, such as on-site ARFF. While opportunities for preparedness activities should rarely be discouraged, the use of TERA exercises by general aviation airports should be cautioned due to the disparity between scenario information and the real-world capabilities available at a general aviation airport. The leadership of individual GAs should assess the viability of each scenario for themselves.

Defining Expectations of TERA

TERA is a largely intuitive system that allows exercise participants to receive scripted injects in a meaningful and realistic manner. The robustness of the system often led participants to expect more from it, particularly beyond the application it was designed for. Our team had to often remind participants that TERA is an interface designed to provide injects and situational

information for an exercise. It is not a resource management system, nor is it an EOC management system. While encouraging participants to communicate through TERA helps to keep exercise communications contained, it does create an artificiality for participants who would otherwise use their own phones, email, and radios to communicate. Participants can, however, still use other tools they may use in real world incidents, such as white boards, computer-based applications, and GIS. The more it was emphasized that TERA existed to simulate exercise communication with non-playing entities, the more smoothly the exercises unfolded and the less people struggled with using TERA.

Remote Access to TERA

As a web-based platform, TERA can be accessed remotely, providing an opportunity to include additional participants or exercise control staff. The occasion of a team member unable to travel to an exercise validation event provided an opportunity to test TERA's ability to monitor and control an exercise remotely. While regular communication by phone and text between on-site staff and the remote staff member were necessary for coordination, the staff member accessing the system remotely was able to fully engage in his role as the exercise simulation cell (simcell) by responding to player inquiries and creating ad-hoc injects based upon player actions. The ability to participate real-time in a TERA exercise from a remote location can be of great benefit to supporting the control of an exercise or adding participants from other locations to an exercise.

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Conclusions and Suggested Research

The outcomes of this project will provide a valuable resource to the airport community. Exercise design is a significant investment, whether performed by staff internally or tasked to consultants. The convenience of the exercise scenarios provided in TERA will allow more airports to test the capabilities of their emergency operations centers with increased frequency. While these exercises are not a replacement for custom-designed scenarios, focusing on an airport's own policies, plans, and procedures; they do provide an opportunity to exercise more and can be a positive contribution to any airports' preparedness efforts.

Conclusions

While the final exercises provided are ready to be deployed, there is a great deal of preparedness that must be done by airports wishing to use the TERA system, as with any exercise, to maximize benefits. The strengths and limitations of TERA must be understood and applied correctly. While most 'exercise in a box' initiatives are often frowned upon in the emergency management community, the accessibility provided by these pre-written scenarios is certainly of great benefit.

The most significant challenge of this project was the development of exercises that could be used across most sizes of airports in locations across the nation. Not all needs and variations can be accounted for, despite built-in customization options in each given scenario. As such, some generalizations were necessary, and some flexibility on the part of the airports using the system is expected. While TERA is a very powerful system, many features were not utilized in the final exercise products. There are many features available to enhance scenarios that are best utilized for custom designed exercises.

As with any implementation, human involvement is necessary. Effective exercise control and evaluation are key to delivering these exercises and maximizing the benefits derived from the effort. A functional knowledge of TERA is also necessary to properly prepare the scenario and set the exercise in motion. While the TERA exercise validation events were received positively, many participants expressed interest in using the system for future exercises.

Suggested Research

Additional research can serve to enhance the resources made available from this project.

1. As indicated in Chapter 3, the development of an Active Shooter/Complex Coordinated Attack scenario is both timely and relevant to airports. While not a Part 139 requirement, the high consequence and increased threat of these attacks places this hazard high for many airports. The inclusion of such a scenario into the TERA catalogue for airports is a positive and proactive step in preparedness.

2. While facilitator and evaluator guides are provided as attachments to this report, there is great value in developing a formal training program for airport emergency management staff wishing to use TERA exercises. While the TERA interface is generally user-friendly, there are certain details that must be addressed by someone scheduling and setting up an exercise in the system. Additionally, not all airport emergency management staff are trained in HSEEP. Supplementing TERA exercise training with HSEEP concepts of exercise facilitation, control, and evaluation will help ensure that airports maximize the outcomes from their efforts.

Abbreviations, Acronyms, Initialisms, and Symbols

AAAE	American Association of Airport Executives
ACRP	Airport Cooperative Research Program
AEP	Airport Emergency Plan
ARFF	Aircraft Rescue and Firefighting
CEAL	Comprehensive Exercise Activities List
CEMS	Citywide Incident Management System (New York City)
DHS	Department of Homeland Security
ECS	Engineering and Computer Simulations, Inc.
EOC	Emergency Operations Center
EPS	Emergency Preparedness Solutions, LLC
ExPlan	Exercise Plan
FAR	Federal Aviation Regulation
FE	Functional Exercise
GA	General Aviation airport
GIS	Geographic Information Systems
HazMat	Hazardous Materials
HSEEP	Homeland Security Exercise and Evaluation Program
ICS	Incident Command System
LH	Large Hub airport
MCI	Mass Casualty Incident
MH	Medium Hub airport
NH	Non-Hub airport
NIMS	National Incident Management System
NPC	Non-Player Characters
SEMS	Standardized Emergency Management System (California)
SH	Small Hub airport
SimCell	Simulation Cell
TERA	Transportation Emergency Response Application
TSA	Transportation Security Administration
TTX	Tabletop Exercise