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Screener Readiness Test - Validation Pilot Testing

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16. Abstract The Screener Readiness Test is a computer-based assessment instrument being developed to test new checkpoint screener candidates after they have been given their initial training. The instrument's computer interface was evaluated as part of the validation process and found to be relatively easy to use. Several revisions needed for the interface are described before the full-scale validation is undertaken..			
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CONTENTS

	<u>Page</u>
1. INTRODUCTION	1
1.1 Background.....	1
1.2 Scope.....	1
1.3 Test Composition	1
1.4 Evaluation Issues	2
2. PILOT TEST AND EVALUATION PROCEDURES	2
3. RESULTS	3
3.1 'User Friendliness'	3
3.2 Effectiveness and Trainability of the Image Resolution Interface	4
3.3 Effectiveness and Trainability of the Knowledge Questions Interface.....	4
4. LESSONS LEARNED.....	4
5. REFERENCES	4
 APPENDIX A: SCREENER READINESS TEST USABILITY	
EVALUATION FORM.....	A-1

ACRONYMS

ACY	Atlantic City International Airport
CBT	Computer-Based Training
FAR	Federal Aviation Regulation
FAA	Federal Aviation Administration
GUI	Graphic User Interface
IED	Improvised Explosive Device
KSA	Knowledge, Skills, and Abilities
OJT	On-The-Job Training
SRT	Screening Readiness Test

1. INTRODUCTION

1.1 Background

Federal Aviation Regulations (FAR) require air carriers to provide for the safety and security of passengers and their property, including actions to prevent terrorism. Air carriers do this with security equipment and trained personnel to screen passengers and their baggage before they board the aircraft. The Federal Aviation Administration (FAA), working with the U.S. aviation industry, is developing new equipment and procedures to improve aviation security. Investigation of human factors is critical to the success of these efforts. The President's Commission on Aviation Safety and Security and the General Accounting Office recognize this need and recommend a greater focus on human factors and training to complement advanced technologies.

According to FAR § 108.17 (*Use of X-ray systems*), there shall be a program for initial and recurrent training of operators of X-ray systems which includes training in the efficient use of X-ray systems and the identification of weapons and other dangerous articles. Section XIII of the Air Carrier Standard Security Program presents the standards for training and testing of persons performing screening and security functions.

For many years, the only FAA-approved training for screener personnel was developed by the Air Transport Association. Their 12-hour, initial screener training program includes 40 multiple-choice questions and 40 X-ray images to assess mastery prior to On-the-Job Training (OJT). In April 1997, the FAA also approved the use of a Computer-Based Training (CBT) system developed by Safe Passage International for initial screener training prior to OJT. The CBT system contains a large library of test questions and trainees are presented with unit tests, a 50-item content mastery test, and a 50-item threat image interpretation test to assess mastery.

With the introduction of Safe Passage's CBT, screener training options have increased and will continue to expand in the future. A standardized test of mastery is needed emphasizing the knowledge aspect of the Knowledge, Skills, and Abilities (KSA) necessary for successful checkpoint screener operations. To address this issue, the FAA's Aviation Security Human Factors Program is developing a valid, reliable, and non-biased, and computer-based completion test for initial screener training, the Screener Readiness Test (SRT). A critical step in the development of the SRT is the assessment of the user's interface.

1.2 Scope

This pilot test report describes an assessment of the user's interface and initial test items of the SRT administered at Atlantic City International Airport (ACY).

1.3 Test Composition

A large set of multiple-choice questions (~280), and two sets of X-ray images of threat and non-threat bags (~1100 images in each set), have been developed using Rapiscan and EG&G X-ray machines (Fobes, Neiderman, & Klock, 1999). An interface has been developed to present the

items on a desktop computer using standard web browser software. This will serve as the prototype for the final computer-based SRT.

The prototype test was designed to have sufficient features in common with the final test so that screeners' performance with individual items would reflect expected performance using these items in the final version. The computer interface had full functionality and the pages reflected the intended test page design of the final product. All instructions were provided on the computer.

Test modules were JavaScript applications running on a desktop computer with Netscape Communicator 4.07. The applications included computer usage and test taking instructions, a personal information form that recorded demographic information, timing and time limits for individual items, and automatic data collection. All interactions of the screeners with the computer were mouse controlled, including picking response alternatives and scrolling through instruction pages.

The version of the SRT tested consisted of a set of multiple choice items and a set of image items for presentation. The multiple-choice items were grouped into eight groups of 35 and the image items into 10 testing groups.

1.4 Evaluation Issues

Participants began the test by filling out the personal information form. They next received an introduction and instructions for answering the 35 multiple-choice questions and the 35 carry-on bag image interpretations test. The screener needed to decide for each image whether a threat was or was not present.

In the test and evaluation plan (Fobes & Neiderman, 1999), a number of issues and criteria were identified for which relevant information was obtained during this pilot test. These included:

Issue 1 – How effective are the SRT's two interfaces?

Issue 2 - How 'user friendly' is the SRT?

Issue 3 - How trainable is the SRT?

2. PILOT TEST AND EVALUATION PROCEDURES

Over the six-day period from 17-22 February 1999, the SRT prototype was given to 17 different screeners, each of whom had some experience at the checkpoint.

Each screener was seated in front of the computer, given a brief introduction to the purpose of the testing, and then allowed to proceed with the test modules which consisted of a 35-item multiple choice knowledge test and a 35-item binary choice (threat/no threat) image test. For each threat/no threat image presented, the screener was given up to 30 seconds to decide whether or not a threat was present.

A human factors engineer observed screeners' interactions with the computer and used a data collection form (see Appendix A) to note significant events and problems that occurred while the test was being taken. Deficiencies were noted using a six-point scale to rate the severity of the problem. The scale values were none, negligible, mild, moderate, major, and severe. Following the test, a brief interview was conducted with each participant to further clarify problems encountered with the test.

Responses to individual items and their associated response times were recorded by the computer. An Excel database was created to store the item responses and the correct answers.

3. RESULTS

The most serious difficulty some encountered with the SRT's interface involved navigational problems using the mouse. There were a number of individuals with no experience with Graphic User Interfaces (GUI), perhaps because this sample of screeners was older than might typically be found at a checkpoint (13 of the 17 screeners were over 60 years of age). These individuals generally needed some initial instruction in using the mouse after which they gradually attained some facility as they proceeded through the instructions and the first few test questions. One screener had problems navigating the interface that were categorized as major, and two had problems described as severe.

These comments notwithstanding, the test went well overall. It should be possible to improve usability of the interface with some relatively minor modifications and proceed with the full item validation.

3.1 'User Friendliness'

Two features of the interface that produced recurrent problems included:

- Screeners accidentally 'right clicking' the mouse which would call up menu options that were irrelevant to the test. This event was very confusing to some.
- Screeners' inability to properly make a response choice because they failed to hold the mouse on the 'radio' button while 'left clicking' in the manner that the interface required. For some screeners, this problem was exacerbated by the small size of the 'radio' buttons of the image test.

For the majority of screeners, these problems were temporary and did not represent a serious disruption. The two screeners who had severe navigational problems were unable to complete the test on their own without considerable frustration. In each case, there may have been some physical disability (tremor) that contributed to the problem. In both cases, it was necessary to lend manual assistance in completing the test.

The median time to complete the modules was 45-50 minutes with individual times ranging from 30 to 90 minutes.

3.2 Effectiveness and Trainability of the Image Resolution Interface

Screeners had no problems understanding the instructions and had no special problems with the interface beyond the navigation problems noted above. There were initially some problems in recording image data. These were corrected by the end of the test and did not impact the screeners' interaction with the interface.

There were two comments that the screeners generally made with regard to the image test:

- Screeners are trained to judge bags as either representing a threat, possible threat, or no threat. They were uncomfortable with the present test where they had to respond threat or no threat. A possible threat was not an option.
- The screeners at ACY are used to interpreting black and white images. The color images used here were unfamiliar to them.

Image resolution outcomes are presented in Table 1.

Table 1. Detection of bombs and weapons.

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3.3 Effectiveness and Trainability of the Multiple Choice Questions Interface

Screeners had no specific problems following the instruction pages and understanding what they were to do. Comments were generally favorable with respect to the content of the knowledge section and the questions were close to the desirable level of difficulty.

4. LESSONS LEARNED

Based upon this pilot test, a number of changes are planned prior to large-scale validation. The screeners' interface will be changed so that the keyboard can be used to make responses. This should eliminate problems that some screeners had with the mouse-based navigation. A "possible threat" response category will be added to the image test so that testing will more closely approximate screeners' training. Finally, a set of grayscale images will be included in the validation to determine if using these images would be appropriate at sites where older (black and white) X-ray systems are in use.

5. REFERENCES

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APPENDIX A

Screening Readiness Test Usability Evaluation Form

Site _____ Station Number _____ Screener Number _____ Gender _____ Race _____

Verbal Unit _____ Image Unit _____

Time to complete the full test. _____ Familiarity with GUIs _____

Difficulty with navigation _____

Difficulty with verbal unit instructions and content _____

Difficulty with image instructions and content _____

Problems encountered with the interface _____

Frustration & Complaints _____

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