DOT/FAA/AR-01/81

Office of Aviation Research
Washington, DC 20591

Project Plan for the Evaluation of X-ray Threat Detection of Explosives at Different Subcertification Weights

Brenda A. Klock

Office of Aviation Security Research and Development
Systems Integration Branch
Federal Aviation Administration
William J. Hughes Technical Center
Atlantic City International Airport, NJ 08405

April 2001

Project Plan

This report is approved for public release and is on file at the William J. Hughes Technical Center, Aviation Security Research and Development Library, Atlantic City International Airport, New Jersey 08405

This document is available to the public through the National Technical Information Service, Springfield, Virginia, 22161



U.S. Department of Transportation
Federal Aviation Administration

NOTICE

This document is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The United States Government assumes no liability for the contents or use thereof. The United States Government does not endorse products or manufacturers. Trade or manufacturer's names appear herein solely because they are considered essential to the objective of this report. This document does not constitute FAA certification policy.

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT/FAA/AR-01/81		

4. Title and Subtitle	5. Report Date
Project Plan for the Evaluation of X-Ray Threat Detection of Explosives at Different Subcertification Weights	April 27, 2001
	6. Performing Organization Code AAR-510

7. Author(s)	8. Performing Organization Report No.
Brenda A. Klock	DOT/FAA/AR-01/81

9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Federal Aviation Administration William J. Hughes Technical Center Aviation Security R&D Division Systems Integration Branch Atlantic City International Airport, NJ 08405	11. Contract or Grant No.

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
Federal Aviation Administration Associate Administrator for Civil Aviation Security, ACS-1 800 Independence Ave., S.W. Washington, DC 20591	Project Plan
	14. Sponsoring Agency Code ACS-1

15. Supplementary Notes
This project plan was prepared by Pamela U. Duke, M.A., Federal Data Corporation

16. Abstract
This plan outlines the field evaluation for threat detection in X-ray images of bags containing explosives at full and subcertification weights. Human Factors Engineers will adminster a test containing a government-supplied set of X-ray images of bags on emulators provided by Rapiscan Security Products. A total of 140 screeners from five airports will participate in this evaluation. Analyses will focus on screener detection of explosives below full certification weight.

17. Key Words	18. Distribution Statement
Threat Detection Threat Image Projection Explosive Certification Weights Subcertification Weights	This report is approved for public release and is on file at the William J. Hughes Technical Center, Aviation Security Research and Development Library, Atlantic City International Airport, New Jersey 08405. This document is available to the public through the National Technical Information Service, Springfield, Virginia, 22161.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	11	

Form DOT F 1700.7 (8-72) **Reproduction of completed page authorized**

TABLE OF CONTENTS

	Page
1. INTRODUCTION	1
1.1 Background	1
1.2 Purpose	1
2. MAJOR PROGRAM ACTIVITIES	1
2.1 Phase 1 - Project Plan	1
2.2 Phase 2 - Test Planning and Coordination	2
2.3 Phase 3 - Data Collection and Analysis	2
2.4 Phase 4 - Final Report and Lessons Learned	2
3. PROJECT MANAGEMENT	2
3.1 Project Planning and Monitoring	2
3.2 Deliverables	3
3.3 Resources	3
3.4 Schedule	3
3.5 Quality Assurance	5
4. REFERENCE	5

LIST OF TABLES

Table		Page
1	Project Deliverables	3
2	Personnel	3
3	Gantt Chart Project Schedule	4

EXECUTIVE SUMMARY

Improvements in the technologies available to aviation security at the checkpoint are essential for efficient and effective operations. X-ray systems in airports are designed to display images of baggage and its contents, including guns, knives, other weapons, and explosives. X-ray systems include a function designed to maintain on-the-job vigilance. Threat Image Projection (TIP) was developed to increase the proficiency of the primary skills required of a screener to interdict threats at the checkpoint. TIP exposes screeners to images of threats (e.g., weapons or explosives) by randomly projecting these threat images onto passenger bags as the bags move through the X-ray system. Alternately, TIP can also project the image of an entire bag containing a threat when there is a suitable gap between passenger bags.

The FAA has established standardized weights for different explosive materials. These weights are used for certification of explosive detection systems. Currently, TIP contains only full certification weight explosives. A previous evaluation of screener performance in detecting explosives at full and subcertification weights was inconclusive [1]. This present project will be a re-evaluation of explosive detection for X-ray images containing full and subcertification weights.

ACRONYMS

FAA	Federal Aviation Administration
FDC	Federal Data Corporation
HFE	Human Factors Engineer
IED	Improvised Explosive Device
QA	Quality Assurance
TIP	Threat Image Projection

1. INTRODUCTION

Federal Aviation Regulation 108.17 requires that X-ray operators undergo initial and recurrent training to ensure the safety of airline passengers and their property. To comply, air carriers procure equipment and train personnel to screen passengers and their carry-on baggage before they board the aircraft. Furthermore, the Aviation Security Improvement Act, Public Law 101-604, mandates that the Federal Aviation Administration (FAA) enhance and improve X-ray baggage screener selection, training, and performance. The Aviation Security Human Factors Program (AAR-510) of the Office of Aviation Security Research and Development is the FAA unit tasked with this responsibility.

1.1 Background

Improvements in the technologies available to aviation security at the checkpoint are essential for efficient and effective operations. X-ray systems in airports are designed to display images of baggage and its contents, including guns, knives, other weapons, and explosives. X-ray systems include a function designed to maintain on-the-job vigilance. Threat Image Projection (TIP) was developed to increase the proficiency of the primary skills required of a screener to interdict threats at the checkpoint. TIP exposes screeners to images of threats (e.g., weapons or explosives) by randomly projecting these threat images onto passenger bags as the bags move through the X-ray system. Alternately, TIP can also project the image of an entire bag containing a threat when there is a suitable gap between passenger bags.

The FAA has established standardized weights for different explosive materials. These weights are used for certification of explosive detection systems. Currently, TIP contains only full certification weight explosives. A previous evaluation of screener performance in detecting explosives at full and subcertification weights was inconclusive [1]. This present project will be a re-evaluation of explosive detection for X-ray images containing full and subcertification weights.

1.2 Purpose

The purpose of this project is to perform a field evaluation to test the hypothesis that screeners will adequately detect explosives below full certification weight. This evaluation will involve comparing threat detection performance with X-ray images of explosives below certification weight and those at full certification weight. The evaluation will be accomplished using a government-supplied set of X-ray images of bags that run on emulators provided by Rapiscan Security Products. The images will include .25, .50, .75, and 1.0 of full weight explosives. Screeners at five airports will evaluate these images.

2. MAJOR PROGRAM ACTIVITIES

2.1 Phase 1 - Project Plan

The first phase of this project is the initial planning. This is completed with this project plan.

2.2 Phase 2 - Test Planning and Coordination

The second phase of this project will begin by identifying the Critical Operational Issues and Criteria associated with the detection of subcertification weight explosives. Measures of Performance will be designed to address these critical issues, and a test and evaluation plan that includes an experimental design to collect relevant information will be developed.

2.3 Phase 3 - Data Collection and Analysis

The third phase of this project will require Human Factors Engineers (HFEs) to administer a test to a total of 140 screeners. Five groups of 28 screeners, each group at five different airport sites, Atlanta Hartsfield, Detroit Metropolitan Wayne County, Newark, Reno-Tahoe, and Seattle-Tacoma International Airports will be utilized for data collection. Each screener will judge a set of X-ray images of innocent bags and bag threats (Improvised Explosive Devices [IEDs]) that will be presented to them on Rapiscan emulators (two per airport). The Rapiscan emulators will record the bag number of every bag and screeners' responses.

HFEs will supervise test administration and download data collected on the Rapiscan emulators. Following data collection, the data from this study will be incorporated into a database developed in Microsoft Access®.

HFEs will import the data into SPSS to complete relevant statistical tests. The analysis will allow HFEs to produce tables of Probability of Detection, Probability of False Alarm, Sensitivity, and Bias for the each explosive type and each IED configuration presented at each full and subcertification weight. The analysis will determine whether any of the measures are significantly affected by certification weight or explosive type. The data reports will consist of these tables and supplementary statistical tables derived from SPSS output. The results of these initial analyses will be included in a quick-look assessment report.

2.4 Phase 4 - Final Report and Lessons Learned

The final test and evaluation report will present a detailed description of this project, a thorough analysis of the results, and implications for the detection of explosives below full certification weight. The final report will also include lessons learned to guide future efforts and any limitations of this project.

3. PROJECT MANAGEMENT

3.1 Project Planning and Monitoring

This project plan forms the baseline for planning and monitoring the progress and status of the project. During the course of the project, bi-weekly activities reports will be provided at the regularly scheduled security meetings. A monthly Earned Value Analysis will also be provided. Any risk associated with the on-time/on-budget completion of the project at the time it arises will be addressed. Periodic reviews of the plan against progress made will be conducted, and any

replanning will be done as necessary. Any replanning associated with this project will be done in consultation with the stakeholders.

3.2 Deliverables

Table 1 identifies the products:

TABLE 1. PROJECT DELIVERABLES

Product	**Scheduled Date**
Project Plan	April 27, 2001
Test and Evaluation Plan	May 29, 2001
Database and Database Documentation	*August 24, 2001
Preliminary Quick-Look Report	*September 6, 2001
Final Test and Evaluation Report	*October 16, 2001

*Approximation

3.3 Resources

Table 2 depicts the personnel necessary to support the project.

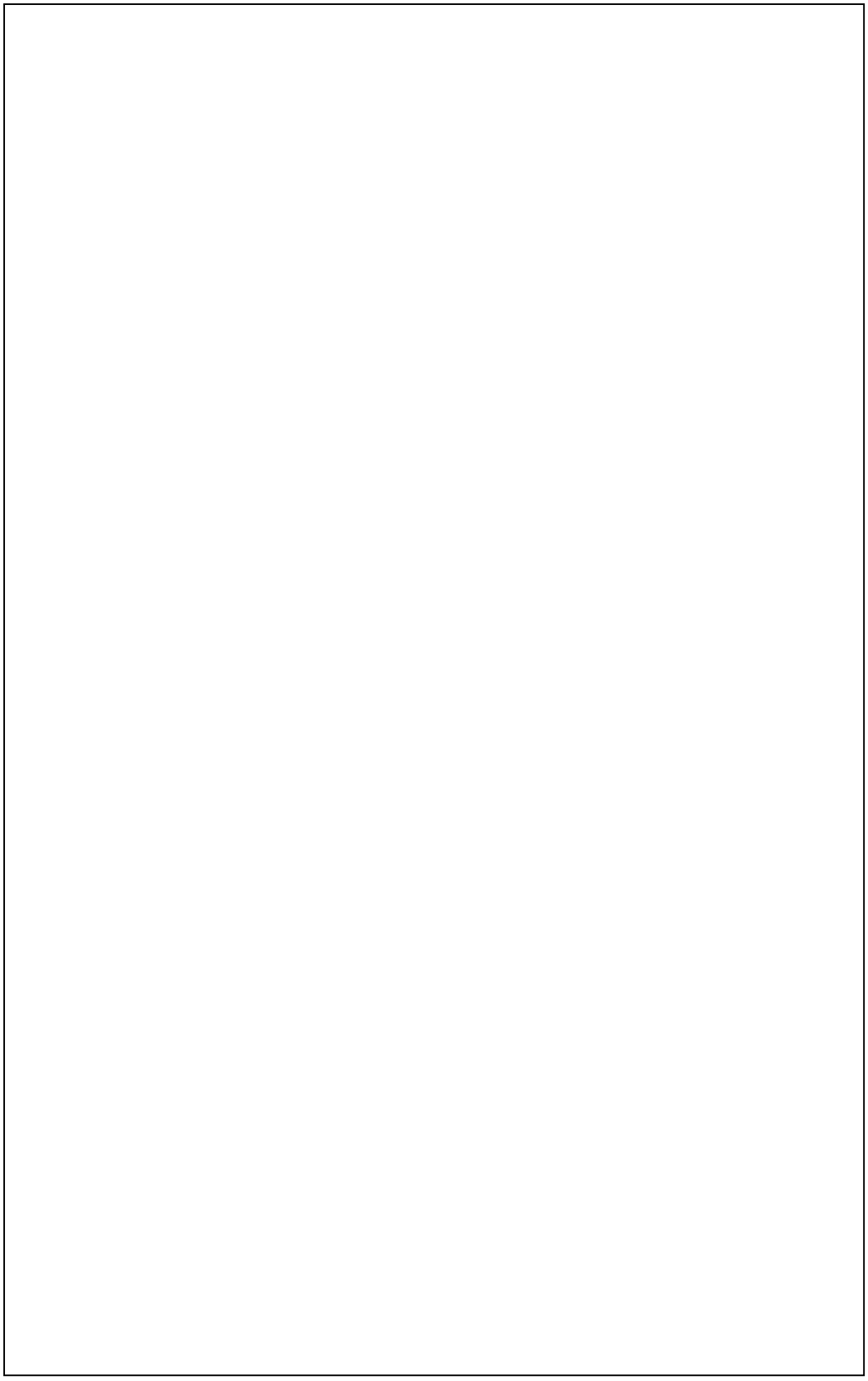
TABLE 2. PERSONNEL

Contract Labor Category
Program Manager
Human Factors Engineer III
Human Factors Engineer I
Computer Systems Specialist
Documentation Specialist
Clerk

3.4 Schedule

The project schedule is shown in table 3. It defines the Work Breakdown Structure, which specifies the tasks that will be performed and the expected completion date fro each task.

TABLE 3. GANTT CHART PROJECT SCHEDULE



3.5 Quality Assurance

The Quality Assurance (QA) Plan requires that each program maintain a quality assurance plan tailored for that program.

The QA activities envisioned for this project include the following:

a. Formal/Informal Reviews – formal and informal reviews will be conducted to evaluate progress towards completion of the current phase and/or assess readiness for the formal reviews. Bi-weekly activity reports will be reviewed by the PM or his designee for this project to ensure that quality standards are being maintained. At the completion of each phase of the project, the PM or his designee will conduct an audit to ensure quality of the products prior to beginning the next phase. In addition, a formal walk-through of the database structure will be conducted.

b. Evaluation/Inspections – evaluation and inspections will be conducted periodically by QA personnel to assess conformance to this project plan and contract requirements.

c. QA Reporting – status reports on the QA program for this project will be contained in the Project Monthly Status Report delivered to the Government, as required. It will include QA activities performed for the reporting period; results of these activities; problems identified and corrected or action items assigned; status of previous action items; and plans for the next reporting period.

d. Final Delivery Certification – prior to delivery of the Final Report, the contractor will ensure that the products meet their original requirements and that the Final Report accurately describes what was performed in each project phase and the results of these activities.

4. REFERENCE

1. Barrientos, M.J., & Neiderman, E.C. "Test and evaluation report for screener performance with full and subcertification threat weights." (In press). Federal Aviation Administration.