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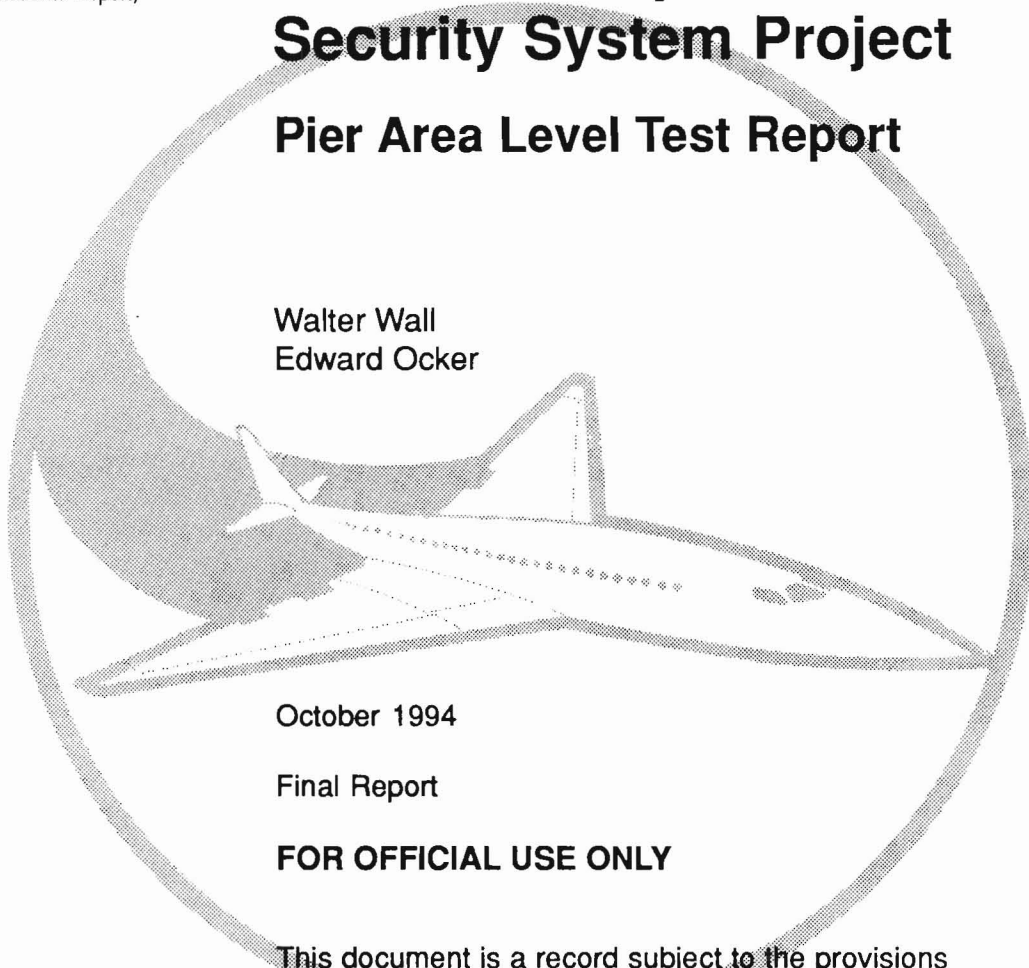
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FAA Technical Center
Atlantic City International Airport,
N.J. 08405

FAA Technical Center Enhanced Airport Security System Project Pier Area Level Test Report

Walter Wall
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October 1994

Final Report

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Technical Report Documentation Page

1. Report No. DOT/FAA/CT-94/17, I		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle FAA TECHNICAL CENTER ENHANCED AIRPORT SECURITY SYSTEM PROJECT: PIER AREA LEVEL TEST REPORT				5. Report Date October 1994	
				6. Performing Organization Code ACA-400	
7. Author(s) Walter Wall and Ed Ocker				8. Performing Organization Report No. A-2001001-94-U-10036	
9. Performing Organization Name and Address U.S. Department of Transportation Federal Aviation Administration Technical Center Aviation Security Research and Development Service Atlantic City International Airport, NJ 08405				10. Work Unit No.	
				11. Contract or Grant No. DTFA03-93-C-00042	
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Aviation Administration Assistant Administrator for Civil Aviation Security, ACS-1 800 Independence Avenue, S.W. Washington D.C. 20591				13. Type of Report and Period Covered Final Report	
				14. Sponsoring Agency Code ACS-1	
15. Supplementary Notes: Report Prepared by: DCS, Inc. Robert Baker, DCS 2511 Fire Road, Suite A-5 Absecon, NJ 08201					
16. Abstract The Pier Area Level Test Report: Enhanced Airport Security System Project at Baltimore-Washington International Airport (BWI) provides the results of the security effectiveness tests conducted at BWI on the security enhancements at the pier level of the enhanced security system. The tests are discussed, with results reported by test category. The two test categories are screening point penetration tests and screening point bypass tests. The unclassified sections provide information on the test objectives, scope, methodology and individual test series descriptions. The CONFIDENTIAL supplement provides specific test results, analysis and conclusions.					
17. Key Words Enhanced airport security; Screening point; x-ray inspection; Image processing; Security testing; Contraband detection; and, Target penetration.			18. Distribution Statement This document is a record subject to the provisions of 14 CFR 191 et seq. Release of the information contained herein is prohibited without the express written approval of the Assistant Administrator for Civil Aviation Security, Federal Aviation Administration, or his designee.		
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of Pages 44	
22. Price					

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PREFACE

This test report is organized into two volumes, this unclassified part and a **CONFIDENTIAL** supplement. The two volumes are intended to be read together. Neither volume stands alone.

In this volume, all classified figures and tables are referenced only. The classified information relative to sections 3 and 4 is provided in the **CONFIDENTIAL** supplement.

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LIST OF ACRONYMS AND ABBREVIATIONS

ACSSP	Air Carrier Standard Security Plan
AOA	Air Operations Area
ASP	Airport Security Plan
BMA	Baggage Make-up Area
BWI	Baltimore-Washington International Airport
CCTV	Closed Circuit Television
CFR	Code of Federal Regulations
CSS	Checkpoint Screener Supervisor
EASSP	Enhanced Airport Security System Project
FAA	Federal Aviation Administration
FAATC	Federal Aviation Administration Technical Center
GD	General Duress Alarm
IP	Image Processing System
LEO	Law Enforcement Officer
LTI	Lead Test Inspector
MAG	(Walk-through) Metal Detector
MSP	Maryland State Police
MTFP	Maryland Toll Facilities Police
PSR	Private Screening Room

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LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

RFP	Response Force Personnel
SCIS	Screening Communication Intercom System
SIDA	Security Identification Display Area
SOC	Security Operations Center
SPM	Security Performance Monitor
TI	Test Inspector
TM	Test Manager
TRP	"Training Plan EASSP at BWI"
WRA	Working Ramp Area

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EXECUTIVE SUMMARY.

This report discusses the Pier Area Level Security Effectiveness testing conducted at Baltimore-Washington International Airport (BWI). These tests were divided into two separate test categories, the Screening Point Penetration Test and the Screening Point Bypass Test. The unclassified sections discuss the test objectives, scope, methodology, and provides detailed descriptions of the individual test series conducted. The CONFIDENTIAL supplement provides the test results and their security implications in detail. The information gained during these tests will provide insight and guidance to others who attempt to implement all or portions of applicable enhancements at other airports.

The Screening Point Penetration Test focused on the effectiveness of the enhanced system configuration in detecting and preventing the introduction of contraband items into the sterile aircraft boarding area through the passenger screening point.

The Screening Point Bypass Test focused on the effectiveness of the enhanced system configuration in detecting and preventing the introduction of such items by an adversary using pathways that bypass the passenger screening point. The pathways tested were the exit path from the sterile area adjacent to the screening point and the walk way through the baggage makeup area (BMA).

The measure of security effectiveness was the difference in contraband detection and target penetration prevention rates between the existing BWI security system (the baseline system) and the BWI security system with specific security enhancements in the personnel, equipment, and procedure areas (the enhanced system configuration).

The test results generally indicated that the enhanced system configuration was only slightly more effective than the baseline system configuration in detecting contraband and markedly more effective in adversary bypass detection. This slight difference could be due to variations in individual employee experience or conscientiousness. Employee inattentiveness to airport security challenge requirements was evidenced throughout the test series.

However, the enhanced system configuration was much more effective than the baseline system in preventing post-detection penetration. This major difference is clearly due to the use of automatic revolving doors to block post-detection adversary entry into the sterile area.

Based on the test results, a number of specific recommendations are made to improve the security effectiveness of each system configuration and airport security in general. These recommendations include personnel staffing and training, equipment additions and modifications, and procedural changes. Recommendations are presented for additional research and testing in the passenger screening and the airport employee security awareness area.

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1. INTRODUCTION.

This report summarizes the results of the Pier Area Level Tests conducted on both piers A and B for the Federal Aviation Administration Technical Center (FAATC) Enhanced Airport Security System Project (EASSP) at Baltimore-Washington International Airport (BWI). The information gained during these tests will provide insight and guidance to others who attempt to implement all or portions of applicable enhancements at other airports. These tests involved the passenger screening points, the concourse exit ways, and the Baggage Make-up Area (BMA). All tests were conducted in accordance with Sections 5.2 and 5.3 respectively of the "Security Effectiveness Test Plan: EASSP at BWI". Specific test objectives, series, and procedures are discussed in detail in this report. Please note that this report is divided into two segments; an unclassified portion and a CONFIDENTIAL supplement. There are several sections which are provided only in the CONFIDENTIAL supplement. Specific test results are presented in this classified supplement.

1.1 OBJECTIVES. The objective of these test series was to evaluate the effectiveness of individual security enhancements at the pier level in detecting, assessing, delaying, and/or preventing the entry of contraband into the sterile concourse areas.

1.2 TEST ORGANIZATION. The pier area tests consist of two major test series; the screening point penetration test series and the screening point bypass test series. Each of these tests series was conducted in the baseline and enhanced system configuration. Portions of each test series were also conducted under either overt or covert conditions using a variety of adversary tactics.

1.3 SCOPE. The scope of the area-level pier tests is detailed in the "Security Effectiveness Test Plan: EASSP at BWI". These test series are intended to evaluate the security effectiveness of the equipment, personnel, and operational procedures associated with the integration of the equipment in specific areas. These areas are the passenger screening point on pier B and the BMA in the main terminal area.

1.4 METHODOLOGY AND APPROACH.

1.4.1 Baseline Versus Enhanced System Configurations. The baseline system configuration refers to the security equipment, personnel staffing, and procedures used prior to the installation of the EASSP equipment and times when the enhanced equipment is not in

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operation. The enhanced test configuration refers to the use of enhanced security equipment, personnel staffing, and procedures at Screening Point B (see figure 1 Screening Point B Enhancements Include Equipment, Personnel and Procedures) and the BMA in the main terminal. These security enhancements include:

- a. Color x-ray with an Image Processing (IP) System;
- b. Security Performance Monitoring (SPM) Room;
- c. Private Screening Room (PSR);
- d. Screener Communications Intercom System (SCIS);
- e. Expanded use of the pier alert and pier duress alarms; and
- f. The addition of a General Duress (GD) alarm.

Under their respective Air Carrier Standard Security Programs (ACSSP), each air carrier is required to perform passenger screening. The screener training and procedures are specified in the ACSSP and are common among the air carriers. Thus, these ACSSP requirements are in effect for both the baseline and enhanced system tests.

The airport security requirements, including their Security Identification Display Area (SIDA) training and employee challenge procedures, are specified in the BWI Airport Security Program (ASP). Thus, these ASP requirements are in effect for both the baseline and enhanced system tests unless specifically waived. In addition, all screening personnel involved in the enhanced system tests completed the Enhanced System Training courses outlined in "Training Plan (TRP): Enhanced Airport Security System Project at Baltimore-Washington International Airport".

1.4.2 Overt Versus Covert Testing. These tests were conducted in either the overt or covert modes. The overt mode refers to test scenarios in which the adversary conspicuously attempts to carry contraband to the target airplane. The covert mode refers to test scenarios in which the adversary attempts to inconspicuously carry contraband to the airplane.

The overt tests were conducted only during non-operational hours to ensure both the safety of the public and the test team members and to prevent operational disruptions due to passenger alarm or delays.

The covert tests were conducted during normal operational hours to allow for a more realistic test environment. Such an environment would necessarily include varied passenger traffic through the screening points with associated personal and bag inspection activity. In the BMA, it included baggage handlers being present sorting and transporting passenger baggage.

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1.4.3 Blind Testing Approach. The blind testing approach provides for the most realistic test environment. Under such an approach, only the test inspectors and the adversary are aware of the test activity. However, due to the safety, operational, and security concerns in an airport environment, this approach was not feasible in many instances. In all covert tests, all screening point personnel were unaware of the specific testing activity.

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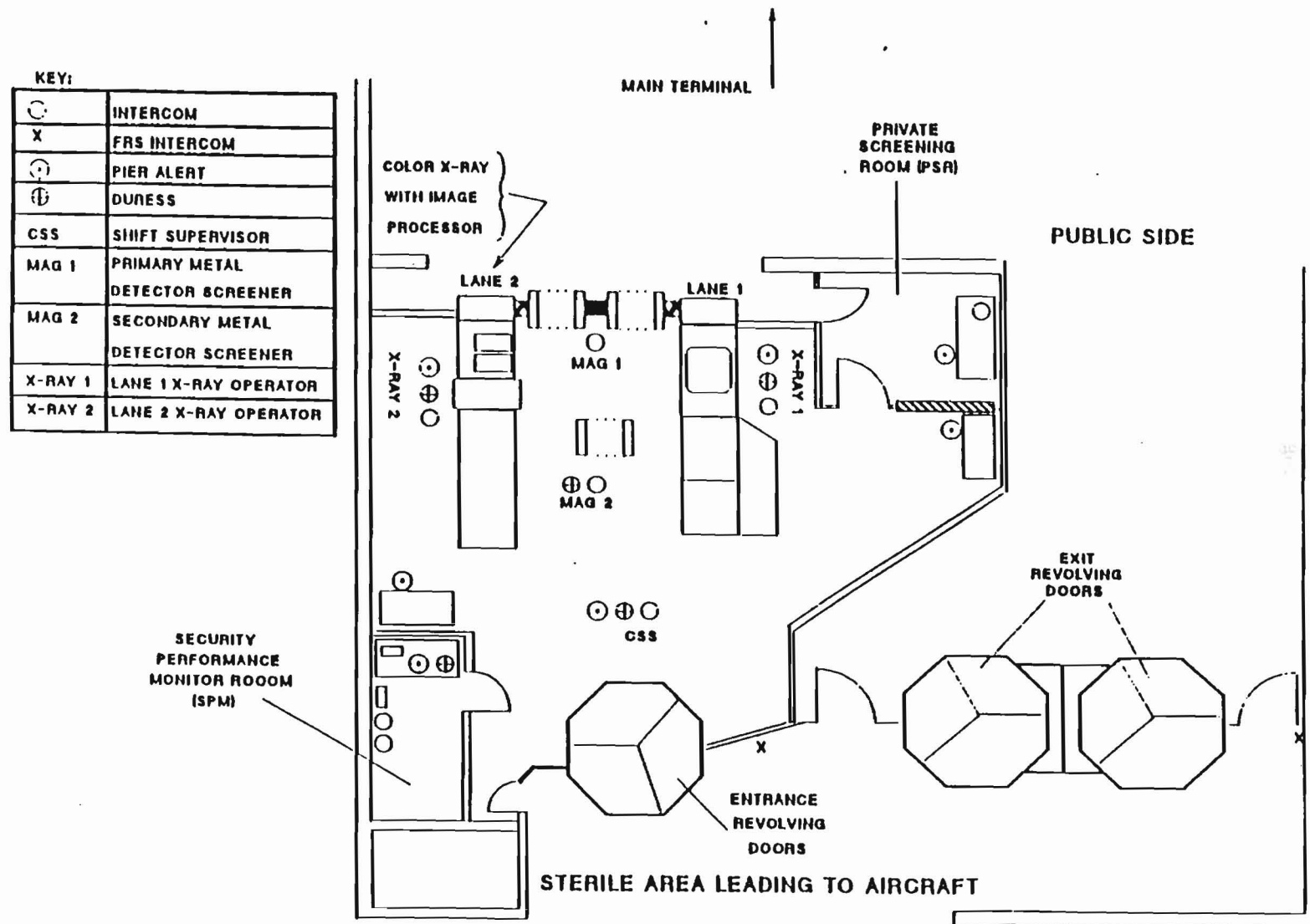


Figure 1. Screening Point B Enhancements Include Equipment, Personnel, and Procedures

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2. TEST DESCRIPTION.

The characteristics that are common to both tests are described in general in paragraphs 2.1 through 2.3. Test descriptions of the specific test series are provided in paragraph 2.4. Summaries of both test series by system configuration are provided in paragraph 2.5.

2.1 TEST TEAM COMPOSITION. These tests were conducted by four or five person teams. The number of test team members was determined by the need to operate the Security Operations Center (SOC) in the manual/test mode. The following list describes each of the test team members and their associated responsibilities:

- a. Test Manager (TM) - Managed the test team and controls the test activity;
- b. Lead Test Inspector (LTI) - Supervised the adversary and other non-test personnel along with coordinating test activities with the responsible law enforcement agencies;
- c. Test Inspector (TI) - Observed and recorded events at the specific test site;
- d. SOC Operator - Operated the SOC according to written procedures without knowledge of the testing activity taking place; and
- e. Adversary and Other Non-Test Personnel - Performed the actions in the various test scenarios. (Please note that all adversaries and extra personnel were specifically briefed on the sensitive nature of this project and the confidential nature of the individual tests performed).

2.2 TEST EQUIPMENT. The test items used in the various test scenarios were standard FAATC test objects for this specific project. The use of standard FAA test objects was avoided due to their familiarity to screeners. The FAATC test objects used were inoperative handguns, toy guns similar in size and weight to their real counterparts, and simulated explosive devices. In all cases, the test objects were appropriately wrapped and labeled as FAA test objects prior to any actual test use. The choice of test objects was based largely on realism, availability, and scenario requirements. Test Sets were developed for use in the various test scenarios to minimize differences in object orientation, construction, and packaging throughout the test period. Each Test Set identified the specific test object, its packaging or masking materials, and gave specific instructions as to its placement in containers and/or luggage. The test sets used are identified with accompanying photographs in Appendix A. Test Sets.

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2.3 DATA COLLECTION, REDUCTION, AND ANALYSIS. During testing, the following data collection methods were employed to ensure accuracy:

- a. Quadruplex video recording of all screening point tests;
- b. Video recording of x-ray images taken during tests;
- c. Automatic alarm recording and print out at the SOC; and
- d. Manual event recording by test inspectors.

The video recordings, alarm print outs, and test inspectors notes were reviewed, coordinated, collated, and identified with individual test runs to ensure accurate event sequencing and timing.

The initial data analysis focused on the number of specific test runs conducted by series number in each test category and their security effectiveness in each of the system configurations, baseline and enhanced.

The primary analysis was the comparison of security effectiveness across both tests between the two system configurations. The results of this analysis are used to formulate conclusions on the overall effectiveness of the systems approach to aviation security and the specific effectiveness of the enhanced equipment.

2.4 SCREENING POINT PENETRATION TEST. The purpose of this test was to evaluate the enhancements in the screening point effectiveness compared to the baseline. The basic intent was for the adversary carrying the contraband item to attempt to penetrate through the passenger screening point. This test was designed to evaluate the screening point equipment, personnel and procedures as an integrated element of the security system. The measures of effectiveness include contraband detection, target penetration, communications efficiency, and procedural effectiveness. For baseline tests, Screening Point B was used without its enhanced features operational.

The following sections define the specific test series, cases and runs conducted under the screening point penetration test category. These runs were scheduled in a random order to reduce bias in the test results due to screener familiarity and specific test tactic awareness. The adversaries and test objects were also frequently varied to further reduce such factors. These test series were performed under both system configurations unless otherwise stated.

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Five (5) test series were defined to address specific combinations of adversary objective, type of contraband, and specific path through the screening point. These five (5) test series are:

- a. Adversary carrying a weapon through the metal detector (MAG);
- b. Weapon in carry-on baggage, through the x-ray machine;
- c. Adversary with a weapon, bypassing the MAG;
- d. Adversary carrying a bomb; and
- e. Bomb in carry-on baggage, through the x-ray.

Within each test series, individual test cases were defined for specific tactics (overt, covert) and for the equipment configuration of the test (baseline or enhanced). Each case was run several times, intentionally spaced throughout the test period.

2.4.1 Adversary Carrying a Weapon, Through the MAG. This test series evaluates the effectiveness of the screening process in detecting an adversary attempting to carry a simulated weapon through the MAG and past the screening point.

The first tactic was an overt penetration attempt. The adversary, carrying a test weapon (Test Set 1B), simply walked through the MAG (expecting to cause the MAG to alarm). When challenged by the screener responsible for the MAG, the adversary responded by attempting to run through the screening point into the sterile area.

The second tactic was a stealth attempt by the adversary. The adversary placed an item (containing a simulated weapon) in the inspection bin bypassing the MAG while he passed through the detector. The concealment items used were a sunglass case and a cargo pad. The weapon was simulated by two different metal toy guns, and an FAA Operational Test Piece, (Test Set 2B).

2.4.2 Weapon in Carry-on Baggage, Through X-ray Machine. This test series evaluated the effectiveness of the screening process in detecting an adversarial attempt to pass a simulated weapon through the screening point with the weapon concealed in carry-on baggage which is passed through the x-ray machine.

The first tactic was an overt penetration attempt. The simulated weapon was placed in the carry-on bag with no attempt to hide or disguise its presence. An FAATC test weapon was used in this case (Test Set 1B). When the x-ray screener detected the presence of the weapon, the adversary attempted to snatch the bag from the x-ray machine belt and run through the screening point into the sterile area.

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The second tactic was a stealth attempt by the adversary. The simulated weapon was shielded using a metallic covering as a shielding material, attempting to mask the identity of the weapon to the x-ray screener. If the screener challenged the adversary, no attempt was made to prevent inspection of the contents of the bag. In this case, an FAATC test revolver was placed in a cardboard box surrounded by steel wool and wrapped with aluminum foil (Test Set 1B).

The third tactic was also a stealth tactic similar to the second. In this case, the weapon was disguised in an attempt to elude detection by the screener. In this case, an FAA test automatic handgun was disassembled and placed within the carry-on bag (Test Set 1A).

2.4.3 Adversary With a Weapon, Bypass MAG. This test series evaluates the effectiveness of the screening process in detecting an adversarial attempt to carry a simulated weapon through the screening point by somehow getting the weapon around (or bypassing) the MAG.

The first tactic was an attempt to deceive the screeners. The adversary privately told the Checkpoint Screener Supervisor (CSS) that he was carrying an authorized weapon and must bypass the MAG. The primary element of evaluation in this case is the effectiveness of using the PSR. After completing one test run, this test tactic was discontinued as the passenger screener's verification procedure did not usually involve the use of the PSR.

The second tactic was also an attempt to deceive the screeners. In this case, the adversary was disguised as a disabled person in a wheelchair. The test weapon was hidden under the adversary, with the intent of having the weapon go undetected during the physical inspection. In this case, a simulated pistol and an FAATC test revolver were placed under the adversary who was seated in a wheelchair during the test runs (Test Sets 2A and 1B).

2.4.4 Adversary Carrying a Bomb. This test series evaluated the effectiveness of the screening process in detecting an adversarial attempt to carry a simulated bomb through the MAG and past the screening point.

The first tactic was an overt penetration attempt. The adversary, carrying a simulated pipe bomb, walked through the MAG (expecting to cause the MAG to alarm), and when challenged by the screener responsible for the MAG, the adversary responded by running through the screening point into the sterile area. In this case, a metal test object was substituted for the metal pipe bomb and was carried in the adversary's pocket (Test Set 3).

The second tactic was a stealth attempt by the adversary. The adversary carried the simulated explosive charge through the MAG, and passed a carry-on bag containing the

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remaining components of a bomb (battery, simulated blasting cap, and timing device) through the x-ray machine. The adversary intent was to assemble the bomb once inside the sterile area. In this case, a disassembled simulated time bomb was employed by the adversary. The adversary carried a simulated plastic charge through the MAG and placed the remaining components; a 9 volt battery, a small travel clock, and a simulated blasting cap with associated wires in a carry-on bag (Test Set 3).

2.4.5 Bomb in Carry-on Baggage, Through X-ray. This test series evaluated the effectiveness of the screening process in detecting an adversary attempting to pass a simulated bomb in a carry-on bag through the x-ray machine and past the screening point.

The first tactic was an attempt to shield the bomb to avoid detection by the x-ray screener. The simulated bomb was shielded using a metallic covering, attempting to mask the identity of the bomb from the x-ray screener. When the screener challenged the adversary, no attempt was made to prevent inspection of the contents of the bag. In this case, a simulated time bomb was wrapped in aluminum foil and surrounded with steel wool in an cardboard box. The box was then placed in the adversary's carry-on bag (Test Set 3).

The second tactic was also an attempt to avoid detection by the screeners. In this case, the simulated bomb was packed in the bag surrounded by electronic items similar in appearance so that the bomb was not obvious (Test Set 3).

The third tactic was an attempt to deceive the x-ray screener. In this case the bomb was packaged in a very well sealed box or container. When the screener asked to inspect the box contents based on x-ray interpretation, the adversary attempted to talk the screener into allowing the box or container to go unopened because it was expensively gift wrapped, or a light sensitive item (Test Sets 4A and 4B).

2.5 SCREENING POINT BYPASS TEST. The purpose of this test is to evaluate the effectiveness of the security enhancements in screening point and BMA area security compared to the effectiveness of the baseline system configuration. In this test series a mock adversary, who simulated carrying contraband attempted to bypass the security screening point and gain entry into the sterile course area by walking up the sterile concourse exit way and by walking through the BMA. Each of these paths allows unscreened entry from the public side of the terminal to sterile pier areas.

This test series was designed to specifically evaluate the security effectiveness of the unidirectional, exit revolving doors, security officer control of the exit way, screening personnel responsiveness, and security procedures as an integrated element of the security

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system. This test series was also designed to evaluate the effectiveness of the enhanced security alarm system in the BMA and employee awareness and use of security challenge procedures. The measures of effectiveness included adversary identification and interruption, communications efficiency, adherence to operational procedures and procedural effectiveness. For baseline tests, screening point A and screening point B were used without any of the enhanced equipment operational.

Two test series were defined to address two specific paths from the public side to the sterile area, bypassing the screening point. These two (2) test series were:

- a. Adversary with contraband, through the BMA; and
- b. Adversary with contraband, through the exit path along side the screening point.

Within each test series, individual test cases were defined for specific tactics (overt or covert) and for the system configuration of the test (baseline or enhanced). Each case was run several times, intentionally spaced throughout the test period.

The following sections define the specific test series, cases and runs planned for the screening point bypass test category. These runs were scheduled in a random order to reduce bias in the test results due to screener familiarity and specific test tactic awareness.

2.5.1 Adversary With A Weapon, Through BMA. All airport personnel are required by the ASP to wear a security identification badge while in any SIDA Area and to challenge any person that they observe in such an area who is not displaying the appropriate badge. Depending on the response to the challenge, the challenger may also be required to immediately report the incident to their supervisor or the Response Force Personnel (RFP) (The BWI RFP included the Maryland State Police (MSP) and the Maryland Toll Facilities Police (MTFP)).

This test series evaluated the effectiveness of the personnel working in the BMA to detect an adversary attempting to carry a simulated weapon through the area without properly displayed identification. Actual carriage of a weapon was simulated for safety reasons. Two cases are defined, one against the baseline and one against the enhanced system configuration. The difference between the baseline and the enhanced system is the addition of a general duress alarm and associated procedures under the enhanced configuration.

The basic tactic is an overt penetration attempt. The adversary, carrying a metal object simulating a weapon, crosses from the public side in the baggage claim area, through the employee door (simulating entry via the conveyer belt opening or immediately behind an authorized employee), into the BMA. The adversary then proceeds through the BMA, under

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pier B to the gate B-2 stairway leading up to the pier on the sterile side of the screening point. If challenged by an employee in the BMA, the adversary will proceed toward the target, causing the employee to act according to the SIDA employee challenge procedures and communicate the event.

2.5.2 Adversary With Contraband, Through the Pier Exit Path Alongside the Screening Point. The air carriers are required to perform passenger screening in accordance with Code of Federal Regulations (CFR) 108 as specifically defined in the ACSSP. The ACSSP requires that the air carriers maintain the integrity of the sterile concourse area during all operational hours and to reinspect the area for contraband should that integrity be breached even momentarily. The passenger screeners maintain this integrity by screening all passengers for contraband and ensuring that no unscreened persons enter the area via the concourse exit way. This test series evaluates the effectiveness of the exit path controls of the baseline system, using screening personnel to control unauthorized entry, compared to the enhanced exit path control provided by the unidirectional exit revolving doors.

The first tactic was an overt penetration attempt against the baseline configuration. In this case, the adversary ignores the challenge of the exit path screener and used the exit path for entry into the sterile area. This tactic was simulated for safety and operational reasons as other similar test data was available. Actual event timing was used to determine the probable success of the adversary in reaching the target before the response force could arrive.

The second tactic used deceit by the adversary who approached the exit path screener, acting as if they had just lost a child or urgently needed to see an employee in the concourse area. If detected, the adversary attempted to verbally persuade the screener to allow them to pass using the urgency of finding the child or employee as a ploy.

The third tactic used stealth in which the adversary would wait until the attention of the screener was diverted and then attempt to enter unauthorized. Diversion themes used were unusual boxes requiring physical inspection or persons carrying numerous metal objects requiring hand wand or physical inspections.

The fourth tactic is another stealth tactic where the adversary loitered around in the exit passageway area, and attempted to sneak through, during a period of high traffic flow entering or exiting the pier.

The fifth tactic is an insider adversary tactic based on deceit. The adversary, displaying a proper badge for identification, attempted to walk (with confidence) the wrong way through the exit passage into the sterile area.

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The sixth tactic is another insider tactic based on deceit. In this case, the adversary posed as a new employee, acting confused, and attempted to walk through the wrong way. When challenged, the adversary tried to talk his way through based on the new job confusion story. The last tactic applies to the enhanced screening point and is an overt attempt to defeat the exit revolving doors. The adversary attempted to defeat the exit doors by forcing the door against the normal direction of travel and gaining entry into the sterile area.

2.6 TEST SUMMARY INFORMATION. In the Screening Point Penetration Test, sixty-two (62) test runs were performed. After the initial baseline run, test series six (6) was cancelled because it failed to test PSR effectiveness. Two (2) overt test series were cancelled as the data duplicated other test series. Nine (9) test series were conducted in the covert mode. Three (3) test series were conducted in the overt mode.

In the following tables, the number of individual test runs performed in each test series are summarized in both the baseline and enhanced system configurations.

2.6.1 Screening Point Penetration Test. In Table 1, Baseline Screening Point Penetration Tests, thirty-one (31) test runs were performed. Test series six (6) was discontinued and not used in the test analysis. Overt test series eight (8) was cancelled as it duplicated test series one (1). Nine (9) test series were conducted in the covert mode. Three (3) test series were conducted in the overt mode.

In Table 2, Enhanced Screening Point Penetration Tests, (outlined in table 2), thirty-one (31) test runs were performed. Thirty-four (34) test runs were used for analysis purposes, Series 1 duplicated Series 8. Test Series 6 was discontinued. Test Series 8 was cancelled as it duplicated Test Series 1. Nine (9) test series were conducted in the covert mode. Three (3) test series were conducted in the overt mode.

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Table 1. Baseline Screening Point Penetration Tests.

TEST SERIES	RUNS	TEST MODE	COMMENTS
1. Weapon through MAG.	3	Overt	Data also used for test series 8 analysis.
2. Weapon in Article Bin.	3	Covert	
3. Weapon in Carry-On Bag, Adversary Grabs.	3	Overt	
4. Weapon in Carry-On Bag, Shielded.	3	Covert	
5. Weapon in Carry-On Bag, Disguised.	3	Covert	
6. Adversary With Weapon, Bypass, fake Law Enforcement Officer (LEO).	1	Covert	Discontinued. No Analysis.
7. Adversary With Weapon, Bypass, Wheelchair.	3	Covert	
8. Adversary With Bomb, Runs Through MAG.	0	Overt	Test series 1 data used for analysis.
9. Adversary With Bomb, Disassembled.	3	Covert	
10. Carry-On, X-ray, Shielded Bomb.	3	Covert	
11. Carry-On, X-ray, Disguised Bomb.	3	Covert	
12. Carry-On, X-ray, Sealed Box.	3	Covert	
TOTAL TEST RUNS	31		33 runs are used for analysis.

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Table 2. Enhanced Screening Point Penetration Tests.

TEST SERIES	RUNS	TEST MODE	COMMENTS
1. Weapon through MAG.	3	Overt	Data also used for test series 8 analysis.
2. Weapon in Article Bin.	4	Covert	
3. Weapon in Carry-On Bag, Adversary Grabs.	3	Overt	
4. Weapon in Carry-On Bag, Shielded.	3	Covert	
5. Weapon in Carry-On Bag, Disguised.	3	Covert	
6. Adversary With Weapon, Bypass, Wheelchair.	3	Covert	
7. Adversary With Bomb, Runs Through MAG.	0	Overt	Test series 1 data used for analysis.
8. Adversary With Bomb, Disassembled	3	Covert	
9. Carry-On, X-ray, Shielded Bomb	3	Covert	1 test invalid, 2 used in analysis.
10. Carry-On, X-ray, Disguised Bomb	3	Covert	
11. Carry-On, X-ray, Sealed Box	4	Covert	1 test invalid, 3 used in analysis
TOTAL TEST RUNS PERFORMED	32		33 runs used for analysis.

2.6.2 Screening Point Bypass Test. In the enhanced Screening Point Bypass Test, thirty-two (32) test runs were performed. After considering invalid and duplicate runs, thirty-three (33) runs were available for analysis purposes. Eighteen (18) runs were conducted in the Exit Way test series; fifteen (15) baseline and three (3) enhanced. Eight (8) test runs were conducted in the BMA test series; three (3) baseline and five (5) enhanced. The overt baseline test series was cancelled as the data was readily available from other timed test runs. All test series were conducted in the covert mode. In the following tables, the number of individual test runs performed in each test series is summarized in both the baseline and enhanced system configurations Table 3. Baseline Screening Point Bypass Tests and Table 4. Enhanced Screening Point Tests respectively.

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Table 3. Baseline Screening Point Bypass Tests.

TEST SERIES	RUNS	TEST MODE
Adversary With Weapon, Through BMA.	3	Covert
Adversary With Contraband, Through Exit Way.	15	Covert
TOTAL TEST RUNS PERFORMED	18	

Table 4. Enhanced Screening Point Bypass Tests.

TEST SERIES	RUNS PERFORMED	TEST MODE
Adversary With Weapon, Through BMA.	5	Covert
Adversary With Contraband, Through Exit way.	3	Covert
TOTAL TEST RUNS PERFORMED	8	

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3. RESULTS AND RELATED DISCUSSION.

The information contained in Section 3. is provided in the CONFIDENTIAL supplement accompanying this report.

3.1 SCREENING POINT PENETRATION TEST RESULTS. The information contained in Section 3.1 is provided in the CONFIDENTIAL supplement accompanying this report. In addition, the following tables from this section are also provided in the CONFIDENTIAL supplement:

Table 5. Contraband Detection Ratios.

Table 6. Contraband Detection Rates by Inspection Method.

Table 7. Post Detection Target Penetration Ratios.

3.2 SCREENING POINT BYPASS TEST RESULTS. The information contained in Section 3.2 is provided in the CONFIDENTIAL supplement accompanying this report. In addition, the following tables and figure 2 from this section are also provided in the CONFIDENTIAL supplement:

Table 8. Concourse Exitway - Effectiveness of Security Controls.

Table 9. BMA Entry - Adversary Detection Rates by System Configuration.

Figure 2. The Concourse Exitways for Piers A & B Differed Significantly.

3.3 OPERATIONAL TEST RESULTS. This section includes a review of both the operational effects of the enhanced system configuration in existing airport operations and the performance of the major equipment enhancements. These reviews focus primarily on the passenger screening and emergency response operations from an efficiency, procedural, and equipment perspective.

3.3.1 Effects on Air Carrier and Airport Operations. During enhanced system configuration, the staffing requirement for Screening Point B were only slightly increased due to the additional enhancements. In addition to the baseline screening complement, an additional screener was needed to operate the secondary MAG and to act as SPM. However, this increase was mostly offset by the reduction of a screener to watch the exit way resulting

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from the installation of the revolving door enhancement and the potential cross utilization of the SPM by both Screening Points. The screener used as loader in the baseline configuration was redeployed as the screener for the PSR. When not so employed, the screener reverted to their bag loader tasks. The cross utilization of this screener could create some bag inspection delay if a large number of PSR inspections occur during peak traffic periods.

The role of the SPM in the enhanced screening point organization was to review the real time x-ray images of bag contents simultaneously with the x-ray operators. Based on the SPM's experience, the SPM could require the operator to stop and inspect any of the bags being examined. The extent to which this individual enhancement resulted in additional contraband detections could not be determined independent of the color and IP x-ray enhancements without component-level testing. Since the SPM was only used to monitor one active x-ray unit during the tests, the potential capacity of the SPM to handle two or more active x-ray units simultaneously is uncertain. Due to the degree of concentration and attention to detail required, it is very unlikely that the SPM could adequately monitor more than one active x-ray unit unless an operator or IP unit alerted the SPM to specific bags. During x-ray interpretation, the x-ray operators were unclear as to the SPM authority in relation to the CSS's authority to trigger an alarm. In practice, the CSS routinely reviews suspect x-ray images before the x-ray operators trigger an alarm. Without additional guidance, the operator, the SPM, and the CSS all commonly review the x-ray image before triggering an alarm.

While the enhanced configuration's effect on passenger flow was minimal, some unanticipated passenger screening delays were experienced at times. When the x-ray IP was employed, the passenger flow slowed noticeably due to the additional processing time required for each item x-rayed. The use of the secondary metal detector also created some unanticipated delays contrary to its intended purpose of reducing passenger backup. These delays appeared to stem from the unnecessary redundant screening of passengers who assumed they should pass through the secondary metal detector due to its placement. The placement also resulted in numerous alarms triggered by passengers bumping the detector or striking it with their bags. The metal detector's placement was dictated by space limitations in the screening configuration. This delay could be avoided and passenger flow time improved with the proper placement of the secondary detector.

During the use of the PSR, the screeners advised that some of the passengers voiced concern over their carry-on bags being out of their sight during the inspection. While the screeners believed the PSR provided more privacy for the passengers, they were concerned about potential liability due to passenger allegations of misconduct and the risk that a passenger might react violently upon discovery of a dangerous weapon in such a private area. With the proper notification signs, the use of closed-circuit television (CCTV) cameras in the PSR might solve both the privacy and safety concerns. Such inspections could be videotaped for both safety and training purposes.

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During the test, the other operational area noticeably impacted by the enhanced system operation was the pier duress system response. When the pier duress alarm is activated in the enhanced configuration, several doors leading from the screening point through the sterile area to the airplanes are automatically locked. These doors include the revolving entry door to the sterile area, the entrance bypass door, the individual aircraft loading bridge doors at both ends, and the ramp door at the aircraft end of the bridge see figure 3. During Pier Duress Lockdown Features Are Activated. During the test, the dual locking entrance bypass door impacted adversely on RFP ability to quickly enter the sterile area from the public terminal side. The responding officer had to wait for the CSS to unlock the manual lock on the door and the SOC to release the magnetic lock on the door before the officer could enter the sterile area in pursuit of the adversary. These actions were further complicated by procedural and communications problems. Procedurally, the CSS has custody of the door key. However, the CSS is also expected to discreetly trail such a violator down the concourse to ensure RFP identification of the violator and his approximate location. Thus, the CSS would not normally be present with the door key when the RFP member arrives. The SOC operator deactivates the entrance bypass security lock during lockdown upon radio notification by the RFP. Both of these steps add delay to RFP entry into the concourse area. These delays could be avoided by equipping the door with a coded access control device. Such a device would allow the RFP officer to immediately enter the area by momentarily deactivating both the manual door lock and the system magnetic lock; while maintaining the system-wide lockdown of all other doors.

RFP personnel arriving at the aircraft end of the loading bridge were unable to enter the bridge without contacting the SOC directly. Since they were unaware of this requirement, their entry was significantly delayed. This problem would also occur in the baseline configuration as the RFP could not enter the bridge door from the ramp as they did not have the necessary code to the combination door lock.

The current procedure calling for the gate agent to re-open the loading bridge door to allow passengers in the bridge to exit into the sterile concourse area during pier duress, allows the opportunity for an adversary to gain entry into the loading bridge.

These findings suggest that the sterile entry bypass door should be equipped with a coded lock and the RFP provided with the code. The RFP should also have immediate access through rampside loading bridge doors. The procedure requiring passenger evacuation of the loading bridges during pier duress situations should be reviewed to minimize adversary entry potential.

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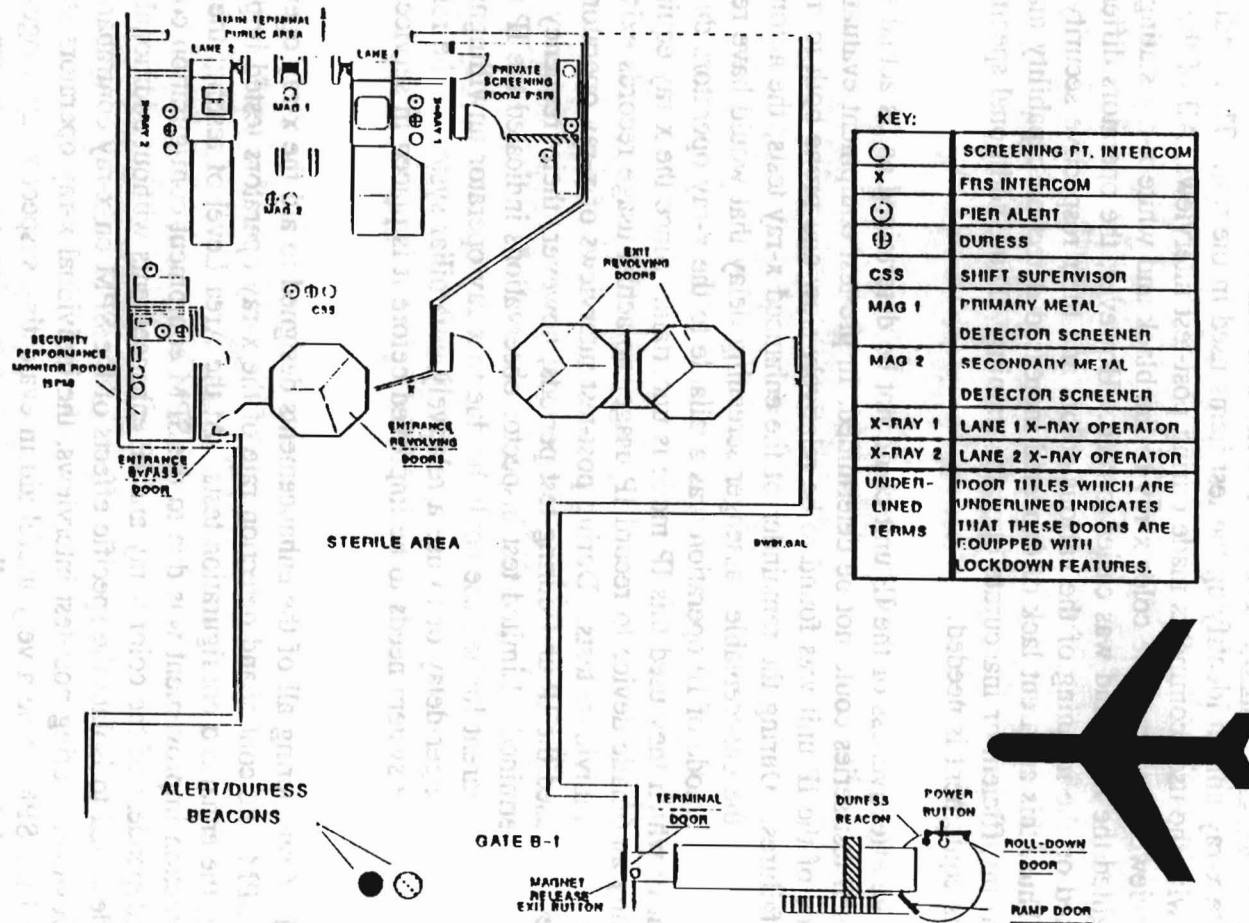


Figure 3. During Pier Duress, Lockdown Features are Activated

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3.3.2 Equipment Operation. The various pieces of equipment used in the enhanced system configuration are discussed in terms of their effectiveness, (comparatively when possible), reliability, and user friendliness as reflected during the test periods.

3.3.2.1 Color X-ray Unit with IP. The color x-ray unit was not any more effective than the black and white x-ray unit in identifying the test items used in the test. This finding appears to be at issue with the user comments made during post-test interviews. All of the x-ray operators interviewed preferred the color x-ray to the black and white x-ray stating it more clearly highlighted the items and was easier to read. However, the operators differed greatly when questioned on the meaning of the various colors and their respective security implications. Thus, this apparent lack of expected increased detection capability may be due in large part to insufficient or inaccurate operator training. Thus, additional specific operator training on this equipment is needed.

The comparative effectiveness of the IP unit could not be determined as its actual usage during any given test series could not be determined. In pre-test equipment evaluations, the automatic mode of the IP unit was found to be relatively slow and prone both to mechanical and software failures. During the remainder of the enhanced x-ray tests, the automatic mode was not used due to the unacceptable passenger screening delay that would have resulted. Although the manual mode of IP operation was available to the x-ray operators during such test, the extent to which they used this IP mode is uncertain. Since the x-ray equipment used did not have any automatic device to record IP usage, no actual usage records exist for either the test series or for individual tests. During post-test interviews of x-ray operators, most stated that they had used the IP unit during test periods; however, their frequency of such use could not be determined. Limited test inspector observations indicated the IP unit was seldom used. This apparent limited use could be due to x-ray operator unwillingness to create a potential passenger delay or to use a relatively unfamiliar system. The reliability and efficiency of the IP system needs to be improved before it is placed in service.

3.3.2.2 SPM. Considering all of the enhancements designed to aid the x-ray operator, including the SPM, the contraband detection rate of the x-ray operators tested improved slightly during the enhanced configuration tests. At the Area Level of testing, the extent to which this detection improvement was due to the SPM equipment configuration could not be determined independent of the color x-ray and IP enhancements without additional component level testing designed to isolate the specific effects of the SPM on x-ray contraband detection capability. However, during post-test interviews, the individual x-ray operators stated that they had found the SPM to be a very useful aid in evaluating suspect x-ray images. They explained that the ability to instantly call upon another experienced x-ray screener who could see the same x-ray image that they were evaluating often helped them to make a more confident and prompt evaluation of suspect items.

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3.3.2.3 PSR. The use of the PSR did not appear to increase the effectiveness of the physical searches conducted in any demonstrable manner. While the PSR undoubtedly provided a more private inspection area, it also heightened the concern about perceived or actual inappropriate screener behavior resulting in an additional monitoring requirement. Passenger concern about his or her carry-on baggage being temporarily out of their view was another problem. Procedural changes to allow for CCTV coverage within the PSR and physical inspection of the individual's carry-on bags in the PSR could alleviate these problems.

3.3.2.4 SCIS. This system appeared to be more effective than simple voice communication in both relating security information between distant screeners and in doing so discreetly. These findings are based largely on test inspector observations during the test periods and limited post-test screener interviews.

During these interviews, all six (6) screeners stated they had used the system and would continue to use it if it was available. One (1) screener would use it only for communications between the CSS, the x-ray Operators, and the SPM due to their distance apart. All of the screeners complained that the headsets were uncomfortable. This could be due to the random rotation of the headsets between screening personnel or the design of the individual headset itself. This problem could perhaps be alleviated by individually assigning the headsets or redesigning them.

3.3.2.5 Pier Duress Automatic Pier Lockdown. The automatic lockdown features of this system were extremely effective in preventing adversary entry into the sterile area and the airplane. In all three overt enhanced test runs, the adversary was not able to penetrate the sterile area after detection. On the initial run, the equipment failed to operate properly causing the pier alarm to continuously sound. After the system was repaired, no such malfunctions occurred. All the doors identified in figure 3 automatically locked as anticipated.

3.3.2.6 GD Alarms. The operational effectiveness of this system enhancement was significantly limited by deletion of CCTV coverage and two-way communications between the GD alarm sites and the SOC. This complementary CCTV and communications coverage was in the original design; it was later removed due to budgetary constraints. As a result, the SOC operator could not promptly determine why a GD alarm was triggered or who triggered the alarm. Without such information, the operator could not reasonably assess the situation and determine if the RFP should be dispatched or not. Since the operator had no means of identifying the individual triggering the alarm, the operators only recourse was to wait for the individual to call the SOC or to individually call the supervisors for the air

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carriers known to work in that general area to attempt to identify the source of the alarm. The installation of complementary CCTV coverage and communications between the specific GD alarm locations and the SOC would minimize these problems.

The mobile GD alarm pendant transmitters worked as designed providing area specific alarms regardless of their actual locations. Since they are area specific, the users must be fully informed of their assigned areas and of the need to immediately notify the SOC by telephone should they trigger their alarm while outside their assigned area. Any failure to do so would lead to the SOC Operator's misidentification of the actual location of the alarm in attempting to contact the responsible area supervisor or dispatching a RFP officer.

3.3.2.7 Unidirectional Exit Revolving Security Doors. The unidirectional revolving exit way doors performed well. They effectively detected and blocked all attempts to gain entry through them. Their individual local and remote alarm indicators functioned during each abortive entry attempt. The installation of an additional remote alarm and intercom between the doors and the screening point would enhance screener control and responsiveness.

3.3.2.8 Secondary MAG. This MAG experienced sporadic false alarms due to interference from other operating equipment and repeated bumping by passengers and their baggage. The placement of the MAG was dictated by the space availability in the screening point area and the screening point configuration. This unit would operate effectively and smooth passenger flow if sufficient clearance was provided from other operating equipment and metal structural supports along with placing it in an offset position to normal passenger flows. Additionally, clearly defined passenger lanes would greatly reduce passenger confusion and unintentional bumping of the unit.

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4. **CONCLUSIONS.** The information contained in Section 4. is provided in the **CONFIDENTIAL** supplement accompanying this report.

5. **RECOMMENDATIONS.** Based on the discussion and conclusions stated in the **CONFIDENTIAL** supplement to this report, the following recommendations are made to improve pier security:

- a. Develop more effective and practical physical inspection methods and procedures for inspecting disabled individuals;
- b. Establish more specific procedures for inspecting articles left in the inspection bins to decrease inconsistency among screeners and improve their effectiveness;
- c. Provide remedial training for Screening Point B passenger screening personnel in the physical inspection methods and procedures;
- d. Develop more effective means of testing screening points including more realistic test objects and standard testing protocols;
- e. Develop a more effective training and proficiency testing program for screening personnel. This program should include the use of more realistic test objects and focus on x-ray image recognition of such objects and their component parts;
- f. Conduct a study to identify key x-ray image identification characteristics used by screeners to recognize weapons and bombs. Identify technological enhancements and personnel training methods that will ensure screener ability to recognize these signatory contraband characteristics;
- g. Conduct regular security response drills to ensure that screening point, air carrier, airport, and RFP are aware of their roles in security situations;
- h. Conduct an in-depth human factors study of screening point operators to improve the human/technological interface to maximize the effectiveness of the personnel and equipment;
- i. Use the revolving doors to control the sterile concourse entry and exit paths;
- j. When a security officer is used for controlling the sterile exitway, the officer should be positioned at discharge point and be exclusively assigned to exitway control duty;

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k. Provide additional emphasis on the maintenance of the sterile area integrity during CSS training. This training should clearly define the need and procedure to re-inspect the sterile area after a known penetration, even if it occurs during a temporary non-operational period;

l. The GD reporting procedure should be revised to require the individual triggering the alarm to immediately call the SOC operator and then inform their supervisor;

m. Improve the effectiveness of the GD system by providing the SOC operator with direct 2-way communications and CCTV coverage of alarm sites. CCTV coverage was in the original design of the system, however, it was not actually installed due to budgetary constraints;

n. The use of the two tier pier alarm system should be adopted. However, the pier alarm levels need to be more clearly defined and procedures written to enable air carrier personnel to be more effectively used during both pier alert and pier duress situations;

o. The key lock on the entrance bypass door should be replaced with a coded device and the RFP should be given the access code to this lock;

p. The enhanced system pier lockdown feature needs to be modified to provide automatic closure of the loading bridge entry doors and the roll-down door at the aircraft entry point. Automatic closure devices on these doors must be equipped with local warning alarms to alert employees and passengers of imminent closure and signs to inform the public of the emergency operational nature of the doors;

q. The enhanced system pier lockdown system should be expanded and modified to allow independent lockdown of critical doors both inside the affected concourse and outside on the rampside. This would allow for a more threat-specific SOC response;

r. Develop a model airport operational security program which will increase the daily security awareness and compliance of aviation personnel. Such a program could be patterned to some extent after successful neighborhood watch programs.

s. Develop a quality assurance program and accurately evaluate screening point effectiveness on a regular basis. The results could be provide to the FAA, air carriers and contract screening company officers to enable them to improve both their training efforts and screener proficiency;

t. After additional equipment specific operator training, the color x-ray unit should be used in lieu of the black and white x-ray unit;

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u. The SCIS should be adopted for regular use as it provides more discreet and effective communications among screeners. Sufficient headsets should be made available to allow for assignment to each individual during an entire shift; and

v. The use of the secondary MAG should be discontinued unless sufficient space is available for it to be positioned properly.

6. REFERENCES.

a. FAA Office of Civil Aviation Security, Air Carrier Standard Security Program (ACSSP) (baseline document).

b. DOT/FAA/CT-93/50, FAA Technical Center - Enhanced Airport Security System Project (EASSP), Baltimore-Washington International Airport: Master Test Plan, Final Plan, January 1993;

c. DOT/FAA/CT-93/19, FAA Technical Center - Aviation Security Research and Development Division, Training Plan, EASSP at BWI, July 1993;

d. FAA Technical Center - Enhanced Airport Security System Project (EASSP), Security Effectiveness Test Plan, DRAFT, July 14, 1993;

e. DOT/FAA/CT-93/45, FAA Technical Center - Aviation Security Research and Development Division, Screening Point Procedures, September 1993;

f. DOT/FAA/CT-93/47, FAA Technical Center - Aviation Security Research and Development Division, Revolving Door Procedures, September 1993;

g. DOT/FAA/CT-93/58, FAA Technical Center - Aviation Security Research and Development Division, General Duress Procedures, October 1993;

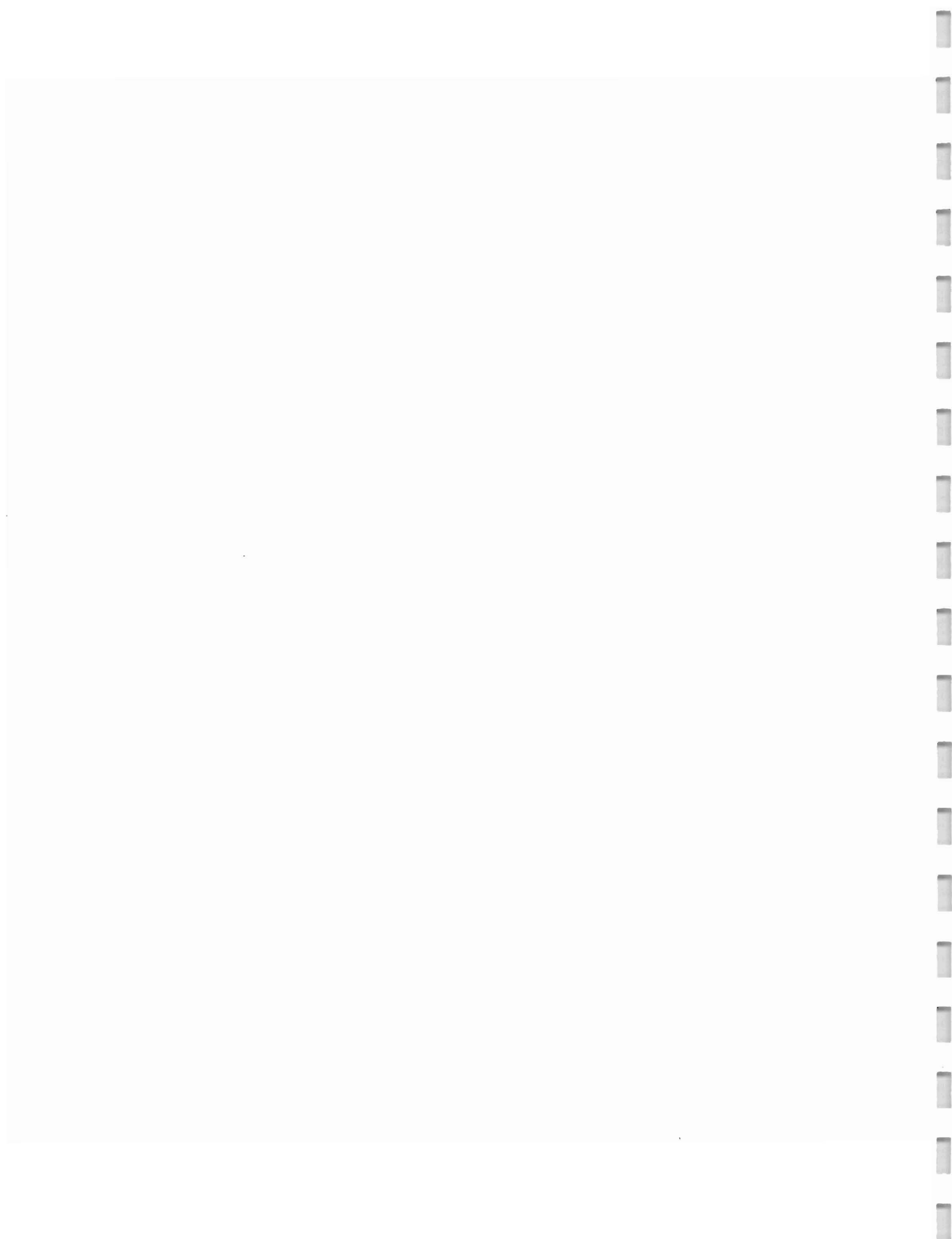
h. DOT/FAA/CT-93/82, FAA Technical Center - Aviation Security Research and Development Division, Image Processing Procedures, December 1993;

i. DOT/FAA/CT-93/73, FAA Technical Center - Aviation Security Research and Development Division, Communications Procedures, December 1993;

j. DOT/FAA/CT-93/83, FAA Technical Center - Aviation Security Research and Development Division, Security Operations Center Procedures, December 1993; and

k. Maryland Aviation Administration, Airport Security Program (ASP) at BWI.

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**APPENDIX A
TEST SETS**

These items are to be used for testing purposes only.



Handgun

Handgun



Handgun

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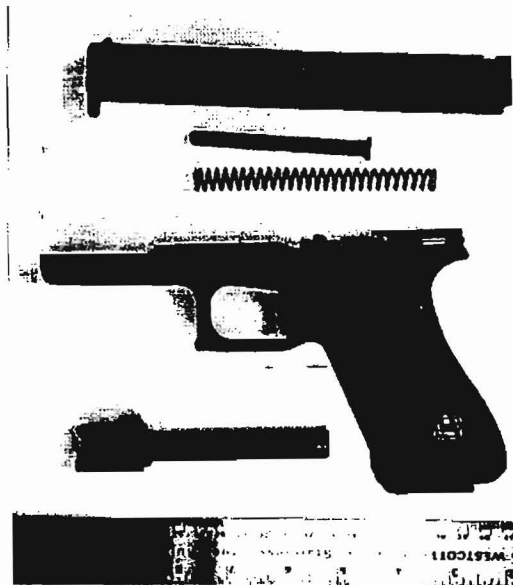
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The test sets used are pictured and described in this appendix. Test items are grouped by inspection method or procedure tested. All test objects were appropriately wrapped and labeled as FAA Test Objects prior to any actual test use.

TEST SETS 1A and 1B - TEST WEAPONS USED IN X-RAY DETECTION TESTS:



1A - Basic items include a deactivated .38 caliber revolver.



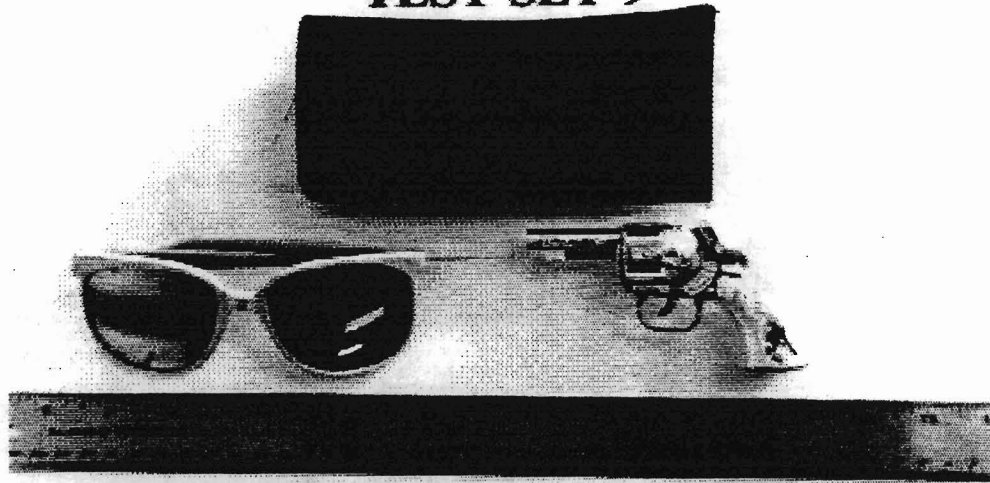
1B - Disassembled, deactivated GLOCK 17 automatic handgun.

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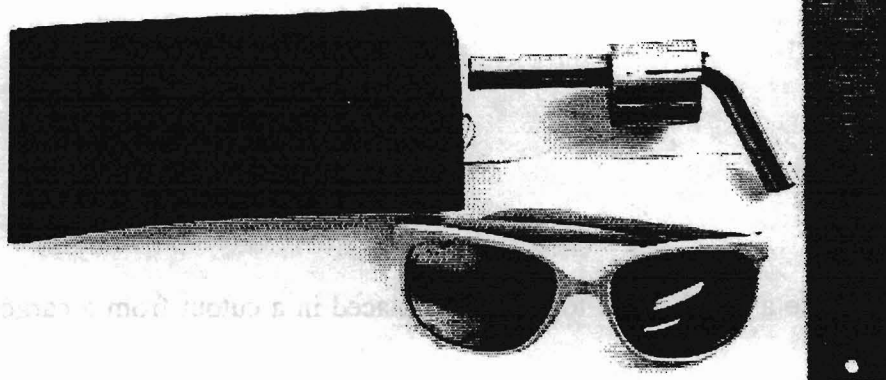
TEST SETS 2A, 2B and 2C - TEST ITEMS USED IN PHYSICAL INSPECTION:

TEST SET 9



2A - Items include a small metal toy pistol, sunglasses and sunglass case.

TEST SET 10



2B - Items include an FAA Operational Test Piece, sunglasses, and sunglass case.

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TEST SET 13



2C - Items include a small metal toy revolver placed in a cutout from a cargo receipt pad.

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Test Set 3 - Simulated Time Bomb Used in X-ray Detection Tests:

Because it is difficult to discern how this test set was constructed and used from the photograph, the following additional information is provided:

(1) Basic construction materials:

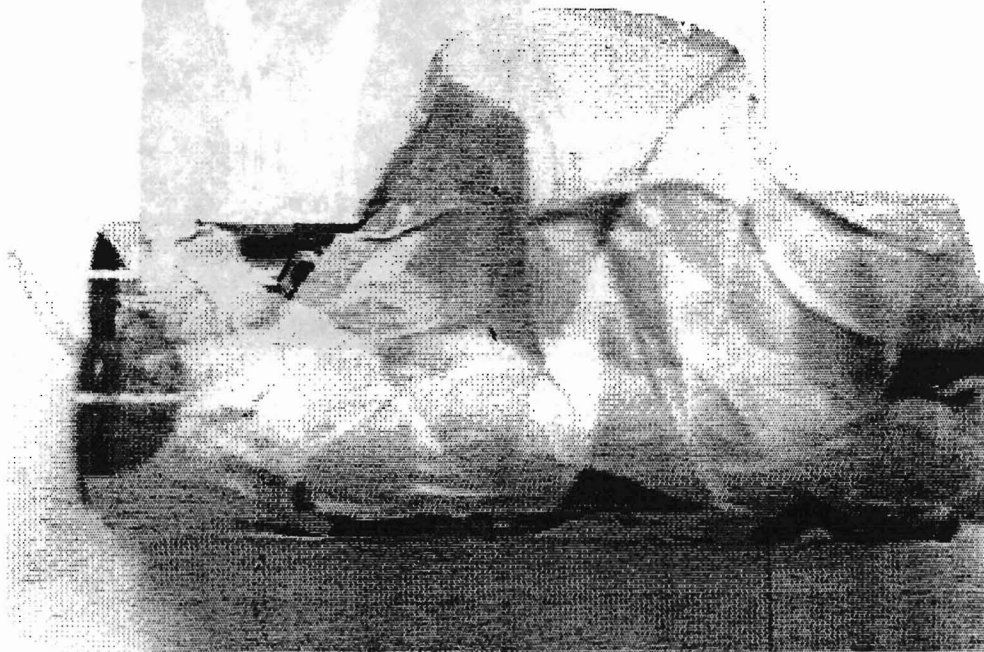
- 3 sticks (8"x2") of clear plastic or a small block of wood (simulated explosive charge);
- 1 3" alarm clock (timing device);
- 1 9 volt battery (power source); and,
- 1 simulated blasting cap assembled wiring (initiator).

(2) Test Configurations:

a. **DISGUISED** - This test set (intact) was placed in a carry-on bag containing a tape recorder and hair dryer along with assorted clothing.

b. **SHIELDED** - This test set (intact) was placed inside a small cardboard box, pack with steel wool, and wrapped with heavy metal foil. The box was then placed in a carry on bag with assorted clothing.

c. **DISASSEMBLED** - The individual components of this test set, except the explosive charge, were placed separately in a carry on bag with assorted clothing. The small block of wood (simulating a block of plastic explosive) was carried through the MAG by the adversary.



3 - Simulated time bomb wrapped in tape (components/configurations are noted above).

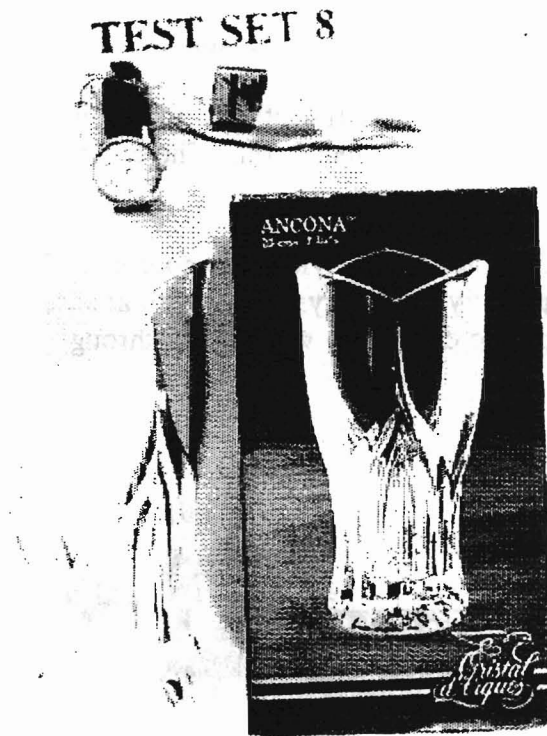
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**Test Sets 4A and 4B - Simulated Bomb Configurations used in X-ray
Detection Tests with Sealed Box**

(1) Basic construction materials:

- 1 stick (8"x2") of clear plastic (simulated explosive charge);
- 1 3" alarm clock or a wrist watch (timing device);
- 1 9 volt battery (power source); and,
- 1 simulated blasting cap assembled wiring (initiator).

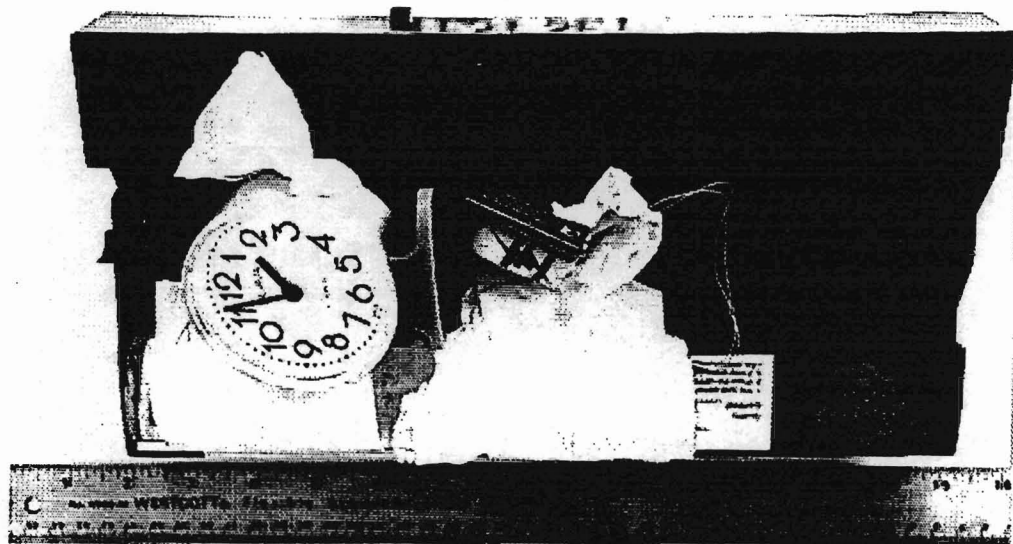


4A - This test set was placed in a 24% lead crystal vase, and then in a gift wrapped box.

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TEST SET



4B - This test set was placed in a copier toner package and sealed in a box labelled with a warning not to expose contents to light.

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