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FAA Technical Center Enhanced Airport Security System Project

Revolving Door Subsystem Cost Benefit Analysis

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LIST OF ACRONYMS AND ABBREVIATIONS

BWI	Baltimore-Washington International Airport
CBS	Cost Breakdown Structure
CCTV	Closed Circuit Television
COTS	Commercial Off-The-Shelf
DOT	Department of Transportation
DWG	Engineering Drawing
EASSP	Enhanced Airport Security System Project
FAATC	Federal Aviation Administration Technical Center
FCC	Federal Communications Commission
FRS	Fire Rescue Service
GSC	Ground Security Coordinator
HBS	Hardware Breakdown Structure
INSPC	Initial Spares and Consumables
INST	Installation
LCC	Life Cycle Cost
LCCA	Life Cycle Cost Analysis
MAA	Maryland Aviation Administration
MAN	Technical Manuals
MDT	Maryland Department of Transportation
MTBF	Mean Time Between Failure

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

MTTR	Mean Time To Repair
NDI	Non-Development Items
NICAD	Nickel-Cadmium
PME	Prime Mission Equipment
RAIDS	Ramp Area Intrusion Detection System
#REP	Number of Repairs
R&D	Research and Development
REPMTL	Repair Material
REPS	Replenishment Spares
SFT	Software
SOC	Security Operations Center
TST	Testing
WRA	Working Ramp Area

EXECUTIVE SUMMARY.

The Federal Aviation Administration Technical Center (FAATC) established the "Enhanced Airport Security System Project" (EASSP) at the Baltimore-Washington International Airport (BWI) as a Research and Development (R&D) Project in 1988. Installation of the EASSP equipment took place between late 1991 and early 1993. System evaluation and testing was completed in December of 1993.

The Revolving Door Subsystem of the EASSP provides increased security at Screening Point B for entrance and egress to and from the secure area of the pier. The entrance door locks down during a duress condition providing a physical barrier to a potential threat attempting to enter the secure area. The exit doors provide free egress while preventing entrance to the secure area.

The purpose of this Life Cycle Cost Analysis/Cost Benefit Analysis is to present estimates of the sum total of costs in all phases of the Revolving Door Subsystem. This document details the assumptions, cost methodology and data used in the analysis. Also addressed are the quantitative and qualitative benefits of the Revolving Door Subsystem as compared to a baseline system.

The benefits of the EASSP are both monetary and qualitative. Monetary benefit in excess of one-half million dollars are realized from the savings of one security guard over the ten-year life cycle versus the cost of the revolving doors. Additionally, non-monetary benefits are realized in the enhanced security achieved with the installation of the revolving doors.

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1. INTRODUCTION

1.1 OBJECTIVES. This is the Life Cycle Cost Analysis (LCCA) for the Revolving Door Subsystem of the Enhanced Airport Security System Project (EASSP) at Baltimore-Washington International Airport (BWI) for contract DFTA03-93-C-00042, Task Order 001. This report is formatted in accordance with U.S. Department of Transportation (DOT) Federal Aviation Administration (FAA) Order 1810.3 and presents estimates of the sum total of the direct, indirect, recurring, non-recurring, and other related costs in the design, development, production, operation, maintenance, support, and phase-out of the Revolving Door Subsystem of the EASSP.

1.2 SCOPE. This report presents the LCCA for the Revolving Door Subsystem installed at the pier B Screening Point, South Terminal Area at BWI. Only equipment directly associated with the revolving doors are analyzed. Excluded from this analysis are the Closed Circuit Television (CCTV) cameras, the emergency exit doors, and the Pier Alert/Duress equipment.

2. SYSTEM DESCRIPTION. There are three revolving doors installed as part of the EASSP screening point at pier B. These doors are designed to control access to the sterile area of pier B. Cleared persons enter the pier from the screening point using the entrance revolving door. Persons may exit the pier through one of the two exit revolving doors that operate independently. Each revolving door is nine feet in diameter and rotate in a counter-clockwise direction at approximately five revolutions per minute when a person approaches their entrance. Approaching people are sensed by infrared motion detectors mounted on the screening point side of the entrance door and on both sides of the exit doors.

Each door has a clearly marked button that will slow the rotation speed by two-thirds to permit disabled persons or anyone requiring more time to negotiate through the door more effectively. After three revolutions, the door returns to normal speed. Lighted signs above each of the doors direct the traffic flow. These signs display "ENTER" or "DO NOT ENTER" as appropriate. Upon alarm or lockdown, the signs above the appropriate door will blink on and off to direct response force personnel to the appropriate door. When the alarm or lockdown condition is cleared, the doors and signs return to normal operation.

The entrance and exit revolving doors also have back-pressure sensing and emergency stop features. During normal rotation, any back pressure by the door wings (usually generated by a slow-moving person or luggage) causes the door to stop. The door rotates again after a short time has elapsed. On the exit doors, if two consecutive back-pressure stops are detected, an emergency stop and alarm is signaled and the door broadcasts "WRONG WAY! PLEASE EXIT!" The vertical safety edges on the door also detect if an object is caught between the door wing and the wall. When this occurs, the emergency stop feature causes the door to stop. After a pre-set delay of between two to fifteen seconds, the door will again rotate forward. This feature continues until the object is cleared.

The two exit revolving doors provide a barrier to unauthorized personnel or contraband entering the secure area along the exit pathway. Each exit door has a sensed zone that should always be unoccupied. This zone contains pressure-sensitive floor mats and an infrared light curtain to detect intruders or contraband. Upon detection of an intruder or contraband, the door stops rotating and locks in place. A "WRONG WAY! PLEASE EXIT!" message is announced and an alarm is generated at the Security Operations Center (SOC). After a delay, the door rotates backward to clear the sensed section. Once the section is clear, the door rotates forward again.

When a pier duress alarm occurs, the entrance revolving door automatically ceases rotation and locks in place preventing entrance into the secure area. A red push-button control on the upper right-hand side of the entrance door enables security or response force personnel to rotate the door backwards to free anyone trapped in the door during lock-down.

A detailed Hardware Breakdown Structure (HBS) for the Revolving Door Subsystem is presented in Table 1, EASSP Life Cycle Cost Hardware Breakdown Structure Revolving Door Subsystem.

Table 1. EASSP Life Cycle Cost Hardware Breakdown Structure
Revolving Door Subsystem

I. ELECTRICAL ASSEMBLIES

- 1.1 C9090 Uninterruptable Power Supply (3)
- 1.2 C9920 Motor Drive Control Assy (3)
 - 1.2.1 C9923-2 Motor Drive Board
 - 1.2.2 C9828 Motor Relay
 - 1.2.3 C9829-1 Transformer
 - 1.2.4 C9979-1 Plug-Stop Module
 - 1.2.5 C9948 Circuit Breaker
- 1.3 C9921 Microprocessor Control Assy (3)
 - 1.3.1 C9110 Circuit Breaker
 - 1.3.2 C9950 Microprocessor Board
 - 1.3.3 C9951 Input Board
 - 1.3.4 C9953 Output Board
 - 1.3.5 C9954 Miscellaneous Function Board
 - 1.3.6 C9955 Power Supply

Table 1. EASSP Life Cycle Cost Hardware Breakdown Structure
Revolving Door Subsystem (Continued)

- 1.4 C9985 Magnetic Breakout (3)
 - 1.4.1 C9110 Circuit Breaker
 - 1.4.2 C1849-1 Transformer
 - 1.4.3 C2216 Battery Charger
 - 1.4.4 C2217 Module (4 ea)
 - 1.4.5 C9828-1 Relay 3PDT
- 1.5 Light Curtain/Logic Control Assy (2)
 - 1.5.1 C1710-2 Photoelectric Module (40 ea)
 - 1.5.2 Logic Control Box
- 1.6 C1150 Automatic Motion Detector (5)
- 1.7 C1850M-3 Remote Alarm Contacts/Relay (3)
 - 1.7.1 C1850M-3-24V Relay Board
 - 1.7.2 C8166 Relay 4PDT

2. ELECTROMECHANICAL/MECHANICAL ASSEMBLIES

- 2.1 C9100 Gear Drive (3)
- 2.2 C9910 Brake (3)
- 2.3 C9011 Motor (3)
- 2.4 C9790 Security Switches (mats) (3)
- 2.5 C9670-1 Perimeter Safety Edges (12)
- 2.6 C529 Key Switches (11)
- 2.7 C9888 Magnetic locks/brushes/sliprings (3)
- 2.8 Door Panels (9)
- 2.9 Door Frame/Structure (3)

3. ASSUMPTIONS.

3.1 ECONOMIC YEAR OF ESTIMATE. This analysis is prepared using constant year 1992 prices. To properly inflate these 1992 dollar estimates to present value dollars, use the yearly inflation rates published by the General Accounting Office or the methodology described in FAA-APO-82-1, "Economic Analysis of Investment and Regulatory Decisions--A Guide."

3.2 NON-RECURRING COSTS. All EASSP hardware and software is assumed to be Commercial Off-the-Shelf (COTS) or Non-Development Items (NDI) with the exception of the exit revolving door light curtain (HBS 1.5). The light curtain associated non-recurring costs have been borne by the manufacturer. Therefore, for the purpose of this analysis, no non-recurring costs are included.

3.3 PROGRAM LIFE CYCLE. For the purpose of this analysis, the program life cycle was assumed to be ten (10) years. The Production, Installation and Test phase of the project was assumed to be two (2) years - 1 January 1992 through 31 December 1993. The Operation and Support Phase was assumed to be seven (7) years - 1 January 1994 through 31 December 2000. The Termination Phase was assumed to be one (1) year - 1 January 2001 through 31 December 2001.

3.4 PROGRAM MANAGEMENT. For the purpose of this analysis, no program management costs are included. It is assumed that this subsystem will be installed in an operational environment; therefore, no program management efforts are directly attributable to the life cycle costs of the hardware/software.

3.5 OPERATIONS/SUPPORT PERSONNEL. It is assumed that this subsystem will be installed at an operational airport as part of a total security system, which will be manned on a 24-hour per day basis. One operator will man the total system, of which this subsystem is assumed to require ten percent (10%) of the operator's effort. The fully burdened cost of an operator is assumed to be \$50 per hour and the system operating time is assumed to be 78,840 hours (see paragraph 3.6), for a total system operating cost of \$3,942,000. The ten percent (10%) of the total operator time apportioned to this subsystem results in a subsystem operations cost of \$394,200. Support costs are a factor of the number of repair actions predicted, the mean time for each repair and the cost of support personnel. It is assumed that fully burdened costs for support personnel will be \$65 per hour. The Mean Time To Repair (MTTR) and Number of Repairs (#REP) for each component of the subsystem are indicated in Table 3. Revolving Door Subsystem HBS with Cost Estimates.

3.6 EQUIPMENT OPERATING HOURS PER YEAR. The EASSP equipment was assumed to operate full-time. Therefore, for the purpose of this analysis, the operating hours per year were assumed to be 8,760. Total operating time is assumed to be nine (9) years (excludes Termination Phase) or 78,840 hours.

3.7 ENERGY AND UTILITIES. The cost of energy and utility usage at BWI is included in the overall charges for building maintenance and overhead and, as such, is passed on to the tenants in their baseline rental fees. Since power consumption is not a separate chargeable item. For the purpose of this analysis considered to be zero (\$0).

3.8 RELIABILITY AND MAINTAINABILITY. The factors used herein for reliability (i.e. Failure Rates, Mean Time Between Failure (MTBF)) and maintainability (i.e. Mean Time To Repair (MTTR)) are derived from either best engineering estimates or from observed failures and/or repair actions. While attempts were made to obtain this data from the respective manufacturers, they stated that COTS equipment is not normally subjected to quantitative reliability or maintainability analysis. Failure data from field service and factory repair personnel are utilized to identify product improvement target areas, but are not quantified into reliability predictions. Therefore, the reliability data presented herein are not based on quantitative analysis, but on the analyst's best judgement and experience with similar hardware. For a detailed history of all failures and maintenance actions involving the EASSP hardware, refer to the monthly Maintenance Repair Reports prepared under this contract.

3.9 EQUIPMENT REPAIR COSTS. These estimates are for material only. Where an item must be replaced, the full cost of that item is assumed to be its repair cost. Where an assembly may be repaired by replacing a component, the cost assumed is that of an average (or highest failure rate) part. The number of repair actions is based on the MTBF, number of identical items, on-hand (initial) spares and the total operating time. Where the number of repair actions is calculated to be less than one (1), it is assumed to be zero (0), otherwise any fraction will be raised to the next highest whole number.

3.10 PECULIAR SUPPORT EQUIPMENT. No peculiar (unique) support equipment was used to maintain the EASSP equipment. For the purposes of this analysis, the peculiar support equipment cost was assumed to be zero (\$0).

3.11 COMMON SUPPORT EQUIPMENT. The total estimated cost of the EASSP common tools and test equipment (hand tools, multimeters, oscilloscope and various other generic test equipment) was \$20,000. For the purpose of this analysis, an allocation of one tenth of the total program cost is assumed to be the cost apportioned to this subsystem.

3.12 INVENTORY MANAGEMENT AND STORAGE. For the purpose of this analysis, it is assumed that there were no charges for inventory management and storage. The EASSP equipment is not part of a military-type supply system and is managed by on-site personnel as part of their normal duties. Storage charges are assumed to not apply as the number of on-hand spares are extremely small in both quantity and size.

3.13 TRANSPORTATION AND PACKAGING. This cost element includes packaging, handling, and transportation of spares, repair parts and other materials between supply points and the equipment to be maintained. Since all of the EASSP hardware is COTS, and many manufacturers include shipping costs in the price of their assemblies, this cost element is a very minor one. However, for the purposes of this analysis, it was assumed that ten percent (10%) of the cost of repairs may be allocated for packaging and shipping charges, either by manufacturers or by EASSP personnel returning components to the manufacturers for repair.

3.14 TERMINATION COSTS. This element collects costs associated with returning the airport to the condition it was before the EASSP equipment was installed. It includes dismantling and transporting any equipment from the site as well as site restoration costs. For the purpose of this analysis, it was assumed that the cost of termination was twenty percent (20%) of the cost of installing the hardware. All sub-elements of this cost category were included in this assumed percentage.

3.15 SALVAGE VALUE. Salvage value is defined as the cash value (on the commercial market) of the equipment after completion of its useful or programmed life. Due to projected advances in technology, and especially electronics, from the start of the EASSP (assumed to be 1 January 1992) to the end of the system life (per Paragraph 3.3, 31 December 2001), it was anticipated that the salvageable hardware would have greatly diminished value. For the purposes of this analysis, the salvage value was assumed to be ten percent (10%) of the original cost (in 1992 dollars) of the hardware.

4. COST METHODOLOGY AND DATA.

4.1 COST BREAKDOWN STRUCTURE. The following Cost Breakdown Structure (CBS) will be utilized to estimate the LCC for the analyzed subsystem. Details of the methodology and calculations used to arrive at each individual CBS element are contained in the description of the LCC model presented in Section 5, Cost Estimates.

COST BREAKDOWN STRUCTURE
(DOT FAA Order 1810.3)

$$LCC = C_1 + C_2 + C_3 + C_4 - C_5$$

C_1 NON-RECURRING COST

****NOTE**** All EASSP hardware and software is assumed to be Commercial Off-the-Shelf (COTS) or Non-Development Items (NDI) with the exception of the exit revolving door light curtain (HBS 1.5). The light curtain associated non-recurring costs have been borne by the manufacturer. Therefore, for the purpose of this analysis, no non-recurring costs are included.

C_2 PRODUCTION AND INSTALLATION

- $C_{2.1}$ Program Management
- $C_{2.2}$ Real Property Improvements
- $C_{2.3}$ Prime Mission Equipment
- $C_{2.4}$ Peculiar Support Equipment
- $C_{2.5}$ Common Support Equipment
- $C_{2.6}$ Equipment Installation and Test
- $C_{2.7}$ Initial Spares and Consumables
- $C_{2.8}$ Initial Training
- $C_{2.9}$ Data

C_3 RECURRING COSTS - OPERATION AND SUPPORT

$C_{3.1}$ OPERATIONS COSTS

- $C_{3.1.1}$ Personnel
- $C_{3.1.2}$ Consumables
- $C_{3.1.3}$ Energy and Utilities
- $C_{3.1.4}$ Leases and Subcontracts
- $C_{3.1.5}$ Training (Operator)

C_{3.2} SUPPORT COSTS

C _{3.2.1}	Personnel
C _{3.2.2}	Replenishment Spares
C _{3.2.3}	Repair Material
C _{3.2.4}	Support Equipment Maintenance
C _{3.2.5}	Inventory Management and Storage
C _{3.2.6}	Transportation and Packaging
C _{3.2.7}	Recurring Training

C₄ TERMINATION COSTS

C₅ SALVAGE VALUE

4.2 COST DATA. The following cost data from Table 2. Life Cycle Cost Data Analysis was utilized in the preparation of the LCC Analysis. Prices were supplied by the manufacturer, Horton Automatics, and the supplier/installer, Superior Automatic Door, Inc.

Table 2. Life Cycle Cost Data Analysis

HBS#	PRICE	DESCRIPTION
1.1	\$550.00	C9090 Uninterruptable Power Supply (3)
1.2	244.00	C9920 Motor Drive Control Assy (box only) (3)
1.2.1	350.00	C9923-2 Motor Drive Board
1.2.2	65.00	C9828 Motor Relay
1.2.3	101.00	C9828-1 Transformer
1.2.4	140.00	C9979-1 Plug-Stop Module
1.2.5	35.00	C9110 Circuit Breaker
1.3	177.00	C9921 Microprocessor Control Assy (box only)(3)
1.3.1	29.00	C9110 Circuit Breaker
1.3.2	848.00	C9950 Microprocessor Board

Table 2. Life Cycle Cost Data Analysis (Continued)

HBS#	PRICE	DESCRIPTION
1.3.3	\$ 184.00	C9951 Input Board
1.3.4	162.00	C9953 Output Board
1.3.5	246.00	C9954 Miscellaneous Function Board
1.3.6	118.00	C9955 Power Supply
1.4	200.00	C9985 Magnetic Breakout (box only) (3)
1.4.1	29.00	C9110 Circuit Breaker
1.4.2	76.00	C1849-1 Transformer
1.4.3	109.00	C2216 Battery Charger
1.4.4	55.00	C2217 Module (4 ea)
1.4.5	33.00	C9828-1 Relay 3PDT
1.5	200.00	Light Curtain/Logic Control Assy (box only) (2)
1.5.1	172.00	C1710-2 Photoelectric Module (40 ea)
1.5.2	250.00	Logic Control Board
1.6	236.00	C1150 Automatic Motion Detector (5)
1.7	84.00	C1850M-3 Remote Alarm Contacts/Relay (3)
1.7.1	84.00	C1850M-3-24V Relay Board
1.7.2	36.00	C8166 Relay 4PDT
2.1	4,225.00	C9100 Gear Drive (3)
2.2	814.00	C9910 Brake (3)
2.3	675.00	C9011 Motor (3)
2.4	882.00	C9790 Security Switches (mats) (3)
2.5	508.00	C9888 Magnetic locks/brushes/sliprings (3)
2.6	50.00	C529 Key Switches (11)
2.7	945.00	C9888 Magnetic locks/brushes/sliprings (3)
2.8	1,100.00	Door Panels (9)
2.9	1,500.00	Door Frame/Structure (3)

5. COST ESTIMATES. The following is a detailed description of the LCCA model utilized for this analysis. Each element of the CBS is addressed along with the cost estimating relationships or formulae used to quantify that element. Table 3. Revolving Door Subsystem HBS with Cost Estimates, contains the details of the HBS including MTBF, initial spares, repair costs and repair material estimates. Table 4. Life Cycle Cost Model, is the LCC model that calculates each cost element based on the formulae below.

$$LCC = C_1 + C_2 + C_3 + C_4 - C_5$$

$C_1 = \$0$ (see paragraph 3.2, Non-Recurring Costs)

$C_2 = C_{2.1} + C_{2.2} + C_{2.3} + C_{2.4} + C_{2.5} + C_{2.6} + C_{2.7} + C_{2.8} + C_{2.9}$ Where:

$C_{2.1} = \$0$ (see paragraph 3.4, Program Management)

$C_{2.2} = \$0$ (No Real Property Improvements were made or purchased in association with the EASSP)

$C_{2.3} = \text{PME}$ (Total of Prime Mission Equipment Cost - see Table 3. Revolving Door Subsystem HBS with Cost Estimates)

$C_{2.4} = \$0$ (see paragraph 3.10, Peculiar Support Equipment)

$C_{2.5} = \$2,000$ (see paragraph 3.11, Common Support Equipment)

$C_{2.6} = (\text{INST} + \text{TST}) = \$80,333$, Where:

INST = \$80,333 (Total SOC/Screening Point installation cost per Sandia National Laboratories report, December 2, 1993, Paragraph 4.3.3 is \$241,000. It is estimated that the Revolving Doors consumed one-third of the installation costs. Therefore, $\$241,000 \div 3 = \$80,333$)

TST = \$0 (There is no cost directly attributable to certification, commissioning or flight test that is not included in the INST costs.)

$C_{2.7} = \text{INSPC}$ (Initial Spares and Consumables - see Table 4. Life Cycle Cost Model)

$C_{2.8} = \$0$ (No initial maintenance or operational training is required for operation of this subsystem over and above normal familiarization that is accounted for in personnel costs)

$C_{2.9} = \text{DATA}$ (see Table 4. Life Cycle Cost Model)

$C_3 = C_{3.1} + C_{3.2}$ Where:

$C_{3.1} = C_{3.1.1} + C_{3.1.2} + C_{3.1.3} + C_{3.1.4} + C_{3.1.5}$ and

$C_{3.2} = C_{3.2.1} + C_{3.2.2} + C_{3.2.3} + C_{3.2.4} + C_{3.2.5} + C_{3.2.6} + C_{3.2.7}$

$C_{3.1.1} = \$394,200$ (see paragraph 3.5, Operations/Support Personnel)

$C_{3.1.2} = \$0$ (There are no consumable materials associated with this subsystem)

$C_{3.1.3} = \$0$ (see paragraph 3.7, Energy and Utilities)

$C_{3.1.4} = \$0$ (There are no leases or subcontracts associated with the operation or support of this subsystem)

$C_{3.1.5} = \$0$ (There is no recurring training necessary to operate this subsystem)

$C_{3.2.1} = \$65 \times 190$ hours (see Table 3. Revolving Door Subsystem HBS with Cost Estimates = \$12,350) (see paragraph 3.5, Operational Support Personnel)

$C_{3.2.2} = \text{REPSP}$ (see Table 3. Revolving Door Subsystem HBS with Cost Estimates)

$C_{3.2.3} = \text{REPMTL}$ (\$0 - included in REPSP costs - see Table 3. Revolving Door Subsystem HBS with Cost Estimates)

$C_{3.2.4} = \$0$ (The EASSP common support and test equipment does not require maintenance)

$C_{3.2.5} = \$0$ (see paragraph 3.12, Inventory Management and Storage)

$C_{3.2.6} = \text{REPSP} \times .1$ (see paragraph 3.13, Transportation and Packaging)

$C_{3.2.7} = \$0$ (There is no recurring training necessary to maintain this subsystem)

$C_4 = (\text{INST} + \text{TST}) \times .20$ (\$80,333 $\times$.2 = \$16,066) (see paragraph 3.14, Termination Costs)

$C_5 = \text{PME} \times .10$ (See Table 3. Revolving Door Subsystem HBS with Cost Estimates for the PME, see paragraph 3.15, Salvage Value)

Table 3. Revolving Door Subsystem HBS with Cost Estimates

HBS#	PRICE	QTY	MTBF (HRS)	MTTR	INSPC	\$/REPAIR	TPME \$	INSPC\$	# REP	REPS\$
1.1	\$ 550	3	300,000	2	0	\$ 550	\$1,650	\$ 0	1	\$ 550
1.2	244	3	500,000	4	0	244	732	0	0	0
1.2.1	350	3	200,000	1	0	350	1,050	0	1	350
1.2.2	65	3	100,000	1	0	65	195	0	2	130
1.2.3	101	3	200,000	1	0	101	303	0	1	101
1.2.4	140	3	250,000	1	0	140	420	0	1	140
1.2.5	35	3	500,000	2	0	35	105	0	0	0
1.3	177	3	500,000	4	0	177	531	0	0	0
1.3.1	29	3	500,000	2	0	25	87	0	0	0
1.3.2	848	3	100,000	1	0	160	2,544	0	2	320
1.3.3	184	3	200,000	1	0	184	552	0	1	184
1.3.4	162	3	200,000	1	0	162	486	0	1	162
1.3.5	246	3	200,000	1	0	246	738	0	1	246
1.3.6	118	3	250,000	1	0	118	354	0	1	118
1.4	200	3	500,000	4	0	200	600	0	0	0
1.4.1	29	3	500,000	2	0	29	87	0	0	0
1.4.2	76	3	200,000	1	0	76	228	0	1	76
1.4.3	109	3	100,000	1	0	109	327	0	2	218
1.4.4	55	12	200,000	1	0	55	660	0	5	275
1.4.5	33	3	100,000	1	0	33	99	0	2	66
1.5	200	2	500,000	4	0	200	400	0	0	0
1.5.1	172	80	75,000	1	30	172	13,760	5,160	84	9,288
1.5.2	250	2	250,000	2	0	250	500	0	1	250
1.6	236	5	250,000	2	0	236	1,180	0	2	472
1.7	84	3	150,000	2	0	84	252	0	2	168
1.7.1	84	3	250,000	2	0	84	252	0	1	84
1.7.2	36	3	100,000	1	0	36	108	0	2	72
2.1	4,225	3	500,000	16	0	844	12,675	0	0	0
2.2	814	3	200,000	16	0	160	2,442	0	1	160

Table 3. Revolving Door Subsystem HBS with Cost Estimates (Continued)

HBS#	PRICE	QTY	MTBF (HRS)	MTTR	INSPC	\$/REPAIR	TPME \$	INSPC\$	#/REP	REPS
2.3	\$ 675	3	200,000	8	0	\$ 675	\$ 2,025	\$ 0	1	\$ 675
2.4	882	3	200,000	6	0	882	2,646	0	1	882
2.5	508	12	500,000	8	0	508	6,096	0	2	1,016
2.6	50	11	250,000	1	0	50	550	0	3	150
2.7	945	3	75,000	4	0	250	2,835	0	3	750
2.8	1,100	9	500,000	8	0	500	9,900	0	1	500
2.9	1,500	3	500,000	8	0	600	4,500	0	0	0
TOTAL		217			30		\$ 71,869	\$ 5,160		\$17,403

DATA = DWG + MAN + SFT	(DWG-ENG, MAN-TECH MNLS, SFT-SOFTWARE)
DWG = \$50,000	(SANDIA CONTRACTED BPLW ENGINEERING DRAWINGS)
MAN =	(NO IDENTIFIED INDIVIDUAL COSTS FOR MANUALS)
SFT = \$0	(NO SOFTWARE)
DATA = \$50,000	

Table 4. Life Cycle Cost Model

CBS	COST BREAKDOWN STRUCTURE ELEMENT	COST
C1	Non-Recurring Cost	\$ 0
C2	Production and Installation	209,362
C2.1	Program Management	0
C2.2	Real Property Improvements	0
C2.3	Prime Mission Equipment	71,869
C2.4	Peculiar Support Equipment	0
C2.5	Common Support Equipment	2,000
C2.6	Installation and Test	80,333
C2.7	Initial Spares and Consumables	5,160
C2.8	Initial Training	0
C2.9	Data	50,000
C3	Recurring Costs - O&S	425,693
C3.1	Operations Costs	394,200
C3.1.1	Personnel	394,200
C3.1.2	Consumables	0
C3.1.3	Energy & Utilities	0
C3.1.4	Leases/Subcontracts	0
C3.1.5	Operator Training	0
C3.2	Support Costs	31,493
C3.2.1	Personnel	12,350
C3.2.2	Replenishment Spares	17,403
C3.2.3	Repair Material	0
C3.2.4	Support Equipment Maintenance	0
C3.2.5	Inventory Management & Storage	0
C3.2.6	Transportation & Packaging	1,740
C3.2.7	Recurring Training	0
C4	Termination Costs	16,067
C5	Salvage Value	7,187
TOTAL LIFE CYCLE COST (C ₁ + C ₂ + C ₃ + C ₄ - C ₅)		\$ 643,935

6. COST BENEFIT ANALYSIS.

6.1 BASELINE SYSTEM DESCRIPTION. There is no baseline Revolving Door Subsystem. Before the installation of the EASSP at BWI, access to and from the secure area of pier B was open and controlled by security personnel only. The screening point was separated from the exit corridor by a glass wall, with a security guard positioned in the exit corridor to prevent persons from entering the secure area without first passing through the screening point.

6.2 BASELINE SYSTEM LIFE CYCLE COST ESTIMATE. The cost of the original screening point dividing wall (including installation) is estimated at \$16,000 by Greiner, Inc., architects working in the BWI modification project, in March 1994. The only other costs of the baseline system is for personnel. An extra security guard is required during operation hours in the baseline configuration. Operating hours of pier B are from 0430 to 2330 daily, or 19 hours per day, 365 days per year, for an annual sum of 6935 hour per year. The fully-burdened cost of a guard is assumed to be \$20 per hour, for an annual cost of \$138,700. The cost of the additional guard over the ten year life cycle of this analysis would then be \$1,387,000, for a total cost of the baseline system of \$1,403,000.

6.3 COST COMPARISON. The Life Cycle Cost of the EASSP Revolving Door Subsystem has been estimated at \$643,935 (see Table 4. Life Cycle Cost Model). The Life Cycle Cost of the baseline system has been estimated at \$1,403,000 (see paragraph 6.2, Baseline System Life Cycle Cost Estimate). The cost of the baseline system over the enhanced is, therefore, \$759,065.

6.4 BENEFITS. The benefits of the EASSP Revolving Door Subsystem are both monetary and qualitative. Monetary benefits in excess of one-half million dollars are realized from the savings of one security guard over a ten-year period versus the cost of the revolving doors. Additionally, non-monetary benefits are realized in the enhanced security achieved with the installation of the revolving doors. While not quantified in this analysis, the benefit of preventing one threat from reaching an intended target could be in the multi-millions of dollars. It is left to the appropriate federal, state, and local responsible parties to assess the security benefits of the revolving doors.

7. REFERENCES. The following documents were either referenced herein or were utilized as source documents for this analysis.

a. U.S. Department of Transportation, Federal Aviation Administration ORDER 1810.3, Cost Estimation Policy and Procedures, 5/15/84 (Including Chg 1, 10/27/89);

b. U.S. Department of Transportation, Federal Aviation Administration ORDER 1810.1C, Major System Acquisition;

c. FAA-APO-82-1, Economic Analysis of Investment and Regulatory Decisions--A Guide;

d. Sandia National Laboratories Report, Enhanced Airport Security System Project Final Report (Draft), 12/2/93;

e. Earles, Mary Eddins, Factors, Formulas, and Structures for Life Cycle Costing (Second Edition), Eddins-Earles Publishing, Concord, Mass, 1981; and

f. TTO-ORT-032A-80-V3-APF, Cost Effectiveness Program Plan for Joint Tactical Communications, Life Cycle Costing, Vol. III, Appendix F, TRI-TAC Life Cycle Cost Model, Joint Tactical Communications Office, Ft. Monmouth, NJ, January 1980.

