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

FAA Technical Center Enhanced Airport Security System Project

Secure Communications Subsystem Cost Benefit Analysis

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Final Report

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16. Abstract

A ten-year Life Cycle Cost/Cost Benefit Analysis has been conducted on the Secure Communications Subsystem of the Enhanced Airport Security System Project at Baltimore-Washington International Airport (BWI). The Life Cycle Cost of the subsystem is estimated at $296,276, as compared with a baseline system cost of $0. The primary benefit of this subsystem is in an increased level of airport security.

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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
REPSP	Replenishment Spares
SCS	Secure Communications Subsystem
SFT	Software
SOC	Security Operations Center
TST	Testing
WRA	Working Ramp Area

1. INTRODUCTION.

1.1 OBJECTIVES. This is the Life Cycle Cost Analysis (LCCA) for the Secure Communications 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 (termination at the end of the hardware's useful life) of the Secure Communications Subsystem of the EASSP.

1.2 SCOPE. This report presents the LCCA for the Secure Communications Subsystem installed in conjunction with the Security Operations Center (SOC). The SOC is located on the third floor of the BWI Main Terminal and in various portable/temporary positions around the airfield. Only equipment directly associated with the Secure Communications Subsystem is analyzed in this document. The screening point intercom system and the Fire Rescue intercom are not part of the Secure Communications System.

2. SYSTEM DESCRIPTION. The Secure Communications Subsystem, as part of the FAATC's EASSP, provides radio communications that contribute to increased airport security. It provides the means for interaction between personnel involved in the security system. This subsystem utilizes a separate 800 Mhz communications channel that permits secure digital voice privacy. Digital Voice Privacy-Extended Range (DVP-XL) encryption code has been selected for this application. The Secure Communications Subsystem incorporated the following hardware elements:

2.1 DISPATCHER CONTROL CONSOLE AND BASE STATION INTERFACE ELECTRONICS. This hardware is located in the SOC (on the lower level of Pier B at BWI Airport). This control console and its associated interfaces provides the means for the SOC operator to monitor and communicate with all EASSP personnel. The console not only controls the secure communications channel, but monitors Maryland Aviation Administration (MAA) Maintenance, MAA Fire Rescue Service (FRS), MAA Operations, Maryland Department of Transportation (MDT) Police, and the wide area assistance network that interconnects police and fire departments in the cities and counties surrounding the BWI area. The SOC operator may crosspatch or simulcast on any or all of these channels in the event of a security emergency.

Table 1. EASSP Life Cycle Cost Hardware Breakdown Structure
Secure Communications Subsystem

1. DISPATCHER, CONTROL CONSOLE & BASE STATION INTERFACE

    1.1 W665 Control Station Operator
    1.2 B1630A 8-Channel Control Console
    1.3 T5007X Encryption Console Interface

        1.3.1 C797D DVP-XL Full Duplex Operation Module
        1.3.2 C144 Four-wire Audio Module
        1.3.3 C311 Full Duplex Module

    1.4 K634 Dispatcher

        1.4.1 K702 Microphone

    1.5 DC Current Board, Control Line

2. 3-WATT HAND-HELD RADIOS

    2.1 STX #H99LX087H 3-Watt 800-MHZ Hand-Held Radio (11)
    2.2 H797 SECURENET DVP-XL Encryption

3. VEHICLE MOBILE RADIOS

    3.1 DC2ZX071W 15-Watt 800-MHZ Mobile Radio (3)
    3.2 W797 SECURENET DVP-XL Encryption
    3.3 NMF6050 Microphone, Public Safety Speaker

4. BASE STATION ANTENNA

    4.1 TDF6481 Celwave Unity Gain Antenna
    4.2 TDN 6596-20 Coax Transmission Line

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). 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 purposes 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, with secure radios being carried by airport personnel that are funded under other programs, of which this subsystem is assumed to require five percent (5%) 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 five percent (5%) of the total operator time apportioned to this subsystem results in a subsystem operations cost of $197,100. 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, Secure Communications Subsystem HBS with Cost Estimates.

3.12 INVENTORY MANAGEMENT AND STORAGE. For the purpose of this analysis, it was 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 two percent (2%) 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 seventy five percent (75%) of the cost of installing the hardware. All sub-elements of this cost category are 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 in 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 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) was 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.

$C_{3.2}$ 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

C_4 TERMINATION COSTS

C_5 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 extracted from the Sandia National Laboratories System Inventory, 1 April 1993.

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, Secure Communications 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)

$C_{2.3}$ = PME (Total of Prime Mission Equipment Cost - see Table 3, Secure Communications 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)

$C_{2.6}$ = (INST+TST) Where:

INST = \$3768 (Installation costs paid to Motorola [\$2,738] and Bell Atlantic [\$1,030] for setup of the Repeater, Base Station, and DC Control lines)

TST = \$0 (There is no cost directly attributable to certification, commissioning or flight test that is not included in the INST costs. While an FCC license was required for operation, no cost is directly attributable to this requirement.)

$C_{2.7}$ = 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)

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

Table 3. Secure Communications Subsystem HBS with Cost Estimates

HBS#	PRICE	QTY	MTBF (HRS)	MTTR	INSPC	$/REPAIR	T PME $	INSPC$	#REP	REPSP
1.1	$ 380	1	75,000	2	0	$ 380	$ 380	$0	2	$ 760
1.2	9,502	1	50,000	4	0	950	9,502	0	2	1,900
1.3	3,657	1	75,000	4	0	730	3,657	0	2	1,460
1.3.1	214	1	75,000	1	0	214	214	0	2	428
1.3.2	250	1	75,000	1	0	250	250	0	2	500
1.3.3	122	1	100,000	2	0	122	122	0	0	0
1.4	680	1	50,000	4	0	136	680	0	2	272
1.4.1	160	1	75,000	1	0	160	160	0	2	320
1.5	1,544	1	100,000	2	0	1,544	1,544	0	0	0
2.1	2,420	11	15,000	1	0	75	26,620	0	58	4,350
2.2	319	11	90,000	1	0	319	3,509	0	10	3,190
3.1	1,745	3	50,000	4	0	350	5,235	0	5	1,750
3.2	319	3	90,000	1	0	319	957	0	3	957
3.3	176	1	100,000	1	0	176	176	0	0	0
4.1	365	1	100,000	1	0	365	365	0	0	0
4.2	220	1	100,000	8	0	220	220	0	0	0
5.1	7,093	1	50,000	4	0	1,400	7,093	0	1	1,400
5.1.1	1,100	1	75,000	1	0	220	1,100	0	1	220
5.1.2	541	1	75,000	1	0	541	541	0	1	541
5.1.3	401	1	75,000	1	0	401	401	0	1	401
5.1.4	64	1	100,000	1	0	64	64	0	0	0
5.1.5	1,304	1	75,000	1	0	260	1,304	0	1	260
6.1	365	1	100,000	1	0	365	365	0	0	0
6.2	298	1	100,000	8	0	298	298	0	0	0

Table 4. Life Cycle Cost Model

CBS	COST BREAKDOWN STRUCTURE ELEMENT	COST
C1	Non-Recurring Cost	$ 0
C2	Production and Installation	74,561
C2.1	Program Management	0
C2.2	Real Property Improvements	0
C2.3	Prime Mission Equipment	67,884
C2.4	Peculiar Support Equipment	0
C2.5	Common Support Equipment	2,000
C2.6	Installation and Test	3,768
C2.7	Initial Spares and Consumables	0
C2.8	Initial Training	0
C2.9	Data	909
C3	Recurring Costs - O&S	225,677
C3.1	Operations Costs	197,100
C3.1.1	Personnel	197,100
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	28,577
C3.3.1	Personnel	9,035
C3.2.2	Replenishment Spares	19,159
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	383
C3.2.7	Recurring Training	0
C4	Termination Costs	2,826
C5	Salvage Value	6,788
TOTAL LIFE CYCLE COST (C1+C2+C3+C4-C5)		$ 296,276

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

e. 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.