DOT/FAA/CT-94/29

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

FAA Technical Center Enhanced Airport Security System Project

System Environmental Compatibility Report

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October 1994

Final Report

U.S. Department of Transportation
Federal Aviation Administration

NOTICE

Technical Report Documentation Page

1. Report No. DOT/FAA/CT-94/29	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle FAA TECHNICAL CENTER ENHANCED AIRPORT SECURITY SYSTEM PROJECT: SYSTEM ENVIRONMENTAL COMPATIBILITY REPORT		5. Report Date October 1994 6. Performing Organization Code ACA-400
7. Author(s) Walter Wall and Edward Ocker		8. Performing Organization Report No. A-2001001-94-U-10077
9. Performing Organization Name and Address 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:
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16. Abstract
This report provides an analysis of the effect of the environmental conditions present at BWI on the equipment utilized in the Enhanced Airport Security System Project. Analyses of Technicians notebooks and sensor alarm reports printed out by the Security Operations Center online printer were performed. The effect of various natural phenomena and man-made effects are discussed in this report along with, where applicable, the steps taken to minimize any adverse effects.

17. Key Words
Environmental Compatibility, Compatibility Issues, Natural phenomena, man-made effects, CCTV, Infrared, cold, rain, fog, snow, wind, sunlight, animals, vegetation, jet blast, snow removal, EMI, and RFI.

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

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	17	

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LIST OF ACRONYMS AND ABBREVIATIONS

BMA	Baggage Make-up Area
BWI	Baltimore-Washington International Airport
CCTV	Closed Circuit Television
EASSP	Enhanced Airport Security System Project
EMI	Electromagnetic Interference
FAATC	Federal Aviation Administration Technical Center
FRS	Fire Rescue Service
HVAC	Heating, Ventilation, and Air Conditioning System
IPID	Infrared Perimeter Intrusion Detector
IR	Infrared
IRIN	Infrared Interference
RAIDS	Ramp Area Intrusion Detection System
RFI	Radio Frequency Interference
SLU	Signal Logic Unit
SOC	Security Operations Center
VMD	Video Motion Detector
WRA	Working Ramp Area

EXECUTIVE SUMMARY.

This Environmental Compatibility report has been prepared in support of the Federal Aviation Administration Technical Center (FAATC) "Enhanced Airport Security System Project" (EASSP), established as a research and development project. The Environmental Compatibility report identifies various environmental conditions present at Baltimore-Washington International Airport (BWI) and assesses their effect on the various security devices utilized in the EASSP.

The environmental conditions at BWI were observed throughout the seasonal changes which occur in the geographical location, and daily notebook entries were made to record the effects of the various weather patterns to which the security devices were subjected. In addition, man-made environmental conditions were observed for the security devices.

1. INTRODUCTION.

1.1 OBJECTIVES. This Environmental Compatibility report has been prepared to provide information relating to the environmental effects on the security equipment utilized in the Enhanced Airport Security System Project (EASSP) at Baltimore-Washington International Airport (BWI). This Environmental Compatibility report covers the environmental conditions and their impact on the operation of the equipments utilized and covers the period January 1, 1993 through December 17, 1993.

1.2 ORGANIZATION. The Environmental Compatibility Report is organized into two types of environmental conditions: natural phenomena and man-made effects. Subsystems and individual sensors may be discussed under both topic areas. Descriptions of the security devices and the placement within the EASSP are contained in DOT/FAA/CT-93-8, I&II FAA Technical Center Enhanced Airport Security Demonstration Project, Integrated Airport Security - A Systematic Approach, October 1993.

1.3 SCOPE. The environmental impacts for a given subsystem, sector, and sensor are grouped together in the appropriate topic area (natural phenomena or man-made effects). The subsystems of interest are as follows:

a. Pier Alert/Duress;
b. Pier Delay/Intercom/FRS;
c. Security Operations Center (SOC);
d. Ramp Area Intrusion Detection System (RAIDS);
e. Vehicle Portal;
f. Revolving Doors; and
g. Secure Communications.

The sectors of interest are RAIDS sectors 1 through 14, Pier A, Pier B, and spaces within the South Terminal Baggage Make-up Area (BMA) and the Delta Ticket Counter. Refer to figure 1.

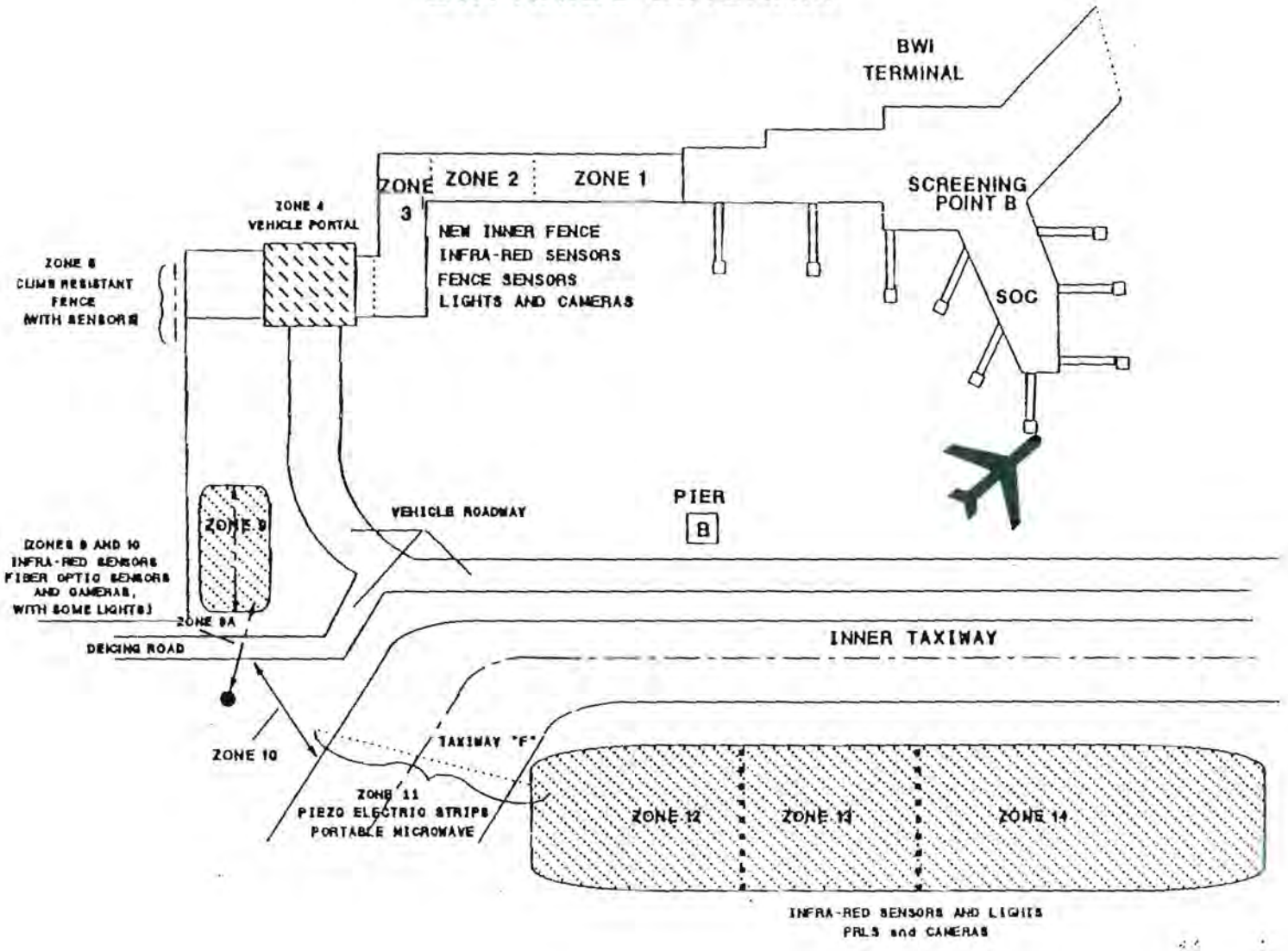

Figure 1. Enhanced Airport Security System Project at BWI

2. DESCRIPTION.

2.1 ENVIRONMENTAL CONDITIONS. Conditions in a non-sheltered environment can vary greatly between geographic areas. Conditions within a shelter or housing can be more easily controlled. Both of these conditions are applicable to the EASSP at BWI.

2.1.1 Non-Sheltered Environments. Equipment or sensors operated in a non-sheltered environment are unprotected from the elements (i.e. rain, snow). Equipment intended for operation in a non-sheltered environment must be more robust in design than equipment intended for operation in a sheltered environment.

2.1.2 Sheltered Environments. Equipment or sensors which are operated within a sheltered environment are those which have some type of man-made barrier to minimize exposure to the elements. These shelters range from simple metal housings to the air conditioned environments of piers A and B.

2.2 DATA COLLECTION. The basis for this Environmental Compatibility Report are the daily notebooks kept by the on-site personnel and the printed reports of the various sensor alarms which were recorded by the SOC equipment. These notebooks and printouts have been reviewed and analyzed to determine the environmental compatibility of the EASSP equipment.

3. DISCUSSION. Equipment or sensor environmental compatibility is a product of equipment or sensor design, and system or subsystem design, to compensate for the environmental conditions to which the equipment will be exposed.

The following paragraphs discuss the environmental conditions (both natural phenomena and man-made effects) found at BWI.

3.1 NATURAL PHENOMENA. Natural phenomena are those conditions which occur in a non-sheltered environment. The subsystems and sensors exposed to the effects of natural phenomena at BWI are located within the RAIDS and Vehicle Portal subsystems. During design of the EASSP, consideration was given to sheltering requirements for these equipments. Provisions for sheltering were made where it was considered necessary and feasible. Modifications were made after installation, where practical, to enhance equipment environmental resistance. The following paragraphs discuss the initial environmental effects of natural phenomena, and the modifications made to improve performance.

3.1.1 Heat. During the summer months the ambient temperature at BWI frequently rose above 90°F (32.2°C). These high temperatures had adverse effects on some of the electronic components utilized in the RAIDS subsystem. These components are housed in metal field junction boxes mounted either on the ground or on pedestals above the ground. Temperatures in excess of 90°F frequently caused the Signal Logic Unit 1 (SLU-1) in sector 9 to go into thermal shut down. In this event, all sensor information passing through SLU-1 (that is all of the RAIDS subsystem with the exception of closed circuit television (CCTV) cameras and Video Motion Detectors (VMDs)) were rendered inaccessible to the SOC. The SLU-1 housing, which is a pedestal mounted junction box, was modified with a muffin fan and an opening in the bottom of the junction box to allow air to circulate around the SLU processor. No further heat related failures were experienced after this corrective action.

Another effect of the high temperatures noted during the summer months was the erratic functioning of the processor in the sector 9 fiber optic sensor enclosure. Internal temperatures within this enclosure were frequently in excess of 122°F (50°C), causing unacceptable levels of false alarms. There have been no modifications to this enclosure, but the manufacturer (Fibersens Systems) has been made aware of the problem and is pursuing design changes.

3.1.2 Cold. Moisture accumulation from rain or melted snow combined with temperatures below 32°F (0°C), and bright sunlight created situations which impacted performance of RAIDS Infrared (IR) sensors and the vehicle portal gates. Bright sunlight reflecting from ice induced Infrared Interference (IRIN) alarms in the various IR sensors. Since this anomaly occurred infrequently, no modification or corrective action was implemented.

Extended periods where the temperature remained below 32°F (0°C) allowed ice to accumulate at the vehicle portal (A gate) and interfered with the operation of the gates. There is no identifiable method to prevent the ice buildup. The most effective solution available was to remove the ice buildup causing the problem.

3.1.3 Rain. The various components utilized in the RAIDS subsystem were affected by rain. These effects included initiation of taut wire sensor alarms, obscuring the CCTV camera views, initiation of alarms on the Bird-Eye infrared IR and Infrared Perimeter Intrusion Detector (IPID) sensors, and moisture intrusion into the RAIDS equipment (i.e. Fiber Optic transmitters on camera poles). In addition, heavy rain storms caused erosion of the soil around the IPID tripod legs in sector 9A causing the sensor to be unstable and go into a constant alarm condition. Heavy rain storms also temporarily obliterated CCTV camera views in sectors 1 through 5, and 9 through 14, and caused false VMD alarms in sectors 2, 5, 10, and 12 through 14.

3.1.4 Fog. The occurrence of fog obscured CCTV camera views and desensitized VMD. IR sensors, IPIDs and taut wire sensors remained functional. The ability to assess the cause of an alarm was impaired by the loss of the CCTV camera capability.

3.1.5 Snow. Falling snow also obscured CCTV camera views. Heavily falling snow totally obliterated the CCTV camera views, which desensitized the VMDs functionality and initiated IR alarms on the Bird-Eye and IPID infrared sensors. In the event of extended periods of snowfall with accumulations in excess of five (5) inches, the IR in sector 9 went into a constant alarm condition. Initiation of the Lower Beam cutoff by the SOC Operator restored the IR sensor to the secure condition and the sector was again secure. Heavier snowfalls, with accumulations or drifts in excess of eight (8) inches, initiated constant alarm conditions on the IR sensors in sectors 1, 2, 3, and 4. Initiation of the Lower Beam cutoff by the SOC Operator would return the IR sensors to a secure condition and the sectors were again secure.

Bright sunlight reflected from snow on the ground also induced infrared interference alarms in sectors 1, 2, 3, 4, and 9.

3.1.6 Wind. The instability of the tripod mounting legs on the IPID in sector 9A contributed to frequent alarms during those times when there was significant wind velocity. The IPID manufacturer, ECSI, is modifying the tripod design to improve stability. These modified IPIDs will be further evaluated for improved performance.

In addition, the wind also initiated alarms on the taut wire sensors on vehicle portal gate A2.

Wind of significant velocity contributed to the VMD alarms by causing motion of the frangible camera tower in sectors 10, 12,13,and 14.

Wind also caused VMD alarms due to the movement of high grass in sectors 10, 12, 13 and 14.

3.1.7 Sunlight. Sunlight, combined with various reflective surfaces in and around the Working Ramp Area (WRA) induced interference alarms on the IR sensors. This interference was noted primarily in sectors 1 through 4. The close proximity of vehicle traffic and parking areas was considered to be the major contributors to these alarms. Additional shielding installed on the IR poles in sectors 1 and 2 has greatly reduced the number of interference alarms in these sectors. An additional modification, the installation of polarizing filters, is planned for these sectors.

3.1.8 Animals. The impact of birds and animals on the RAIDS sensors was relatively predictable. The alarms caused by animals were considered nuisance alarms, and the time of day was frequently predictable. The sectors that were affected the most by birds/animals were sectors 9, 9A, 12, 13, and 14. These sectors all have either IR, VMD, or IPIDs which detect moving objects. The majority of the alarms were caused by the birds which came to feed during the early morning and again in the evening. No attempt was made to eliminate the migration of birds from sector 14 through sector 9/9A.

3.1.9 Vegetation. The geographic area in which BWI is located receives sufficient rain- fall to allow various species of vegetation to prosper. The grounds maintenance personnel have ensured that the vegetation in the area occupied by the RAIDS subsystem is kept cut relatively close to the ground. Occasionally this vegetation becomes tall enough, approximately six (6) inches, to allow sufficient movement to cause alarms on the IPIDs or VMDs. This type of alarm is cyclical in nature and was easily eliminated by mowing the grass.

3.2 MAN-MADE EFFECTS. Man-made effects are those conditions which can be directly attributed to human actions (i.e. snow removal). These effects include normal environmental conditions, which may be aggravated by human interaction, or installation of ancillary equipment.

3.2.1 Jet Blast. The proximity of the RAIDS sensors to the WRA and operational aircraft presented opportunities for adverse effects on the sensors. Jet blast from arriving and departing aircraft at passenger gate A1 frequently interfered with the sensors in sectors 9 and 9A causing sufficient movement of the sensors to initiate an alarm condition. Additionally, jet blast would cause any debris present to pass through the IR beam which would initiate an alarm condition.

3.2.2 Snow Removal. The taxiway "F" piezo sensors in sector 11 and the IR lights in sectors 12, 13, and 14 are susceptible to damage by snow removal equipment. The removal of snow in the Working Ramp Area (WRA) frequently caused snow mound deposits in the RAIDS sensor areas (i.e. sector 9 IRs), which then initiated constant alarm situations. Several IR lights were broken by chunks of ice discharged by the snow blowers. The Taxiway "F" piezo sensors have sustained considerable damage from the snow plows.

3.2.3 Debris, Dust, and Dirt. Foreign objects and debris are controllable environmental conditions. There were times when blowing debris, either from wind or jet blast, initiated alarm conditions at the IR sensors in sectors 1, 2, 3, 4, 9, and 9A.

Revolving Door sensor functionality is affected by dust and dirt. Although the revolving doors are located in a sheltered and environmentally controlled area, the heating ventilation, and air conditioning system (HVAC) develops a positive pressure on the sterile side of the doors. The air flow from the sterile area to the public area must pass through the doors and over components which are located above the doors. This air flow carries with it a substantial amount of dust and debris which accumulates on the light modules and light curtain components contributing to frequent random (nuisance) alarm situations. The current method utilized to counteract this situation is the frequent cleaning of the revolving door light curtain components and covering the light modules with plastic trash bags.

3.2.4 Electromagnetic Interference (EMI)/Radio Frequency Interference (RFI). The proximity of electromagnetic and radio frequency emitting equipment to the EASSP equipments had a significant impact on the taut wire sensors utilized at the vehicle portal and at zones 1-3. Frequent alarms were initiated when these sensors were subjected to these emissions. These alarms were reduced with the use of Radio Frequency (RF) chokes.

4. REFERENCES.

DOT/FAA/CT-93-8, I&II FAA Technical Center Enhanced Airport Security Demonstration Project, Integrated Airport Security - A Systematic Approach, October 1993.