NUREG-0271
Two in a Series of
Five Reports

PHYSICAL PROTECTION EQUIPMENT STUDY

Final Report

The MITRE Corporation
for
U. S. Nuclear Regulatory Commission.

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PHYSICAL PROTECTION EQUIPMENT STUDY

Final Report

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Division of Safeguards, Fuel Cycle and Environmental Research
Office of Nuclear Regulatory Research
U. S. Nuclear Regulatory Commission
Under Contract No. AT(49-24)-0376

ABSTRACT

This report summarizes the work performed by MITRE for the U. S. Nuclear Regulatory Commission on each assigned task. The major products of this effort are a Catalog of Physical Protection Equipment, a Guide for Evaluation of Physical Protection Equipment, a book of Reference Materials, and a set of guidelines for use in the development of a methodology for measuring levels of security system effectiveness. A summary of recommendations resulting from this study are also presented. This report has been prepared in partial fulfillment of MITRE's responsibilities under NRC contract AT(49-24)-0376.

ACKNOWLEDGEMENTS

The author wishes to express his appreciation to Mr. Ronald N. Lawson and Mr. William L. Parlee for preparing draft material for Section II of this report and to Dr. Albert J. Graff and Dr. Gerhard O. Sauermann for preparing draft material for Section III. In addition, Appendices I and II were prepared by Mr. Parlee and Appendices IV and V by Dr. Graff. Mr. Robert Hansen assisted in the assembly of Appendix III. The assistance of Miss Rosemary Hanafin in typing of the report is also gratefully acknowledged.

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SECTION I

INTRODUCTION

This final report on the work performed by MITRE for the U. S. Nuclear Regulatory Commission (NRC) under contract AT(49-24)-0376 summarizes the effort on each of the major assigned tasks and describes the documentation produced as a result of that effort. The tasks were performed under the direction of the NRC Office of Nuclear Regulatory Research (RES) in support of the needs identified by the Office of Inspection and Enforcement (I&E). However, the products of this effort are expected to have broader application within NRC.

The U. S. Nuclear Regulatory Commission has, among its other responsibilities, the task of approving proposed physical security plans submitted by its licensees as part of the licensing process. The licensees are commercial facilities that handle significant amounts of special nuclear materials (SNM) as defined in Title 10, Chapter 1 of the Code of Federal Regulations (10 CFR 50.2). NRC also has the task of inspecting and enforcing all standards, regulations and conditions of the license at each of the licensee's facilities to ensure that the physical security systems of those facilities meet the established requirements. Some efforts have been made by NRC to standardize the basis for licensing and inspection of these systems at the various facilities. However, further and more specific documentation was needed to improve this process. The tasks assigned to MITRE have been a direct result of this need.

Two major products have been delivered to NRC under this contract. The first is a Catalog of Physical Protection Equipment (described in Section II) that provides a single reference source for important information on a large segment of all commercially available physical protection equipment and barrier structures.

The second is a Guide for Evaluation of Physical Protection Equipment (described in Section III) that is designed for use by inspectors in ascertaining, during preoperational and operational inspection visits to the facilities, that the equipment has been installed properly and is being properly operated and maintained. The data obtained by inspection of the equipment, and by analysis and measurement of various parameters associated with the equipment (or structures), will then be used to ascertain compliance of the licensee with the appropriate regulations and license conditions as well as to ascertain the overall effectiveness of the physical security system.

To aid in the process of determining system effectiveness, a methodology must be developed that will utilize the data provided by the inspectors to arrive at a measure of the level of effectiveness. One of the tasks assigned to MITRE under this contract was the preparation of guidelines that could be used by NRC, or its contractors, as the basis for developing the required methodology. This effort is described further in Section V.

The final product of the MITRE program is a document containing reference material relevant to the Equipment Catalog and the Evaluation Guide. Specifically it includes cross-reference indices between those two documents accessed both by manufacturer and by equipment category. A list of manufacturers for all equipment included in the Catalog (along with addresses and, where available, telephone numbers) and a glossary of terms and abbreviations used are also provided in the reference materials volume. All of these and their use are described further in Section IV of this report.

In performing the work under this contract, MITRE has not only contacted by letter, telephone or in person approximately 800 companies that manufacture or sell physical protection equipment to obtain information relevant to the Catalog and Evaluation Guide,

but we have also met with a number of people within NRC and with others who are part of organizations under contract to NRC in order to obtain additional information and ideas. During the first two months of the contract (mid-October to mid-December 1976), MITRE staff visited each of the four NRC Regional Field Offices having Safeguards Branches at that time (Regions I, II, III and V). The purpose of these visits was to describe the work MITRE was doing under this contract to the personnel responsible for inspecting physical protection systems at licensed commercial nuclear facilities and to learn from those personnel any information about their inspection activities that would help us to make the Catalog and Evaluation Guide more useful documents.

To obtain further experience and information on how physical protection systems at nuclear facilities are inspected currently, MITRE staff accompanied inspectors from Region II to the Florida Power Corporation's nuclear power reactor at Crystal River, Florida. Tentative plans were made to visit other facilities as well, but other commitments on the part of the Regional Offices prevented this from occurring. However, a good deal of insight into the techniques used by inspectors and the desired scope of their effort was derived from both our visits to the Regional Offices and to the single facility.

In order to ensure that the documentation to be produced by MITRE would be useful not only to I&E, but to the other operating offices as well, MITRE staff met with representatives of Nuclear Reactor Regulation (NRR), Nuclear Materials Safety and Safeguards (NMSS) and Standards Development (SD) to discuss our work and its relationship to the needs of each of those offices as described by the NRC staff. In this way, it is believed that we have been better able to provide documents, particularly the Equipment Catalog, that will have a more universal application throughout

NRC in the physical security area.

In addition, MITRE met with a number of other Government agencies and laboratories doing work for NRC in the safeguards area. These included Sandia Laboratories in Livermore, CA, and Albuquerque, NM, Lawrence Livermore Laboratories, CA, Los Alamos Scientific Laboratories, NM, and U. S. Army MERADCOM, at Ft. Belvoir, VA. These meetings were held to learn more about what each of these organizations was doing with respect to physical protection systems and equipment and the enhancement of techniques for the safeguarding of special nuclear materials, MITRE was also able to ensure ourselves and NRC that there would be no unnecessary duplication of effort between MITRE's work and the work assigned by NRC to these other organizations. Information obtained from Sandia Laboratories, Albuquerque, was of significant use in completing our work on the guidelines for developing a methodology for measuring levels of effectiveness. MITRE also utilized information from these agencies and others in the preparation of the Catalog and Evaluation Guide whenever applicable data was available as the result of tests, evaluations or analyses performed on the equipment to be included in those two documents.

In addition to our discussions with each of these agencies, organizations and offices within NRC, there were many other sources of information from which we derived the material utilized in our study. Most of these were connected with the preparation of the Equipment Catalog and are covered in Section II; others were utilized in the development of the effectiveness methodology guidelines and are discussed in Section V. On the other hand, there were a number of documents requested from NRC at the outset of the program that were not received for one reason or another (e.g., because of our lack of a facility security clearance, because documents were out of print, etc.). Whether or not any of our results suffered as

a consequence is, of course, unknown. In addition, there are known to be some items of equipment that are commercially available, and which may even have been installed at licensee's facilities, but that are not included in the Catalog because we were unable to obtain data from the manufacturer or vendor. These should be included by NRC or their contractors in any updated version of the Catalog produced at a later date.

The entire Catalog, Evaluation Guide and Reference Materials volumes have been typed on tape cassettes or have been computerized for ease in making corrections or additions during the editing process and in future revisions and updates. Although every attempt has been made to eliminate errors from the text some may remain. It is expected that these will be brought to the attention of NRC Research so that they can be corrected at the time of a subsequent revision. In addition, suggestions for improvements, for items or categories of equipment that should be included in the Catalog, and for new or additional evaluation procedures not covered in the Guide are welcome and will be taken into consideration.

The work involved in assembling the documentation required under this contract was of necessity limited by available time and manpower. As mentioned above, there remain other items of equipment to be included in the Catalog as well as additional categories of equipment that were not even considered because of those limitations. Further, there were many instances, particularly in the case of intrusion detection components, for which insufficient information was available from the manufacturer. The consequences of this and our recommendations for overcoming this situation are discussed in Sections II and VI of this report. More, too, can be added to the Evaluation Guide to improve its comprehensiveness and perhaps to the Guidelines for Developing Levels of Effectiveness to clarify the requirements. However, both documents are believed to be more than sufficient to serve the purpose for which they were prepared.

In summary, then, the products of this program, while their limitations are recognized, are believed to provide a significant level of improvement in the tools available to NRC to conduct their safeguards function.

SECTION II

CATALOG OF PHYSICAL PROTECTION EQUIPMENT

OVERVIEW

The Catalog of Physical Protection Equipment presents information for use in assessing the security of fixed-site licensee facilities. Each of the eight volumes in the Catalog covers one major area of physical security (e.g., barrier structures and components, sensors), and these have been further organized into sections for similar groups of equipment (e.g., locks, proximity sensors). When appropriate, a final subdivision, that of specific categories of equipment (e.g., mechanical locks, or external proximity sensors), has been made. An equipment category consists of a number of items that all possess certain similarities, such as their performance data being comparable, and items within the category may often be interchangeable. Overall, approximately 1750 items from 410 manufacturers are described in the Catalog. A detailed listing of the various Catalog subdivisions is given in Appendix I.

Data sheets are used to present the information on items of equipment in each category; they emphasize the performance data and the physical data for each item. These data provide what is considered to be the minimum information required by an NRC inspector to recognize the equipment and quickly determine its basic operational characteristics. When available, supply/logistics data and cost data are provided. A general equipment description has been included as a preface to the data sheets for each equipment category. This material is intended to provide insight into the use and operation of items in each category by describing operating principles, component parts, limitations and vulnerabilities that are generally applicable to all items in the category. It should be noted that the similar capabilities of equipment in a specific category will

enable an inspector to accommodate unlisted items of the same category that may be encountered in the field. Also, new items can be added to the appropriate category with minimal need to update the general category descriptions. Although these descriptions were not a contractual requirement, they were added by MITRE to make the Catalog more comprehensive and useful.

The list of equipment used at licensee facilities that was provided to MITRE by NRC has been correlated with the items in the Catalog, and a list indicating which of these are included is presented in Appendix II. Although some of this equipment from specific manufacturers may not be listed in the Catalog, descriptions of similar equipment produced by other manufacturers generally are contained in that document.

The entire Catalog is contained in three looseleaf notebooks to facilitate revisions and updatings, and to permit NRC inspectors to remove pertinent data sheets prior to facility visits. Volumes I and II are included in Book One, Volumes III, IV and V are in Book Two, and Volumes VI, VII and VIII are in Book Three. Each looseleaf notebook has been tab indexed to indicate volume and section. It should be pointed out that the Catalog does not represent a qualified products list, and inclusion of any item does not constitute an endorsement by either MITRE or NRC.

CATALOG USES

The information that has been provided in the Catalog is expected to be of significant value to all NRC staff concerned with safeguards at licensee facilities. It will provide a reservoir of data on the capabilities of commercially available equipment that can be used in the development of standards and Regulatory Guides on physical security. Both the general descriptions and the data sheets have specific information that can be excerpted directly for use by the Office of Standards Development in the preparation of this documentation.

The data provided will also be useful to NRC licensing personnel responsible for the review and approval of physical security plans by providing the information needed by both Nuclear Materials Safety and Safeguards and Nuclear Reactor Regulation to develop exemplary physical protection systems for purposes of comparison with those designed by the licensees or for direct use in gaining knowledge of the specific (or generic) equipment that a licensee has proposed to use in terms of its operational capabilities, limitations and vulnerabilities. To the extent that the information is available or will be included at some later time in the data sheets, licensing will have the information they need to make useful judgments on the acceptability of the physical security plans submitted to them.

Under the auspices of Nuclear Regulatory Research studies are being conducted that will lead to a methodology for determining physical security system effectiveness. One aspect of this will be the use of both generic and specific performance capabilities as an input to effectiveness models now being developed. When all or most of the performance data is available, the Catalog data sheets should serve as a valuable source of that information.

Perhaps most important of all will be the use of the Catalog by NRC inspectors in the Regional Offices. It is expected that they will utilize the data to obtain pertinent facts about equipment that must be evaluated during both preoperational and annual or routine physical security inspections at licensee facilities. This serves as a companion document to the Evaluation Guide discussed in Section III, which has been designed as a basic tool for the inspectors, and provides details on specific models of equipment.

SOURCES OF DATA

Companies that manufacture or distribute physical protection equipment were identified as a result of previous MITRE experience and through a review of advertisements and vendor guides both in Security World magazine and in electronic products guides. These companies were sent letters explaining the purpose of the Catalog

and requesting information (i.e., performance measures and operational, physical, interface, and cost data) for inclusion therein. MITRE's ability to accommodate proprietary data was also discussed in this letter. Those companies that did not respond to the first letter received a second letter again requesting information. Also, an announcement was prepared by MITRE requesting vendors to submit information similar to that asked for in our first letter, and this was placed by NRC in the Commerce Business Daily on December 10, 1976. The announcement was used as a means of ensuring that all equipment vendors and manufacturers were given the opportunity to provide data for inclusion in the Catalog. Responses were to be received at NRC by December 30, 1976.

The data sent by most companies varied widely in scope and typically did not provide all the information necessary to complete each data sheet. Therefore, telephone calls were made to many of the equipment vendors in an attempt to collect more information and to resolve any ambiguities that may have resulted from a lack of explicit data such as evaluation results that could be used to substantiate performance claims. In some cases, meetings were required to complete data sheets as fully as possible.

Project schedule requirements were such that any data received at MITRE after January 3, 1977 were not included in the Catalog. Instead, these data, which represent the responses from several dozen vendors, have been filed separately from the product data included in the Catalog so as to be readily available for inclusion in any updated documentation.

The data presented in the Catalog have been extracted from written material (advertising brochures, engineering reports, etc.) provided by the item manufacturers and/or from verbal communications held with them. Test results from independent test agencies (U. S. Army/MERADCOM, ERDA/Sandia, and commercial testing laboratories)

applicable to Catalog items have been included and footnoted where appropriate. Much of the Catalog's data has not been independently verified, and information in those instances is based solely on manufacturer's claims. It is important to emphasize that with few exceptions the data included in the Catalog is objective, not judgmental, and is based upon the information derived from these sources. Only in areas where a manufacturer's performance claims were vague or unsubstantiated were subjective judgments made as to whether to: (1) include the information; (2) state that it is based solely on the manufacturer's claims; or (3) state that either no information was available at all or that useful data concerning a particular parameter was not made available to MITRE (e.g., claims that probability of detection is "high" or false alarm rate is "low") and therefore was not included. Another exception is that of the susceptability of an item of equipment to spoofing or jamming. Since such information is not usually provided by most of the sources used, the comments made on the data sheets are based on MITRE's analysis of the design and our experience with similar equipment.

Accepted standards applicable to physical security at licensee facilities were consulted in the course of preparing the catalog. These documents included the Interim Federal Specification W-A-00450B (GSA-FSS); USNRC documents including Regulatory Guides; Underwriters Laboratory Standards; Military Standards and Specifications; American National Standards (ANSI) documents; Law Enforcement Standards Program documents; Electronic Industry Association (EIA) Standards; Factory Mutual Approval Guides, Approval Standards and Data Sheets; National Fire Protection Association publications; and Micromeasurements/Measurements Group Sheets. Other documentation used included Carnahan Conference Proceedings, articles in Consumer Reports magazine, and reports in special interest journals such as Security World magazine. Finally, a considerable

number of MITRE documents generated during other programs (e.g., the Base and Installation Security System work) formed a basis for developing this Catalog. A list of references is given in Appendix III.

In order for an item to be included in the Catalog, it must have been: (1) commercially available (i.e., completely developed and in production); (2) intended for use in a physical security system; (3) usable in an industrial or commercial environment; and (4) not intended solely for residential or hobby use. Items known to be in use at a licensee's facility, even though no longer in production, were included to the extent that MITRE was provided with the list of items and information on the items was available from vendors by January 3, 1977 (see Appendix II).

Many of the responses from vendors contained data on items not yet commercially available. The level of development ranged from conceptual to pre-production prototype (i.e., equipment that will probably be available within a few months). Although these have not been included because they do not meet the stated criteria, their status should be monitored during any effort to update the Equipment Catalog.

CRITERIA USED IN SELECTING DESCRIPTIVE PARAMETERS

Each item is characterized as fully as possible in the Catalog, using available data, by means of several parameters. One group of parameters includes performance characteristics of the item, which are intended to furnish primarily quantitative data as to how well the item can perform its intended physical protection function. These data may be used in estimating the usefulness and effectiveness of the item in a security system, and/or in developing a data base against which field performance measurements can be compared. MITRE believes that the performance parameters included on the data sheets are those most critical to the description of the item from

a physical security standpoint. Some of the more important parameters are as follows:

In Volume I, Barriers and Structural Components, the penetration times required to breach the structure or component are provided because these measures indicate how effective the item is expected to be in delaying an intruder. Volume II, Intrusion Detection Components, which is the largest volume, provides available data on probability of detection and sensitivity to indicate how well the item can perform its function of detecting an intruder. False and nuisance alarm rates are also included as an indication of the usefulness of each item in an operational environment. Since an operator would have to acknowledge each alarm and determine its cause, high false/nuisance alarm rates could seriously degrade system performance.

In Volume III, Entry Control Components, the Type II error (the probability that an unauthorized person will be admitted) is reported since it indicates the system's effectiveness in rejecting potential adversaries. Type I error (the probability that an authorized person seeking entry to a secure facility will be rejected), data on random reading errors of coded devices, and processing times are also addressed since they affect the usefulness of an entry (access) control system and the acceptability of the system to the entrants required to use it. Volume IV, Surveillance Components, provides several sets of performance parameters, depending on the section under consideration. Probability of detection of imaging systems is presented since this parameter provides a measure of how well an intruder entering the zone of surveillance will be detected. The sensitivity of video cameras indicates the minimum light level required for use. Environmental requirements for camera enclosures and mechanical requirements for camera positioning equipment indicate the variation in capabilities available from these components. Finally, the input signal formats for video

monitors and tape recorders characterize their interconnection capabilities. Volume V, Contraband Detection Components, presents data on maximum package size and minimum target size that can be accommodated by X-ray inspection equipment. Inspection rate is also given as an indication of device usefulness in the field. Probability of detection for metal and SNM detectors is presented as a measure of the effectiveness of these devices in detecting these forms of contraband, while false alarm rates for these two detectors are given as an indication of their usefulness in the field, where an operator must reconcile the cause for each alarm.

Volume VI, Automated Response Components, gives the probability of correct activation of each device as a measure of how often it will respond to the proper stimulus. False activation rate and nuisance alarm rate are presented since they indicate how often each device will disturb its environment by unintentional responses. Volume VII, General Purpose Display Components, describes parameters of the display (e.g., character height, width, and stroke dimensions; contrast ratio; luminance; etc., as applicable to each section) that the equipment operator must perceive in order to react to the information presented to him. The controls available to the operator that provide assistance in using the equipment are also described since they indicate the usefulness of the equipment in a field environment. Volume VIII, General Purpose Communication Equipment, indicates the probability of transmission error of alarm signalling systems since this parameter shows how well a system is able to communicate the correct data without errors. Data relative to transmitter and receiver design parameters of portable voice communication equipment (e.g., radiated power, sensitivity, modulation bandwidth, distortion, etc.) are also provided since these numbers offer a more useful means of quantitatively characterizing component performances than do measures of speech intelligibility.

In addition to the above performance characteristics, this group of parameters also includes, when appropriate and to the extent information is available, operational data that would be useful in determining vulnerability or susceptibility of any item to such threats as spoofing, tampering, and electro-magnetic interference, and for ensuring that the device is compatible with the intended local environment. To this end, temperature, humidity, and other meteorological data, and any interference that may be generated are addressed. Interface data is also included in varying degrees of detail.

The next group of parameters presents physical data, such as size, weight and emplacement recommendations, for each item. This is intended to assist the user in identifying each device and ensuring that it is properly installed. Physical data supplied by manufacturers is presented in both English and metric units unless the data is an ordering size (e.g., 2-inch mesh fence).

The last two groups of parameters present data useful in designing or specifying a physical security system. Logistical data, such as reliability, maintainability, and warranty information, and cost and availability data, are included in these groups.

Certain data originally planned to be provided has not been included in the Catalog. For example, esthetic consideration public acceptability and convenience, were deemed too subject to assess. Data relative to known installation was obtained in several cases, but in many others it was very difficult to obtain since much of the equipment is sold through distributors and therefore would be time-consuming to trace and of doubtful benefit. However, an area on the data sheet titled INSTALLATIONS is provided for the use of NRC. The area has been left blank so that each region may write in this area the installations within the region that use the piece of equipment described in the data sheet. This installation information would then make those particular data

sheets classified National Security Information. However, a composite could be maintained at I&E headquarters for use in comparing the operation of similar peices of equipment.

Each data sheet also has a space for an NRC Identification Number that would be used if the Commission at some time in the future should decide to assign such numbers to all or selected items of physical security equipment.

DATA PRESENTATION

Data sheets of two basic formats are used to present data on items in each category. For those items of equipment having operational uniqueness, significant variations in characteristics, or a limited number of models within its category, individual data sheets with prose descriptions are used for one or several models. Typical examples of these are presented in Figures 1 through 5. For those categories of equipment containing large numbers of items that can easily be grouped by operational techniques or that have little variation in their descriptive characteristics, data sheets with a matrix format are used (see Figures 6 through 8 for examples). The purpose in using this matrix format is to minimize the duplication of similar data that would result had an individual data sheet been used for each model. However, the user should be aware that comparisons and contrasts between items on a matrix should be carefully made, since the conditions under which each parameter has been determined may not necessarily be fixed for all items.

Certain entries in the data sheets and matrices may not be complete due to the lack of available technical information. Measurements of certain statistical parameters (e.g., probability of detection, false alarm rate, false activation and nuisance alarm rates, maintainability, and reliability) often require an extensive, and consequently expensive, formal test and evaluation

MONOSTATIC RADAR COMPONENTS

Manufacturer O Inc.
(Div.)
1 Dr.
T
( )9

Model 1 and 1

Reference Evaluation Guide Procedure No. -2 A NRC Identification No.

NARRATIVE DESCRIPTION

Model and consist of a ...ansmitter a..d doppler receiver combined into a single transceiver package. The transmitter radiates a controlled pattern of microwave energy into the protected area. This energy is reflected back to the receiver by objects in the area. When an intrusion occurs, both amplitude and frequency of reflected energy are changed. These changes are sensed by the receiver and an alarm is initiated.

PERFORMANCE DATA

Probability of Detection:	99 percent.
False Alarm Rate:	1 per month due to internal electronics.
Nuisance Alarm Rate:	Adjustable.
Sensitivity:	Information not available.
Detection Mechanism:	Doppler shift of reflected energy from a moving intruder is detected and activates an alarm.
Target Characteristics:	Information not available.
Detection Range/Area/ Volume:	Two ranges: 0 to 35ft (0 to 10.5m) length x 22ft (6.6m) width; or 35 to 70ft (10.5 to 21m) length x 45ft (13.5m) width. Has a hole in the coverage within 10ft (3m) of the unit.
Resistance to Spoofing and Tampering:	Case has tamper-proof switch. ECM causes an alarm rather than deactivation.
Indoor/Outdoor Operation:	Indoor.
Temperature:	0 to 120F (- 18 to + 50C).
Humidity:	Information not available.
Other Environmental Characteristics:	Information not available.
Radio Characteristics:	10.525GHz at 10mW. Field strength at 100ft (30m) is 100mV per m^2.
Operator Controls:	Range control, sensitivity control.
Interface:	Alarm contacts SPDT 2A at 28V dc.

PHYSICAL DATA

Size:	7¾x5¼x3¾in (20x15x9.5cm).
Weight:	4lb (1.8kg).
Power (Primary/Secondary):	115V ac, 50/60Hz at 2.5W with standby battery.
Emplacement:	Wall bracket mounting, 6 to 9ft (1.8 to 2.8m).

DATE	CATALOG VOLUME	SECTION	CATEGORY	DATA SHEET	PAGE
31 December 1976	II	2	a	10	1

Figure 1. Example of Catalog Data Sheet - Intrusion Detection

SUPPLY/LOGISTICS DATA

Documentation and Training:	Manuals are available. Training is not provided.
Parts and Repairs:	Available from manufacturer.
Reliability:	MTBF is 20,000 hours.
Maintainability:	MTTR not available.
Warranty Information:	One year, repair or replace parts including labor.
Government or Professional Standards:	UL-listed, UL spec. 639 intrusion detection devices; GSA spec. WA00045B.
Lead Time:	Off-the-shelf.

COST DATA

Unit Acquisition Cost:	$199 for transceiver with motion level indicator light and battery.
Unit Installation Cost:	1 hr. labor.
Training Cost:	Information not available.
Maintenance Cost:	Information not available.
Operation Cost:	Information not available.

NOTES

The Model replaces Model .
Some information contained in this data sheet was obtained by a telephone conversation with a company representative.

INSTALLATIONS

Figure 1. Concluded

727 227

MAGNETIC CARD SYSTEMS

Manufacturer C
2 St
C
( )8

Model Series

Reference Evaluation Guide Procedure No. III-4.A NRC Identification No.

NARRATIVE DESCRIPTION

The Series is a centrally controlled magnetic card access system. The system is comprised of a central access controller, a card reader at each access point, an optional printer and an optional void card alarm control. When a valid magnetic card is inserted into any reader, the multiplexer within the central controller scans all reader stations at remote access points. When the active reader is located, a signal is transmitted to halt the multiplexer. The controller then requests and accepts the data from that reader. When the controller determines that the card is valid, it generates a signal that is transmitted to an access control unit such as a door strike. The access control unit remains actuated as long as the valid card is held in the reader, but the multiplexer is released within one-half second to cycle to the next reader waiting to be read. Memory has capability of either 999 three-digit card numbers or 9,999 four-digit card numbers. System has capability for 10 to 30 card readers. Void cards are denied access and an alarm switch is actuated. Alarm devices are optional. Printer-display is optional.

PERFORMANCE DATA

Random Reading Error: Information not available.

Processing Time: Polling time of ½ second per reader in addition to processing time. Processing time less than ½ second.

Identification Mechanism: Encoded magnetic card is matched against both a program matrix card in each reader and the code stored in the central controller. Each card contains two separate coded portions.

Enrollment Capacity: Either 999 three-digit numbers or 9,999 four-digit numbers.

Terminal/Reader Capacity: Either up to 10 readers or up to 30 readers depending on the selected option.

Terminal/Reader Characteristics: Each card reader is similar to the series card lock. Level or zone coding is performed at the readers by changing the program matrix card. Each reader contains a PSL lock cartridge for matching against one portion of the coded card and a set of magnetic sensors to respond to the second portion of the card and to transmit the code to the central controller.

Central Display Characteristics: The central controller consists of a multiplexer, data converter, access controller and void-a-matic unit. All code numbers are valid until voided. Voiding is achieved by manually inserting a void pin in the socket corresponding to that card number in the void panel located under the lockable lid to the controller. Printer-display is optional. Test digit switches on controller to check void cards.

Resistance to Tampering and Spoofing: Immediate voiding of cards possible at central controller; anti-passback available with card readers using IN-X-IT option. No tamper switches for card readers or central controller.

Temperature: Information not available.

Humidity: Information not available.

Other Environmental Characteristics: Card readers have weatherproof housing; central controller is for indoor use.

Interface: Access control units can switch 28V dc 5A. Telephone interface Mode available to connect readers and access control units to central controller.

DATE	CATALOG VOLUME	SECTION	CATEGORY	DATA SHEET	PAGE
31 December 1976	III	4	a	2	1

Figure 2. Example of Catalog Data Sheet - Entry Control

PHYSICAL DATA

Size:	Central controller is 12¼x20x17¼in (31x51x44cm) desk mount or 10½x19x20¼in (26.5x48x51.5cm) rack mount. Card readers (approximate depending on housing) 4.5x5.3x4.75in (11.5x13.5x12cm).
Weight:	Information not available.
Power (Primary/Secondary):	No back-up power. Central controller, 117V ac, 100W. Reader, no power required. Power required for access devices (door strikes) 28V dc 5A.
Emplacement:	Central controller, desk top or rack mount. Readers have flush mount, surface mount, weather proof pole mount housing.

SUPPLY/LOGISTICS DATA

Documentation and Training:	Manuals are available. Information concerning training not available.
Parts and Repairs:	Information not available.
Reliability:	MTBF not available.
Maintainability:	MTTA not available.
Warranty Information:	Information not available.
Government or Professional Standards:	Information not available.
Lead Time:	Information not available.

COST DATA

Unit Acquisition Cost:	Coded card $1.45 to $1.90 depending on option; program matrix cards $5.50; central controller $2,866.00 to $9,444.00 depending on options; card readers $617 to $926 depending on options.
Unit Installation Cost:	Information not available.
Training Cost:	Information not available.
Maintenance Cost:	Information not available.
Operation Cost:	Information not available.

NOTES

Magnetic cards are sealed in laminated polyvinylchloride. Card size is 2.125x3.375x0.065in max. (5.4x8.6x0.17cm) Cards may be slotted, stamped, printed and have I.D. photos mounted.

Printer/display is optional. If a printer is included in the central controller, simultaneous with actuation of the access control unit the printer records:

- Time of day
- Date
- Reader station number
- Card number
- Valid or void status

Printout data is displayed visually on the front panel until the next print command.

Special card readers with IN-X-IT option (requiring separate entry and exit card readers) are available for anti-passback control.

INSTALLATIONS

III-4.a.2-2

Figure 2. Concluded

727 229

WALK-THROUGH ALL-METAL DETECTION COMPONENTS

Manufacturer I
6 Ave.
C
( )6

Model -1

Reference Evaluation Guide Procedure No. V-3.A NRC Identification No.

NARRATIVE DESCRIPTION

The Model Weapons Detector is a walk-through structure employing a detector designed to detect any metal by using pulsed magnetic fields to excite transient eddy currents in target metal objects, and to sense and process secondary signals during the ON and/or OFF time of the excitation pulses. This unit is widely used within government agencies and by major aviation and industrial corporations. Double portal, co-planar portable and battery-operated versions are available for screening personnel or non-metallic containers. Sensor coils are encapsulated in ruggedized panels with formica finish; console is constructed of heavy gauge aluminum with solid walnut end-panels.

PERFORMANCE DATA

Probability of Detection:	Detection of .22 caliber handgun with non-ferrous frame or a 2oz(57g) knife with confidence level of 95 percent or better; alarm level adjustable.
False Alarm Rate:	Information not available.
Detection/Operation Time:	Information not available.
Detection Mechanism:	Pulsed magnetic field/eddy current decay, self-balancing — field balancing not required.
Target Characteristics:	Will detect a .22 caliber handgun with non-ferrous frame or 2oz(57g) knife.
Area (Volume) of Coverage:	Defined by sensor coil emplacement.
Alarm Presentation:	Adjustable audio; red alarm lamp; green stand by/normal lamp.
Self-Test Capability:	Information not available.
Indoor/Outdoor Operation:	Indoor and outdoor within temperature limits.
Resistance to Spoofing and Tampering:	Insensitive to fixed metal objects in vicinity. Relatively insensitive to electromagnetic or electrostatic interference.
Temperature:	32 to 131F (0 to 55C).
Humidity:	Up to 95 percent.
Other Environmental Characteristics:	Information not available.
Interface:	Shielded pair cable for remote alarm devices up to 200ft(61m) from console; remote alarm contacts are provided on alarm relay and are accessible at screw terminals in the rear of the console; uses standard ac outlet.

PHYSICAL DATA

Size:	Passageway, 13½x30x77in (34x76x196cm); Overall Arch Assembly, 13½x36x79½in (34x91x202cm); Electronic Console, 12½x17½x6½in (32x44x16cm).
Weight:	Archway, 60lb (27kg); Console, 20lb (9kg).
Power (Primary/Secondary):	115/230V ac, 50/60Hz, less than 100VA; battery operation optional.
Emplacement:	Sensor panels can be relocated to suit special applications.

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Figure 3. Example of Catalog Data Sheet - Contraband Detection

SUPPLY/LOGISTICS DATA

Documentation and Training:	Installation, operation and maintenance manuals available. Training information not available.
Parts and Repairs:	PC boards and IC's are removable and available.
Reliability:	MTBF not available.
Maintainability:	MTTR not available.
Warranty Information:	One year from acceptance date in accordance to terms specified in technical documentation.
Government or Professional Standards:	Meets requirements of FAA Security Manual, Chapter 5; U.S. Bureau of Standards criteria; NILECJ Standards for security levels 1, 2 and 3.
Lead Time:	Information not available.

COST DATA

Unit Acquisition Cost:	Information not available.
Unit Installation Cost:	Information not available.
Training Cost:	Information not available.
Maintenance Cost:	Information not available.
Operation Cost:	Information not available.

NOTES

INSTALLATIONS

V-3 & 3-2

Figure 3. Concluded

AUTOMATIC DIALERS

Manufacturer A
3
A
( )2

Model D

Reference Evaluation Guide Procedure No VI-4.A NRC Identification No.

NARRATIVE DESCRIPTION

This device will automatically send (over a dedicated, pre-connected telephone line) alarm data (i.e., a message code) from up to six input channels. Each channel can service a sensor loop. The device employs a parity check technique to insure that correct messages are received; a garbled or incomplete message will be resent. This device is intended to be used with the A.

PERFORMANCE DATA

Probability of Correct Response:	High; parity check tests for complete messages. Verified quantitative data not available.
False Alarm Rate:	Low; special codes are used. Verified quantitative data not available.
Nuisance Alarm Rate:	Depends upon the design of the external sensor loop. Verified quantitative data not available.
Sensitivity:	Information not available.
Response Mechanism:	Switch-activation causes message to be sent over dedicated line to receiver, which sounds audible alarm and provides printout of alarm condition.
Coverage—Range/Area/Volume:	Depends upon the design of the external sensor loop.
Response Duration:	Typically 10 seconds.
Response Delay:	Minimal; dedicated line used.
Resistance to Spoofing and Tampering:	Depends upon the design of the external sensor loop. Enclosures should be equipped with tamper alarms. Telephone line could be cut.
Indoor/Outdoor Operation:	Indoor only.
Temperature:	Information not available.
Humidity:	Information not available.
Other Environmental Characteristics:	Information not available.
Interface:	Normally-open (N.O.) contacts (up to six channels) for interface with sensor alarm circuitry. Direct-couple (or through coupler) to telephone line for interface with communication links.

PHYSICAL DATA

Size:	15¼x11¼x4¼in (39x29x11cm).
Weight:	9lb (4.1kg).
Construction:	Locking steel cabinet.
Power (Primary/Secondary):	12V ac self-contained batteries for up to 100 hours of standby.
Emplacement:	Wall mount.

DATE	CATALOG VOLUME	SECTION	CATEGORY	DATA SHEET	PAGE
31 December 1976	VI	4	a	2	1

Figure 4. Example of Catalog Data Sheet - Automated Response

SUPPLY/LOGISTICS DATA

Documentation and Training:	Manuals are available. No special training requirements.
Parts and Repairs:	Commercially available.
Reliability:	MTBF not available.
Maintainability:	MTTR not available.
Warranty Information:	One year warranty.
Government or Professional Standards:	Telephone line compatible.
Lead Time:	Variable (typically off-the-shelf).

COST DATA

Unit Acquisition Cost:	$170 each ($155 for 10, up); $1,500 for Central Station Receiver.
Unit Installation Cost:	Under $50.
Training Cost:	None.
Maintenance Cost:	Negligible.
Operation Cost:	Information not available.

NOTES

Options: Multiple message, Auto re-dial, Line seizure, Anti-jam, Listen-in.

INSTALLATIONS

VI-4.a.2-2

Figure 4. Concluded

727 233

TRANSILLUMINATED DISPLAYS

Manufacturer H
5 Ave.
D
( )7

Model 9

Reference Evaluation Guide Procedure No. VII-3.A NRC Identification No.

NARRATIVE DESCRIPTION

This is a small display which operates from dc power and is designed to monitor up to ten unattended detectors or processes. A two-position slide switch for each sensor selects either normally open or normally closed field contact operation. A panel light is lighted whenever any channel goes into the alarm state.

PERFORMANCE DATA

Legibility: ⅛in (0.3cm) characters.
Indicator Visibility: Nameplates are next to 24V incandescent lamps.
Response Time of Display: As fast as an incandescent lamp can respond.
Display Mechanism: Incandescent lamps.
Capacity: 10 inputs.
Illumination Requirements: Room ambient.
Display Controls: 10 access/secure switches; 1 Acknowledge; 1 Power On.
Resistance to Spoofing and Tampering: None.
Temperature: 0 to 140F (-15 to +60C) operating; 30 to 150F (-35 to +65C) storage.
Humidity: Information not available.
Other Environmental Characteristics: Information not available.
Interface: Switch closures N.O. or N.C.

PHYSICAL DATA

Size: 5¼x8¼x8in (13x21.5x30cm).
Weight: 5lb (2.3kg).
Power (Primary/Secondary): 125V dc or 48V dc; current approximately 750mA.
Emplacement: Desk-top.

SUPPLY/LOGISTICS DATA

Documentation and Training: Manuals are supplied; training is not required.
Parts and Repairs: Return to factory.
Reliability: Limited by derated lamp bulbs. At least 10,000 hours.
Maintainability: MTTR not available.
Warranty Information: One year, parts and labor.
Government or Professional Standards: None.
Lead Time: 60 to 90 days.

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Figure 5. Example of Catalog Matrix Data Sheet - Displays

COST DATA

Unit Acquisition Cost:	$840.
Unit Installation Cost:	Nil.
Training Cost:	None.
Maintenance Cost:	$5. per year.
Operation Cost:	Information not available.

NOTES

INSTALLATIONS

VII-3.b.2-2

Figure 5. Concluded

HINGES

Manufacturer	L S ( )6	L S ( )6	H 1 Blvd. S ( )4
Model	C Hinge	E	C H.
Evaluation Guide Procedure I-2 A	NRC Identification No.		

PERFORMANCE DATA

Penetration Characteristics/Resistance to Tampering	Mortise-type, used to transmit low voltage electrical current to locksets, deadlock electric strikes; available only with the Maximum Security Pin series hinge; concealed wiring prevents tampering	Mortise-type, used to transmit a signal to a monitoring station that door is open, closed, or to activate an alarm; regularly furnished with the non-removable pin and bottom plug	Mortise type, used to transmit low voltage electrical current to locksets, deadlock, electric strikes; does not expose any evidence that door is electrically controlled

PHYSICAL DATA

Size	4½, 5in (11.5, 12.5cm) full mortise ball-bearing hinge	4, 4½, 5in (10, 11.5, 12.5cm) full mortise ball-bearing hinge	4, 4½, 5in (10, 11.5, 12.5cm)
Hinge Leaves Base Metal	Steel, plated, solid brass or bronze	Steel, plated, solid brass or bronze	Non-ferrous, stainless steel
Pins	Stainless steel, 18-8	Stainless steel, 18-8	Information not available

ELECTRICAL DATA

Switching Arrangement	Not applicable	SPDT or DPDT	Not applicable
Switch Rating	Information not available	5A at 125V ac (low voltage recommended, 48V maximum)	1A at 6-12-24V ac or dc

SUPPLY/LOGISTICS DATA

Reliability	Information not available	Information not available	Information not available
Warranty	Information not available	Information not available	Information not available
Government or Professional Standards	Information not available	Information not available	UL-listed
Lead Time	4 to 6 weeks	4 to 6 weeks	Information not available

DATE	CATALOG VOLUME	SECTION	CATEGORY	DATA SHEET	PAGE
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Figure 6. Example of Catalog Matrix Data Sheet - Barriers

COST DATA			
Unit Acquisition Cost	Information not available	Information not available	Information not available
Unit Installation Cost	$20 above cost of hinge	$20 to $50 above cost of hinge	Information not available

NOTES

INSTALLATIONS

12a2:2

Figure 6. Concluded

CAMERAS WITH STANDARD VIDICONS

Manufacturer	J. 6 L ( )6	J Circle Corp. 2 Rd. H ( )6	P M C One S ( )3
Model	M E	T	W W

Evaluation Guide Procedure IV-2.A NRC Identification No.

PERFORMANCE DATA

Sensitivity			
10 Gray Scale	1.0fc (10lm/m²)	0.3fc (3lm/m²)	0.3fc (3lm/m²)
Usable Picture	Information not available	0.06fc (0.6lm/m²)	Information not available
Signal Transfer Distance	Information not available	Information not available	Information not available
Scan Format	See notes	Information not available	200P: 2:1 Random 240P: 2:1 Random/ external
Scan Fail Protection	Information not available	Information not available	Information not available
Automatic Gain Control	10,000:1	8,000:1	5,000:1
Automatic Iris	Optional	NO	NO
Remote Control Provision	NO	NO	NO
Controls/Control Unit	On rear panel, Target, Focus, Beam	Self-contained/Ext. Beam, Target, Mechanical Focus, Focus	Self-contained/controls are Internal, Manual, Light Control switch
Temperature	15 to +120F (-10 to +50C)	-15 to +120F (-10 to +50C) Indoor	-15 to +120F (-10 to +50C) Indoor
Humidity	Information not available	Information not available	Information not available

PHYSICAL DATA

Camera Tube	8844	Any standard 2/3 Sep. Mesh EL. MAG. VID.	20 PE-13A or 8844
Lens Mount	"C"	"C"	"C"
Lens Provided	Information not available	f/1.6, 16mm	f/1.6, 16mm
Weight	5.5lb (2.5kg)	3.5lb (1.6kg)	4.4lb (2.0kg)
Size H	3.2in (8cm)	2.8in (7cm)	5.6in (14cm)
W	4.3in (11cm)	4.5in (11.5cm)	3.7in (9.4cm)
L	10.0in (25cm)	9.5in (24cm)	10.3 (26cm)
Output Connector	UHF	BNC	BNC
Input Voltage	24V ac	120V ac	117V ac
Input Power	18W	14W	8W

COST DATA

Price	$433 $379	$347	Information not available

Figure 7. Example of Catalog Matrix Data Sheet - Surveillance

NOTES

Scan format-2:1 Self-contained Crystal-controlled sync : Scan format-2:1 random, 2:1, external E1A standard switch for internal or external sync

Model for 24V ac input. Self contained

INSTALLATIONS

IV-2.a.1-36

Figure 7. Concluded

UHF PORTABLE VOICE COMMUNICATIONS

Manufacturer	A P.O. Box R ( )8	A P.O. Box R ( )8	E 2 Ave. W ( )8
Model	T	P	F

Evaluation Guide Procedure VIII-2.A NRC Identification No.

NARRATIVE DESCRIPTION

Personal portable radio is all solid state and utilizes dual phase locked loop circuitry to automatically track the other transmitter for system stability. Available with or without tone squelch. Utilizes plug-in circuit modules.	P is a fully solid state modular FM portable radio, employing plug-in circuit modules. 3 models available with different RF power output.	The F incorporate all solid state construction and dual phase locked loop to keep receiver on frequency when station drifts. Meets EIA standards RS-152-A and RS-204 for vibration and shock.

PERFORMANCE DATA

Receiver			
Modulation Accep.	±7.5kHz	±5kHz	±7.5kHz
Sens. (20dB Quiet	0.5μV/0.35μV sinad	0.5μV/0.35μV sinad	.5μV/.35μV sinad
Select. (EIA Sinad)	>70dB	70dB	>70dB
Intermodulation	>60dB	60dB	>60dB
Spur/Image Reject	>60dB min/>40dB min	60dB/60dB	>60dB
Freq. Stability	±0.0002%	±0.0008%	±0.0005%
Squelch Sens.	0.25μV	0.25μV	0.25μV
Audio Output (5% Dist)	600mW at 8% dist.	600mW at 8% dist.	600mW at 8% dist.
Multi-freq. Spread	———	3.0MHz	1MHz
Transmitter			
RF output	2W/ 4W	Adjustable on all models Models — 0.2 to 0.4W — 1.0 to 2.0W — 2.0 to 4.0W	— 2W — 4W
Modulation	±5kHz		±5kHz for 100% at 1kHz
Emission	16F3	16F3	20F3
Spur emissions	>46dB below carrier	46dB below carrier	46dB (2W) – 49dB (4W)
Harmonics	>46dB below carrier	46dB below carrier	46dB (2W) – 49dB (4W)
Hum & Noise		50dB	
Freq. Stability	±0.0005% (30 to 60C)	±0.0005%	±0.0005%
Audio Distortion	<5% at 1000Hz	5% at 1000Hz	5%
Audio Response	Within +1 to –3dB of EIA	Within +1 to –3dB of EIA	———
Chan. Spread	———	———	5MHz

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Figure 8. Example of Catalog Matrix Data Sheet - Communications

General			
Frequency Range	450 to 512 MHz	450 to 700 MHz	450 to 512 MHz
No. of Channels	Up to 6 channels	Up to 6 channels	Up to 6 channels
Channel Spread	———	6.0MHz	———
Channel Spacing	———	———	———
RF Impedance	———	———	———
	PHYSICAL DATA		
Size	6.8x2.58x1.5in (17x6.6x3.8cm)	6.8x2.58x1.5in (17x6.6x3.8cm)	6.8x2.6x1.5in (17x6.6x3.8cm)
Weight	21oz (0.6kg) w/battery	22oz (0.6kg) w/battery	21oz (0.6kg) w/battery
Temperature	−21 to +140F (−30 to +60C)	−21 to +140F (−30 to +60C)	−21 to +140F (−30 to +60C)
Controls	ON-OFF, VOL, SQUELCH	ON-OFF, VOL, SQUELCH PUSH-TO-TALK	
Battery/Life Cycle	12.5V dc/8hr; 10% tr-10% rec	12.5V dc/Std: 8hr; heavy duty: 11hr; alkalaine: 35hr; 10% tr-10% rec (2W); 5% tr-5% rec (4W)	12.6V dc/8hr 10% tr-10%rec
	LOGISTICS/SUPLY DATA		
Documentation	Oper., maint. & install.	Oper., maint. & install.	Units sold thru dealers Oper., maint. & install. available
Parts & Repairs	Change modules		
Reliability	MTFB not available	MTFB not available	MTFB not available
Maintainability	MTTR not available	MTTR not available	MTTR not available
Warranty	90 day equip.; 1 year spec. parts	90 day equip.; 1 year spec. parts	1 year parts & labor
Lead Time	8 weeks	8 weeks	3 to 9 weeks, depends on crystal availability
FCC Certification	Rules 21, 89, 91 & 93	Rules 21, 89, 91, 93 & 95A	Rules 15, 21, 89, 91 & 93
	COST DATA		
Price	$671	, $786	6ch, $1071; w/6 ch, $1186
	NOTES		
Options	Battery chargers complete line for 2, 4, 8, 12 units, external spkr & mike		Numerous accessories and options
	INSTALLATIONS		

VIII-2.a.1-2

Figure 8. Concluded

program, which the vendor may not want to fund since it may hurt profits and not necessarily increase sales. In some cases a manufacturer may present a number for a performance measure, yet fail to give any test conditions under which the number was obtained, and so substantiation of the number is not possible. On occasion, a knowledgeable and/or cooperative person with relevant specific data could not be located at a vendor's facility, although this was usually a problem only with questions relative to price data. At other times a manufacturer was unwilling to release certain data to MITRE, specifically performance measures, in spite of the assurance that any proprietary information would be safeguarded and controlled in an appropriate manner. Although among military-oriented firms, MITRE's reputation for its ability to have access to proprietary data without fear of compromise is well known, not all of the vast commercial physical security equipment manufacturing community has been as cooperative in this regard. Finally, price, availability, and, to some extent, warranty data are functions of the site-specific installation. In a number of cases, data in the Catalog for these parameters should be considered as approximations only and not necessarily the final information to be used to obtain complete and precise security system costs.

The detail with which information on various items of equipment has been presented in the Catalog often varies considerably. This, of course, is primarily a function of the data made available to us from the several sources cited earlier. Even items for which minimal data was available were included in the Catalog at this time with the expectation that future updated versions of that document would provide expanded information.

RECOMMENDATIONS

There is a definite need to maintain the Catalog and to keep

it current in terms of new information on already included items. In addition, a program of standardized testing should be initiated to include those items known to be used at NRC-licensed facilities and those that have a high probability of being used in the future. This test program would provide performance data not now available and would validate manufacturer-supplied performance data. A more extensive discussion of recommendations is presented in the last section of this report.

SECTION III

GUIDE FOR THE EVALUATION OF PHYSICAL PROTECTION EQUIPMENT

OVERVIEW

The Evaluation Guide presents information for use by NRC inspectors in assessing, during both preoperational and operational inspection visits to licensee facilities, that the physical protection equipment has been installed properly, is operating properly and is being maintained in good condition. An important benefit will be the standardization of equipment evaluation techniques for all of the NRC Regional Offices.

The overall format of the Guide is identical to that of the Catalog in order to facilitate reference between the two documents. In general, separate evaluation procedures are provided for each category (generic type) of equipment contained in the Catalog unless the inclusion of a separate procedure would have resulted in unnecessary repetition. For example, in Volume III separate procedures are provided for Card Locks and Code Combination Locks while no procedure is provided for integral Code Combination and Card Lock Devices since the evaluation methodology can be extracted from the first two procedures. Because the Guide is written on a generic device basis, the procedures should be applicable, with few exceptions, to new equipment having similar principles of operation. The Evaluation Guide contains 62 procedures, a detailed listing of which is presented in Appendix IV.

Each evaluation procedure in the Guide lists first the Equipment Catalog reference information stating the category or categories of equipment for which the procedure is suitable. It then presents in one column the performance characteristic and measurement procedure to be used for that characteristic, and in the second column it presents the appropriate test equipment or documentation required for that procedure.

The procedures contain methodology suitable for both preoperational and operational inspections. In preoperational inspections, primary emphasis is placed on the evaluation of the installation of the equipment and the verification of certain appropriate performance parameters (such as sensitivity and area of coverage). Quantitative measurements are stressed in the preoperational inspection, and the data obtained are intended to become a reference base for comparison with future measurements. In operational inspections, emphasis is placed on demonstrations of system performance (typically by means of a subset of the procedures for the preoperational inspection) as well as on an evaluation of equipment performance for the period of time since the last inspection, usually by means of a review of security alarm data, maintenance records, etc. Quantitative measurements may be required on a sample basis for comparison with the ones taken previously. The Guide is structured in such a way that the inspector can choose among the techniques provided in order to satisfy time and manpower constraints.

As a further aid to the inspector, a general description of the equipment (similar to or identical to the one in the Catalog) precedes each section of the Guide. This information will provide further insight into the operation, limitations and vulnerabilities of the equipment to help put the evaluation procedures in proper perspective. These are repeated in the Guide in order to make that document more comprehensive, and to reduce the need for cross-reference to the Catalog.

It must be emphasized that, inasmuch as most of the equipment has never been formally evaluated or tested by an independent agency, it might not be possible to correlate the manufacturer's claimed performance with the data generated by the inspector in the field. Furthermore, MITRE did not have an opportunity to evaluate the equipment using these procedures as part of this program, and therefore many of the procedures require verification in the field.

The entire Evaluation Guide is contained in a looseleaf notebook to facilitate revisions, updating and the removal by NRC inspectors of pertinent procedures prior to facility visits. Each procedure is numbered independently in a manner similar to that in the Catalog. Each volume and section are tab-indexed, and dividers are employed to separate the individual procedures within each section.

GUIDE USES

The evaluation techniques provided in the Guide are expected to be of significant value in standardizing and upgrading safeguards equipment inspections throughout the NRC Regional Offices. In MITRE's discussions with NRC inspectors in the field, evaluation standardization was expressed as a primary concern. Much of this concern was based on the nonhomogeneity in the inspectors' backgrounds. While in general the inspectors have had only a little experience in engineering/science related areas, most have extensive knowledge in the area of law enforcement. Therefore they may tend to place more emphasis on the evaluation of operational procedures than on equipment evaluations beyond the level of simple demonstrations.

The Guide should be of use to NMSS and NRR in their evaluation of physical security plans since many problems of a site-specific nature which could adversely affect equipment performance and have an impact on the suitability of the equipment for the intended application, are addressed in the Guide. It may also be useful in developing more comprehensive acceptance criteria for these physical security plans.

In addition to its use by NRC personnel responsible for facility inspections and review/approval of physical security plans, it is expected that the Evaluation Guide will be useful in developing a quantitative performance data base which can be drawn upon for inputs

to fixed-site physical protection system effectiveness models now being developed (see Section V).

EVALUATION METHODOLOGY

The Evaluation Guide has been written with the current NRC facility inspection practices and inspectors' problems in mind to ensure that it can be used effectively by them. For example, it was recognized that time and manpower constraints, type of facility (power reactor, research reactor, fuel facility) and type of inspection (preoperational, operational) all have a direct bearing on how detailed an inspection can be. Another constraint will be the technical expertise of the inspector. The procedures therefore have been made comprehensive enough to enable the inspector to perform a credible evaluation of the physical protection system and yet permit him to tailor the evaluation to meet the overall objectives of the inspection visit within any time and manpower constraints. A fundamental concept for the procedures is that they establish the fact that the equipment is operational; they do not require an inspector to engage in troubleshooting activity which is clearly the responsibility of the licensee.

The techniques presented in the Guide are:

Inspection -	Visual checks of system and component installation and direct verification of performance characteristics which determine the suitability of the equipment for the job it must perform.
Analyses -	Review of applicable system and component maintenance and test data, experience data, mathematical or physical models, etc.
Demonstrations -	Verification of proper operation or adjustment of the system or equipment against a qualitative standard.

Tests - Examinations and trials which yield emperical or quantitative data indicative of the overall performance capabilities of the equipment. Where possible, standardized test aids and test equipment are recommended for use.

Inspectors in the NRC Regions currently conduct a combination of inspections, analyses and demonstrations. However, only a limited number of standard tests as defined above are currently performed (e.g., limited quantitative assessment of line supervision capabilities and measurement of perimeter illumination values).

Complicated step by step procedures were included in the Guide only when absolutely necessary. In several cases where tests are required to generate quantitative data, the procedures are presented in what is believed to be sufficient detail to produce the required results with the suggested test equipment. The Evaluation Guide together with the Equipment Catalog should enable an inspector to acquire sufficient information to enable him to:

1) Determine that the equipment employed by the licensee is in compliance with the approved physical security plan, letters of commitment from the licensee, the applicable portions of the Code of Federal Regulations (10 CFR 73.50 and 73.55), the NRC Regulatory Guides, and to a limited extent, requirements of the Interim Federal Specification W-A-00450B (GSA-FSS) when applicable.

2) Substantiate any of his claims that the equipment is not in compliance when deficiencies are found.

3) Determine that the physical protection equipment is operational and performs the functions called for in the physical security plan.

The level of detail of the evaluation procedures was determined by these three criteria.

During a preoperational inspection, it is envisioned that the evaluation procedures will be employed in detail to evaluate the equipment. Special emphasis will be placed on inspection of system

installation and demonstration of system capabilities through the performance of quantitative tests. The emperical data collected during the preoperational visit will provide a base-line that can be compared with performance observed and data obtained later during operational inspection visits so that a determination may be made as to whether or not the equipment has been properly maintained. It is expected that less comprehensive techniques may be performed during operational inspection visits to verify system performance and check for system/component degradation. As is the current practice, it is envisioned that the appropriate operational procedures called for in the Evaluation Guide, as they relate to a specific site, would be performed over several visits during the annual inspection cycle.

Many of the devices employed in a physical protection system are characterized by such performance parameters as probability of detection, false/nuisance alarm rate, etc. In general, it would not be feasible to conduct in the field the number of repeated trials required to verify the manufacturer's claims, if any, for these parameters. In such a situation, the Evaluation Guide contains a method of measurement that will establish, for example, device sensitivity through the use of standard test targets or stimuli, its area or volume of coverage through the use of appropriate measurement equipment, etc. These data will provide an indication of the device's overall detection capabilities and a quantitative basis for comparison with performance data acquired during succeeding evaluations. When repeated tests and/or random testing of sensors is required, appropriate guidance is provided along with a rationale for interpreting the results of such tests.

In order to measure a given performance parameter for a particular device, the use of special test equipment (meters, probes, etc.) and/or test aids (standard test targets, etc.) might be called for in the Evaluation Guide. Instructions are then given as to when and

where the measurements are to be made. In several cases appropriate test equipment is either not available, too complicated to use or too expensive. In this event, special test devices are recommended that may require development (either modification of existing equipment or a new design). The equipment descriptions provided in the Guide are believed to be sufficient to indicate the general nature of these devices. It is also suggested that test programs be established to verify the test procedures which employ these developmental items. The concepts for the design of the developmental items was guided by the experience of MITRE staff personnel who have performed a large number of field tests of similar complexity and nature in the past. Later in this section, recommendations are made for a program of research and development to produce the needed, noncommercially available test equipment and aids.

Although it is recognized that many of the inspectors do not have extensive technical backgrounds, in writing the Evaluation Guide it was assumed that the NRC inspectors could be given any technical training necessary to complete the evaluations called for, including instructions on how to use any of the test equipment. This training would emphasize "hands-on" experience for the use of any special test equipment and for following the evaluation methods prescribed for various types of equipment. (In our visits to the NRC Regional Offices, "hands-on training" was often suggested by the inspectors.) A benefit of the evaluation format selected is that technical expertise will generally be required only in the performance of certain tests, while the inspectors should be able to perform many of the tests and most inspections, analyses and demonstrations with their current backgrounds, training and experience. As the inspectors acquire additional technical training, they should be able to employ the more sophisticated test techniques and continually upgrade the inspection process.

SOURCES OF DATA

The specific evaluation methodology for each category of equipment was prepared, in most cases, by MITRE personnel who have had prior experience in dealing with similar devices, or devices which operate under similar principles. This experience was supplemented with the results of independent evaluation studies whenever available (for example, those provided by the U. S. Army MERADCOM, Department of Transportation / Transportation Systems Center (TSC), Sandia Laboratories (Albuquerque), Factory Mutual Research and the Los Alamos Scientific Laboratories (LASL)). In addition, accepted professional/government standards and standard test procedures, applicable to the physical protection equipment contained in the Catalog, were consulted in the course of preparing the Evaluation Guide. These documents have been listed earlier in Section II.

RATIONALE FOR THE SELECTION OF EQUIPMENT PARAMETERS

The rationale for selection of parameters for the equipment evaluation procedures was governed by four considerations:

1) Equipment performance has to be examined as thoroughly as possible to ensure compliance with original system design specifications which were intended to provide a defined level of physical protection.

2) The system itself has to be inspected to ensure that it is properly maintained and serviced by qualified people at the required intervals.

3) The system must be verified to be resistant to various adversary countermeasures and sources of interference. For example, in spite of proper original installation, the system may have been tampered with resulting in either temporary or permanent performance degradation. Special emphasis has been given to procedures to identify vulnerability to tampering or outright sabotage.

4) The system evaluation must be performed with a minimum of test equipment and without dismantling portions of the system or causing major disruption of the security procedures. At the same time the evaluation must be sufficiently detailed to produce clear and valid results.

In the following paragraphs the selection of some of the specific parameters and associated evaluation techniques are discussed.

In Volume I, Barriers and Structural Components, it was difficult to adopt a standard set of parameters throughout because of the unique nature and characteristics of the components contained in each section. The recommended evaluation methods and procedures for barrier and structural components are heavily concentrated in visual inspection activities since there are few opportunities for significant analysis, demonstration, or formal nondestructive testing (except, for example, in the case of locks). One reason for this is the obvious constraint upon use of test or demonstration procedures that could destroy or degrade the integrity of the item being evaluated. The need for nondestructive evaluation procedures has been assumed.

For some materials and components addressed in this volume, destructive testing under controlled conditions has already been accomplished independently. For example, fire and burglary resistant vault door products and locks have been tested and rated, based upon their design and construction characteristics, by Underwriters Laboratories or similar rating agencies. Ratings of bullet resistant glazing materials have also been established through controlled test programs conducted using procedures developed by Underwriters Laboratories and the U. S. Army. Similarly, the critical characteristics of break resistant glazing materials and the aging characteristics of fencing materials when exposed to extreme environmental conditions, have been tested and qualified to meet industry-sponsored, federal, and/or military specifications

and standards.

Another category of components, which many times represent the weakest points of the barrier protection provided, are mechanical locks, switch locks, gate operators and similar devices. The requirements for very careful inspection of these devices, including a determination of whether or not their function can be bypassed by tampering and spoofing, are called out with special emphasis in this volume.

Volume II, Intrusion Detection Components, contains evaluation procedures for devices that have much in common (i.e., an intruder causes a physical change in the specific local environment which activates an alarm). Therefore, the set of parameters selected for evaluation were more standardized than for Volume I. This set includes installation related parameters, sensitivity/area of coverage, false/nuisance alarm rates, spoofing and tampering, maintenance related parameters, environmental requirements and power system checks if appropriate.

For active devices which emit a beam or create a field in its vicinity, quantitative measurement of the value of the field strength at various locations in the area of coverage, beam divergence, beam modulation, etc. are usually required since relatively small changes in these parameters (e.g., due to accidental or purposeful misalignment, component degradation, changes in system or area configuration) can have a great influence on the performance of the system. For passive sensors which monitor existing or ambient local conditions, emphasis has been placed on determining the sensitivity of the device to a minimum stimulus as well as the range over which the device is sensitive to a standard stimulus and/or a human intruder employing various methods of approach For both active and passive sensors, verification of the ability of the device to detect a human intruder is included.

In Volume III, Entry Control Components, emphasis is placed on the evaluation of system operation. Also included are procedures for the evaluation of installation parameters, maintenance, spoofing and tampering, and the power system. The procedures focus primarily upon the equipment itself and not on the operating/administrative procedures adopted by the licensee. It must be recognized by the inspector, however, that how the equipment is used is just as important as what type of equipment is used.

Volume IV, Surveillance Components, provides evaluation procedures for sophisticated electronic devices and systems (thermal imaging and television imaging devices and systems). Due to the complexity of these devices, and the need for a great deal of technical expertise and laboratory conditions for component evaluation, system performance checks are emphasized. Within this framework, the evaluation procedures were designed to obtain relevant results as quickly and completely as possible using the smallest amount of electronic test equipment believed reasonable.

The types of evaluations necessary for thermal imaging and closed circuit TV are identical in most cases. Inspection of components for signs of proper maintenance is often required. Whenever devices can be operated or adjusted in different ways, procedures are included to verify that the present configuration has the same capabilities as that found in the original preoperational inspection. Also included are evaluation of susceptibility to interference, maintenance procedures, environmental requirements, power system, and safety.

Volume V contains evaluation procedures for Contraband Detection Components. Detailed written procedures are included only for portable and walk-through explosives detectors and for X-ray inspection equipment. The evaluation procedures for ferrous metal and all-metal detectors are being prepared by the U. S. Army MERADCOM under a separate NRC contract; SNM detector evaluation procedures

are being prepared by LASL. The procedures generated by these agencies are referenced in the Evaluation Guide, and no separate procedures were prepared in order to avoid duplication of effort.

Contraband detectors are generally sophisticated devices and have received a lot of attention as a result of their extensive use for airport security applications. Therefore, many of the devices have been tested and/or approved by, for example, the FAA, ERDA, DOT, etc., and in some cases formal performance standards exist. The Evaluation Guide emphasizes the operation of the devices and their ability to detect a minimum amount of contraband material. It is expected that there will exist at the facility minimum target test devices/samples which can be used by NRC inspectors in their evaluations since the licensee must test the performance of the detectors periodically.

Automated Response Components are evaluated in Volume VI. The verification of proper operation of those devices and their susceptibility to spoofing and tampering and power requirements are also evaluated.

In Volume VII, General Purpose Display Components, the evaluation procedures draw heavily on the requirements contained in MIL-STD-1472B (Human Engineering Design Criteria). Measurement/evaluation of such characteristics as legibility, contrast, and effectiveness of the display are considered. Procedures are also provided for the evaluation of noise levels (for printers), maintenance procedure suitability, and control functions.

General Purpose Communications Components are evaluated in Volume VIII. As in the case of other sophisticated equipment system level checks of alarm signalling systems are preferred over individual component performance checks since the more detailed the evaluation becomes, the more special test equipment is required and the more technical expertise is required of the inspector. Methods of evaluating line supervision circuits in alarm signalling

systems are provided, however. In the case of portable voice communications equipment, special performance tests are outlined to enable the inspector to ensure that the licensee is capable of properly maintaining the equipment and that radio frequency interference is eliminated.

MEASUREMENT EQUIPMENT

Many of the evaluation procedures call for the use of measurement equipment to obtain quantitative data. A list of the commercially available equipment included in the Evaluation Guide is provided in Table I. A typical device is often listed by manufacturer and model as an example of equipment whose characteristics would be suitable for the procedure with which it is connected. However, other equipment having similar characteristics can usually be used. In many cases the Evaluation Guide calls for the use of records and test equipment that are maintained by the licensee; these are also listed in Table I. If such records and equipment are not currently kept, the licensee should be encouraged to do so in order to facilitate the evaluation. For many of the procedures, manufacturer's documentation should be available at the licensee's facility. The inspector may also wish, however, to obtain a copy of the available documents for the more sophisticated equipment to increase his familiarity with its installation, operation and maintenance.

As discussed earlier in this section, suitable test equipment or standard test aids are not always commercially available. When this is the case, a description of the required equipment is provided in the Evaluation Guide beside the portion of the procedure in which it is used. A summary of all the recommendations for test equipment and test aid development is presented in Appendix V. For convenience, the equipment is listed under the evaluation procedure in which it is to be used.

TABLE I

Measurement Equipment/Test Aids

Commercially Available Equipment

Hand calculator - such as Texas Instruments SR-52

Camera, such as Polaroid with close-up lens set

Walkie-Talkie, such as Federal Signal Corporation Model HVP45 (two each per inspection team)

Stop watch timer

Lock picking tools

Glass cutter

Pocket knife

Credit card

Clip leads;12 in (30 cm)

Capacitors: 820 pf, 22 pf

Multimeter such as Simpson Model 260

Decade resistance box (six decades, 10 MΩ maximum)

Portable battery operated oscilloscope such as Tektronix Model 323 with oscilloscope camera

Field strength meter such as Singer Model NM-67

Frequency counter such as Hewlett Packard Model 5340A

Electronic counter such as Hewlett Packard Model 5245L

Frequency counter such as Hewlett Packard Model 5383A

Distortion analyzer such as Hewlett Packard Model 332A

Communications monitor such as Cushman Model CE-6A, Lampkin Model 107C or Motorola Model 1200A

TABLE I (Cont'd)

Ultrasonic signal strength meter/analyzer such as Microphone #4133, Preamp #2619, Meter #2209, Analyzer #2010, and Filter #1616 from B&K Instruments, Cleveland, OH

Sound level meter such as General Radic Model 1565-A

Magnetic field strength meter such as RFL Model 505, Walker Model MG-2A or F. W. Bell Model 600 (with transverse probe)

Photometer such as United Detector Technology, Model 40X with photometric and radiometric filters and cosine corrected foot-candle diffuser

Spot meter such as Photo Research Model UBD-1/4°

Neutral Density filters (for near infrared) circular, 4 in (10 cm) diameter with density values 1.0, 2.0 and 3.0

X-ray gray scale test chart such as Philips Electronic Instruments, Inc. (Catalog No. 650-903-01)

Faceplate illumination calculator (available from PRODSEC Division of General Electric Co.)

Field of view nomograph for CCTV lenses as described in manufacturer's Application Note 205 and Tech Note 245 (available from VICON Industries)

Automatic dialer verification instrument such as Bodine Model VF-400

Ultraviolet light gun (Pyrotector, Inc.)

Flame source (e.g., flammable liquid, wick, or punk-stick)

Quick freeze aerosol such as G.C. Electronics Catalog No. 8668

Electronegative gas (such as Freon or SF_6)

Dynamite stick, 40 percent, 1/2 lb (250g)

Measuring tape, steel--at least 20 ft (6m) long

Ruler, steel--6 in (15 cm)

Drafting compass

TABLE I (Cont'd)

Protractor

Vernier calipers

Inside/outside calipers

Micrometer

Feeler gauge set

Machinists deflection gauge

Wire gauge measuring tool

Depth gauge

Paint depth gauge

Comparator such as Edmund Scientific Company (Catalog No. 41055)

Reticule such as Edmund Scientific Company (Catalog No. 30539)

Wire tension gauge such as Defender Industries MARK II or spring force scale (to 75 lb/35 kg)

Contact pressure meter such as Ademco Model 35

Flat blade screwdriver

Philips head screwdriver

Allen wrench set

Wedge

Pry bar

Screw type jack

Torque wrench

Hacksaw blade

Machinists hammer

Calibration test hammer such as United Security Model 709

TABLE I (Cont'd)

Small magnetic compass

Small bar magnet

Water spray bottle

Rubber boots

Heavy glove (rubber, of the type used to handle chemicals)

Plexiglass rod, 1/2 in (1.25 cm) diameter by 3 ft (1m)

Opaque cardboard cards (6 each), 12 in (30 cm) and 6 in (15 cm) square

Glass squares 3 x 3 x 1/16 in (76 x 76 x 1.5 mm)

Aluminum block 3 x 3 x 1/4 in (76 x 76 x 6.3 mm)

Weight set, 10 lb (4.5 kg), 10 each; 80 lb (36 kg), 1 each; 2.2 lb (1 kg), 1 each

Licensee/Manufacturer Supplied Items

Licensee:

Walkie-Talkie

Hand tools

High impedance headset (earphones)--for testing alarm signalling equipment

Explosives samples

Metal test samples--for metal detectors

Construction materials

Keys (master keys, etc.)--for testing locks

Coded cards--for testing card readers

End-of-line diode (if applicable)--for testing line supervision circuits

Incandescent light--20 to 60 watts

TABLE I (Concl'd)

Thermal shielding (such as blankets, loose fitting clothes, etc.)--for evaluating infrared sensors

Vehicles

Approved Physical Security Plan

Facility drawings, floor plans, sensor coverage area plans

Security alarm logs

Maintenance schedules and

Test schedules and logs

Manufacturer:

Installation manual Operation manual Maintenance manual	For each type of equipment

RECOMMENDATIONS

While the procedures contained in the Evaluation Guide have been prepared by personnel who have had previous experience in developing and/or testing safeguards related equipment, many of the procedures, especially those in which developmental equipment or test aids are recommended, require verification. As the procedures are verified, the Evaluation Guide should be updated to reflect any changes that may be required. It is also important that any feedback received from the principle users of the Guide, the inspectors, be incorporated in future revisions. As new safeguards equipment becomes available and as new test aids/equipment or techniques are developed, the Guide must also be updated. In addition, the results and techniques employed in any independent physical security equipment evaluations must be utilized in revising the Evaluation Guide. The procedures and the data resulting from their use should enable the inspector, then, to generate the data needed for measuring the system level of effectiveness.

Although each evaluation procedure is intended to be complete in itself, there are a few cases in which the methods contained in a procedure for one category of equipment may be applicable to equipment in other categories as well. Such methods can and should be adapted for use in these other categories as appropriate. Since comparison of data between preoperational and operational inspections is often required by the procedures, it is recommended that the inspector employ a notebook or a set of data sheets (not included in the Evaluation Guide) to record the results of equipment Evaluations at each facility for future reference. These data sheets should be prepared by NRC for each procedure to standardize the recording process.

Many of the procedures contained in the Evaluation Guide are quite comprehensive and extensive and will require considerable time and manpower to perform completely, particularly during preoperational inspection visits. However, these procedures are necessary if the inspector is to evaluate fully the equipment and structures used by the licensee in his physical protection system. The complete procedures should usually be performed only once, during the pre-operational inspection, so that a baseline of performance can be established. Then subsequently, less time consuming evaluations using selected portions of the detailed procedures as indicated in the Guide will generally be adequate to verify that performance has not deteriorated. Because of the larger resources required to conduct the initial or preoperational inspections in accordance with the procedures contained in the Evaluation Guide, the possibility exists that NRC could employ a contractor for this purpose. An alternative would be to have the licensee, as a condition of the license, contract with an independent third party to perform these inspections, with the NRC reviewing the data for acceptability. In either case, a team of specialized personnel would be used to overcome any size limitations on the Regional Office physical security system inspection staff, although an inspector could accompany each contractor team during preoperational evaluation visits. Use of one or two special teams to perform these initial evaluations would also tend to increase the level of standardization among the Regional Offices.

SECTION IV

REFERENCE MATERIALS

One of the products of this program is a volume that contains several sections of useful reference material pertinent to the Equipment Catalog and the Evaluation Guide. An important part of this material comprises the two cross-reference indices that will enable the user of the Catalog and Guide to locate quickly the information needed and to determine the relationship between the Catalog and corresponding portions of the Evaluation Guide. Another section provides a complete, alphabetized list of the names, addresses and telephone numbers (in most cases) of all manufacturers whose equipment is included in this version of the Catalog. The last section is a glossary of terms and abbreviations used in the two documents. In addition, space has been provided in the looseleaf notebook containing the reference materials to hold a copy of this final report so that it can be referred to as necessary in clarifying certain information.

CROSS-REFERENCE INDICES

Two indices have been provided in the reference material volume to permit the user to have rapid accessibility to information on each of the approximately 1750 items included in the Equipment Catalog and to its equivalent section in the Evaluation Guide. The first index (see Figure 9) is referenced by an alphabetical listing of the equipment categories. Next to each category is an alphabetical listing of manufacturers who provide equipment in the given category, and for each manufacturer there is a further alphabetical listing of the models produced. The page designation for each model included in the Equipment Catalog and for the corresponding section in the Evaluation Guide is provided next to each model listing.

CATEGORY	MANUFACTURER	MODEL	CATALOG VOL	SEC	CAT	SH	PG	EVALUATION GUIDE VOL	SEC	PR
ALPHANUMERIC WITH LTD GRAPHICS CRT DIS	GTE	IS/7800	VII	1	B	1	3	VII	1	A
	INCOTERM CORP.	SPD10/20	VII	1	B	1	3	VII	1	A
	ITT	3100D GRALPHASCOPE	VII	1	B	1	4	VII	1	A
	ONTEL CORPORATION	D.P.-1	VII	1	B	1	4	VII	1	A
	PHILCO-FORD	D-33	VII	1	B	1	4	VII	1	A
	PHOTOPHYSICS	45-SERIES 20	VII	1	B	1	5	VII	1	A
		45-SERIES 24	VII	1	B	1	5	VII		
		45-SERIES 40	VII	1	B	1	5	VII	1	A
		45-SERIES 44	VII	1	B	1	5	VII	1	A
		45-SERIES 60	VII	1	B	1	5	VII	1	A
		45-SERIES 64	VII	1	B	1	6	VII	1	A
		45-SERIES 80	VII	1	B	1	5	VII	1	A
		45-SERIES 84	VII	1	B	1	6	VII	1	A
	SUGAMAI LABORATORIES	4000 SERIES	VII	1	B	1	6	VII	1	A
	TEKTRONIX INC.	4023	VII	1	B	1	6	VII	1	A
	TEXAS SCIENTIFIC	ENTELEKON 80	VII	1	B	1	7	VII	1	A
	VMP INDUSTRIES INC.	TE-100	VII	1	B	1	7	VII	1	A
	ZENTAC CORP.	9002	VII	1	B	1	7	VII	1	A
		9003	VII	1	B	1	7	VII	1	A
AUTOMATIC DIALERS	ADCOR ELECTRONICS, INC.	DAT-2	VI	4	A	1	1	VI	4	A
		DAT-6	VI	4	A	2	1	VI	4	A
		NW 122	VI	4	A	3	1	VI	4	A
		NW 122 AC	VI	4	A	4	1	VI	4	A
	ADENCO	DIGITAL DIALER SYS.	VI	4	A	6	1	VI	4	A
		612	VI	4	A	5	1	VI	4	A
	DETECTION SYSTEMS, INC.	1600	VI	4	A	7	1	VI	4	A
	DETRON,INC.	D-206	VI	4	A	8	1	VI	4	A
		D-212	VI	4	A		1	VI	4	A
		EC-2010	VI	4	A		1	VI	4	A
		FA-2010	VI	4	A		1	VI	4	A
		KL-5000	VI	4	A		1	VI	4	A
	[illegible] INC.	KE-7101	VI	4	A	5	1	VI	4	A
	UNIV[illegible] INSTR., INC	TD-4	VI	4	A	5	1	VI	4	A
AUTOMATIC ILLUMINATION CONTROLS	SCIENTIFIC DIMENSIONS, INC.	INTRUTEK MMA-1	VI	2	A	1	1	VI	2	A
AUTOMATIC PHOTOGRAPH CONTROLS	CPI CAMERA DIV.	700 MA	VI	3	A	1	1	VI	3	A
BADGE COMPARISON	GENERAL BINDING CORP.	PHOTO ID SYSTEM	III	5	B	1	1	III	5	B
BISTATIC RADAR COMPONENTS	ADVANCED DEVICES LABORATORY	3500	II	2	B	1	1	II	2	A
	JOHNSON CONTROLS, INC.	AG-1760	II	2	B	3	1	II	2	A
	MICROWAVE & ELECTRONIC SYSTEMS	FENCEGUARD PR200	II	2	B	2	1	II	2	A
		FENCEGUARD PT200	II	2	B	2	1	II	2	A
	OMNI-SPECTRA INC.	300	II	2	B	3	1	II	2	A
		305	II	2	B	4	1	II	2	A
	RACON, INC.	14000	II	2	B	5	1	II	2	A
	SHORROCK, LTD.	33-MICROWAVE FENCE	II	2	B	6	1	II	2	A
CAMERAS-INTENSIFIED TARGET TUBE	CONU, INC.	2855B-202/302	IV	2	C	1	1	IV	2	A
		2855B-203/303	IV	2	C	1	1	IV	2	A
		2855B-203/303	IV	2	C	1	1	IV	2	A

Figure 9. Example Cross-Reference Index By Category

The second index (see Figure 10) uses a similar scheme. However, the first reference is alphabetically by manufacturer, and then next to each is an alphabetical listing of the categories of equipment associated with that particular manufacturer. Finally, next to each category is an alphabetical listing of models included therein. Page designations for each model are provided as in the first index.

The index by category is intended for use, of course, when the category of the equipment is known, whereas the index by manufacturer will provide rapid access to the pertinent Equipment Catalog or Evaluation Guide information when the manufacturer is known. When the model nomenclature is not precisely known, a scan under CATEGORY (using the first index) or MANUFACTURER (using the second index) can be made to see if the item of interest, or one similar to it, is contained in the Catalog.

Both of these indices have been entered into a computer data base for ease of correction and maintenance and to permit them to be updated periodically as new equipment models or new categories are added to the Catalog. While this has significantly aided in the generation of the indices, the limitation on characters per line and the need to maintain fixed fields for each heading has made it necessary, in a few cases, to use abbreviations, the most prevalent being DET. for DETECTION.

Following an analysis of available tools for constructing the two indices, MITRE selected the data base system DS/2 (Systems Development Corp., California) for use as it provides a convenient vehicle for alphanumeric sorting and preliminary formatting of the data. The data base is being stored on disk at MITRE and can be accessed for convenient updating via the time-sharing option (TSO) on MITRE's IBM 370/158 computer. Since the data base is program-independent, it can be used with an alternative

MANUFACTURER	CATEGORY	MODEL	CATALOG VOL	SEC	CAT	SH	PG	EVALUATION GUIDE VOL	SEC	PR
MOSLER SAFE CO.	DOORS AND FRAMES	BANDIT BARRIER DOORS	I	1	A	4	3	I	1	A
		VAULT DOORS	I	1	A	5	1	I	1	A
	INFRARED PASSIVE COMPONENTS	INFRAGUARD	II	3	A	2	1	II	3	A
	INTERIOR PROXIMITY DETECTION COMPONENTS	AL-26	II	7	A	4	1	II	7	A
		400A	II	7	A	4	3	II	7	A
	PASSIVE ACOUSTIC COMPONENTS	SENTINEL 5	II	1	B	3	1	II	1	A
MP VIDEO, INC.	PHOTO BADGE AND CCTV VERIFICATION	IDENTI-CABINET	III	5	C	2	1	III	5	C
MRL INC.	TRANSILLUMINATED DISPLAYS	CAB SERIES	VII	3	B	5	1	VII	3	A
MULTIGUARD, INC.	PASSIVE ACOUSTIC COMPONENTS	MS-2	II	1	B	4	1	II	1	A
MULTITONE ELECTRONICS, INC.	UHF PORTABLE VOICE COMMUNICATION	TR-300 SERIES	VIII	2	A	1	1	VIII	2	A
	VHF VOICE COMMUNICATION	TR-20C	VIII	2	B	1	2	VIII	2	A
		TR-300 SER, MULTITONE	VIII	2	B	1	3	VIII	2	A
NAPCO SECURITY SYSTEMS, INC.	ELECTRICAL/MAGNETIC SWITCHES	MS-21	II	13	A	5	1	II	13	A
		MS-31	II	13	A	1	1	II	13	A
	WINDOW BREAKAGE DETECTION COMPONENTS	GG-1	II	8	B	4	1	II	8	B
NATIONAL NUCLEAR CORP.	SNM DETECTION COMPONENTS	DM-2	V	4	A	2	1	V	4	A
		DM-3	V	4	A	3	1	V	4	A
NCR	ALPHANUMERIC CRT DISPLAYS	795	VII	1	A	1	23	VII	1	A
	KEYBOARD TELEPRINTERS	260 KSR	VII	2	C	1	17	VII	2	A
	SERIAL AND READ-ONLY PRINTERS	260RO	VII	2	A	1	7	VII	2	A
NOVAR	KEYBOARD TELEPRINTERS	5-41	VII	2	C	1	18	VII	2	A
		5-50	VII	2	C	1	18	VII	2	A
		5-60	VII	2	C	1	18	VII	2	A
ODETICS	VIDEO TAPE RECORDERS	VTL700	IV	4	A	1	4	IV	4	A
		VL210	IV	4	A	1	2	IV	4	A
		TL500	IV	4	A	1	3	IV	4	A
		TP400R	IV	4	A	1	3	IV	4	A
		VL310	IV	4	A	1	2	IV	4	A
		VT1510	IV	4	A	1	3	IV	4	A
OLIVETTI AMERICA	ALPHANUMERIC CRT DISPLAYS	TCV260	VII	1	A	1	23	VII	1	A
	KEYBOARD TELEPRINTERS	TE-308-SR	VII	2	C	1	19	VII	2	A
		TE-315	VII	2	C	1	19	VII	2	A
		TE-318	VII	2	C	1	19	VII	2	A
		TE-319	VII	2	C	1	20	VII	2	A
		TE-338	VII	2	C	1	20	VII	2	A
		TE-339	VII	2	C	1	20	VII	2	A
	SERIAL AND READ-ONLY PRINTERS	RE315RO	VII	2	A	1	7	VII	2	A
		RE318RO	VII	2	A	1	8	VII	2	A
		RE338RO	VII	2	A	1	8	VII	2	A
		RE339RO	VII	2	A	1	8	VII	2	A
		RE405RO	VII	2	A	1	8	VII	2	A
		SV40	VII	2	A	1	7	VII	2	A

Figure 10. Example Cross-Reference Index By Manufacturer

data base product or application program system if desired. This will permit it to be used in the future by NRC, or a contractor, to update the indices. A copy of the disk can be made available to NRC if requested.

LIST OF MANUFACTURERS

In addition to the two indices, a separate listing of manufacturers and their addresses is provided in the reference materials volume. This is expected to be useful to NRC inspection or licensing personnel if they wish to obtain more specific information about an item from the manufacturer. The manufacturers' address list was created using IBM's Advanced Text Management System (ATMS), and is also stored on disk. It will be possible to update and reprint the list using this system whenever necessary and as items from new manufacturers are added to the Equipment Catalog. As in the case for the cross-reference indices, a copy of the disk can be made available to NRC if requested.

GLOSSARY OF ABBREVIATIONS AND TERMS

The last section of this reference materials volume is an alphabetical listing of most of the unusual terms and abbreviations employed in the Catalog and Evaluation Guide. Its purpose, of course, is to provide the user of these documents with a handy place to learn the definition of unfamiliar terms. MITRE has attempted to make this list complete, but we feel certain that there will be terms or abbreviations either overlooked by us or unfamiliar to the user that should be added. The Office of Nuclear Regulatory Research should be made aware of these so that they can be added at an appropriate time and a revised glossary generated. The entire list has been typed on a dual-cassette Redactron unit so that new entries can be placed easily in their correct alphabetical order and then quickly printed out in a form suitable for reproduction.

SECTION V

GUIDELINES FOR DEVELOPING LEVEL OF EFFECTIVENESS MEASUREMENTS

Sandia Laboratories, under contract to NRC, is developing a computer simulation model that has as its purpose the determination of expected levels of effectiveness for generalized (or site-specific) fixed-site physical protection systems. As part of our effort MITRE prepared some concepts for both the data bases (component-specific and generic) and the subsystem simulation to be used in that program. These concepts were based upon our work on the Equipment Catalog and our previous experience in the physical protection area.

Our main effort, however, has been involved in preparing guidelines that can be used by NRC, or its contractors, for the development of a methodology that would be used to measure the levels of effectiveness of all or a part of a fixed-site physical protection system. The method, when developed, would be used to describe the actual level of effectiveness achieved by a specific facility based upon measurements made by inspectors in the field. The guidelines prepared by MITRE indicate how a method can be developed that will permit a determination to be made as to the effectiveness of an operating system, for standard threat levels to be defined by NRC, by converting either objective or subjective data taken by the inspectors into a form useful for making a quantitative determination of the level of effectiveness. The guidelines provide some basic definitions of effectiveness and outline some types of physical protection capabilities at facilities whose effectiveness is to be evaluated.

A hierarchy of objectives for physical protection systems beginning with the overall requirement to protect the health and safety of the public serves as the basis for the measures of

effectiveness (MOE) to be developed in response to these guidelines. Lower levels of objectives within this hierarchy build upon the effectiveness of individual barrier structures, protection equipment, and administrative or operational procedures. All effectiveness measures would be based on the availability of system elements to perform their assigned function when called upon to do so, the dependability of those elements to continue to function during their period of use, and the capability of elements to meet the higher order system objectives of detection, delay and/or deterrence/neutralization as appropriate for that element. The specific factors that should be considered for each element category are discussed in terms of data that must be obtained and the conversion algorithms that need to be developed to provide a useful measurement of effectiveness. Also, a relationship of the potential threat characteristics to the measurement of effectiveness levels is discussed as part of the guidance necessary to develop the sought for methodology.

The objective then for the follow-on research effort resulting from the guidelines will be to establish a specific methodology for quantitatively determining the level of effectiveness of physical protection systems installed and operating at licensee's facilities. To carry out this objective, a range of threats will have to be defined and supplied by NRC. It appears desirable to establish three or more standard threat levels as the basis for assessment of levels of system effectiveness. Although many of the parameters that are pertinent to the measurement of physical protection equipment and system performance and to the establishment of their levels of effectiveness are contained in the guidelines, based upon those parameters developed for the Evaluation Guide, other pertinent parameters will have to be developed as well. Then, algorithms that relate each of these parameters to the overall measure of

effectiveness would have to be developed. These algorithms would be developed for each threat level, whichever method future analyses indicate to be the more rigorous and meaningful technique.

As a result of these analyses, new methods for testing physical protection system performance may be required, and inspectors would have to be provided with the necessary information (plans and procedures) and test equipment so that they can develop the information needed to make determinations of actual effectiveness. Not only would protection equipment performance be included, but guard force performance must also be ascertained in order to establish an overall effectiveness level. Many of the specific equipment and barrier structure parameters that must be examined and evaluated by inspectors will be based on information provided in the Evaluation Guide. Others pertaining in particular to administrative and operational procedures will require new methodologies for their evaluation. The guidelines will therefore also address the development of methodologies concerned with administrative and operational procedures. If analyses based upon effectiveness models have been conducted to indicate the expected level of performance/effectiveness at a given site, (using, for example, the Sandia model), the results can be compared with actual performance. If the results differ, either adjustments would have to be made to the prediction model or the actual equipment would be modified to achieve any higher levels of capability that might be indicated by the manufacturer or by independent equipment evaluations.

There are many factors affecting overall system effectiveness. These include probability of detection and false/nuisance alarm rates for sensors, which are generally related to measurable parameters such as sensor sensitivity and level of potential (or actual) nuisance alarm sources in the area. Another factor related to effectiveness is time delay from initiation of an adversary action

to response of guards capable of deterring, delaying or neutralizing the adversary force. This time delay is related to sensor operation, communication link design and operation, and central alarm monitoring station operator performance and effectiveness. Consideration must be given to such factors as the actual display perception ability of operators, the actual level of local interference affecting communication links, and the measured response times of internal guard forces and local law enforcement agencies. Many more pertinent factors must be considered along with determining the feasibility of inspectors to make unique measurements on site that are related to these factors. The guidelines provide further elaboration in these areas.

SECTION VI

SUMMARY OF RECOMMENDATIONS

As a result of the study program conducted to prepare the Equipment Catalog, the Evaluation Guide and the guidelines for developing a measurement of effectiveness methodology, it became evident that there are a number of further efforts which should be pursued by NRC in order to achieve improvements in their licensing, inspection and standards preparation functions. The following is a set of recommendations concerning activities that NRC should undertake, either directly or through their contractors, and that represent a logical continuation of the work performed by MITRE. These recommendations are derived from our many meetings and discussions with NRC personnel working on safeguards in each of the five main headquarters offices (I&E, NRR, NMSS, SD and RES) and with the NRC safeguards inspectors at the Regional Offices as well as from the specific work performed on this contract.

UPDATE EQUIPMENT CATALOG AND EVALUATION GUIDE

It is evident that both the Catalog and the Evaluation Guide must be updated periodically, probably no less often than once each year. The updating of the Equipment Catalog should include (1) new items of physical protection equipment that are applicable for use by NRC licensees and that have become commercially available subsequent to the publication of the Catalog; (2) items that have not been included in the current edition because data were not available; (3) additional information on items already in the Catalog obtained as a result of independent equipment evaluations as recommended below; and (4) the addition of new categories of physical protection equipment not previously included in the Catalog such as duress sensors, power supplies appropriate for security use (tamper resistant, noninterruptable, etc.), security lighting systems, and guard equipment.

The Equipment Evaluation Guide should be updated as necessary to reflect both changes made in and additions to the Catalog. Information on new test aids, test equipment or test techniques, either developed commercially or as a result of work on the items identified for development in the Guide would have to be incorporated into any revisions. Other improvements in content as a result of suggestions made by inspectors or others at NRC should also be made.

DEVELOPMENT OF TEST EQUIPMENT/PROCEDURES FOR INSPECTORS

The inspectors in each of the Regional Offices, at the time of the MITRE visit, had little if any test equipment which they could use to determine how well physical protection systems at licensee facilities are performing, and what equipment they had was not standardized for all Regions. The Evaluation Guide identifies both currently available test equipment that can be used by inspectors as well as new equipment that requires development. Some means of obtaining both a standard set of test equipment and the procedures for the use of that equipment by inspectors in the field is needed.

A set of specifications should be prepared that define such a standard set of test aids/equipment/techniques to be used by inspectors in all Regions for the evaluation of the performance and effectiveness of physical protection equipment. NRC should then contract to obtain those items identified in the Evaluation Guide as requiring development, and handbooks explaining how the test equipment is to be used should be provided by the contractor.

In addition, the Evaluation Guide identifies several procedures that require validation before they can be ascertained as serving their intended purpose as well as procedures that must be developed more fully. It is important that the work required for validation or further development of these, or any new procedures, be performed either by NRC or their contractors.

STANDARDIZED EVALUATIONS OF PHYSICAL PROTECTION EQUIPMENT

In the process of developing the Equipment Catalog, it was found that much of the performance data was based on information supplied by the equipment manufacturers because no other data was available, and that in many cases no useful performance data was provided at all. Although some evaluations have been performed in the past by various Government agencies, these are either out of date or only represent a small sample of the equipment available. None of these have been done in a standard and consistent manner because no uniform procedures have been adopted for use; nor are they generally reported on in uniform formats that can serve as a means of comparing similar items in terms of performance. This type of performance data is needed to update the Catalog and to provide the information data base required for developing meaningful measures of equipment (and eventually systems) effectiveness. The results of these evaluations will also be useful to Standards Development in their preparation of new/revised NRC Regulatory Guides or NUREG documents.

It is therefore recommended that items of physical protection equipment be evaluated by independent tests to determine their actual performance capabilities. The items to be selected for evaluation should be based on a review of equipment being used and an assessment of items most likely to be used in the future by licensees. Plans should then be prepared indicating the nature of the tests to be performed, the measurements to be made and the general approach to be taken in evaluating each selected category or item of equipment. Reports on the results of these evaluations should be provided by those performing the work and should be in a standardized format approved by NRC. The Equipment Catalog (and Evaluation Guide) should then be updated as a result of the information obtained.

CATALOG OF AND EVALUATION GUIDE FOR SAFEGUARDS ADMINISTRATIVE AND OPERATIONAL PROCEDURES

The current MITRE contract has been concerned with the techniques for evaluation by NRC inspectors of a selected set of performance measures for physical protection equipment. However, physical security at a given facility is provided by a combination of both equipment and administaative/operational procedures. The Evaluation Guide is only related to the equipment, but the NRC inspectors must also concern themselves with the adequacy and effectiveness of the procedures used in the process of providing site protection. Therefore a guide that addresses the methodology to be followed in the evaluation of those procedures appears to be necessary. The evaluation of administrative and operational procedures is particularly important if an attempt is to be made to obtain a quantitative measure of the total physical protection system's level of effectiveness. Unless the procedures being used by a licensee are appropriate and effective, the benefits gained through use of sophisticated protection equipment may be offset, and such equipment, therefore, would not be the limiting factor in terms of security. One example of this concerns entry control in which sophisticated techniques and equipment are involved in verifying the identity of an individual already enrolled in the system, but the administrative control on who is enrolled is not adequate. Another example might be the reduction in effectiveness of a closed circuit television system for surveillance and alarm assessment that would result from the absence of appropriate operational procedures (which include guard response actions). As a third example, the procedures used by roving or patrolling guards may consist of a routine and consistent route. This could permit an adversary who can observe the patrol to begin an intrusion attempt after the patrol has just passed the planned point of penetration.

There are also a number of facilities that employ guards rather than equipment to provide certain types of protection, particularly those types that require guards to identify people by badges, to search packages and personnel for contraband such as weapons and explosives, and to guard the protected area perimeter when sensors are unavailable or inoperable. These are but a few of the many areas in which the availability and use of proper administrative and operational procedures is critical to the level of protection being afforded a fixed site.

It is therefore recommended that a survey and analysis of typical administrative and operational procedures dealing with physical protection of fixed facilities be conducted to determine what the currently used procedures are, how they compare to precribed procedures, how often they are used by licensees, and what their advantages and limitations are. Based on this analysis, the most effective procedures should be described in a document similar to the Equipment Catalog. The procedures should be categorized as to those used in perimeter protection, entry control, surveillance and assessment, interior protection, response, contraband detection, etc., and further divided into subcategories for purely administrative procedures pertinent to security (guard training, identification of personnel for badging purposes, change of shift procedures, etc.) and those that deal with operational activities (entry control, surveillance, alarm assessment, patrolling, response to alarms, etc.). The latter, however, should not be a set of equipment operating manuals, but rather the generic procedures used by the guard force as related to these activities. Based on the procedures identified, a guide should then be prepared, similar to the Evaluation Guide, that will delineate a methodology to be used by NRC inspectors to evaluate the level of performance achieved at specific installations in which these procedures are employed. The methodology would include a checklist to assist the inspector in arriving at a

quantitative measure of the security provided by each identified procedure. These methodologies and checklists would then have to be verified at typical installations by utilizing them in obtaining performance results before the evaluation techniques are finalized.

NEW AND REVISED NRC REGULATORY GUIDES

As a result of our study, MITRE has learned that some of the NRC Regulatory Guides are not completely up-to-date in reflecting current performance capabilities of physical protection equipment, and for certain categories of equipment no Regulatory Guides exist. It appears that more explicit guidance is required in several areas for use by the licensee, by licensing personnel and by the inspectors in their enforcement of the requirements for physical protection systems. Information resulting from the Equipment Catalog and Evaluation Guide as well as any independent equipment evaluations should be used in the preparation of this guidance.

It is recommended that revisions be made, as necessary, to the following NRC Regulatory Guides:

- 5.7 Control of Personnel Access to Protected Areas, Vital Areas, and Material Access Areas (6/73)
- 5.12 General Use of Locks in the Protection and Control of Facilities and Special Nuclear Materials (11/73)
- 5.14 Visual Surveillance of Individuals in Material Access Areas (11/73)
- 5.20 Training, Equipping, and Qualifying of Guards and Watchmen (1/74)
- 5.27 Special Nuclear Material Doorway Monitors (6/74)
- 5.30 Materials Protection Contingency Measures for Uranium and Plutonium Fuel Manufacturing Plants (6/74)
- 5.43 Plant Security Force Duties (1/75)
- 5.44 Perimeter Intrusion Alarm Systems (Revision 1, 6/76)

New Regulatory Guides should be prepared in at least the following areas:

Interior Intrusion Alarm Systems
Explosive Material Doorway Monitors
Weapons/Metal Detection Monitors
Personnel Identification Techniques
Barrier Structures and Vaults
Perimeter Surveillance - CCTV Use and Lighting Standards
CCTV for Interior Surveillance
Security System Effectiveness

We are aware of work by the Office of Standards Development that will lead to new standards in several of these areas, and it is hoped that the information provided in the Equipment Catalog and Evaluation Guide will be useful in that work.

NRC STAFF TRAINING

Inspector Training

Based on MITRE's visits to the Regional Offices and discussions with the inspectors and their supervisors, we learned that there is a concern with respect to the need for more formalized training of inspectors in areas connected with safeguard equipment, how the equipment should perform and how to evaluate the equipment properly. Although on-the-job training is currently the technique employed, there are many types of evaluations that require skills not presently found within the inspection groups at each Region. This will be even more the case after the Evaluation Guide becomes available. The inspectors emphasized the need for "hands-on training" in the use of electronic equipment to test such security areas as communication line supervision, proper lighting levels, field strength of certain active sensors, etc. Also, more standardized training is needed so that regulations and guidelines are more uniformly applied from Region to Region.

Licensing Personnel Training

A concern was expressed by inspectors in the four Regions visited by MITRE that the physical security plans (PSP) prepared by the licensee and approved by licensing were not complete and comprehensive enough in all cases to provide a firm basis for evaluation by the inspectors of the individual physical protection systems. Personnel with specific backgrounds in physical security have been brought into the approval process. However, it would appear that just as the inspectors need more training, so do the licensing personnel. The training should include information on the technology involved in physical protection equipment with specific emphasis on the weaknesses, limitations and vulnerabilities of that equipment. Principles related to design, installation and operation should also be covered.

USE OF THE GUIDELINES ON LEVELS OF EFFECTIVENESS MEASUREMENT

Based upon guidelines prepared by MITRE under this contract, a specific methodology must be developed that will indicate the measurements to be made by inspectors in the field, the algorithms to be applied to provide a quantitative or relative measure of equipment effectiveness achieved, and the way in which this measure can be compared to previously established standards or norms for levels of effectiveness based, say, on the outputs of the model prepared by Sandia Laboratories.

Three or more standard threat levels should be established by NRC as the basis for assessment of levels of equipment effectiveness. The parameters that are most pertinent to the measurement of physical protection equipment and subsystem performance and to the establishment of a level of effectiveness should then be determined. Algorithms that relate each parameter to an overall measure of equipment or subsystem effectiveness should be developed that will

use the results of tests and evaluations normally made by inspect at each site to determine the quantitative level of performance achieved by the total security system. It may be determined that new methods for testing physical protection equipment performance are required, and these should be developed. Similar studies relative to measuring the effectiveness of specific procedures used at licensee facilities to provide physical protection should also be conducted based on results of efforts that may be performed under the recommendation concerning a catalog and evaluation guide for administrative and operational procedures.

SUMMARY

All of the recommendations made in this section are intended to improve the knowledge and capabilities of the NRC staff in carrying out their mission. There is a strong interrelationship among all of these recommended efforts leading, eventually, to a method for evaluating the effectiveness of both proposed and installed physical protection systems. Figure 11 is a chart indicating how the products of the MITRE contract (the Equipment Catalog and Evaluation Guide) and the products that would result if the recommended efforts were conducted interact to achieve a total program that will be of significant benefit to the NRC in the conduct of their regulatory functions in the safeguards area.

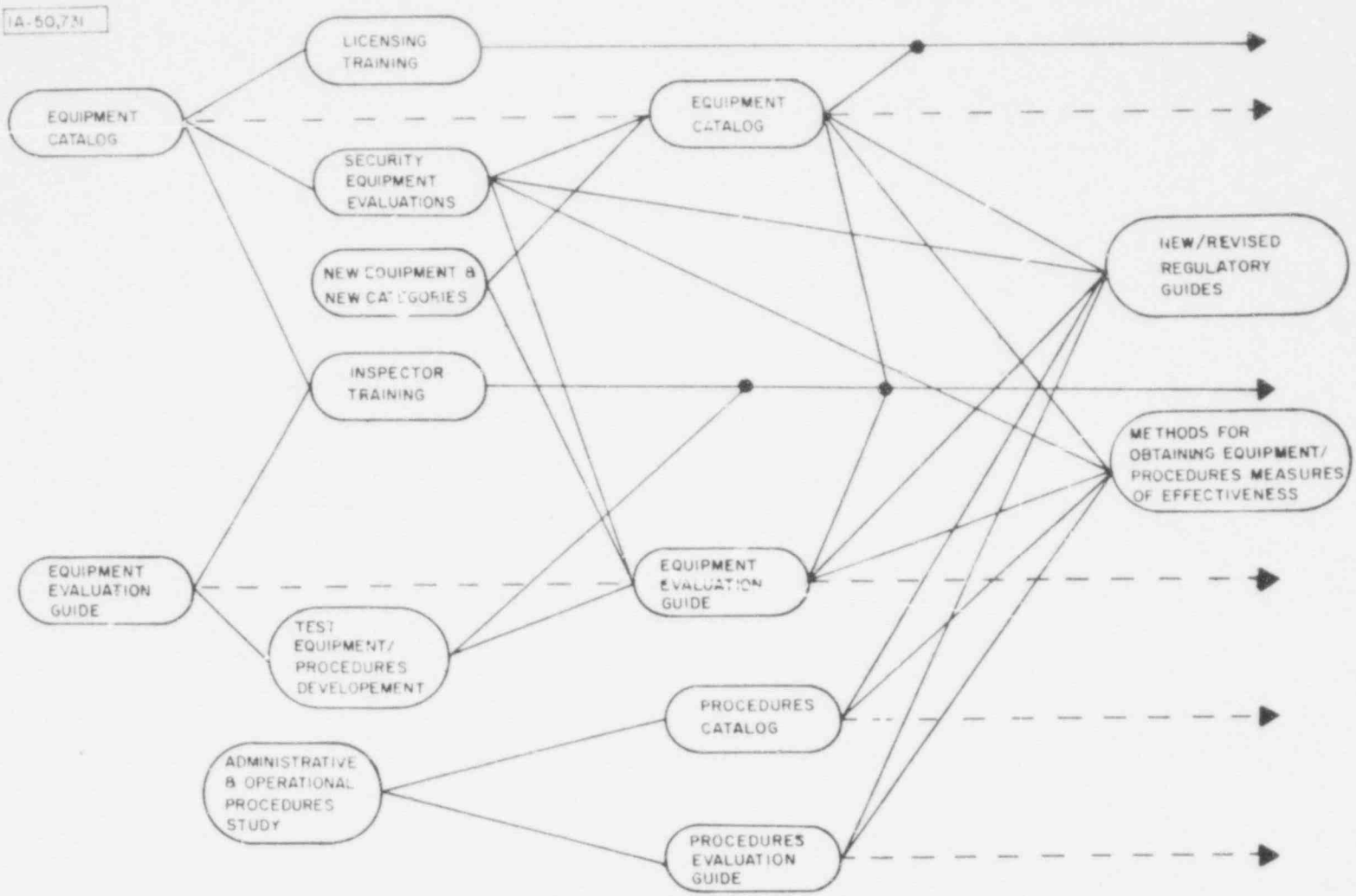

FIGURE 11 CHART OF INTERACTIONS FOR MITRE RECOMMENDATIONS

APPENDIX I

CATALOG SUBDIVISIONS

BOOK 1

VOLUME I. BARRIERS AND STRUCTURAL COMPONENTS

Section 1. Doors and Frames

Section 2. Hinges

Section 3. Locks

- Category a. Mechanical Locks
- Category b. Electro-Magnetic Locks
- Category c. Switch Locks

Section 4. Gate Operators

Section 5. Gates/Turnstiles

Section 6. Glazing Materials

Section 7. Window Guards

Section 8. Fence

- Category a. Galvanized Steel Fence
- Category b. Net Barriers and Entrapments

Section 9. Structural Materials

Section 10. Wide-Area Detection Mirrors

VOLUME II. INTRUSION DETECTION COMPONENTS

Section 1. Acoustic Components

- Category a. Active Acoustic Components
- Category b. Passive Acoustic Components

Section 2. Microwave/Radar Components

- Category a. Monostatic Radar Components
- Category b. Bistatic Radar Components

Section 3. Electro-optic Barriers

- Category a. Infrared Passive Components
- Category b. Infrared Active Components
- Category c. Video Motion Detection Components

Section 4. Electric Field Components

Section 5. Orientation Components

Section 6. Ferrous Metal Detection Components

Section 7. Proximity Detection Components

- Category a. Interior Proximity Detection Components
- Category b. Exterior Proximity Detection Components

Section 8. Vibration Detection Components

- Category a. Fence-Mounted Vibration Detection Components
- Category b. Window Breakage Detection Components
- Category c. Wall/Object-Mounted Detection Components

Section 9. Seismic Components

Section 10. Pressure-Sensitive Components

- Category a. Mechanical Deformation Detection Components
- Category b. Trap Wires

Section 11. Pressure Mats

Category a. Personnel Detection, Foot-Activated Sensors
Category b. Personnel Detection, Hand or Finger-Activated Sensors
Category c. Vehicle Pressure Detection Sensors
Category d. Object Removal Detection Sensors

Section 12. Continuity Components

Section 13. Electrical/Magentic Switches

Section 14. Fire Detection Components

Category a. Heat Detection Components
Category b. Smoke Detection Components
Cateogry c. Flame Detection Components
Category d. Heat Detection/Control and Display Instruments

Section 15. Mechanical Contact Switches

BOOK 2

VOLUME III. ENTRY CONTROL COMPONENTS

Section 1. Code Combination Locks

Section 2. Card Locks

Category a. Magnetic Card Locks
Category b. Capacitive Card Locks
Category c. Embossed Card Locks
Category d. Radio Frequency Card Locks
Category e. Code Circuitry Card Locks

Section 3. Code Combination and Card Locks

Section 4. Card Systems

Cateogry a. Magnetic Card Systems
Category b. Capacitive Card Systems
Cateogry c. Optically Coded Card Systems
Category d. Coded Circuitry Card Systems

Section 5. Personal Characteristics Verification Systems

Category a. Fingerprint Verification Systems
Cateogry b. Hand Geometry Verification Systems
Category c. Photo Badge and CCTV Verification Systems
Category d. Badge Comparison Verification Systems

VOLUME IV. SURVEILLANCE AND ALARM ASSESSMENT COMPONENTS

Section 1. Thermal Imaging Systems

Section 2. Video Camera Equipment

Category a. Cameras with Standard Vidicon
Category b. Cameras with Silicon Diode Vidicon
Category c. Cameras with Intensified Target Tube
Cateogry d. Cameras with Special Sensor
Category e. Video Camera Enclosures
Category f. Video Camera Positioning Equipment

Section 3. Video Monitors

Section 4. Video Tape Recorders

VOLUME V. CONTRABAND DETECTION COMPONENTS

Section 1. Explosives Detectors

Category a. Portable Explosives Detection Components
Category b. Walk-Through Explosives Detection Components

Section 2. Ferrous Metal Detectors

Cateogry a. Hand-Held Ferrous Metal Detection Components
Category b. Walk-Through Ferrous Metal Detection Components

Section 3. All-Metal Detectors

Category a. Hand-Held All-Metal Detection Components
Category b. Walk-Through All-Metal Detection Components

Section 4. SNM Detection Components

Section 5. X-Ray Inspection Equipment

BOOK 3

VOLUME VI. AUTOMATED RESPONSE COMPONENTS

Section 1. Siren and Bell Controls

Section 2. Automatic Illumination Controls

Section 3. Automatic Photograph Controls

Section 4. Automatic Dialers

VOLUME VII. GENERAL PURPOSE DISPLAY COMPONENTS

Section 1. Cathode Ray Tubes (CRT)

- Category a. Alphanumeric CRT Displays
- Category b. Alphanumeric with Limited Graphics CRT Displays
- Category c. Graphics CRT Displays

Section 2. Printers

- Category a. Serial and Read-Only Printers
- Category b. Data Logging, Digital and List Printers
- Category c. Keyboard Teleprinters

Section 3. Other Displays

- Category a. Event Displays and Recorders
- Category b. Transilluminated Displays

VOLUME VIII. GENERAL PURPOSE COMMUNICATION COMPONENTS

Section 1. Alarm Signalling Systems

Section 2. Portable Voice Communications

- Category a. UHF Portable Voice Communications
- Category b. VHF Portable Voice Communications

APPENDIX II

LIST OF CURRENT LICENSEE EQUIPMENT INCLUDED IN EQUIPMENT CATALOG

Company	Model	
AIR SPACE DEVICES	Perim-alert	Included
APPLIED METRO TECHNOLOGY, INC	Bird-Eye Fence Alarm	Included
CALSPAN TECHNOLOGY PRODUCTS, INC	Finger Scan Automatic Fingerprint Recognition System	Included
CARDKEY SYSTEMS	Security Card - Series SCD	Included
FOLGER ADAMS COMPANY	Gates, Door Strikes	Not Included (1)
GENERAL ELECTRIC CO.	TE-33 - Camera	Included
GTE SYLVANIA	FPS-1 Fence Protection Sensor	Included
HATHAWAY	Annunciator - Model 901	Included
HONEYWELL COMMERCIAL DIVISION	Alpha 3000 - computerized system	Included
	Alpha 1000 - computerized system	Included
	W676B/C - audio electronic vibration detector panel	Not Included (1)
	TC-10 - electronic vibration detector	Included
	IMPMG4TB - weatherproof magnetic contact balanced w/ tamper switch	Not Included (1)
INFINETICS, INC	Friskem - hand held and walk thru magnetic detection device (metal detector)	Included

Company	Model	
INTELCOM RAD TECH (IRT)	Rad Tech - SNM doorway monitors	Included
ION TRACK INSTRUMENTS	Model 58 - explosive detector	Included
	Model 62 - explosive detector	Included
JOHNSON CONTROLS, INC	G-1 - microwave motion detector	Included
	G-3 - microwave motion detector	Not Included (1)
MARDIX SECURITY SYSTEMS, INC	VG-3000 - videoguard	Included
MARSLAND ENGINEERING LTD	Sentry 301 - explosive detector	Included
MOORE SYSTEMS	Model AL - consol	Included
NATIONAL NUCLEAR CORP	SNM detector and Metal detector	Included
OMNI SPECTRA, INC	Model 300 - outdoor microwave detector	Included
	Model 305 - outdoor microwave detector	Included
	Model 115 - indoor microwave detector	Included
OPTRONIXS, INC	Lite Link P-22 - IR perimeter sensor	Not Included (1)
RCA ELECTRO OPTICS & DEVICES	TC-1010 auto Vu LL - CC TV (silicon target vidicon)	Included
RUSCO ELECTRONIC SYSTEMS, INC	IDEK Model R-20 - card reader	Included
SENTRACON CORP	Card readers	Included

Company	Model	
SOLCO ENGINEERING	Electro Search - hand held and walk thru metal detection system	Included
SYSTRON DONNER, CORP	Stress sensors and panels	Not Included (2)
VICON INDUSTRIES	CCTV lens, housing, controls	Included
WALTER KIDDE & CO.	Ultrasonic Intrusion detector system DR-850 - balanced magnetic switch	Included
	KD-3 Acoustic	Included
ADVANCED DEVICES LABORATORY, INC	Microwave intruder detector	Included
CONTINENTAL INSTRUMENTS CO.	Cypher lock	Included
SIMPLEX	Lock	Included
BEST	5K, 6A6G2-H door locks	Not Included (2)
SARGENT AND GREENLEAF	8100 series	Included
POTTER	MDSBM	Not Included (2)
PLASTIC MASTER CORP	Roll Laminator	Not Included (2)
SANYO	CCTV	Included
RENS	15	Included
LUDLUM	SNM Detector-16	Not Included (3)
GBC	CCTV Monitor	Included
POTTER	BAC-24, DLP-9	Not Included (2)
MOTOROLA	MH-70	Not Included (2)
METOR	Metal Detector	Included

Company	Model	
RACON	Microwave	Included
STELLAR	EF-20/E-601	Included
JOHNSON SERVICE	DG1002, BG1008	Not Included (2)
MOSLER	Electrical Auto Lock	Not Included (3)
SCAN INSTRUMENT	Annunciator-Bell	Not Included (2)
KENCO	Model 100	Included
UNITED SECURITY	704, 507, Pressure mat	Included Not Included (2)
IDENTI-LOGIC	3001/3060	Not Included (2)
DELTA	10400	Included
INTERFACE	Door Alarm	Not Included (2)
ADVISOR	Advisor III	Included
RADATION CORP	Motion Detector	Not Included (2)

(1) Manufacturer's data was not available before 3 January 1977.

(2) Information from Inspection and Enforcement concerning licensee use of this item was received too late for data to be obtained from manufacturer.

(3) MITRE does not consider this item to be physical protection equipment.

APPENDIX III

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5.14 Visual Surveillance of Individuals in Material Access Areas (11/73)

5.20 Training Equipping, and Qualifying of Guards and Watchmen (11/74)

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UL 365 Police Station Connected Burglar Alarm Units and Systems

UL 437 Key Locks

UL 464 Audible Signal Appliances

UL 609 Local Burglar Alarm Units and Systems

UL 611 Central-Station Burglar-Alarm Units and Systems

UL 632 Electrically Actuated Transmitters

UL 634 Connectors and Switches for Use with Burglar Alarm Systems

UL 639 Intrusion-Detection Units

UL 768 Combination Locks

UL 827 Central-Station for Watchman, Fire-Alarm and Supervisory Services

UL 864 Control Units for Fire-Protective Signalling Systems

UL 904 Vehicle Alarm Systems and Units

UL 972 Burglary Resisting Glazing Material

UL 983 Surveillance Cameras

UL 1022 Line Isolation Monitors

UL 1034 Burglary-Resistant Electric Door Strikes

UL 1037 Antitheft Alarms and Devices

UL 1076 Proprietary Burglar Alarm System Unit

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NILECJ-STD-0204.00 Voice Privacy Equipment for Law Enforcement Communications Systems

NILECJ-STD-0301.00 Magnetic Switches for Burglar Alarm Systems

NILECJ-STD-0302.00 Mechanically Activated Switch for Burglar Alarm Systems

NILECJ-STD-0302.00 Test Procedures for Night Vision Devices

NILECJ-STD-0303.00 Image Quality Criterion for the Identification of Face

NILECJ-STD-0304.00 Simplified Procedures for Evaluating the Image Quality of Objective Lenses for Night Vision Devices

NILECJ-STD-0305.00 Active Night Vision Devices

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NILECJ-STD-0306.00 Physical Security of Door Assemblies and Components

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APPENDIX IV

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*Evaluated under separate NRC contract to MERADCOM

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APPENDIX V

RECOMMENDATIONS FOR TEST EQUIPMENT/TEST AID DEVELOPMENT

Evaluation Procedures I-1.A, -2.A, -3.A, B and C.

A test aid which will enable an inspector to apply a measured amount of force to doors and frames, such as a calibrated pry bar/torque wrench, requires development in order to standaridze "manual force" employed in the evaluation procedures cited above. In addition, a study as to the amount of force required to perform an adequate test of the door without causing permanent damage must be made. The inspector would use the results of such a study as a guide.

Evaluation Procedure I-1.A.

A procedure for evaluating door frames in which a screw jack is used to deform the frame nondestructively requires development and verification.

Evaluation Procedure II-1.B.

A standard noise generator for testing passive acoustic sensors requires development. A possible system could consist of an audio frequency oscillator, power amplifier and high performance speaker or ultrasonic transducer. The oscillator should be capable of producing frequencies over the range from 50 to 7000 Hz; and the amplifier should be capable of driving the speaker to a suitable sound pressure level to be determined during equipment development. The output level adjustment should be calibrated on a relative scale. Since such a system may be costly to implement, it may be possible to substitute a calibrated high quality portable cassette tape recorder that operates over a limited frequency range with pre-recorded intrusion sound scenarios. The feasibility of using such a cassette tape recorder requires verification.

Evaluation Procedure II-2.A.

In order to present a standard motion stimulus to evaluate monostatic microwave components, a "doppler wheel" requires development. This device would consist of four corner reflectors (for 10 GHz) mounted at equal spacing around the perimeter of a variable speed, motor-driven disk. The wheel would be placed at various distances from the sensor and in various orientations in order to map the sensitive area of the sensor.

Evaluation Procedure II-2.B.

In order to standardize the target presented to bistatic microwave sensors, an aluminum sphere could be used rather than a human. The size of the sphere necessary to simulate a 5 ft (1.5 m) tall, 80 lb (36kg) intruder would be approximately 2 ft (0.6 m) in diameter; to make it easier to carry, the sphere could consist of a metallized, inflatable ball. In order to ensure that the sphere is moved through the sensor coverage zone at a uniform rate, a transport mechanism must be developed. This mechanism should be capable of transporting the sphere at various heights above the ground and at speeds from 1 in/sec to 10 ft/sec (0.03 to 3m/sec).

Evaluation Procedure II-3.A.

The testing of passive thermal detectors (infrared passive sensors) requires the use of a calibrated, variable thermal radiation source. This test aid could consist of a heater element, with provisions for varying and controlling the temperature, housed in an appropriately constructed enclosure. Ideally, the test aid would be capable of operating from batteries for field use.

Evaluation Procedure II-3.B.

Quantitative measurements of active infrared sensor beam modulation requires the fabrication of an infrared sensitive photodiode with an integral amplifier for use in the field. Particular attention

should be paid to the rise-time of the diode/amplifier to ensure that it will be capable of responding to all modulation rates that may be encountered.

Evaluation Procedure VI-3.C.

Evaluation of video motion detectors requires that an appropriate target be presented to the system. While the use of a human intruder would suffice, it would be more convenient to employ a test aid that would enable the inspector to evaluate the device using a standard input stimulus. A video tape recorder, modified to accept any system generated synchronization signals, would be used to provide a video input to the motion detector. The modification, if required, would consist of adding a circuit to the recorder which enables the recorder's sync generator to lock to the external system-supplied sync signal.

A special test tape should be prepared containing a number of recorded test scenarios/targets. As one of many possibilities the following test sequences of ten seconds duration are suggested:

Sequence 1. Equally spaced stationary horizontal white bars (20 bars per picture height) of 100 percent contrast.

Sequence 2. Black background.

Sequence 3. Equally spaced horizontal white bars (20 bars per picture height) of 50 percent contrast.

Sequence 4. Black background.

Sequence 5. Equally spaced horizontal white bars (20 bars per picture height) of 5 percent contrast against the background.

Sequences 1 through 5 should be repeated with 30 and 50 horizontal bars per picture height and with 20, 30 and 50 vertical bars; all sequences should be run with the bars in motion. Provisions should also be made to include sequences in which square areas (of dimension approximately .0 TV lines) having contrast levels as

described above move across the field in various locations and at various speeds. (In order to use this type of sequence in the field, it may be necessary to adjust the detection zones of the video motion detector to ensure that they will intercept the moving squares.

Evaluation Procedure II-5.A.

A test tool should be developed to test fence-mounted orientation sensors. This test tool might consist of a bar with claw-shaped arms for hooking into the fence, a lever arm for hand activation, and a spirit level indicator capable of being offset by a predetermined number of degrees so that it would indicate a level condition when the fence material has been tilted by that same number of degrees. A test program would also be required to determine the correct tilt for testing these sensors.

Evaluation Procedure II-5.B.

In order to evaluate window/frame mounted orientation sensors for susceptibility to vibration-induced alarms, a calibrated impact device consisting of an adjustable spring loaded hammer requires development. This device differs from the one described under procedure II-8.A for evaluating fence and object mounted vibration sensors in that a smaller impulse is required. The possibility exists that a single impact device capable of delivering a wide range of impulses would be suitable for use in all the referenced procedures.

Evaluation Procedure II-6.A

For the evaluation of ferrous metal detectors, a means of presenting a standard stimulus to the sensor requires development. The test aid would produce, from a distance, a known measurable perturbation in magnetic field at the detector. It could consist of a circular coil of wire energized by an alternating current oscillator. The test aid would be set up at a given distance from the sensor and activated; the magnetic field produced at the sensor could

be monitored by a magnetic field strength meter or a pickup coil. The magnitude and frequency of the field required to activate the sensor would have to be determined during test aid development. A test aid similar to this is described in NILECJ-STD-0602.00

Evaluation Procedure II-7.A.

A test circuit consisting of an 820pf and 22pf capacitor, and a well insulated knife switch, requires fabrication. The circuit should be enclosed (shielded) to prevent interference from external stray capacitance.

Evaluation Procedures II-8.A and C.

Fence vibration sensors are generally equipped with sensitivity and variable time constant adjustments. In order to evaluate the sensitivity of the sensor, a calibrated fence impulse device consisting of a calibrated spring loaded hammer similar to one developed by USAF RADC for this purpose is required. Detailed testing of sensitivity and time constant adjustments requires a variable frequency/ amplitude fence vibration exciter. This device could consist of a variable speed motor driving a variable eccentric cam which would produce vibrations over the range from 1 to 200 Hz.

Evaluation Procedure II-8.B.

In order to evaluate the sensitivity of window and object mounted vibration sensors, a variable frequency/amplitude vibration exciter is needed. This device, which differs from that described for procedure II-8.A in that smaller amplitudes and a wider range of frequencies (up to ultrasonic) are required, could consist of a variable speed motor driving a variable eccentric cam. However, if higher frequencies are required, an electro-dynamic exciter (such as a modified audio speaker or piezoelectric ultrasonic transducer) could be used.

Evaluation Procedure II-9.A.

The evaluation of seismic sensors requires the use of a sinusoidal

seismic disturbance generator. The generator might consist of a motor driven weight which would produce a sinusoidal seismic disturbance. Due to the site-specific peculiarities of each installation and the fact that the propagation characteristics of the ground may be different at each facility (and perhaps from zone to zone within a facility), the feasibility of using such a test aid requires verification.

Evaluation Procedures II-11.A and B.

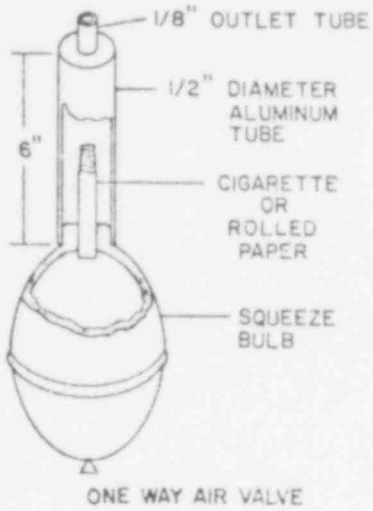
Testing of pressure mats, cables and ribbons can be standardized through the use of a calibrated pressure applicator. The device could consist of a modified spring force scale (perhaps mounted in a tube) which would be used to apply force over a specified area by means of attachable bases of various sizes.

Evaluation Procedure II-14.A.

Evaluation of heat detectors can be accomplished using a calibrated/adjustable heat source. Such a device could consist of a specially modified hair dryer with thermostatically controlled heat elements and/or air intake. The configuration of most heat detectors would prohibit the use of contact heat sources. In addition, a means of measuring the temperature of the detector is recommended.

Evaluation Procedure II-14.B.

In order to test the sensitivity of smoke detectors against manufacturer's quantitative specifications, a calibrated smoke generator suitable for use in the field requires development. A simple device suitable for qualitative operational tests (demonstrations) is illustrated on the next page. A more sophisticated device which would allow for the generation of various densities of smoke composed of specific particulate sizes might not be feasible for use in the field.



Evaluation Procedure II-14.C.

As described in the procedure, a calibrated infrared light gun for use in evaluating infrared flame detectors is currently under commercial development.

Evaluation Procedure IV-1.A.

The evaluation of a thermal imaging system includes the measurement of system resolution and dynamic range. A test aid consisting of ten appropriately sized parallel bars, each of which is heated or cooled to a different absolute temperature, requires development to enable the measurement of dynamic range (analogous to a gray scale test chart for conventional television system evaluation). This same device could be modified to produce a resolution chart (equal temperature, unequally spaced parallel bars) similar to an optical bar chart for evaluating TV systems. The devices above should be capable of operating from batteries for use in the field.

Evaluation Procedures IV-2.A.

In order to measure the overall resolution and gray scale

performance, special test charts require fabrication. These charts would consist of appropriately enlarged conventional gray sc le and resolution charts.

Evaluation Procedures V-1.A and B.

In order to perform a quantitative test of explosives detector sensitivity, a means of introducing a known volume concentration of explosive effluent (calibrated vapor source) must be developed for field use. Several different types of military and commercial explosives should be used to verify claimed sensitivity to various compounds. A vapor source for laboratory use is under development by the Department of Transportation, Transportation Systems Center, Cambridge, MA.

Evaluation Procedure V-5.A.

The measurement of X-ray system resolution can be accomplished using a resolution test chart which consists of 6.3 in. (16 cm) lengths of both bare and vinyl insulated copper wire of 24, 26, 28, 30 and 32 guage mounted on an appropriately sized 1/8 inch thick sheet of plexiglass. This test aid requires fabrication. (Refer to NILECJ-STD-0603.00 for fabrication details.)

Evaluation Procedure VII-1.A.

In order to measure CRT display stability, an appropriate gauge must be fabricated. This test aid would consist of a transparent sheet upon which axial lines are ruled. Stability is determined by noting the drift of any displayed characters from the reference point established by the gauge.

For all devices or systems which use batteries as the prime or back-up source of power, a special battery tester should be developed. The device would consist of an appropriate load resistor, an ammeter, a high impedance voltmeter and perhaps a chart recorder.

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The tester would produce data that would enable the internal impedance of the battery to be calculated. The result of the calculation would be compared to the battery manufacturer's ampere-hour capacity curves.

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