UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

APR 10 1978

MEMORANDUM FOR: Clifford V. Smith, Jr., Director
Office of Nuclear Material Safety
and Safeguards

FROM: Saul Levine, Director
Office of Nuclear Regulatory Research

SUBJECT: RESEARCH INFORMATION LETTER NO. 23 - "EASI" ADVERSARY SEQUENCE EVALUATION MODEL (COMPUTER GRAPHICS VERSION)

Introduction

This memorandum transmits the results[1] of completed research on developing a graphics display version of a computer model called Estimate of Adversary Sequence Interruption (EASI). This is part of a continuing NRC research activity entitled "Effectiveness Evaluation Methods for Fixed-Site Physical Protection." The study was performed by Sandia Laboratories, Albuquerque, New Mexico, for the Office of Nuclear Regulatory Research (RES) in response to a research request (NMSS-77-1) from your office in which a need was identified for evaluative methods for fixed-site theft and sabotage prevention systems. Documentation[2-4] has already been made available throughout NRC concerning programmable pocket calculator versions of the EASI model.

The objective of the "EASI" method is to provide a usable evaluation method which can serve as either a physical protection system design aid or as a decision aid in the licensing and inspection process. The EASI Graphics program allows the user to input facility and adversary path attributes at a computer graphics terminal, and obtain as output a CRT "perspective view" line plot. The method can treat both theft and sabotage objectives by threats of insiders, outsiders, and combinations of each group.

Discussion

The basis for the EASI method is that, to avert resolute attempts at theft or sabotage at nuclear facilities, the response force (or other delay alternatives) must be notified of the attempt while there is still sufficient time remaining in the adversary's action sequence for the force to respond and interrupt the sequence. The response force is assumed to be adequate at least to delay adversary progress until additional forces arrive to neutralize the adversary. The actual force composition required is a function of the threat and must be determined by other means.

The EASI evaluation method is a probabilistic approach which analytically evaluates basic functions of the physical security system (detection, assessment, communications, delay) with respect to response time and provides an estimate of adversary encounter probability. Adversary action sequences can include an outsider either gaining access to a vital area for the purpose of sabotage or gaining access to SNM and egressing. Each assessment of physical protection system performance is made with respect to a specific adversary action sequence.

The dependent variable for each EASI Graphics plot is the probability of encounter. The dependent variable may be plotted as a function of one or two independent variables related to the input data, i.e., response time, probability of communication, task time, or probability of detection. The three-dimensional surfaces and two-dimensional curves generated by EASI Graphics may be used to estimate the value of probability of interruption for different values of the independent variables.

It should be noted that one of the penalties of a simple evaluation method is that the user has the responsibility to assure that the input data properly reflects conditions of the actual security system.

Results

The results of the EASI analysis are expressed in terms of the probability that the physical protection system can respond in time to interrupt an adversary along a physical path (action sequence). To supplement the EASI calculations, EASI Graphics provides the analyst with a selection of six two-dimensional and eight three-dimensional plots. These plots allow the user to examine the sensitivities of various components along the adversary's path and to study the effect on the probability of interruption of varying the performance of these components.

A FORTRAN code has been written for the NOS time-sharing system with extensive interactive graphic capability. NOS core requirements are about 70K octal. Generally, three-dimensional sensitivity surfaces require less than one second of CPU time.

The Sandia Laboratories EASI Graphics program uses a Tektronix 4014 graphics terminal to interface with a CDC 6600 time-sharing computer. A Tektronix 4631 paper copy unit provides a hard copy of the CRT display plots. The EASI Graphics code is also available as an ANSI standard FORTRAN program which should be easily adapted to any computer with adequate memory and a compatible graphics terminal.

The EASI method has had application (under ERDA sponsorship) at Argonne National Laboratory, Oak Ridge, and Savannah River. Several engineering firms and power utilities have also usefully applied EASI.

Recommendations

It is recommended that the EASI method be used by NMSS and other offices as an ancillary aid in developing performance oriented regulations or in carrying out a comprehensive evaluation program. Since there is no automated data bank available for use with EASI, it may be helpful to recall that Appendicies C and D of Reference 4 provide barrier penetration test data and intrusion detection systems information, respectively. This version of EASI requires a graphics display time-sharing terminal and a compatible paper copier is highly desirable. This requisite equipment, identical with Sandia's system, is available (thru RSR) on the 12th floor of the Willste building. Technical questions regarding the EASI method may be referred to R. C. Robinson of the Technical Support Branch.

Publications

1. Sasser, D. W., "User's Guide for EASI Graphics," Sandia Laboratories, Albuquerque, New Mexico, SAND78-0112, March 1978

2. Bennett, H. A., "The EASI Approach to Physical Security Evaluation," Sandia Laboratories, Albuquerque, New Mexico, SAND76-0500, January 1977

3. Sasser, D. W., "EASI on the HP-25, HP-65, and HP-67," Sandia Laboratories, Albuquerque, New Mexico, SAND76-0597, May 1977

4. Bennett, H. A., "User's Guide for Evaluating Physical Security Capabilities of Nuclear Facilities by the EASI Method," Sandia Laboratories, Albuquerque, New Mexico, SAND77-0082, June 1977

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