The ASSESS Neutralization Analysis Module

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ABSTRACT

The ASSESS Neutralization Analysis module (Neutralization) is part of Analytic System and Software for Evaluation of Safeguards and Security, ASSESS, a vulnerability assessment tool. Neutralization models a fire fight engagement between security inspectors (SIs) and adversaries. Results are based on probability of neutralization, P(N), which estimates the likelihood that SIs will win, given that SIs interrupt the attackers and begin an armed engagement. The calculating engine of the module is the Brief Adversary Threat Loss Estimator, BATLE. Engagements can have as many as 30 combatants on a side. Reinforcements may be introduced or combatant characteristics may be changed as many as ten times in one engagement. Inputs may be made with or without programmed guidance to the user. Seven different Combatant characteristics, which come from a modifiable library, can be independently specified for each combatant. Graphs of time distributions and studies of the sensitivity of P(N) to any combatant characteristic of either SIs or adversaries can be requested. Output files from Neutralization are used by Outsider Analysis to produce probability of security system win.

INTRODUCTION

The Neutralization Analysis module (Neutralization) is part of Analytic System and Software for Evaluation of Safeguards and Security [1], ASSESS, a vulnerability assessment tool. Neutralization [2] models a fire fight engagement between security inspectors and adversaries. Results are based on probability of neutralization, P(N), which estimates the likelihood that SIs will win, given that SIs interrupt the attackers and begin an armed engagement. The calculating engine of the module is the Brief Adversary Threat Loss Estimator [3], BATLE. Like all ASSESS modules, Neutralization runs on IBM-PC-compatible computers within Microsoft Windows®, a graphical user interface.

EXAMPLE

Neutralization is illustrated using the User Guidance mode of preparing inputs. Because all SIs will be alike and all adversaries will be alike, the library of combatant characteristics need not be modified. The unguided, shorter, Direct Entry mode is beyond the scope of this paper.

FACILITY

Figure 1 shows the layout of the hypothetical Example Facility. Adversaries seek to steal from a vault in one of the buildings in the Protected Area.

USER GUIDANCE

User Guidance is reached through the Neutralization menu: **Setup** from the menu bar and **Guidance** from the drop down menu. The **Header** window appears.

HEADER

The Header uniquely identifies the case being analyzed. When Neutralization Analysis is used with Outsider Analysis [4], the assumptions of both models must be compatible. The Neutralization Header permits a compatible Outsider analysis to be identified. Figure 2 shows a Header window with pertinent information entered.

TIMELINE

The Timeline of an attack includes the effect of (1) travel time, (2) alarm assessment time, and (3) the time required to issue the order(s) for an SI response.

The Neutralization Timeline begins when an alarm is received for assessment at the Central Alarm Station (t = 0). The first positively assessed alarm requires a response.

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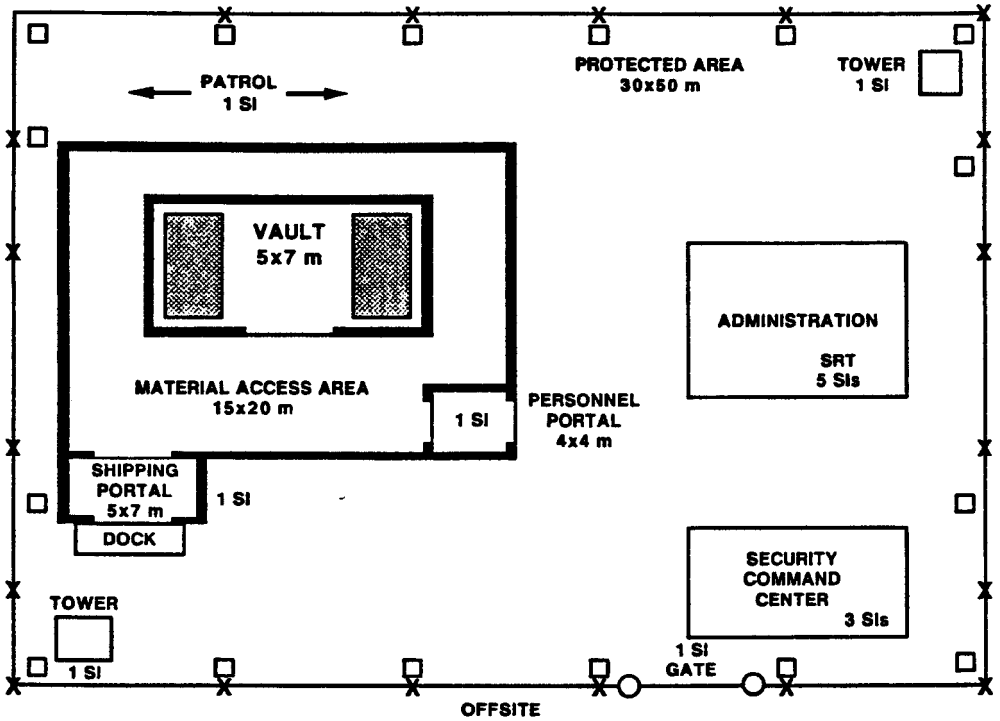

Figure 1. Site Layout of Example Facility

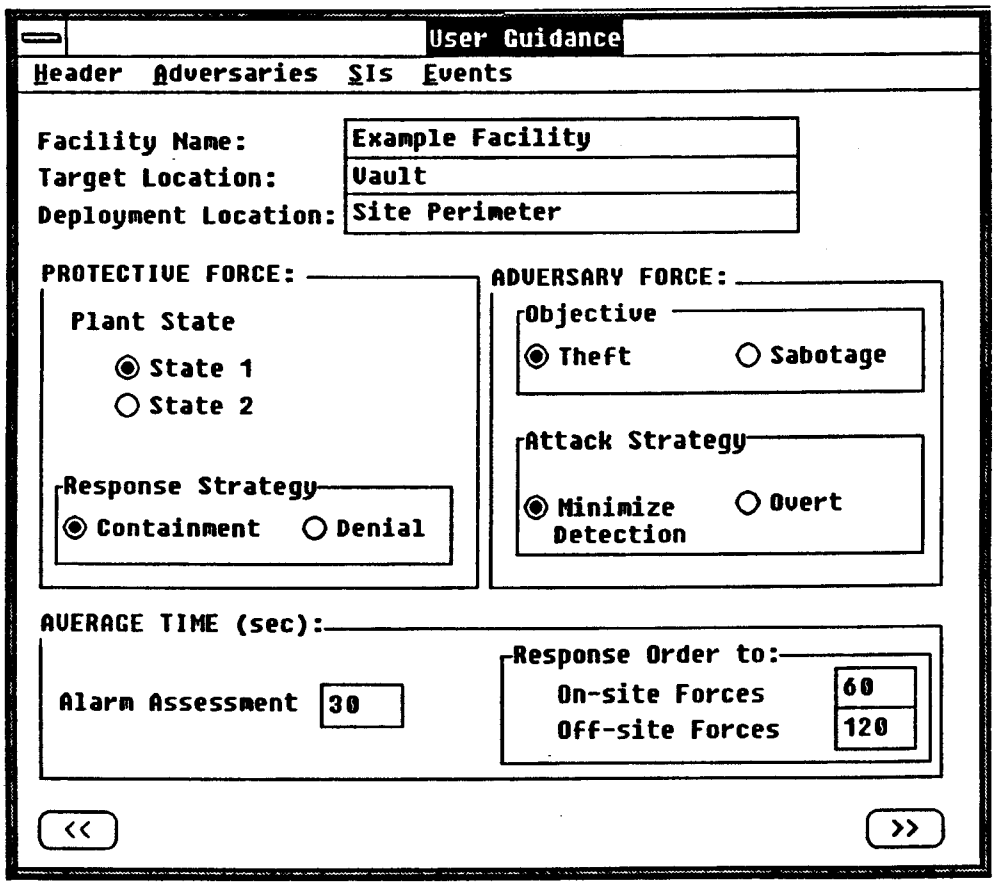

Figure 2. Header Window

After receiving the alarm assessment, the Central Alarm Station (CAS) knows that the site is under attack. It must order a response by appropriate security inspectors on duty at the site (and perhaps by offsite backup forces).

Now SIs begin their travel to the deployment locations. From the first valid alarm at t = 0 seconds, the time elapsed until an SI reaches his deployment location is arrival time. It is the sum of the assessment time, response order communication time, and travel time. The smallest arrival time is the soonest that an engagement can begin.

ADVERSARIES

The Adversaries window is shown in Figure 3. As many as 30 adversaries can be defined.

All adversaries may not be part of the attack team that penetrates to the target, steals it, and tries to leave the site with Special Nuclear Material (SNM). A leader (Command and Control) may stay out of the engagement. A vehicle driver or helicopter pilot may stay with his vehicle. A diversionary team may be used and not rejoin the attack team in time for an engagement. A rear guard could ambush reinforcements for the SIs.

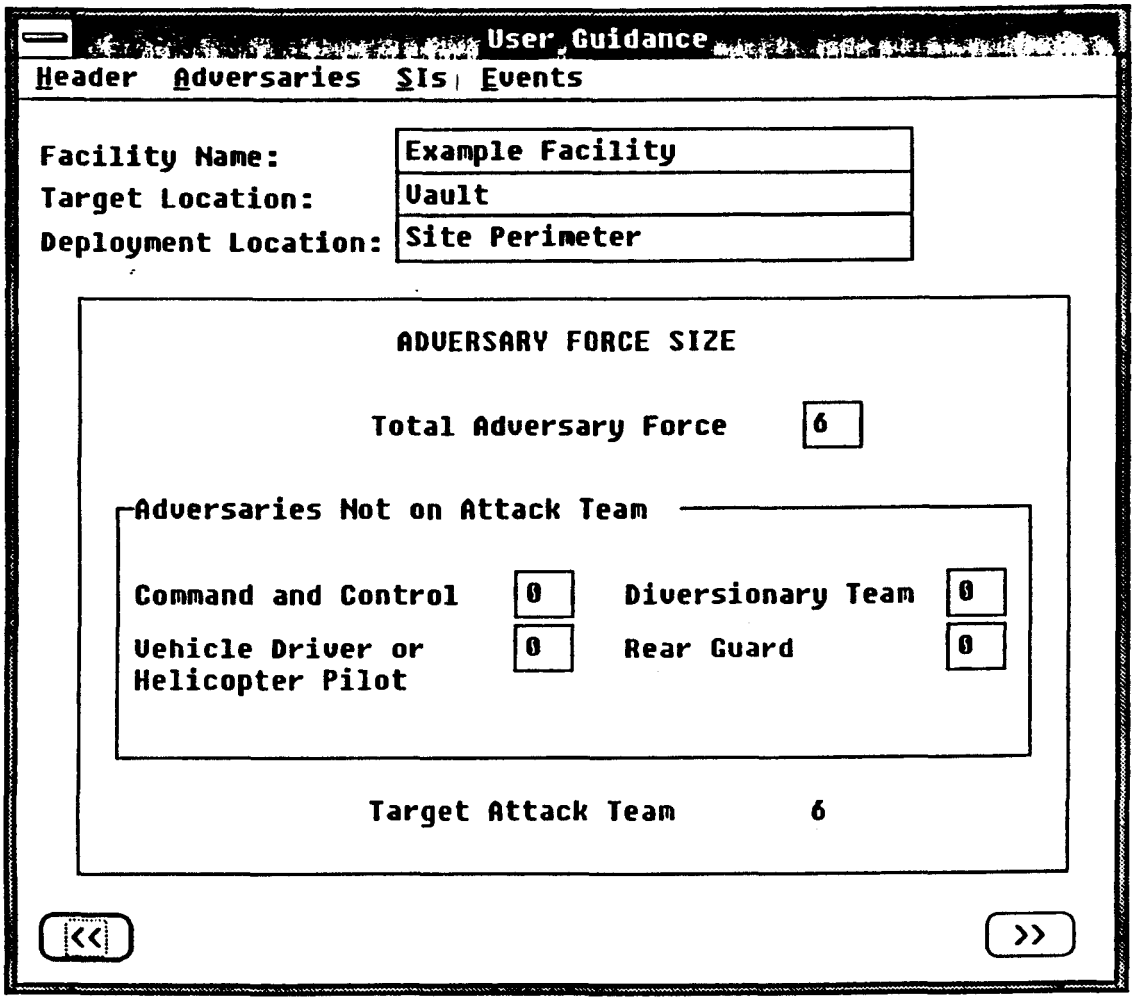

Figure 3. Adversaries Window

SECURITY INSPECTORS

The SIs window is shown in Figure 4. As many as 30 SI combatants can be defined.

The total security resources of Example Facility are shown in Table 1.

SIs already posted at their fighting positions on the site perimeter have zero seconds of travel time. A nonzero travel time is appropriate for an SI stationed at the deployment perimeter but having to travel to a different location along the perimeter.

Table 1. Security Inspector Resources at Example Facility

SI Location	No. Assigned to Post	No. Kept at Post	Travel Time (s)
MAA Post (Personnel, Shipping Portals)	2	2	60
Protected Area Patrol	1	0	0
Protected Area Post (Gate)	1	0	0
Protected Area Security Response Team (SRT)	5	0	180
Protected Area Tower	2	0	0
CAS (Security Command Center)	3	1	60

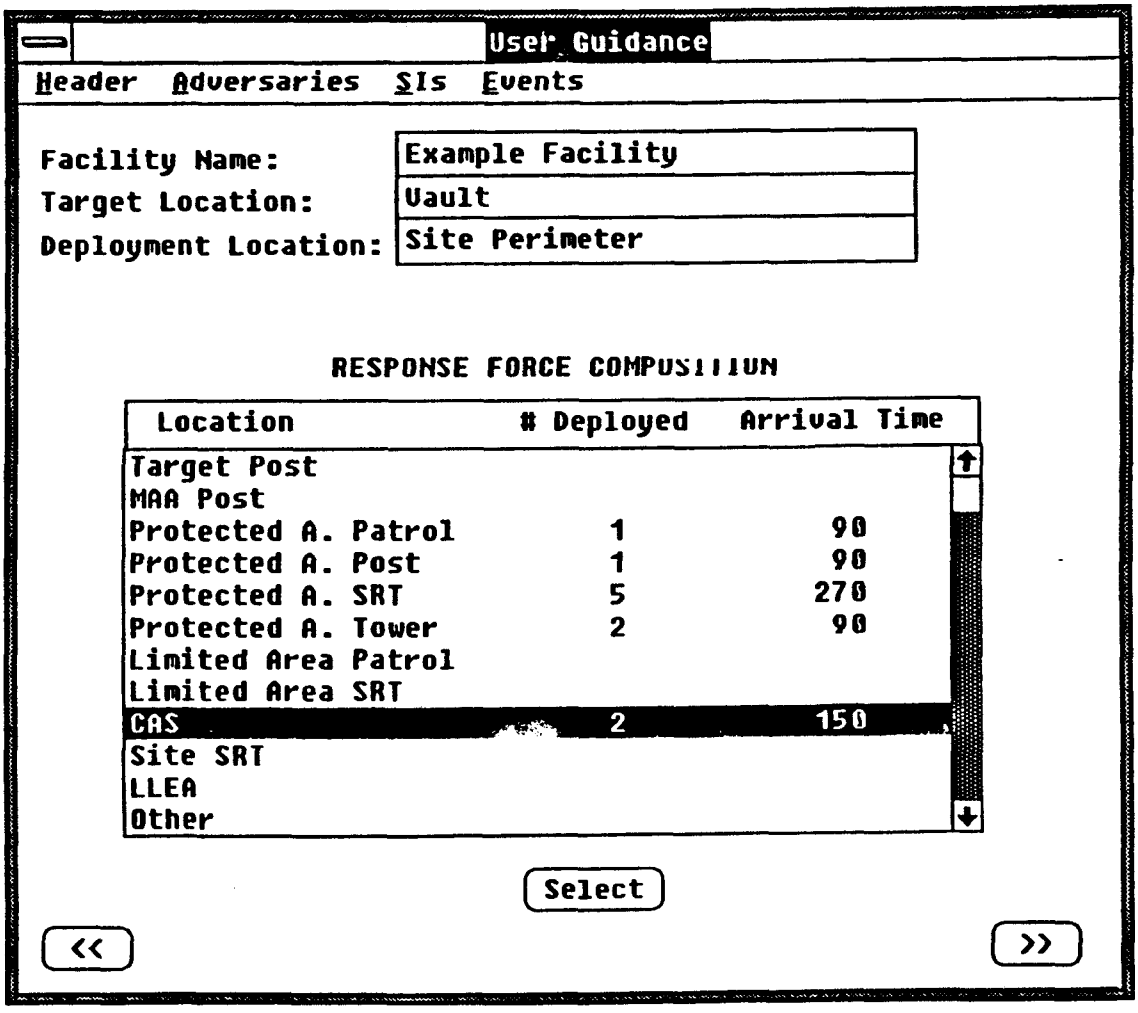

Figure 4. SIs Window After Input

All SIs may not be deployed in response to an attack on the site. For this example, standing orders require that the SIs in the Material Access Area (MAA) personnel portal, MAA shipping portal, and one of the SIs at the Security Command Center/CAS remain at their posts at all times. The remaining SI in the CAS coordinates communications among the response forces.

Data from Table 1 are input through the **Security Force Deployment** window. A successfully deployed SI is one who arrives at the deployment location and may participate in the engagement. The number Successfully Deployed is automatically computed (Figure 5).

EVENTS

As many as 10 events can be defined. A new event allows reinforcement of the SIs or changes of range, fire suppression, or any adversary or SI combatant characteristic.

In the Events window (Figure 6) are two summaries. At the left, Response Force Summary holds the information just input into the SIs window. At the right, Event Summary will list the events in the engagement, their onset times, the total SIs deployed in each event, and the total SIs engaged in each event. Once an SI engages in an event, he can be removed as a casualty only by the model.

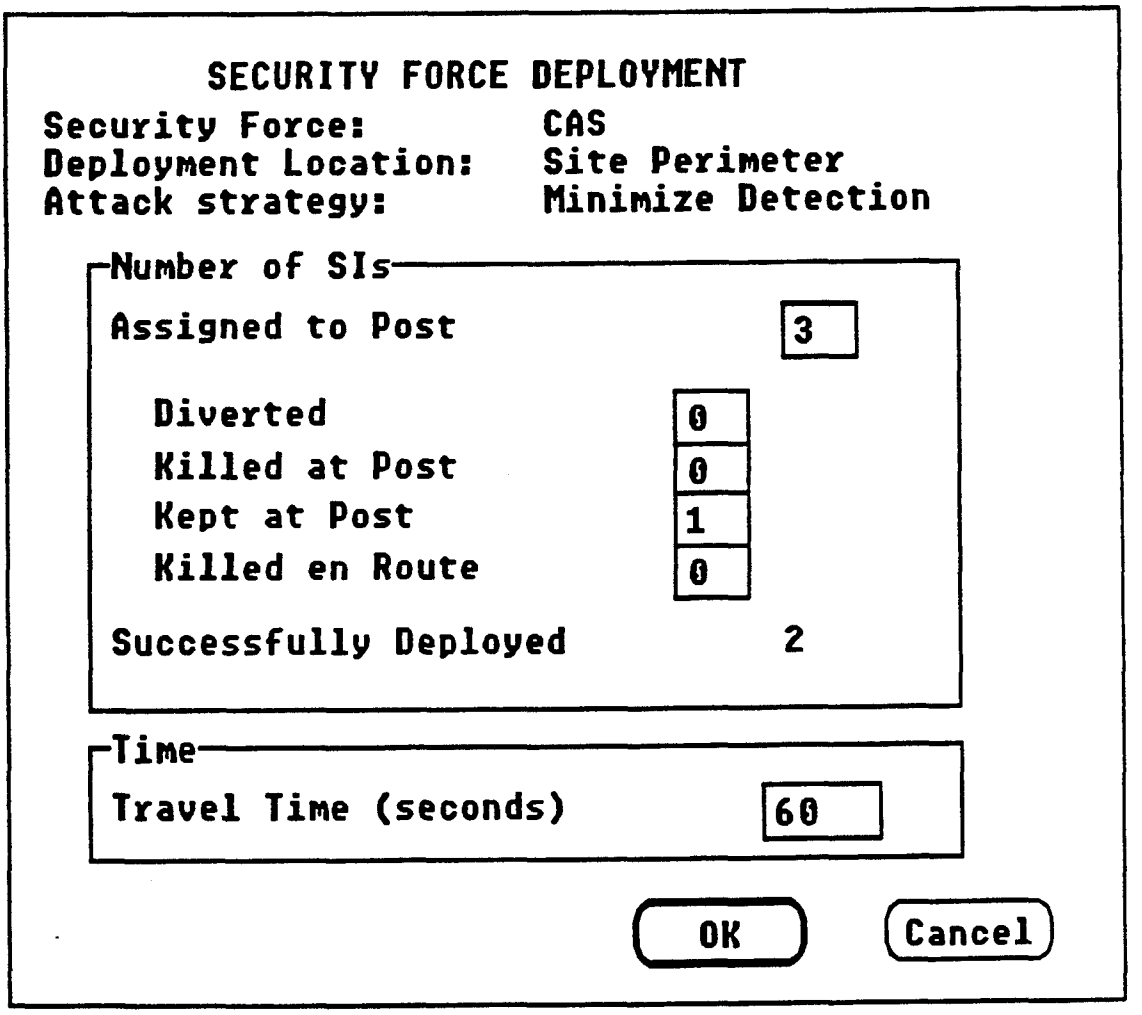

Figure 5. Security Force Deployment

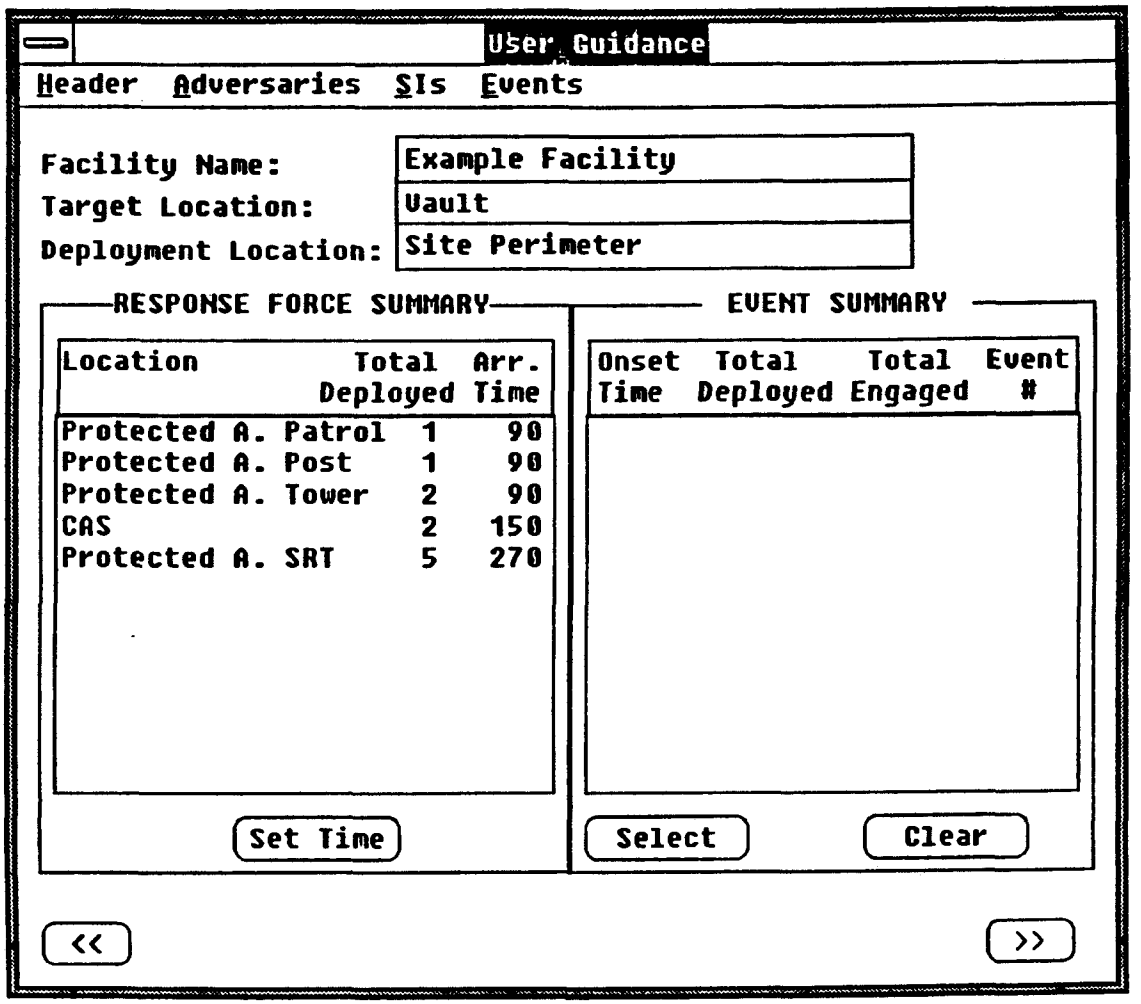

Figure 6. Events Window Before Input

The analyst decides when to begin the engagement. Should the engagement begin as soon as any SIs have deployed? Four SIs are already deployed when the deployment order is received at 90 seconds. To check whether this is sensible, analyze and see whether the results are favorable.

Start (Onset) Time of the first event of the engagement is set at 90 seconds. The four SIs that have completed deployment at Onset Time of 90 seconds are the Protected Area Patrol, the Protected Area Post, and the Protected Area Tower SIs.

The earliest possible SI reinforcements are introduced in a second event, arriving from the CAS at 150 seconds.

The final SI reinforcements, the Site SRT, are introduced in a third event, arriving at 270 seconds. Now the Event Summary has three lines of information— one for each event of the engagement, as shown in Figure 7.

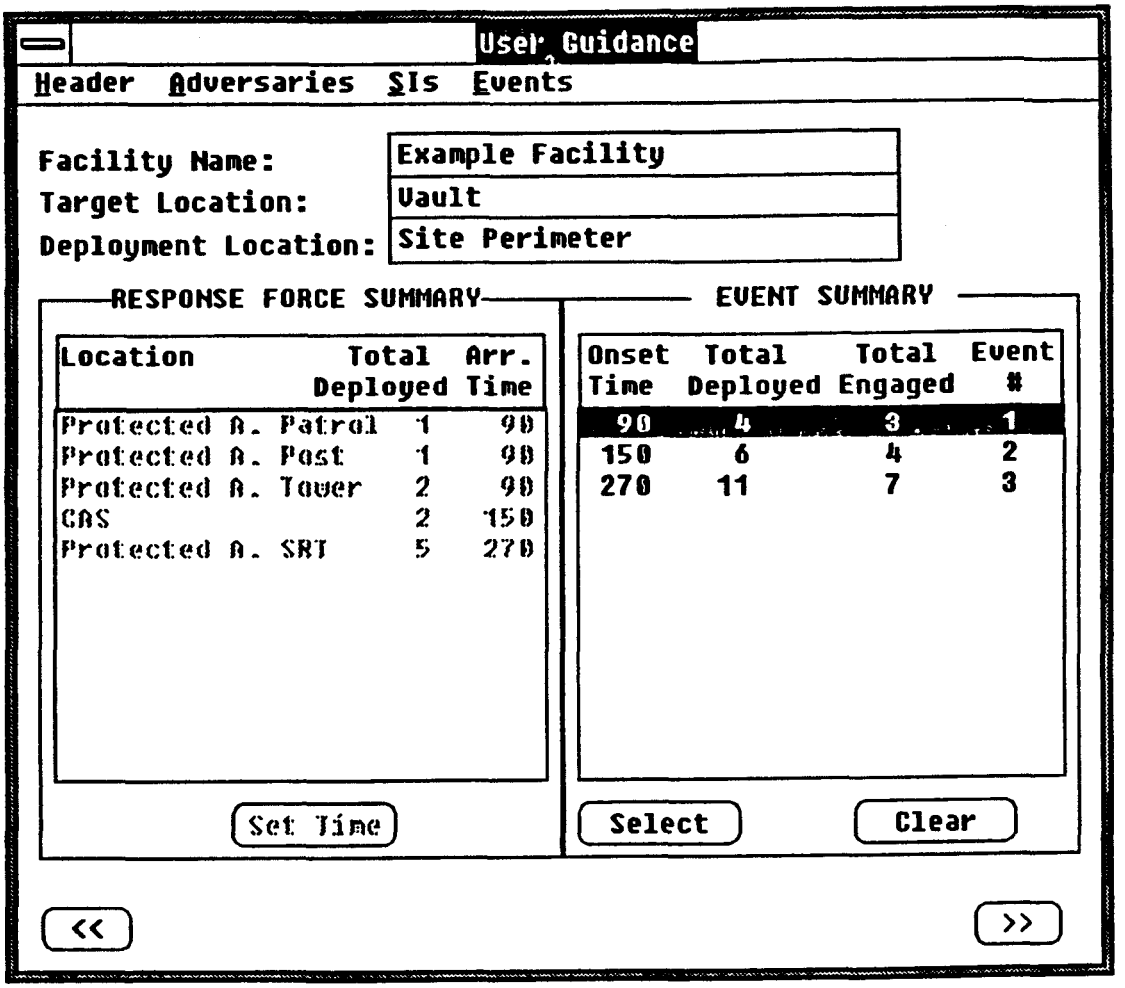

Figure 7. Events Window, Completed

EVENT NUMBER n

The window for Event 3 is shown in Figure 8.

Range between SIs and adversaries can have values from 1 meter through 500 meters. The default is 50 meters.

In Figure 8, fire suppression is described below at the left. The default is no fire suppression. Participation in the engagement by deployed SIs is summarized at top right.

SIs with no line of fire to the adversaries must not be counted as active participants in the engagement. When SIs are deploying along the site perimeter for containment, buildings such as the target building come between some of the SIs and the adversaries.

Some SIs might not fire their weapons if they are not well trained or are inexperienced in combat. In this example, all SIs will fire their weapons. The Total Engaging is automatically computed.

If any deployed SIs do not have a line of fire to the adversaries, the analyst must choose who they are. A Protected Area Tower SI has no line of fire to the adversaries since the two towers are at diagonally opposite corners of the protected area and have different lines of sight (Figure 9).

In the Event Number n window, the information for the selected SIs has been updated. See the SIs Engaging box in Figure 8.

After all three events of the engagement have been defined, the effect on the Events window is seen in Figure 7.

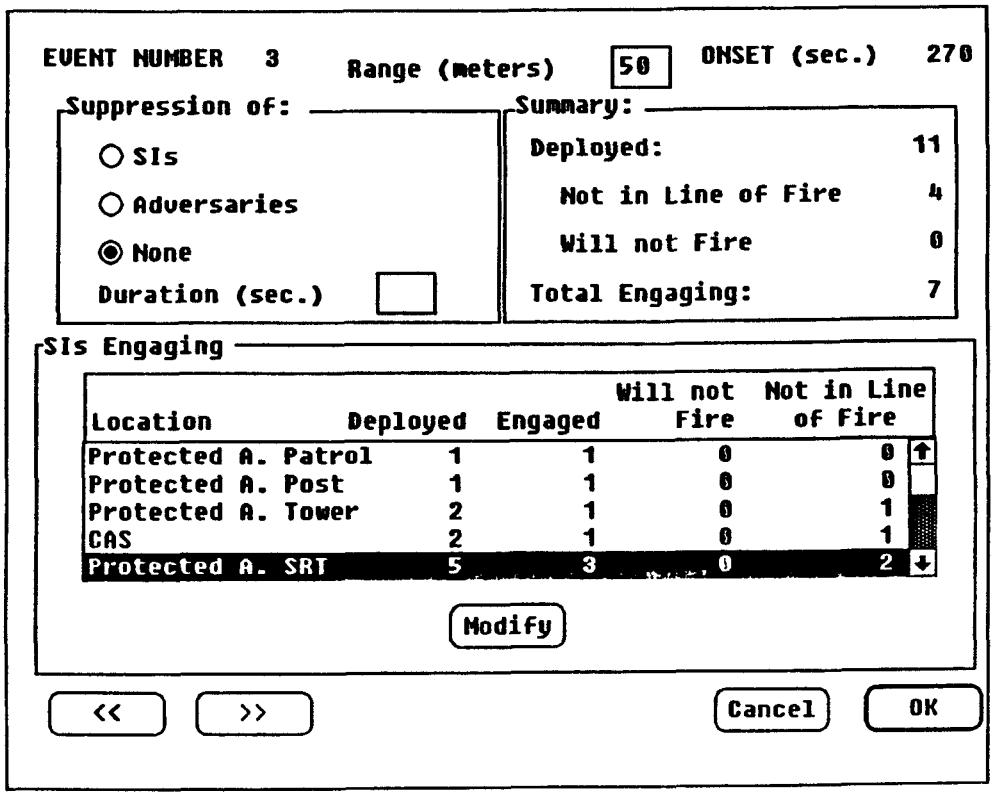

Figure 8. Event Number 3 Window After Input

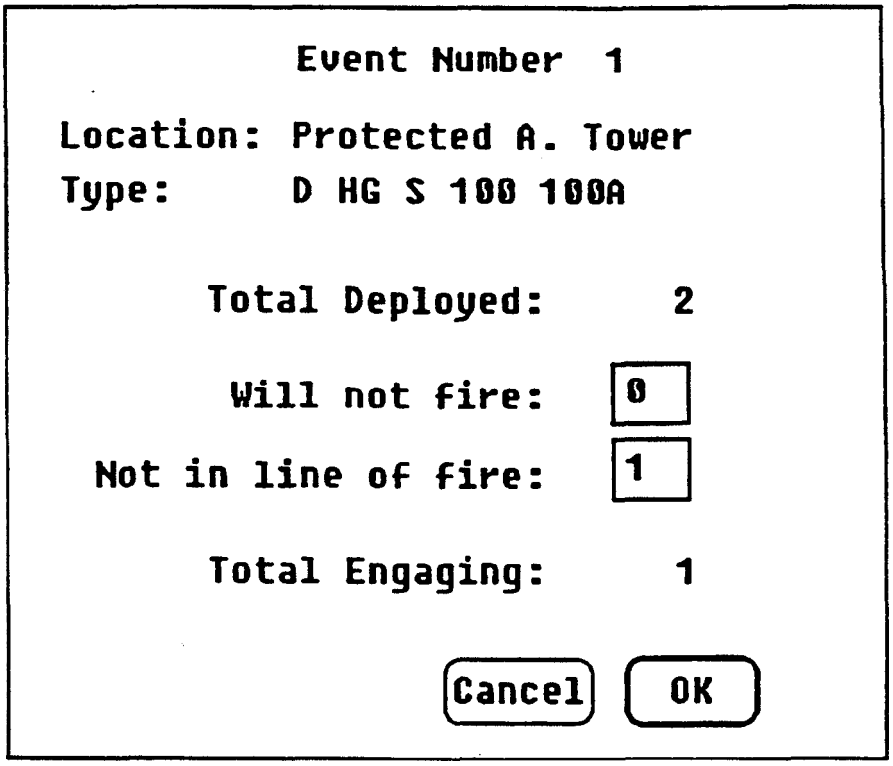

Figure 9. Event Edit Window After Input

SCENARIO

When Neutralization was first entered, the Scenario screen was empty. Now the defined engagement is summarized on the Scenario screen (Figure 10), which summarizes two events at a time. The summary of Event 3 is found by horizontal scrolling.

The SIs ID column lists the locations from which the active SI combatants come. Under each event are two columns of information cells. Each cell, which can be individually edited, summarizes a combatant's default characteristics. To read the characteristics, refer to Table 2.

Table 2. Combatant Characteristics Codes

Example: D SA K 50 75A

Example	Characteristic	Code and Choice
D	Tactic	A =Assault D =Defense
SA	Weapon	HG=Handgun SG =Shotgun SA =Semiautomatic Rifle FA =Fully Automatic Rifle SM=Submachinegun
K	Posture	S =Stand K =Kneel P =Prone
50	Firing Exposure	% Firing Exposure
75	Reload Exposure	% Reload Exposure
A	Other	Indicates only different combinations of other characteristics by a change of letter

SIs	EVENT 1		EVENT 2		EVENT 3	
ID	Security Ins.	Adversaries	Security Ins.	Adversaries	Security Ins.	Adversaries
1 PA Patrl	D SA K 50 50A	A SA K 50 50A	D SA K 50 50A	A SA K 50 50A	D SA K 50 50A	A SA K 50 50A
2 PA Post	D SA K 50 50A	A SA K 50 50A	D SA K 50 50A	A SA K 50 50A	D SA K 50 50A	A SA K 50 50A
3 PA Tower	D SA K 50 50A	A SA K 50 50A	D SA K 50 50A	A SA K 50 50A	D SA K 50 50A	A SA K 50 50A
4 CAS		A SA K 50 50A	D SA K 50 50A	A SA K 50 50A	D SA K 50 50A	A SA K 50 50A
5 PA SRT		A SA K 50 50A		A SA K 50 50A	D SA K 50 50A	A SA K 50 50A
6 PA SRT		A SA K 50 50A		A SA K 50 50A	D SA K 50 50A	A SA K 50 50A
7 PA SRT					D SA K 50 50A	
8						
9						
10						
11						
12						
13						

Figure 10. Scenario Screen

COMBATANT CHARACTERISTICS

Defaults for the combatants are defined in a library file for adversaries as a group and for each SI location listed in Figure 4. The characteristics of a combatant in an event can be made unique by editing each appropriate cell on the Scenario screen.

RESULTS

To analyze the engagement and obtain results, select **Results** on the main menu. A drop down menu appears, giving two choices: **Sensitivity Studies** of single characteristics of combatants, and **Time Function** graphs.

There are five choices for **Time Function**: Probability of Termination, Probability of SI Win, Probability of Adversary Win, Estimated Number of SIs Remaining, and Estimated Number of Adversaries Remaining.

If **Probability of Termination** is selected, a window reports that P(N) = 0.054 and the Engagement Duration = 35 seconds. This value of P(N) could be saved for use by the Outsider module. The engagement terminated early because the probability of termination remained at 90% for more than 5 seconds. The adversaries likely would have annihilated the SIs before the SI reinforcements arrived at 150 seconds for Event 2 and would resume their attack on the site.

The graph "Probability of Termination" as a function of time appears as in Figure 11. The function is plotted until the early termination of the engagement at 90 + 35 = 125 seconds.

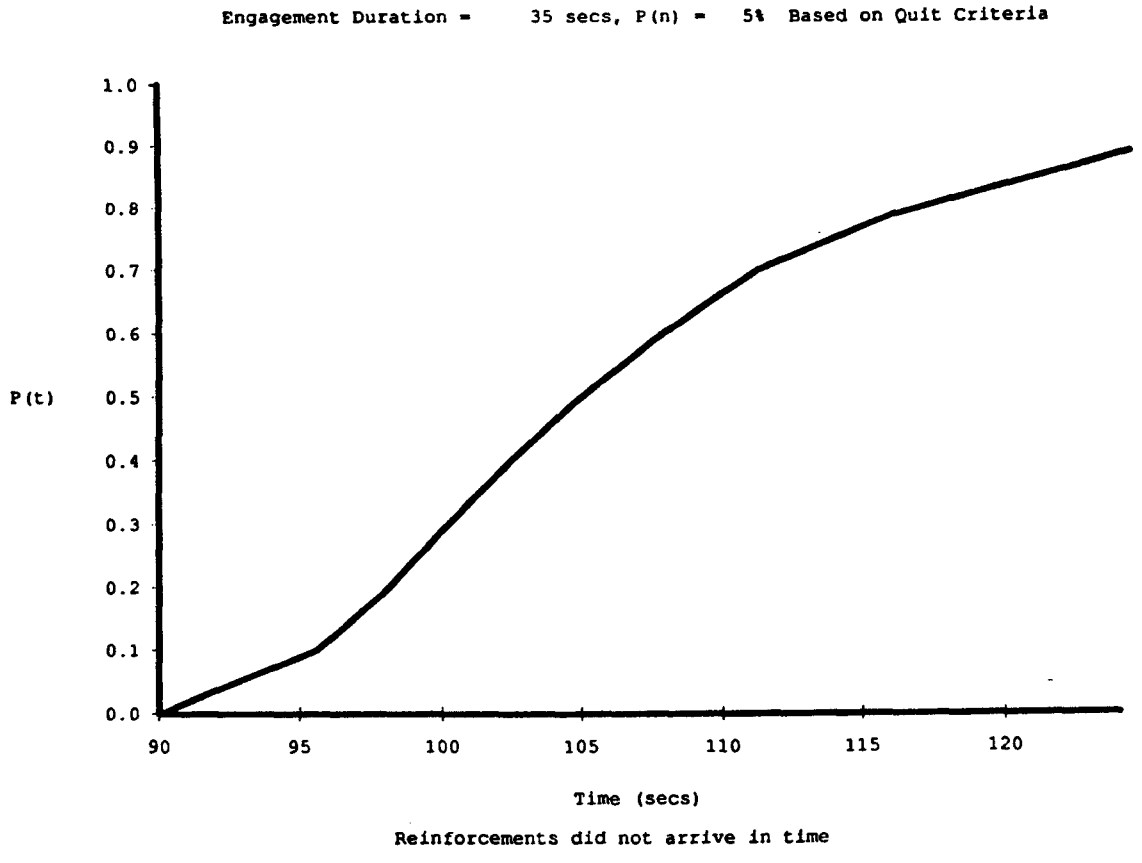

Figure 11. Probability of Termination

There are three choices for **Sensitivity Studies**: Scenario, SI, and Adversary characteristics. For **Scenario** the choices are SI Win as a Function of Number of Adversaries, SI Win as a Function of Number of SIs, SI Win as a Function of Range, and SI Win as a Function of Onset Time. Selecting Number of Adversaries produces on the screen the plot shown in Figure 12.

The choices of Sensitivity Studies for **SIs** and **Adversaries** cover all characteristics of the combatants: Tactic, Weapon, Posture, % Delay, % Firing Exposure, % Reload Exposure, and % Firing Degradation Due to Illumination.

Finally, the resulting P(N) can be saved in a file that the Outsider module will be able to call. Outsider will use P(N) and a P(I) that it calculates to obtain a probability of system win.

SUMMARY

Consider what analysis of this engagement has disclosed. Although in total more SIs than adversaries were actively engaged, starting the engagement at the earliest possible time with relatively few SIs and feeding in the reinforcements as quickly as they were available resulted in a loss for the SIs. As a follow-on exercise, try delaying the start of the engagement until all SIs are deployed at 270 seconds. That is, create a single event engagement whose onset is at 270 seconds. Everything else can be left unchanged. Does this prove advantageous to the SIs?

REFERENCES

1. "An Overview of ASSESS – Analytic System and Software for Evaluating Safeguards and Security," J.C. Matter, R.A. Al-Ayat, and T.C. Cousins, INMM 30th Annual Meeting Proceedings, 1989.

2. "Neutralization and System Effectiveness," W.K. Paulus, INMM 29th Annual Meeting Proceedings, June 26-29, 1988.

3. D. Engi and C.P. Harlan, *Brief Adversary Threat Loss Estimator (BATLE) User's Guide*, NUREG/CR-1432, SAND80-0952 (Albuquerque, NM: Sandia National Laboratories, May 1981).

4. "The ASSESS Outsider Analysis Module," A.E. Winblad, M. Snell, S.E. Jordan, B. Key, B. Bingham, and S. Walker, INMM 30th Annual Meeting Proceedings, 1989.

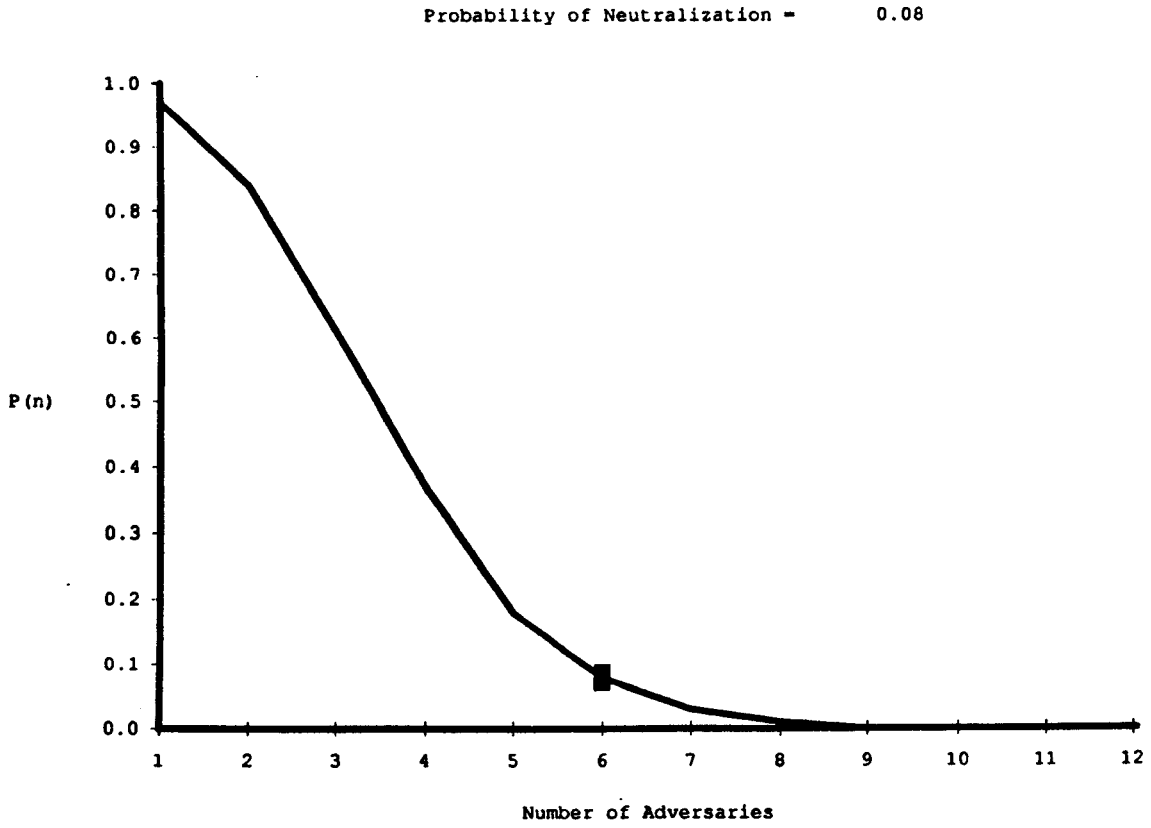

Figure 12. SI Win as a Function of Number of Adversaries