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FEASIBILITY STUDY ON THE USE OF RV DETECTION TECHNIQUES TO DETERMINE LOCATION OF MILITARY TARGETS

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I OBJECTIVE

The purpose of this document is to provide an outline of a program to assess the feasibility of using RV detection techniques to determine the location of military targets of interest.*

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*Throughout this document the abbreviation RV refers to the term "remote viewing," not to its other use as "re-entry vehicle."

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II INTRODUCTION AND BACKGROUND

A. Location of Unknown Military Targets

A continuing requirement in military operations is the determination of the location of tactical and strategic military targets of interest whose positions are not known *a priori*. Examples range from the location of a command post in a tactical battlefield situation to the position of a submarine in a strategic problem.

B. Remote Viewing (RV) as a Location Technology

Of particular interest along the psychoenergetic lines is a human information-accessing capability that we call "remote viewing" (RV). The RV phenomenon, under study at SRI International for the past nine years, pertains to the ability of certain individuals to access and describe, by means of mental processes, information blocked from ordinary perception by distance or shielding, and generally believed to be secure against such access. This has included the ability of subjects to view remote geographical locations given only geographical coordinates or a designated person on whom to target.

The RV abilities of several subjects have been developed to the point where they can describe--often in great detail--geographical and technical material such as natural formations, roads, buildings, interior laboratory apparatus, and real-time activities. Such functioning has been examined both from the standpoint of U.S. use as an intelligence collection technique, and from the standpoint of threat analysis as to the vulnerability of U.S. systems and facilities.[1-5]

In problems of the location type (which have not been addressed in any detail in former programs) the general prospect of a continuum of possible locations can often be reduced to that of a set of discrete possibilities. This is because, for example, only a finite number of deployment sites of a weapons system are available, or because specifying one of a number of grid squares is sufficient to define location. If a location task can be so defined (to be one of a discrete set of possibilities), then a detection method can be designed around one of the standard formats for RV testing, a statistical form of shell game which is a direct analog of the discrete location problem.

One of the standard formats for RV testing is a computerized form of "shell" game which is a direct analog of the military target location situation. The testing procedure addresses the basic problem of choosing, by RV techniques, a "correct" answer from among a number of possible alternatives. An example is provided by an electronically-automated screening study carried out by SRI consultant Charles Tart. Subjects were asked to determine which one of ten possible positions on a circular display had been designated as an active target by the electronic test device's random number generator.[6] From an unselected population of 2000 university students participating in a mass card screening program, seventy of the better subjects accepted an invitation to be further screened using the automated electronic testing system. Of these, ten were finally chosen to participate in a formal study involving 500 trials each. The results obtained with these ten subjects are shown in Table 1. It is seen that five of the ten subjects scored significantly above chance, all in the range of 1.5-2.5 times chance expectation. The best subject averaged a 24.8% hit rate (~2.5 x chance) over the 500-trial sequence; the probability of such a result or better occurring by chance is only $p = 2 \times 10^{-28}$.

Furthermore, as good as these results are, the potential utility of such results can be further enhanced by the use of error-correcting statistical averaging techniques. Such techniques have proven themselves

Table 1

ELECTRONICALLY-AUTOMATED SCREENING STUDY

Subject	Hit Rate (10% Expected)	Probability of Obtaining Such a Result by Chance (one-tailed)
1	24.8%	2×10^{-28}
2	20.6%	1×10^{-14}
3	16.2%	2×10^{-6}
4	16.0%	4×10^{-6}
5	15.6%	2×10^{-5}
6	11.8%	nonsignificant
7	11.4%	nonsignificant
8	10.8%	nonsignificant
9	9.4%	nonsignificant
10	7.8%	nonsignificant

capable of amplifying even small statistical advantages to arbitrarily-high-accuracy results. To cite an example, Czech researcher Dr. Milan Ryzl, a chemist with the Institute of Biology of the Czechoslovakian Academy of Science, carried out an experiment with a subject whose base performance level was that he was generally capable of generating better than a 60% hit rate targeting on sequences of random binary digits, or bits (0, 1), where chance expectation was 50%.

For the purpose of showing the power of psi enhancement by statistical averaging techniques, Ryzl chose as a task the acquisition, without error, of a 50-digit random binary sequence. The effort took 19,350 calls, averaging 9 sec per call. The hit rate for individual calls was 61.9%, 11,978 hits and 7372 misses.[7] By means of repeated passes through the

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sequence and an elaborate (though inefficient*) majority-vote protocol, the subject was able to identify with <u>100% accuracy</u> all 50 bits. The probability that he did so by chance is only one in 10^{15}.

C. <u>Conclusion</u>

Thus, data already extant from RV detection experiments indicate that (a) one target from among a number can, with some statistical advantage, be determined by RV detection techniques, and (b) the accuracy of doing so can be amplified by statistical averaging techniques. These observations thus provide a sound basis upon which to estimate the feasibility of RV detection of randomly distributed military targets, and the protocols in use are essentially directly applicable in their present form.

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*An increase in efficiency by a factor of about 20 could be expected on the basis of a statistical averaging procedure more optimum than that used in the experiment.[1]

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III METHOD OF APPROACH

With regard to determining the vulnerability of military targets to RV detection, an approach that recommends itself is a gradient-scale three-step program involving (1) microcomputer-based screening/training, (2) simulation testing, and (3) demonstration-of-feasibility field study. Each of these are discussed below.

A. Step 1--Microcomputer-Based Screening/Training

The first step of the program would involve screening/training a population of volunteers using microcomputer-based modeling of the location problem. Basically, the individuals participating as remote viewers are asked, in repetitive trials, to determine which one of twenty possible locations (schematically represented as circles on a computer-driven graphics display) has been designated as the simulated military target by the computer's random number generator. The computer display is driven by an LSI-11 microcomputer which, on a trial-by-trial basis, generates a new random display of the circles (to circumvent bias on the part of the remote viewer due to previous choices). The individual enters his selections by button press on a hand device positioned over an X-Y grid (see Figure 1, where a one-in-ten case is shown), and the computer responds by giving immediate feedback as to the correct answer (to encourage learning). As the trials progress, the selections are computer analyzed on line by a statistical averaging program, the output of which indicates whether one of the possibilities has been chosen statistically significantly more often than expected by chance. (In the later application phase essentially the same procedure is followed, with the circles internally

FIGURE 1 COMPUTER MODELING TASK. The circles representing possible target locations are shown in the lower video monitor; a decision graph is shown on the upper monitor. The remote viewer's choice is entered by button press on hand device positioned over x-y grid.

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keyed to actual target site possibilities. The procedure differs only in that trial-by-trial feedback would, of course, not be available).

1. Sequential Sampling Statistical Averaging Procedure

An efficient statistical method for the screening/training process is provided by a sequential-sampling technique used in production-line quality control.[8] The sequential method gives a rule of procedure for making one of three decisions (with regard to each of the possible choices) following each trial, which consists of a remote viewer entering a selection: the accumulated selections have met a pre-established hit-rate criterion (decision positive); the accumulated selection do not exceed chance expectation (decision negative); continue trials (insufficient data to make a decision). The sequential sampling procedure differs from fixed-trial-length procedures in that the number of trials required to reach a decision is not fixed, but depends on the results accumulated with each trial. The principal advantage of the sequential sampling procedure as compared with other methods is that, on the average, fewer trials per decision are required for an equivalent degree of reliability.

To apply the sequential analysis procedure to screening training, we must a priori define the hit rate we require to conclude that useful RV detection is taking place, and what statistical risks we are willing to accept for making an incorrect decision.

To meet these criteria, sequential analysis requires the specification of four parameters to determine from which of two distributions (chance or required-hit-rate) a data stream belongs. They are: p_o, the fraction of selections of a particular target expected in the chance condition (e.g., $p_o = 1/20$ for the case under discussion); p_1, the fraction of selections expected in the presence of a functioning RV capability (e.g., $p_1 = 0.125$ for a $2.5 \times$ chance-expectation requirement, a value that might be chosen because of previous performance in a successful one-in-twenty task); α, an _a priori_ assigned acceptable error rate (e.g., $\alpha = 0.05$) for concluding that accumulated selections of a particular choice derive from the p_1 (RV) distribution when in fact they derive from the p_o (chance) distribution (Type I error); β, an _a priori_ assigned acceptable error rate (e.g., $\beta = 0.05$) for concluding that accumulated selections of a particular choice derive from the p_o (chance) distribution when in fact they derive from the p_1 (RV) distribution (Type II error).

With the parameters thus specified, the sequential sampling procedure provides for construction of a decision graph of the type shown in Figure 2. The decision graph illustrates the rules of procedure for making one of the three possible decisions following each trial: continue test before making a decision (unshaded middle region in Figure 2); decision positive (upper shaded region in Figure 2); decision negative (lower shaded area in Figure 2). The equations for the upper and lower decision lines are given in the Appendix.

With the appropriate equations programmed into the microcomputer, the computer automatically records all data (trial number, target/response pair), and displays on the video graphics system progress on a target decision graph. A cumulative record of remote viewer selections is compiled by the computer until either the upper or lower decision line is reached, at which point a decision is made.

Also given in the Appendix are the equations for the average number of trials to make decisions, positive or negative. A plot of the average number of trials to reach a positive decision for typical cases of interest is shown in Figure 3, where 5% (α, β) error rates have been assumed. As an example, we see that for a 2.5 × expectation rate ($k = 2.5$) hitter, $\bar{n}_1 \approx 62$ trials are required on the average to reach a positive decision on a one-in-twenty target.

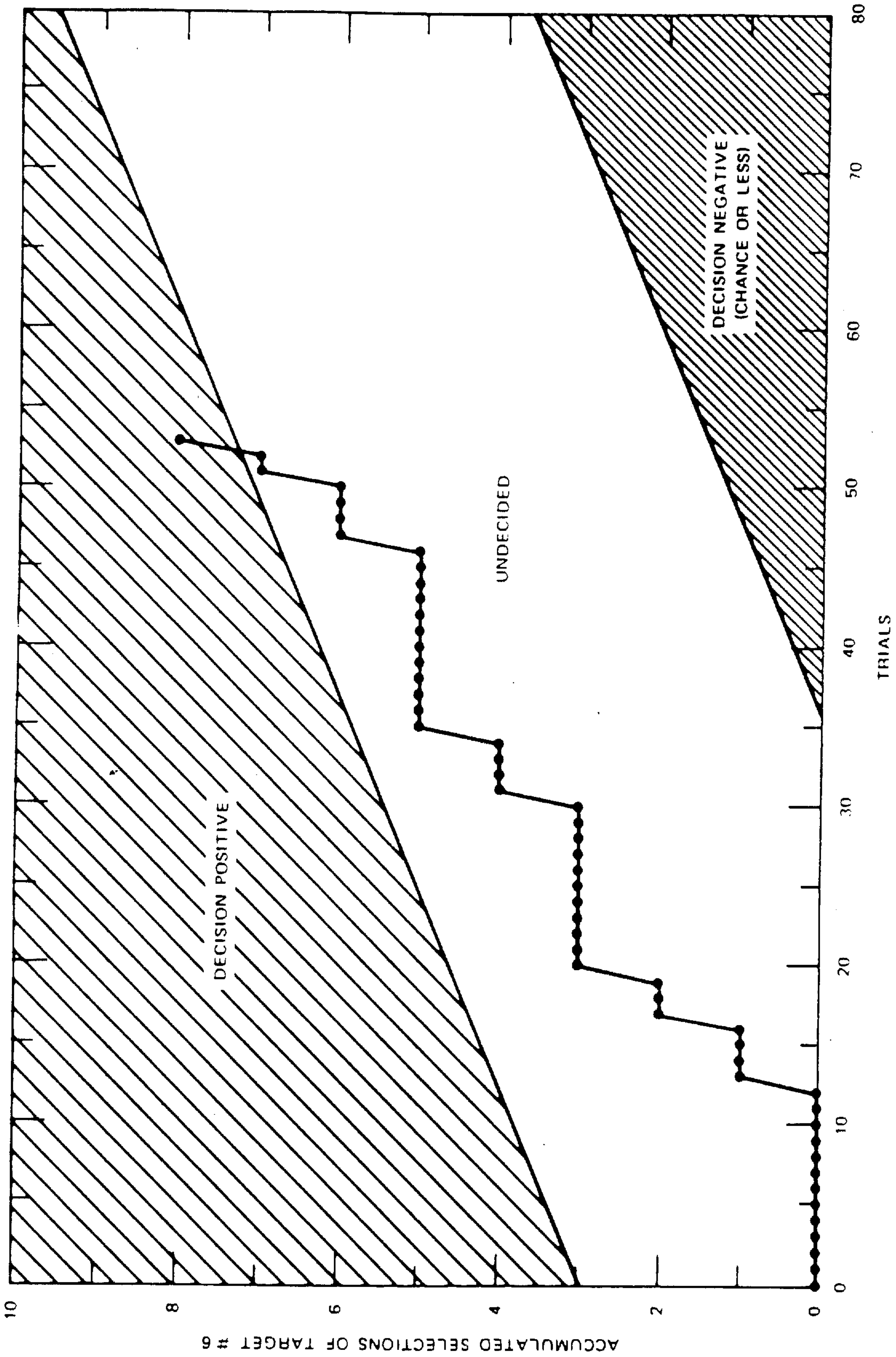

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FIGURE 2 DECISION GRAPH FOR SITE SELECTION (5% Error Rates; 2.5 x Chance Expectation [1/20] Requirement) (U)

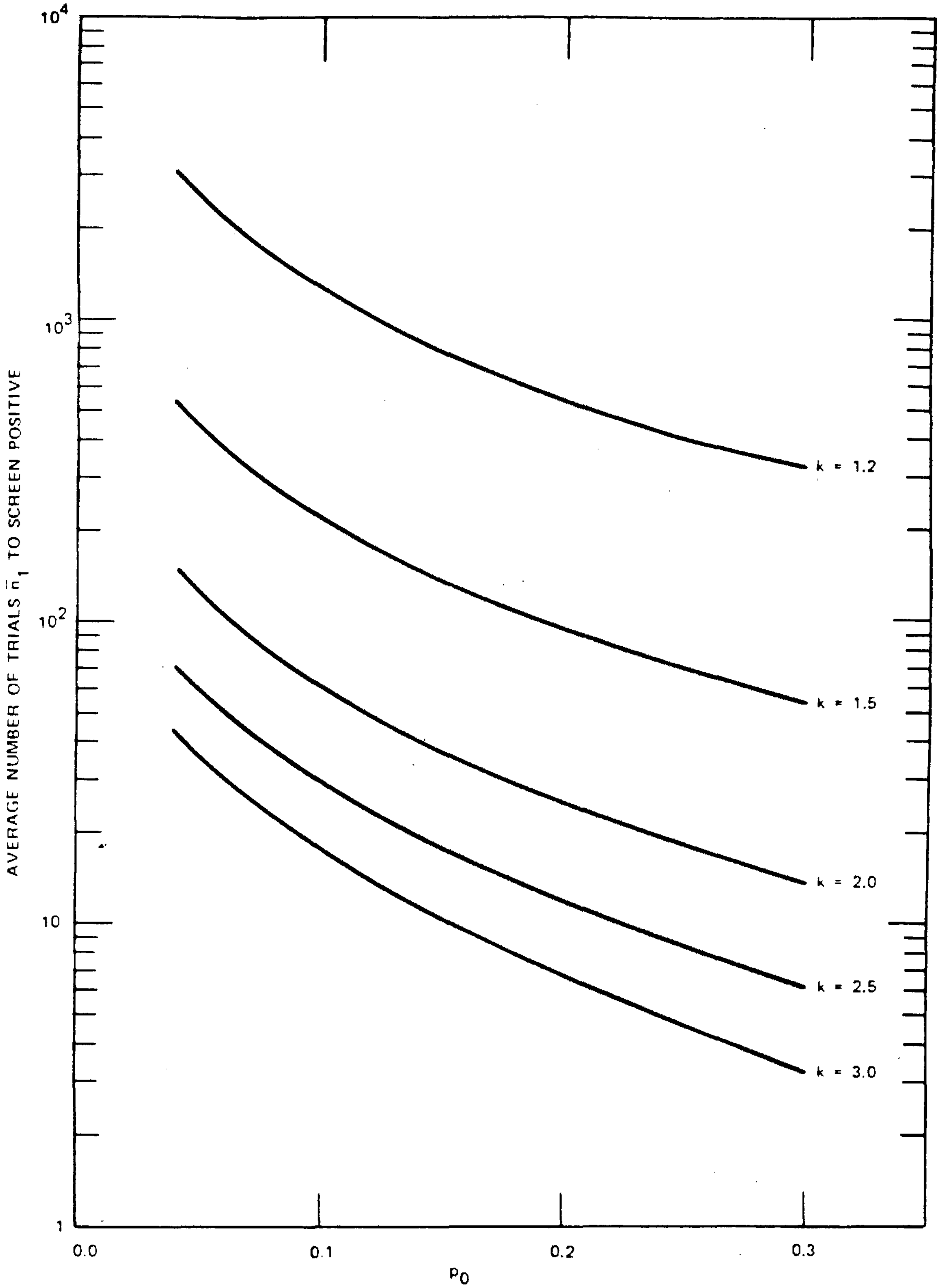

FIGURE 3 AVERAGE NUMBER OF TRIALS $\bar{n}_1$ TO SCREEN POSITIVE
p_0 = chance expectation = 1/N, where N is the number of alternatives.
p_1 = $k x p_0$, where p_1 is the required hit rate and k is the associated strength parameter.
Error rates $\alpha = \beta = 0.05$ are assumed.

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2. System Error

The overall system error is dependent on the type of mode employed in site penetration attempts.

(a) If the RV detection task is approached with a tentative choice having already been made (presumably by more conventional means), then the task of the remote viewer is to verify or reject the tentative decision as a backup test. In this mode, only a single decision graph is plotted in the target choice of interest. The probability of error due to chance ($P_{e,c}$) in this case $\sim \alpha$, being given by the product of the probability of making a selection even though operating at chance, and the percentage of such selections that correspond to an incorrect decision:

$$P_{e,c} = \left(\frac{N-1}{N}\right) \alpha \quad .$$

(b) If the RV detection task is approached as a blind one-in-N task (e.g., one-in-20 task), the N decision graphs are plotted in parallel, one for each of the N target choices, as each selection is being made. In this case, to a good approximation the graphs can be treated in the chance condition as independent, and the probability of error due to chance ($P_{e,c}$) $\sim N\alpha$. Specifically, it is given by the product of the probability of making at least one selection in the N graphs by chance (which is one minus the probability of making no selections), and the percentage of such selections that correspond to an incorrect decision:

$$P_{e,c} = \left(\frac{N-1}{N}\right) \left[1 - (1 - \alpha)^N\right] \quad .$$

For example, with N = 20, a 1% individual-target error rate ($\alpha = 0.01$) leads to $P_{e,c} = 0.17$, or a confidence factor $1 - P_{e,c} = 0.83$; this provides ~ a 17-fold increase in odds over the one-in-twenty confidence factor expected by chance.

3. Test Data

As a test of the above procedure applied to real data, the data generated by Subject #1, Table 1, were processed by passing it through the sequential analysis statistical averaging program (500 trials, 24.8% hit rate on a one-in-ten task). With the parameters set to correspond to a twice-chance-expectation requirement and 5% (α, β) error rates, the results are as shown graphically in Figure 4: twelve correct selections, in a row, of one-in-ten targets were made in 452 trials. Although the data was gathered under the condition that the correct answers were stored in the computer during the runs, and therefore trial-by-trial feedback could be given as the random number generator stepped through its program, the conditions are nonetheless sufficiently similar to the projected task that the results can be taken as evidence that the proposed approach is sound.

4. Summary

In the screening/training program, participants would be screened trained by carrying out the task described in this section, first with trial-by-trial feedback to encourage learning, and then without feedback to model properly an application study. In this initial phase the target for each run would be designated internally by the computer's random number generator.

Carried out on a large-enough scale, the screening training program described in this section would provide realistic estimates of the percentage of population trainable in this task, and the levels of proficiency to which performance in this task could be developed. In a program designed to assess to its fullest the feasibility of locating military targets by RV detection techniques, it is recommended that sufficiently large-scale screening to meet these requirements be considered.

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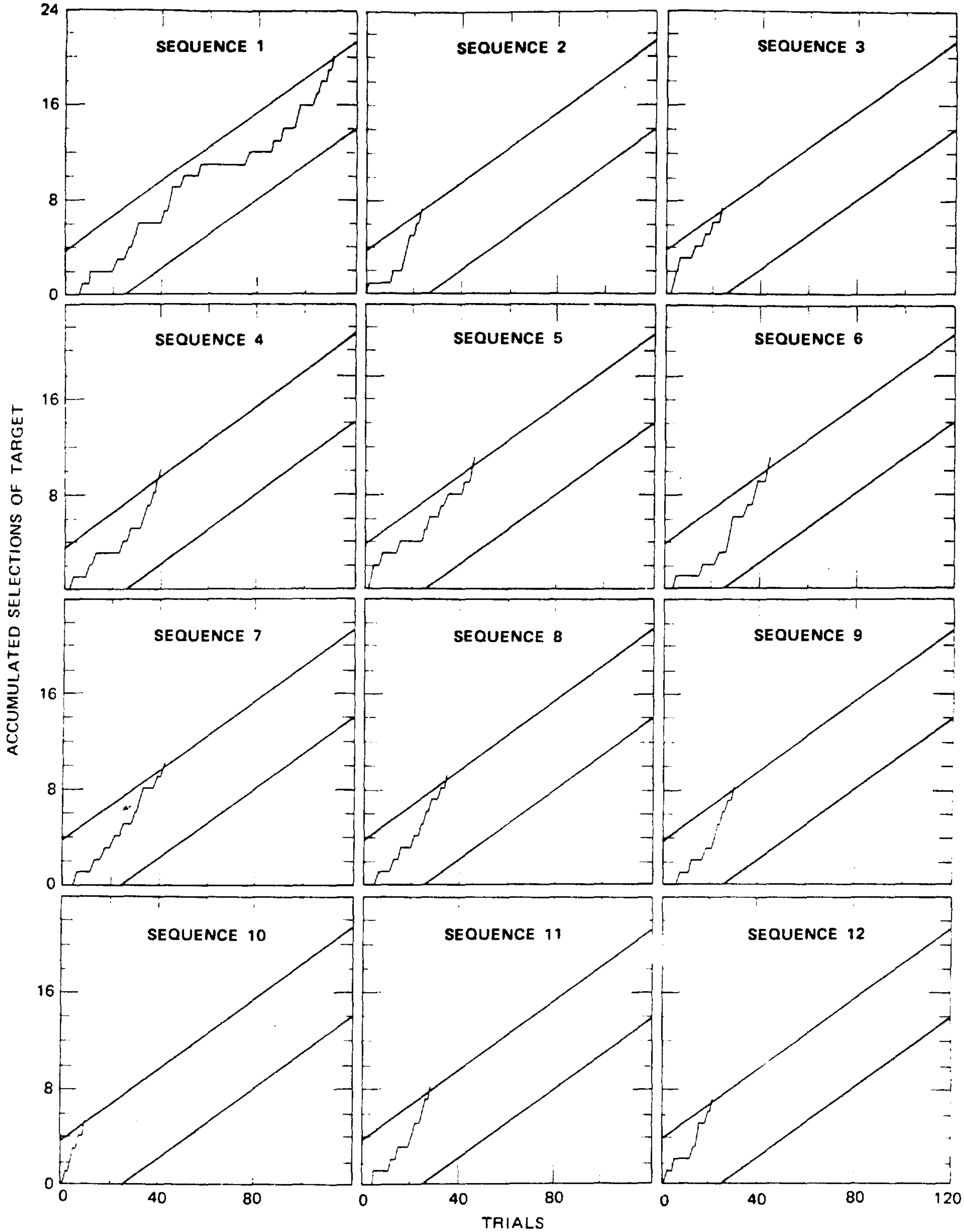

FIGURE 4 DECISION GRAPHS FOR SITE SELECTIONS BASED ON THE DATA OF SUBJECT 1 (TABLE 1) SCREENING STUDY, RESULTING IN TWELVE CONSECUTIVE CORRECT SELECTIONS. Sequential sampling parameters: $p_0 = 0.1$, $p_1 = 0.2$, $\alpha = \beta = 0.05$.

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B. Step 2--Simulation Testing

The participants who emerge from Step 1 with successful performance profiles would then be asked to participate in Step 2. For this step, a model of an actual military situation with a random one-in-twenty designated target would be constructed. The subject's access to the mockup during experimental runs would be by way of video monitor, although secondary means such as maps or photographs might be utilized in later stages of the study if appropriate.

To carry out the test, a participant (or participants) would be briefed as to the task and then be asked to proceed as in Step 1. The sequential sampling parameters in the microcomputer analysis program would be set in accordance with the performance profile established by the participant(s) in the Step 1 screening/training study.

In Step 2 the mechanics of microcomputer recording and analysis of subject selections would be the same as in Step 1. Step 2 differs from Step 1, however, in that a participant's selection from the random circle display, internally keyed to numbered sites, cannot be internally compared to a recorded correct answer.

The results generated by the participant(s) in the site selection procedure would then be tabulated and discussed with the sponsor. Should the results appear encouraging, then Step 3 would be engaged.

C. Step 3--Demonstration-of-Feasibility Field Study

The final step in the three-step vulnerability assessment program would consist of a field-demonstration test involving, e.g., locating an actual tactical command post or an appropriate equivalent. Data would be taken using the successful remote viewers of Step 2, both to determine the degree of correlation between performance on the tasks of Steps 2 and 3, and also to evaluate actual performance in the field study.

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The possibility of success in such a field study is buttressed by the fact that the procedures described here have been used by us successfully in an exploratory program to determine the locations of hidden radioactive material.

Following a series of such tests, performance profiles for the individual remote viewers would be computed and the overall data set would be evaluated to provide an estimate as to the usefulness of RV techniques in locating military targets under operational-like conditions.

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Appendix

The equations for the upper and lower limit lines in the sequential sampling procedure are, respectively,[10]

$$y_1 = d_1 + Sn$$

$$y_o = -d_o + Sn$$

where

$$d_1 = \frac{\log \frac{1 - \beta}{\alpha}}{\log \left[\frac{p_1}{p_o} \frac{1 - p_o}{1 - p_1} \right]}$$

$$d_o = \frac{\log \frac{1 - \alpha}{\beta}}{\log \left[\frac{p_1}{p_o} \frac{1 - p_o}{1 - p_1} \right]}$$

$$S = \frac{\log \frac{1 - p_o}{1 - p_1}}{\log \left[\frac{p_1}{p_o} \frac{1 - p_o}{1 - p_1} \right]} .$$

The average number of trials required to reach a decision in the positive and negative directions, respectively, are given by

$$\bar{n}_1 = \frac{\beta \log\left(\frac{\beta}{1 - \alpha}\right) + (1 - \beta) \log\left(\frac{1 - \beta}{\alpha}\right)}{p_1 \log\left(\frac{p_1}{p_o}\right) + (1 - p_1) \log\left(\frac{1 - p_1}{1 - p_o}\right)}$$

$$\bar{n}_o = \frac{(1 - \alpha) \log\left(\frac{\beta}{1 - \alpha}\right) + \alpha \log\left(\frac{1 - \beta}{\alpha}\right)}{p_o \log\left(\frac{p_1}{p_o}\right) + (1 - p_o) \log\left(\frac{1 - p_1}{1 - p_o}\right)}$$

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