A Pilot Study of Human Factors in SAR (U)

M. Remondini, M. Light, M. Everson

UNCLASSIFIED

CGR/DC-5/82

NL
A Pilot Study of Human Factors in SAR

USCG R&D Center
Avery Point
Groton, CT 06340

This report is the eleventh in a series which documents the Probability of Detection in Search and Rescue Project at the USCG R&D Center.

During three visual detection experiments, the USCG R&D Center collected human factors information. Various human factor parameters thought intuitively to affect the performance of a lookout were measured and analyzed. These included experience level, time on watch, amount of sleep, and lookout position. In addition, Hidden Pattern and Figure Tests were administered to the lookout subjects in these studies.

This report presents the results of this pilot study. Lookout subjects from HH-3F and HH-52A helicopters, 82-ft patrol boats (WPRs), 210-ft medium endurance cutters (WMECs), and 41-ft small utility boats (UTBs) were included.

Time on watch was found to have a marked influence on performance of lookouts on surface units. A marginal relationship was found between test scores and performance. Data from an experiment dedicated to human factors parameters is necessary for a proper investigation.

Search and Rescue, Visual Search, Lookouts, Fatigue, Experience, Testing

Document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161

Unclassified Unclassified
### METRIC CONVERSION FACTORS

#### Approximate Conversions to Metric Measures

<table>
<thead>
<tr>
<th>Symbol</th>
<th>When You Know</th>
<th>Multiply by</th>
<th>To Find</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LENGTH</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>in</td>
<td>inches</td>
<td>2.5</td>
<td>centimeters</td>
<td>cm</td>
</tr>
<tr>
<td>ft</td>
<td>feet</td>
<td>30</td>
<td>centimeters</td>
<td>cm</td>
</tr>
<tr>
<td>yd</td>
<td>yards</td>
<td>0.9144</td>
<td>meters</td>
<td>m</td>
</tr>
<tr>
<td>mi</td>
<td>miles</td>
<td>1.6093</td>
<td>kilometers</td>
<td>km</td>
</tr>
<tr>
<td><strong>AREA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>m²</td>
<td>square meters</td>
<td>0.155</td>
<td>square inches</td>
<td>in²</td>
</tr>
<tr>
<td>km²</td>
<td>square kilometers</td>
<td>0.386</td>
<td>square miles</td>
<td>mi²</td>
</tr>
<tr>
<td><strong>MASS (weight)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>oz</td>
<td>ounces</td>
<td>28.3495</td>
<td>grams</td>
<td>g</td>
</tr>
<tr>
<td>lb</td>
<td>pounds</td>
<td>0.453592</td>
<td>kilograms</td>
<td>kg</td>
</tr>
<tr>
<td><strong>VOLUME</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cup</td>
<td>US liquid quarts</td>
<td>0.236588</td>
<td>liters</td>
<td>L</td>
</tr>
<tr>
<td>tbsp</td>
<td>US tablespoons</td>
<td>0.0133975</td>
<td>milliliters</td>
<td>ml</td>
</tr>
<tr>
<td><strong>TEMPERATURE (exact)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>°F</td>
<td>Fahrenheit temperature</td>
<td>°C</td>
<td>Celsius temperature</td>
<td></td>
</tr>
</tbody>
</table>

#### Approximate Conversions from Metric Measures

<table>
<thead>
<tr>
<th>Symbol</th>
<th>When You Know</th>
<th>Multiply by</th>
<th>To Find</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LENGTH</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>m</td>
<td>millimeters</td>
<td>0.04</td>
<td>inches</td>
<td>in</td>
</tr>
<tr>
<td>cm</td>
<td>centimeters</td>
<td>0.3937</td>
<td>inches</td>
<td>in</td>
</tr>
<tr>
<td>in</td>
<td>inches</td>
<td>3.2808</td>
<td>meters</td>
<td>m</td>
</tr>
<tr>
<td>ft</td>
<td>feet</td>
<td>0.3048</td>
<td>meters</td>
<td>m</td>
</tr>
<tr>
<td>yd</td>
<td>yards</td>
<td>0.9144</td>
<td>meters</td>
<td>m</td>
</tr>
<tr>
<td>mi</td>
<td>miles</td>
<td>1.6093</td>
<td>kilometers</td>
<td>km</td>
</tr>
<tr>
<td><strong>AREA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cm²</td>
<td>square centimeters</td>
<td>0.155</td>
<td>square inches</td>
<td>in²</td>
</tr>
<tr>
<td>m²</td>
<td>square meters</td>
<td>1.196</td>
<td>square feet</td>
<td>ft²</td>
</tr>
<tr>
<td>ft²</td>
<td>square feet</td>
<td>0.0929</td>
<td>square meters</td>
<td>m²</td>
</tr>
<tr>
<td><strong>MASS (weight)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g</td>
<td>grams</td>
<td>0.035274</td>
<td>ounces</td>
<td>oz</td>
</tr>
<tr>
<td>kg</td>
<td>kilograms</td>
<td>2.20462</td>
<td>pounds</td>
<td>lb</td>
</tr>
<tr>
<td><strong>VOLUME</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ml</td>
<td>milliliters</td>
<td>0.0352</td>
<td>fluid ounces</td>
<td>fl oz</td>
</tr>
<tr>
<td>L</td>
<td>liters</td>
<td>1</td>
<td>quarts</td>
<td>qt</td>
</tr>
<tr>
<td><strong>TEMPERATURE (exact)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>°C</td>
<td>Celsius temperature</td>
<td>°F</td>
<td>Fahrenheit temperature</td>
<td></td>
</tr>
</tbody>
</table>

*Note: °C to °F conversion is approximate. For other exact conversions, consult a scientific calculator.*
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acknowledgements</td>
<td>iii</td>
</tr>
<tr>
<td>Executive Summary</td>
<td>v</td>
</tr>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>Methods</td>
<td>1</td>
</tr>
<tr>
<td>Results</td>
<td>4</td>
</tr>
<tr>
<td>Summary</td>
<td>21</td>
</tr>
<tr>
<td>Recommendations</td>
<td>21</td>
</tr>
<tr>
<td>References</td>
<td>23</td>
</tr>
<tr>
<td>Appendix A Example Data File and Data Base Field Definitions</td>
<td>A-1</td>
</tr>
<tr>
<td>Appendix B Computer Programs Flowchart</td>
<td>B-1</td>
</tr>
<tr>
<td>Appendix C &quot;Input&quot; Program</td>
<td>C-1</td>
</tr>
<tr>
<td>Appendix D &quot;Join&quot; Program</td>
<td>D-1</td>
</tr>
<tr>
<td>Appendix E &quot;CUMSCR&quot; Program</td>
<td>E-1</td>
</tr>
<tr>
<td>Appendix F &quot;CHISQD&quot; Program</td>
<td>F-1</td>
</tr>
<tr>
<td>Appendix G Data Files Storage</td>
<td>G-1</td>
</tr>
<tr>
<td>Appendix H Field of View Templates</td>
<td>H-1</td>
</tr>
</tbody>
</table>

**Accession For**

- NTIS (CRD & I) [X]
- DTIC TAR
- Unannounced

**Justification**

- Distribution/
- Availability Codes
- Access and/or Dist:
- Special [A]
<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Test Scores Statistics (Hidden Figures and Hidden Pattern Test)</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Target Detection By All SRUs vs. Hidden Figure Test</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>Target Detection By All SRUs vs. Hidden Pattern Test</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>Hidden Figure Test vs. Hidden Pattern Test</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>Detection of Targets by SRU Type</td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>Detection of Targets by Lookout Position</td>
<td>9-10</td>
</tr>
<tr>
<td></td>
<td>A. Cutters</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B. UTBs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C. Helos</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Experience vs. Detection</td>
<td>11-13</td>
</tr>
<tr>
<td></td>
<td>A. Cutters</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B. UTBs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C. Helos</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D. Test For Homogeneity</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Hours on Watch vs. Detection</td>
<td>14-16</td>
</tr>
<tr>
<td></td>
<td>A. Cutters</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B. UTBs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C. Helos</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D. Test for Homogeneity</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Prior Sleep vs. Detection</td>
<td>17-19</td>
</tr>
<tr>
<td></td>
<td>A. Cutters</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B. UTBs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C. Helos</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D. Test for Homogeneity</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Prior Sleep vs. Detection by all SRUs</td>
<td>20</td>
</tr>
</tbody>
</table>
Acknowledgements:

The authors would like to express their appreciation to the numerous Coast Guard rescue units and personnel that participated in the experiments described in this report.

A special thank you is extended to Ms. Denise Baird and Mr. Carl Buehler who were instrumental in the data and software preparation.
EXECUTIVE SUMMARY

INTRODUCTION

1. Purpose of Report

This report presents the human factors results of three visual detection experiments conducted by the Coast Guard Research and Development Center. The following human factors were analyzed: experience level, time on watch, amount of sleep, lookout position. In an attempt to identify qualities for good lookouts, the Hidden Pattern Test and Hidden Figure Test of the Educational Testing Services were administered.

2. Background

The visual detection experiments were performed in the spring and fall of 1980 in Block Island Sound, and in the winter of 1981 in the Gulf of Mexico off of Panama City, Florida. The experiments were designed for the determination of sweepwidths and probability of detection for various combinations of search units, weather and targets (Reference 1). The collection of data for human factors in visual search was secondary; therefore the usefulness of the data is limited. Data collected on the parameters of relative bearing and lateral range of target, target type, wind speed, sighting range, and cloud cover were analyzed elsewhere (Reference 2).

In the experiments, searches were conducted mostly in the same manner as actual missions. Search targets, consisting of 16-ft open boats, life rafts, 41-ft utility boats (UTBs), and simulated persons in the water (PIWs), were anchored in the search area, while the tracklines of the search units (SRUs) were monitored and recorded using a microwave tracking system. Each SRU had at least one observer aboard to record sighting and human factors information. Valid sightings of targets were determined by a comparison of the sighting reports maintained by observers aboard the SRUs to the scaled reconstruction of the actual search track. A valid detection was recorded as a "hit". The maximum lateral range of detection for each SRU type on the day in question was determined. Any target, whose lateral range was less than or equal to 1.5 times the maximum lateral range of detection, and was not recorded as a sighting, was determined to be a "miss". Templates depicting the field of view of the various lookouts were used with the scaled reconstructions to determine which lookouts should be charged with missing a valid target sighting (Appendix H).

The data were analyzed using a non-parametric statistical method, contingency table for independent samples (Reference 3). This method determines whether two subjects (e.g., hours on watch and detection of target) are independent, but does not determine the nature of the relationship between dependent subjects.
CONCLUSIONS

Human Factors parameters thought to affect lookout performance were analyzed with the following results.

* Hidden Figures and Hidden Pattern tests measuring one's ability to distinguish obscure figures and patterns were administered. A positive, but marginal relationship between higher test scores and higher detection frequency exists.

* The relationship of lookout position and detection frequency shows the bridge crew on cutters performing worse than port and starboard side primary lookouts.

* The relationship of lookout experience and detection frequency shows that persons with less experience had a higher detection frequency for cutters while those with more experience had a higher detection frequency for UTBs and helos.

* The relationship of a lookout's hours on watch and detection frequency shows a reduction in detection frequency as time on watch increased for cutters and UTBs. For helos, hours on watch and detection frequency were independent.

* For all SRU types, detection frequency was independent of the lookout's prior sleep.

RECOMMENDATIONS

1. Since there appeared to be a positive, albeit marginal, relationship between higher written test scores and higher detection frequency, it would seem useful to explore the possibility that these tests or others may be used to identify individuals who would function more efficiently as lookouts.

2. While the analysis made did not provide evidence of a distinction between the frequencies of detection by different SRUs, there would intuitively seem to be differences in efficiency of detection under given conditions. This would possibly be revealed in a different type of analysis (References 1 and 2).

3. The rather curious findings in regard to experience vs. SRU type may be the result of unknown or at least unmeasured parameters. Especially interesting are the consistently lower values for the intermediate levels of experience (1-3 years). One may attribute these findings to some complex of motivation or career pattern influences. This seems important enough for further study.

4. Time on watch has a marked influence on a lookout's performance on surface SRUs. This should be used to modify the procedures employed for assignment of lookouts.

5. Future studies should be dedicated to the collection of human factors data. Such tests would allow direct comparisons to make between SRUs, target
types, and individual lookouts. These future tests should be structured to
gather the appropriate needed data. If real progress is to be made in
understanding and ultimately modeling the human factors that influence the SAR
problem, experiments dedicated to these ends must be undertaken.

6. Training for effective lookout procedures may have to wait until the human
factors that affect it are more sharply defined.

7. Significant difference is found in detection performance of the bridge
crew versus side lookouts for cutters. While it is unreasonable to expect the
Quartermaster of the Watch to do better than dedicated lookouts, some
relocation of the 82-ft patrol boat bridge instrumentation could increase the
performance of the helmsman. When using LORAN for steering, the helmsman must
face aft. Simply placing a LORAN repeater in front of the helmsman would not
only provide another set of eyes for searching, but also make it much easier
for the helmsman to stay on track.
Introduction:

This report presents results of three visual detection experiments conducted by the Coast Guard Research and Development Center. The experiments were performed in the spring and fall of 1980 in Block Island Sound, while those of the winter of 1981 were done in the Gulf of Mexico off Panama City, Florida. These experiments, involving human factors in Search and Rescue (SAR) operations, were secondary to those involved in gathering other information related to the probability of visual detection of various targets (Reference 1). Thus, some limitations existed on the conduct of these experiments. They are to be regarded as pilot studies from which recommendations can be made for future work.

Various human factor parameters thought intuitively to affect the performance of a lookout were measured and analyzed. These include the amount of experience as a lookout, the elapsed time on watch at the time of sighting, the physical position of the lookout on the search and rescue unit (SRU), and the amount of sleep prior to the start of the experiment. In addition, two written tests were administered to all lookouts. These were the Hidden Patterns Test and the Hidden Figures Test (Educational Testing Services). Finally, other data were collected and included the visual aid used, e.g., sunglasses, relative bearing and lateral range of the target, wet type, wind speed, visibility, sighting range, and cloud cover. No attempt was made to analyze these latter parameters because of their heterogeneity and because at least some of them are analyzed elsewhere (Reference 2).

Methods:

These human factor experiments were conducted as addendums to the visual studies described in Reference 1. These human factor experiments used the following classes of SRU's - HH-3F and HH-52A helicopters, 82-ft patrol boats (WPBs) and 210-ft WMEC cutters, and 41-ft utility boats (UTBs). The target types included 16-ft open boats, orange life rafts with and without orange canopies, black rafts, 41-ft UTB boats, and simulated persons in the water (PIW).

The visual search area was controlled and defined depending on environmental conditions. In order to make maximum use of resources and because aircraft with their higher search speeds required a much lower target density, surface craft and aircraft were scheduled on different days. On surface craft days, two cutters and two boats conducted searches; on aircraft days a maximum of two helicopters (HH-3F or HH-52A) and two fixed-wing aircraft (HC-130 or HU-16E) conducted searches, although not enough human factor data was collected on the latter two types of SRU to analyze.

Targets were positioned at predetermined locations by the monitoring vessels. Each day, a microwave tracking system (MTS) was utilized to accurately determine the initial location of anchored targets. Additionally, at the end of each search day, target locations were again checked to ensure that the targets had remained stationary. On some occasions the end-of-day checks indicated that targets had drifted from their initial positions. These targets were then eliminated from the data base since their positions during the search could not be determined to the required accuracy (within 0.1 nm).
The number and positions of the targets relative to planned search tracks were designed to provide about six detection opportunities per hour. This number was a compromise between the desire to obtain as much data as possible in a given interval and not biasing the results of the experiment by overloading the lookouts.

Throughout each experiment the MTS was used to locate the position of SRUs and targets. A master transmitter unit was used in conjunction with up to two secondary units to obtain fixes on the position of each SRU as it searched. The OSC's (on-scene commander's) monitoring vessel was also tracked so that when targets were set, their positions could be marked. Each search unit was equipped with a mobile transponder to re-transmit signals received from the master transmitter. The operation of the MTS is described in detail in References 1 and 2.

When possible, searches were conducted in the same manner as actual SAR missions. Twenty-four hours prior to each search, the Coast Guard R&D Center released a SAR exercise (SAREX) message to each SRU, providing it with the detailed information necessary to prepare for and conduct the desired visual searches. Each morning, targets were towed to the search area and positioned by the monitoring vessel which also served as a command post for the OSC. After the targets were positioned, the SRUs proceeded to designated start positions and initiated search procedures as described in the SAREX message.

Each SRU had at least one observer on board. It was the observer's task to record sighting information, ensure that the search plan was being followed, note any artificial influences which might bias the test results, gather human factors information, and record any suggestions for improving the experiment. The observer also recorded all pertinent data for each target sighting such as the time of day, estimated target range, estimated relative bearing of the target. These were the prime parameters used to decide whether a sighting was a valid detection. Information about each lookout was gathered which included hours of sleep prior to the SAREX, years of experience in SAR, and hours on watch during the exercise.

On each day of the experiment, up to four SRUs searched simultaneously and provided a number of replications for each set of environmental conditions encountered. Boats and cutters searched simultaneously on each search day designated for surface craft. Both helicopters and fixed-wing aircraft searched simultaneously on each search day for aircraft. This procedure was intended to provide data for a direct comparison of different type search units under the same environmental conditions. All units were provided with the same information and similar search instructions to eliminate bias in favor of any particular SRU type. Controllable factors such as search speed and search pattern were randomized in order to minimize bias due to unknown or unmeasurable factors. For example, to minimize the chance that any changes in performance attributed to a change in search speed might be due to uncontrollable or unknown factors, each SRU was assigned a high speed for one search and a low speed for the other. The order in which these speeds were assigned was alternated between successive units. Additionally, search patterns were almost always changed between consecutive searches. Thus, a variety of search speeds for each pattern was obtained. Helicopter and boat crews were generally changed on successive days while the crews for cutters changed weekly. The human study data base includes information on individuals.
Valid sightings of SAR targets were determined by comparison of the sighting reports maintained by observers on board SRUs to the scaled reconstruction of the actual search track. Reconstruction provided SRU tracks annotated with time and target positions. For each sighting, the time of the sighting and the estimated range and relative bearing were compared to actual target positions. If a sighting was determined to be a valid detection, it was recorded as a "hit". The lateral range and values of the other conditions were also recorded. The maximum lateral range of detection for each particular SRU type on the day in question was determined. That value was then multiplied by 1.5. Any target, whose lateral range was less than or equal to 1.5 times the maximum lateral range of detection, and was not recorded as a sighting, was determined to be a "miss". Thus, a separate raw data file was developed for each search unit on a particular day that included all valid hits and all misses that met the criterion above. The use of the 1.5 multiplier is to compensate for the assumption that any particular sighting was not likely to be at the absolute maximum distance at which a sighting was possible under the conditions present at that time.

Templates depicting the field of view of the various lookouts were used with the scaled reconstructions to determine which lookout should be charged with missing a valid target sighting (Appendix H). In this manner, hits and misses with their ancillary information were recorded. Checking and confirmation followed. Thus, a data file was made for each day's activities for each SRU. Where appropriate to do so, data files were combined for certain analyses.

Because of the level of measurement and the type of data collected, much of it must be analyzed using non-parametric statistics. Tests of this nature are useful when one wishes to avoid making assumptions about the level of measurement employed, about the sampling distribution, and other assumptions about the model being used. In general, the fewer the assumptions made, the more general are the conclusions. However, the more powerful statistical tests are those with the strongest assumptions. This can be partially compensated by choosing appropriate tests and getting larger samples.

The method chosen was the contingency table for independent samples (Reference 3). In this test the hypothesis is that rows and columns are independent, i.e. the probability that an individual measurement will occur in any particular row is unaffected by the particular column to which it belongs. To test the hypothesis, one calculates the expected frequency for each cell using the proportional relationships that exist between both marginal totals and the expected cell frequency. After each cell's expected frequency is calculated, the procedure is then to calculate the chi square value \( x^2 \), and to determine the probability associated with that value by using the standard chi square table.

\[
x^2 = \sum_{i=1}^{r} \sum_{j=1}^{k} \frac{(O_{ij} - E_{ij})^2}{E_{ij}}
\]

where

- \( O_{ij} \) = observed number of cases in the \( i \)th row and the \( j \)th column
- \( E_{ij} \) = expected number of cases in the \( i \)th row and the \( j \)th column
\[ i = r \quad j = k \] 

directs one to sum over all rows \( S \) and all columns \( Z \). i.e.,

\[ \sum_{i=1}^{r} \sum_{j=1}^{k} (r) \text{ and all columns } (k) \]

over all cells

The expected value, \( E_{ij} \), for each cell is calculated by multiplying the two marginal totals common to a particular cell and then dividing that product by the total number of cases. The degrees of freedom (d.f.) are calculated as

\[ \text{d.f.} = (\text{rows} - 1)(\text{columns} - 1). \]

The interpretation of the results of this test is based on the following rationale. If the difference between the observed frequencies and the expected frequencies (shown in parentheses in the tables) are quite small then the \( X^2 \) value is also small and this means that the null hypothesis, \( H_0 \), cannot be rejected. The \( H_0 \) is that the sets of characteristics are independent of one another. Alternatively, if the differences between the observed and expected frequencies are large, then the \( X^2 \) is also large. This is interpreted to mean that the groups differ with respect to these characteristics.

Finally, there are certain limitations when using this test. When the number of columns is larger than one and therefore d.f. is \( > 1 \), no more than 20% of the cells may have an expected frequency less than 5. Furthermore, no cell may have an expected frequency less than one.

Results:

The activity of searching for an object is a complex process involving physical and psychological factors. Clearly the rigorous measurement of these parameters would require greater knowledge than is presently available. Nevertheless, in this pilot study it was hoped that some relationship may be discovered between the empirical test results of detecting targets under actual field conditions, the ability to detect hidden patterns and figures in a written examination, and certain other human parameters.

The results of the written examination are presented in Table 1. It is known that the ability to distinguish obscure figures and patterns varies markedly among individuals. Various psychological bases for this are discussed in Reference 4. There may be some correlation between success on the tests and general intelligence level. Surely skill and experience in taking tests are significant factors. Differences observed in Table 1 are likely to be due to several of these factors.

The relationship between each test and the number of detections is depicted in Tables 2 and 3. The rather low probabilities in each are not significantly different from one another. The probabilities are too high to allow the rejection of the null hypothesis that target detection and test scores are independent of one another, i.e. there is some dependence between scores and hits. This dependency is somewhat stronger in the Hidden Figure Test.
<table>
<thead>
<tr>
<th>HIDDEN FIGURE TEST</th>
<th>MEAN</th>
<th>S.D.</th>
<th>RANGE</th>
<th>25 th</th>
<th>50 th</th>
<th>75 th</th>
<th>99 th</th>
<th>MAX. POSSIBLE SCORE</th>
<th>TOTAL</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>UTRs</td>
<td>13.7 ± 1.4</td>
<td>7.6</td>
<td>0 - 27</td>
<td>5.0</td>
<td>10.0</td>
<td>17.0</td>
<td>26.0</td>
<td>32</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>HELOS</td>
<td>18.5 ± 1.7</td>
<td>10.0</td>
<td>1 - 32</td>
<td>10.0</td>
<td>19.5</td>
<td>26.0</td>
<td>32.0</td>
<td>32</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>CUTTERS</td>
<td>12.4 ± 0.9</td>
<td>8.2</td>
<td>0 - 32</td>
<td>5.0</td>
<td>12.0</td>
<td>16.0</td>
<td>31.0</td>
<td>32</td>
<td>83</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>13.7 ± 0.7</td>
<td>8.9</td>
<td>0 - 32</td>
<td>5.5</td>
<td>12.0</td>
<td>20.5</td>
<td>32.0</td>
<td>32</td>
<td>148</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HIDDEN PATTERN TEST</th>
<th>MEAN</th>
<th>S.D.</th>
<th>RANGE</th>
<th>25 th</th>
<th>50 th</th>
<th>75 th</th>
<th>99 th</th>
<th>MAX. POSSIBLE SCORE</th>
<th>TOTAL</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>UTRs</td>
<td>71.4 ± 6.4</td>
<td>31.2</td>
<td>16 - 120</td>
<td>53.0</td>
<td>82.0</td>
<td>88.0</td>
<td>107.0</td>
<td>200</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>HELOS</td>
<td>103.7 ± 4.3</td>
<td>25.0</td>
<td>55 - 171</td>
<td>87.0</td>
<td>102.0</td>
<td>107.0</td>
<td>161.0</td>
<td>200</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>CUTTERS</td>
<td>79.9 ± 2.6</td>
<td>23.9</td>
<td>18 - 141</td>
<td>64.0</td>
<td>81.0</td>
<td>92.0</td>
<td>131.0</td>
<td>200</td>
<td>82</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>84.3 ± 2.4</td>
<td>27.8</td>
<td>16 - 171</td>
<td>67.0</td>
<td>86.0</td>
<td>102.0</td>
<td>150.0</td>
<td>200</td>
<td>139</td>
<td></td>
</tr>
</tbody>
</table>
### TABLE 2: DETECTION OF ALL TARGETS BY ALL SRUs vs. HIDDEN FIGURE TEST

<table>
<thead>
<tr>
<th>PERCENTILES</th>
<th>0 - 25</th>
<th>26 - 50</th>
<th>51 - 75</th>
<th>76 - 100</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>HITS</td>
<td>82</td>
<td>80</td>
<td>92</td>
<td>104</td>
<td>358</td>
</tr>
<tr>
<td></td>
<td>(73.7)</td>
<td>(87.3)</td>
<td>(81.9)</td>
<td>(115.2)</td>
<td></td>
</tr>
<tr>
<td>MISSSES</td>
<td>312</td>
<td>387</td>
<td>346</td>
<td>512</td>
<td>1557</td>
</tr>
<tr>
<td></td>
<td>(320.3)</td>
<td>(379.7)</td>
<td>(356.1)</td>
<td>(500.8)</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>394</td>
<td>467</td>
<td>438</td>
<td>616</td>
<td>1915</td>
</tr>
</tbody>
</table>

CHI SQUARED VALUE = 4.78  
DEGREES OF FREEDOM = 3  
PROBABILITY = .1<P<.2  
(Expected Value)

### TABLE 3: DETECTION OF ALL TARGETS BY ALL SRUs vs. HIDDEN PATTERN TEST

<table>
<thead>
<tr>
<th>PERCENTILES</th>
<th>0 - 25</th>
<th>26 - 50</th>
<th>51 - 75</th>
<th>76 - 100</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>HITS</td>
<td>90</td>
<td>78</td>
<td>85</td>
<td>93</td>
<td>346</td>
</tr>
<tr>
<td></td>
<td>(77.7)</td>
<td>(86.6)</td>
<td>(92.3)</td>
<td>(89.4)</td>
<td></td>
</tr>
<tr>
<td>MISSSES</td>
<td>320</td>
<td>379</td>
<td>402</td>
<td>379</td>
<td>1480</td>
</tr>
<tr>
<td></td>
<td>(332.3)</td>
<td>(370.4)</td>
<td>(394.7)</td>
<td>(382.6)</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>410</td>
<td>457</td>
<td>487</td>
<td>472</td>
<td>1826</td>
</tr>
</tbody>
</table>

CHI SQUARED VALUE = 4.34  
DEGREES OF FREEDOM = 3  
PROBABILITY = .2<P<.3  
(Expected Value)
The highly significant probability associated with the $X^2$ value in Table 4 shows that the two tests are quite similar in what they measure. This is not unexpected since a person scoring high or low on one test would be expected to make a similar score on the other due to the similarity of what the tests purport to measure.

**TABLE 4: HIDDEN FIGURE TEST vs. HIDDEN PATTERN TEST**

<table>
<thead>
<tr>
<th>PERCENTILE</th>
<th>0 - 25</th>
<th>26 - 50</th>
<th>51 - 75</th>
<th>76 - 100</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 25</td>
<td>19</td>
<td>8</td>
<td>7</td>
<td>0</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>(8.4)</td>
<td>(8.4)</td>
<td>(7.9)</td>
<td>(9.2)</td>
<td></td>
</tr>
<tr>
<td>26 - 50</td>
<td>9</td>
<td>14</td>
<td>9</td>
<td>3</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>(8.7)</td>
<td>(8.7)</td>
<td>(8.2)</td>
<td>(9.5)</td>
<td></td>
</tr>
<tr>
<td>51 - 75</td>
<td>3</td>
<td>8</td>
<td>10</td>
<td>15</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>(8.9)</td>
<td>(8.9)</td>
<td>(7.4)</td>
<td>(9.7)</td>
<td></td>
</tr>
<tr>
<td>76 - 100</td>
<td>3</td>
<td>4</td>
<td>6</td>
<td>19</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>(7.9)</td>
<td>(7.9)</td>
<td>(7.5)</td>
<td>(8.6)</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>34</td>
<td>34</td>
<td>32</td>
<td>37</td>
<td>137</td>
</tr>
</tbody>
</table>

**CHI SQUARED VALUE = 55.22**
**DEGREES OF FREEDOM = 9**
**PROBABILITY = P < .001**
**(Expected Value)**
A natural question is to wonder how the three types of SRUs compared in their detection frequencies. Table 5 presents this data and tests the hypothesis that the number of hits or misses is independent of SRU type. The probability associated with that $X^2$ value is too high to allow the rejection of the hypothesis, yet is low enough to indicate that there is considerable variation between SRUs. This type of statistical test makes the fewest assumptions but has an unknown power to distinguish subtle differences. The data depicted in this table is pooled from all target types, weather conditions, search protocols, and target ranges. Clearly the relative efficiency of SRU types is not being tested by this analysis. Nevertheless, at least under these experimental conditions the SRUs did not differ significantly from one another.

TABLE 5: DETECTION OF TARGETS BY SRU TYPE

<table>
<thead>
<tr>
<th></th>
<th>CUTTERS</th>
<th>UTBs</th>
<th>HELOS</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>HITS</td>
<td>244</td>
<td>91</td>
<td>107</td>
<td>442</td>
</tr>
<tr>
<td></td>
<td>(240.8)</td>
<td>(81.2)</td>
<td>(120.1)</td>
<td></td>
</tr>
<tr>
<td>MISSES</td>
<td>1186</td>
<td>391</td>
<td>606</td>
<td>2183</td>
</tr>
<tr>
<td></td>
<td>(1189.2)</td>
<td>(400.8)</td>
<td>(592.9)</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>1430</td>
<td>482</td>
<td>713</td>
<td>2625</td>
</tr>
</tbody>
</table>

CHI SQUARED VALUE = 3.19
DEGREES OF FREEDOM = 2
PROBABILITY = 0.2 < P < 0.3
(Expected Value)
One way that the three types of SRUs differ is the performance of different lookout positions. Tables 6 A, B, and C test for independence of position and detection. A significant difference is found for cutters, with the bridge crew performing much worse than the side lookouts. No difference is found for helos and UTB's.

**TABLE 6: POSITION vs. DETECTION**

(A) CUTTERS

<table>
<thead>
<tr>
<th></th>
<th>PORT LOOKOUT</th>
<th>STARBOARD LOOKOUT</th>
<th>BRIDGE/HELM</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>HITS</td>
<td>99 (69.3)</td>
<td>90 (69.1)</td>
<td>55 (105.6)</td>
<td>244</td>
</tr>
<tr>
<td>MISSES</td>
<td>307 (336.7)</td>
<td>315 (335.9)</td>
<td>564 (513.4)</td>
<td>1186</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1430</td>
<td>482</td>
<td>713</td>
<td>2625</td>
</tr>
</tbody>
</table>

CHI SQUARED VALUE = 52.25  
DEGREES OF FREEDOM = 2  
PROBABILITY = P < 0.007  
(Expected Value)

(B) UTB's

<table>
<thead>
<tr>
<th></th>
<th>PORT LOOKOUT</th>
<th>STARBOARD LOOKOUT</th>
<th>BRIDGE/HELM</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>HITS</td>
<td>34 (33.7)</td>
<td>30 (30.9)</td>
<td>26 (25.4)</td>
<td>90</td>
</tr>
<tr>
<td>MISSES</td>
<td>146 (146.3)</td>
<td>135 (134.1)</td>
<td>110 (110.6)</td>
<td>391</td>
</tr>
<tr>
<td>TOTAL</td>
<td>180</td>
<td>165</td>
<td>136</td>
<td>481</td>
</tr>
</tbody>
</table>

CHI SQUARED VALUE = 0.05  
DEGREES OF FREEDOM = 2  
PROBABILITY = 0.95 < P < 0.98  
(Expected Value)
### TABLE 6: POSITION vs. DETECTION

(C) HELOS

<table>
<thead>
<tr>
<th></th>
<th>PORT LOOKOUT</th>
<th>STARBOARD LOOKOUT</th>
<th>BRIDGE/HELM</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>HITS</td>
<td>10 (14.0)</td>
<td>26 (27.1)</td>
<td>71 (66.0)</td>
<td>107</td>
</tr>
<tr>
<td>MISSES</td>
<td>83 (79.0)</td>
<td>154 (152.9)</td>
<td>368 (373.0)</td>
<td>605</td>
</tr>
<tr>
<td>TOTAL</td>
<td>93</td>
<td>180</td>
<td>439</td>
<td>712</td>
</tr>
</tbody>
</table>

CHI SQUARED VALUE = 1.83
DEGREES OF FREEDOM = 2
PROBABILITY = 0.3<P<0.5
(Expected Value)
One way that the three types of SRUs differ is the performance of different lookout positions. Tables 6 A, B, and C test for independence of position and detection. A significant difference is found for cutters, with the bridge crew performing much worse than the side lookouts. No difference is found for helos and UTB’s.

**TABLE 6: POSITION vs. DETECTION**

(A) CUTTERS

<table>
<thead>
<tr>
<th></th>
<th>PORT LOOKOUT</th>
<th>STARBOARD LOOKOUT</th>
<th>BRIDGE/HELM</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>HITS</td>
<td>99</td>
<td>90</td>
<td>55</td>
<td>244</td>
</tr>
<tr>
<td>(69.3)</td>
<td>(69.1)</td>
<td></td>
<td>(105.6)</td>
<td></td>
</tr>
<tr>
<td>MISSES</td>
<td>307</td>
<td>315</td>
<td>564</td>
<td>1186</td>
</tr>
<tr>
<td>(336.7)</td>
<td>(335.9)</td>
<td></td>
<td>(513.4)</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>1430</td>
<td>482</td>
<td>713</td>
<td>2625</td>
</tr>
</tbody>
</table>

CHI SQUARED VALUE = 52.25  
DEGREES OF FREEDOM = 2  
PROBABILITY = P < 0.001  
(Expected Value)

(B) UTB’s

<table>
<thead>
<tr>
<th></th>
<th>PORT LOOKOUT</th>
<th>STARBOARD LOOKOUT</th>
<th>BRIDGE/HELM</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>HITS</td>
<td>34</td>
<td>30</td>
<td>26</td>
<td>90</td>
</tr>
<tr>
<td>(33.7)</td>
<td>(30.9)</td>
<td></td>
<td>(25.4)</td>
<td></td>
</tr>
<tr>
<td>MISSES</td>
<td>146</td>
<td>135</td>
<td>110</td>
<td>391</td>
</tr>
<tr>
<td>(146.3)</td>
<td>(134.1)</td>
<td></td>
<td>(110.6)</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>180</td>
<td>165</td>
<td>136</td>
<td>481</td>
</tr>
</tbody>
</table>

CHI SQUARED VALUE = 0.05  
DEGREES OF FREEDOM = 2  
PROBABILITY = 0.95 < P < 0.98  
(Expected Value)
<table>
<thead>
<tr>
<th></th>
<th>Port Lookout</th>
<th>Starboard Lookout</th>
<th>Bridge/Helm</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hits</strong></td>
<td>10</td>
<td>26</td>
<td>71</td>
<td>107</td>
</tr>
<tr>
<td></td>
<td>(14.0)</td>
<td>(27.1)</td>
<td>(66.0)</td>
<td></td>
</tr>
<tr>
<td><strong>Misses</strong></td>
<td>83</td>
<td>154</td>
<td>368</td>
<td>605</td>
</tr>
<tr>
<td></td>
<td>(79.0)</td>
<td>(152.9)</td>
<td>(373.0)</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>93</td>
<td>180</td>
<td>439</td>
<td>712</td>
</tr>
</tbody>
</table>

Chi Squared Value = 1.83
Degrees of Freedom = 2
Probability = 0.3 < P < 0.5
(Expected Value)
Tables 7 A, B, and C test for independence of SAR experience and detection of targets by SRU type. All have probabilities which allow the rejection of the null hypothesis of independence at the significant or highly significant level. A test for homogeneity (Table 7D) does not allow the three tables to be pooled. Thus, significant differences exist between SRU types with respect to experience in SAR. Interestingly, persons with less experience detected more targets than expected in cutters while those with greater experience detected more than expected in UTBs and helos. There was a curious lower level of detection than expected in all three SRU types in the 1-3 years category.

### TABLE 7: EXPERIENCE vs. DETECTION

**(A) CUTTERS**

<table>
<thead>
<tr>
<th>YEARS OF EXPERIENCE</th>
<th>&lt;.5</th>
<th>.5 - .9</th>
<th>1 - 3</th>
<th>&gt;3</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HITS</strong></td>
<td>63</td>
<td>62</td>
<td>43</td>
<td>68</td>
<td>236</td>
</tr>
<tr>
<td></td>
<td>(47.1)</td>
<td>(53.2)</td>
<td>(56.5)</td>
<td>(79.2)</td>
<td></td>
</tr>
<tr>
<td><strong>MISSES</strong></td>
<td>217</td>
<td>254</td>
<td>293</td>
<td>403</td>
<td>1167</td>
</tr>
<tr>
<td></td>
<td>(232.9)</td>
<td>(262.8)</td>
<td>(279.5)</td>
<td>(391.8)</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>280</td>
<td>316</td>
<td>336</td>
<td>471</td>
<td>1403</td>
</tr>
</tbody>
</table>

CHI SQUARED VALUE = 14.02  
DEGREES OF FREEDOM = 3  
PROBABILITY = .001 < P < .01  
(Expected Value)

**(B) UTBs**

<table>
<thead>
<tr>
<th>YEARS OF EXPERIENCE</th>
<th>&lt;.5</th>
<th>.5 - .9</th>
<th>1 - 3</th>
<th>&gt;3</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HITS</strong></td>
<td>7</td>
<td>22</td>
<td>30</td>
<td>19</td>
<td>78</td>
</tr>
<tr>
<td></td>
<td>(13.7)</td>
<td>(16.9)</td>
<td>(38.9)</td>
<td>(8.5)</td>
<td></td>
</tr>
<tr>
<td><strong>MISSES</strong></td>
<td>72</td>
<td>75</td>
<td>194</td>
<td>30</td>
<td>371</td>
</tr>
<tr>
<td></td>
<td>(65.3)</td>
<td>(80.1)</td>
<td>(185.1)</td>
<td>(40.5)</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>79</td>
<td>97</td>
<td>224</td>
<td>49</td>
<td>449</td>
</tr>
</tbody>
</table>

CHI SQUARED VALUE = 24.00  
DEGREES OF FREEDOM = 3  
PROBABILITY = P < .001  
(Expected Value)
### Table 7: Experience vs. Detection

<table>
<thead>
<tr>
<th>Years of Experience</th>
<th>&lt;.5</th>
<th>.5 - .9</th>
<th>1 - 3</th>
<th>&gt;3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hits</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>(2.7)</td>
<td>(1.1)</td>
<td>(31.8)</td>
<td>(71.4)</td>
<td>107</td>
</tr>
<tr>
<td><strong>Misses</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>(15.3)</td>
<td>(5.9)</td>
<td>(180.2)</td>
<td>(404.6)</td>
<td>606</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>18</td>
<td>7</td>
<td>212</td>
<td>476</td>
<td>713</td>
</tr>
</tbody>
</table>

Chi-squared value = 14.82
Degrees of freedom = 3
Probability = .001 < P < 0.01 (Expected Value)
### TABLE 7D: TEST FOR HOMOGENEITY OF ALL SRUs EXPERIENCE vs. DETECTION

<table>
<thead>
<tr>
<th></th>
<th>HITS</th>
<th></th>
<th>MISSES</th>
<th></th>
<th></th>
<th></th>
<th>df</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;.5</td>
<td>.5 -.9</td>
<td>1 - 3</td>
<td>&gt;3</td>
<td>Total</td>
<td>&lt;.5</td>
<td>.5 -.9</td>
<td>1 - 3</td>
</tr>
<tr>
<td>CUTTERS</td>
<td>63</td>
<td>62</td>
<td>43</td>
<td>68</td>
<td>236</td>
<td>217</td>
<td>254</td>
<td>293</td>
</tr>
<tr>
<td>UTBs</td>
<td>7</td>
<td>22</td>
<td>30</td>
<td>19</td>
<td>78</td>
<td>72</td>
<td>75</td>
<td>194</td>
</tr>
<tr>
<td>HELOS</td>
<td>1</td>
<td>4</td>
<td>23</td>
<td>79</td>
<td>107</td>
<td>17</td>
<td>3</td>
<td>189</td>
</tr>
<tr>
<td>POOLED</td>
<td>71</td>
<td>88</td>
<td>96</td>
<td>166</td>
<td>421</td>
<td>306</td>
<td>332</td>
<td>676</td>
</tr>
</tbody>
</table>

(Sum of 3 CHI Square values)

<p>| | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\chi^2$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sum</td>
<td>52.84</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Pooled</td>
<td>30.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Homogeneity</td>
<td>22.14</td>
<td>.001 &lt; P &lt; .01</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Tables 8 A, B, and C test the hypothesis of independence of detection and hours on watch. In Table 8A the probability associated with the $X^2$ value allows the rejection of $H_0$ for cutters. The data indicates a reduction in observed detection as time on watch increased with a considerably larger number of detections than expected during the first hour. Table 7B on UTBs shows a similar but weaker trend that yields a probability that is not significant indicating greater independence between time on watch and detection frequency. Table 8C for helos has a probability that indicates clearly an independence between time on watch and detection frequency. The time on task for helos was never greater than three hours in these experiments. Table 8D tests for homogeneity and reveals that it is not possible to pool the data from the three types of SRUs thus confirming that there are clear distinctions between the SRU types and time on watch with respect to detection frequency.

<table>
<thead>
<tr>
<th>Hours on Watch</th>
<th>&lt;1</th>
<th>1 - 1.9</th>
<th>2 - 2.9</th>
<th>3 - 3.9</th>
<th>&gt;4</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>HITS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>244</td>
</tr>
<tr>
<td></td>
<td>161</td>
<td>56</td>
<td>21</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(130.0)</td>
<td>(71.8)</td>
<td>(26.8)</td>
<td>(9.4)</td>
<td>(6.0)</td>
<td></td>
</tr>
<tr>
<td>MISSES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1186</td>
</tr>
<tr>
<td></td>
<td>601</td>
<td>365</td>
<td>136</td>
<td>53</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(632.0)</td>
<td>(349.2)</td>
<td>(130.2)</td>
<td>(45.6)</td>
<td>(29.0)</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>762</td>
<td>421</td>
<td>157</td>
<td>55</td>
<td>35</td>
<td>1430</td>
</tr>
</tbody>
</table>

CHI SQUARED VALUE = 22.41
DEGREES OF FREEDOM = 4
PROBABILITY = P < .001

(Expected Value)
(B) UTBs

<table>
<thead>
<tr>
<th>Hours on Watch</th>
<th>&lt;1</th>
<th>1 - 1.9</th>
<th>2 - 2.9</th>
<th>3 - 3.9</th>
<th>&gt;4</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>HITS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>35</td>
<td>27</td>
<td>16</td>
<td>4</td>
<td>9</td>
<td>91</td>
</tr>
<tr>
<td></td>
<td>(29.5)</td>
<td>(22.1)</td>
<td>(17.6)</td>
<td>(8.9)</td>
<td>(13.0)</td>
<td></td>
</tr>
<tr>
<td>MISSES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>121</td>
<td>90</td>
<td>77</td>
<td>43</td>
<td>60</td>
<td>391</td>
</tr>
<tr>
<td></td>
<td>(126.5)</td>
<td>(94.9)</td>
<td>(75.4)</td>
<td>(38.1)</td>
<td>(56.0)</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>156</td>
<td>117</td>
<td>93</td>
<td>47</td>
<td>69</td>
<td>482</td>
</tr>
</tbody>
</table>

CHI SQUARED VALUE = 7.64
DEGREES OF FREEDOM = 4
PROBABILITY = .1 < P < .2
(Expected Value)

(C) HELOS

<table>
<thead>
<tr>
<th>Hours on Watch</th>
<th>&lt;1</th>
<th>1 - 1.9</th>
<th>2 - 2.9</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>HITS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>63</td>
<td>34</td>
<td>10</td>
<td>107</td>
</tr>
<tr>
<td></td>
<td>(66.3)</td>
<td>(34.7)</td>
<td>(6.0)</td>
<td></td>
</tr>
<tr>
<td>MISSES</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>379</td>
<td>197</td>
<td>30</td>
<td>606</td>
</tr>
<tr>
<td></td>
<td>(375.7)</td>
<td>(196.9)</td>
<td>(34.0)</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>442</td>
<td>231</td>
<td>40</td>
<td>713</td>
</tr>
</tbody>
</table>

CHI SQUARED VALUE = 3.34
DEGREES OF FREEDOM = 2
PROBABILITY = .20 > P > .10
(Expected Value)
### Table 8d: Test for Homogeneity of All SRUs Hours on Watch vs. Detection

<table>
<thead>
<tr>
<th></th>
<th>HITS</th>
<th></th>
<th>MISSES</th>
<th></th>
<th>2</th>
<th>dF</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>&lt;1</td>
<td>1 - 1.9</td>
<td>2 - 2.9</td>
<td>3 - 3.9</td>
<td>&gt;4</td>
<td>TOTAL</td>
</tr>
<tr>
<td>CUTTERS</td>
<td>161</td>
<td>56</td>
<td>21</td>
<td>2</td>
<td>4</td>
<td>244</td>
<td>601</td>
</tr>
<tr>
<td>UTBs</td>
<td>35</td>
<td>27</td>
<td>16</td>
<td>4</td>
<td>9</td>
<td>91</td>
<td>121</td>
</tr>
<tr>
<td>HELOS</td>
<td>63</td>
<td>34</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>107</td>
<td>379</td>
</tr>
<tr>
<td>POOLED</td>
<td>259</td>
<td>117</td>
<td>47</td>
<td>6</td>
<td>13</td>
<td>442</td>
<td>1101</td>
</tr>
</tbody>
</table>

(Sum of Chi Square values) 33.39

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>2</th>
<th></th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>dF</td>
<td>X</td>
<td>P</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sum</td>
<td>10</td>
<td>33.39</td>
<td>&lt;.001</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pooled</td>
<td>4</td>
<td>14.72</td>
<td>.001 - .01</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Homogeneity</td>
<td>6</td>
<td>18.67</td>
<td>.001 - .01</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Tables 9 A, B, C, test for the independence of amount of sleep by lookouts prior to the SAREX and the detection frequency. It is clear that in all types of SRUs tested the amount of sleep seemed to be independent of the detection frequency. In an attempt to achieve greater strength in rejecting the null hypothesis, a test for the validity of pooling the data on all SRUs was made in Table 9D. It is permissible to pool but the probability remains non significant at the 5 percent rejection level. Table 10 shows these calculations.

Table 9: PRIOR SLEEP vs DETECTION

(A) CUTTERS

<table>
<thead>
<tr>
<th>Hours of Sleep</th>
<th>&lt;4</th>
<th>4 - 6</th>
<th>&gt;6</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>HITS</td>
<td>20</td>
<td>47</td>
<td>120</td>
<td>187</td>
</tr>
<tr>
<td></td>
<td>(25.1)</td>
<td>(42.0)</td>
<td>(119.9)</td>
<td></td>
</tr>
<tr>
<td>MISSES</td>
<td>134</td>
<td>211</td>
<td>606</td>
<td>962</td>
</tr>
<tr>
<td></td>
<td>(128.9)</td>
<td>(216.0)</td>
<td>(617.1)</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>154</td>
<td>258</td>
<td>737</td>
<td>1149</td>
</tr>
</tbody>
</table>

CHI SQUARED VALUE = 1.94
DEGREES OF FREEDOM = 2
PROBABILITY = .3 < P < .5
(Expected Value)
### (B) UTBs

#### Hours of Sleep

<table>
<thead>
<tr>
<th></th>
<th>&lt;4</th>
<th>4 - 6</th>
<th>&gt;6</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>HITS</td>
<td>1</td>
<td>25</td>
<td>65</td>
<td>91</td>
</tr>
<tr>
<td></td>
<td>(3.8)</td>
<td>(25.7)</td>
<td>(61.5)</td>
<td></td>
</tr>
<tr>
<td>MISSES</td>
<td>19</td>
<td>111</td>
<td>261</td>
<td>391</td>
</tr>
<tr>
<td></td>
<td>(16.2)</td>
<td>(110.3)</td>
<td>(264.5)</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>20</td>
<td>136</td>
<td>326</td>
<td>482</td>
</tr>
</tbody>
</table>

**CHI SQUARED VALUE** = 2.78  
**DEGREES OF FREEDOM** = 2  
**PROBABILITY** = .2 < $P$ < .3  
(Expected Value)

### (C) HELOS

#### Hours of Sleep

<table>
<thead>
<tr>
<th></th>
<th>&lt;4</th>
<th>4 - 6</th>
<th>&gt;6</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>HITS</td>
<td>1</td>
<td>14</td>
<td>92</td>
<td>107</td>
</tr>
<tr>
<td></td>
<td>(1.2)</td>
<td>(15.8)</td>
<td>(90.0)</td>
<td></td>
</tr>
<tr>
<td>MISSES</td>
<td>7</td>
<td>91</td>
<td>508</td>
<td>606</td>
</tr>
<tr>
<td></td>
<td>(6.8)</td>
<td>(89.2)</td>
<td>(510.0)</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>8</td>
<td>105</td>
<td>600</td>
<td>713</td>
</tr>
</tbody>
</table>

**CHI SQUARED VALUE** = 0.32  
**DEGREES OF FREEDOM** = 2  
**PROBABILITY** = .8 < $P$ < .9  
(Expected Value)
<table>
<thead>
<tr>
<th></th>
<th>HITS</th>
<th>MISSES</th>
<th>2</th>
<th>dF</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;4</td>
<td>4 - 6</td>
<td>&gt;6</td>
<td>TOTAL</td>
<td>&lt;4</td>
</tr>
<tr>
<td>CUTTERS</td>
<td>20</td>
<td>47</td>
<td>120</td>
<td>187</td>
<td>134</td>
</tr>
<tr>
<td>UTBs</td>
<td>1</td>
<td>25</td>
<td>65</td>
<td>91</td>
<td>19</td>
</tr>
<tr>
<td>HELOS</td>
<td>1</td>
<td>14</td>
<td>92</td>
<td>107</td>
<td>7</td>
</tr>
<tr>
<td>POOLED</td>
<td>22</td>
<td>86</td>
<td>277</td>
<td>385</td>
<td>160</td>
</tr>
</tbody>
</table>

(Sum of 3 CHI Square values) 5.04 9

<table>
<thead>
<tr>
<th></th>
<th>2</th>
<th>dF</th>
<th>X</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sum</td>
<td>6</td>
<td></td>
<td>5.04</td>
<td>.5 - .7</td>
</tr>
<tr>
<td>Pooled</td>
<td>2</td>
<td></td>
<td>2.80</td>
<td>.05 - .10</td>
</tr>
<tr>
<td>Homogeneity</td>
<td>4</td>
<td></td>
<td>2.24</td>
<td>.5 - .7</td>
</tr>
</tbody>
</table>
Table 10: DETECTION OF ALL TARGETS BY ALL SRUs vs SLEEP

HOURS OF SLEEP

<table>
<thead>
<tr>
<th></th>
<th>&lt;4</th>
<th>4 - 6</th>
<th>&gt;6</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>HITS</td>
<td>22</td>
<td>86</td>
<td>277</td>
<td>385</td>
</tr>
<tr>
<td></td>
<td>(29.9)</td>
<td>(82.0)</td>
<td>(273.1)</td>
<td></td>
</tr>
<tr>
<td>MISSES</td>
<td>160</td>
<td>413</td>
<td>1386</td>
<td>1959</td>
</tr>
<tr>
<td></td>
<td>(152.1)</td>
<td>(417.0)</td>
<td>(1389.9)</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>182</td>
<td>499</td>
<td>1663</td>
<td>2344</td>
</tr>
</tbody>
</table>

CHI SQUARED VALUE = 2.82
DEGREES OF FREEDOM = 2
PROBABILITY = \(0.2 < P < 0.3\) (Expected Value)
Summary

This report presents Human Factors data gathered during the SAR POD visual detection experiments. Human Factors parameters thought to affect lookout performance were analyzed with the following results.

* Hidden Figures and Hidden Pattern tests measuring one's ability to distinguish obscure figures and patterns were administered. A positive, but marginal relationship between higher test scores and higher detection frequency exists.

* The relationship of lookout position and detection frequency shows the bridge crew on cutters performing worse than port and starboard side primary lookouts.

* The relationship of lookout experience and detection frequency shows that persons with less experience had a higher detection frequency for cutters while those with more experience had a higher detection frequency for UTBs and helos.

* The relationship of a lookout's hours on watch and detection frequency shows a reduction in detection frequency as time on watch increased for cutters and UTBs. For helos, hours on watch and detection frequency were independent.

* For all SRU types, detection frequency was independent of the lookout's prior sleep.

Recommendations:

1. Since there appeared to be a positive, albeit marginal, relationship between higher written test scores and higher detection frequency, it would seem useful to explore the possibility that these tests or others may be used to identify individuals who would function more efficiently as lookouts.

2. While the analysis made did not provide evidence of a distinction between the frequencies of detection by different SRUs, there would intuitively seem to be differences in efficiency of detection under given conditions. This would possibly be revealed in a different type of analysis (Reference 1 and 2).

3. The rather curious findings in regard to experience vs. SRU type may be the result of unknown or at least unmeasured parameters. Especially interesting are the consistently lower values for the intermediate levels of experience (1-3 years). One may attribute these findings to some complex of motivation or career pattern influences. This seems important enough for further study.

4. Time on watch has a marked influence on a lookout's performance on surface SRUs. This should be used to modify the procedures employed for assignment of lookouts.
5. Future studies should be dedicated to the collection of human factors data. Such tests would allow direct comparisons to make between SRUs, target types, and individual lookouts. These future tests should be structured to gather the appropriate needed data. If real progress is to be made in understanding and ultimately modeling the human factors that influence the SAR problem, experiments dedicated to these ends must be undertaken.

6. Training for effective lookout procedures may have to wait until the human factors that affect it are more sharply defined.

7. Significant difference is found in detection performance of the bridge crew versus side lookouts for cutters. While it is unreasonable to expect the Quartermaster on Watch to do better than dedicated lookouts, some relocation of the 82-ft WPB bridge instrumentation could increase the performance of the helmsman. When using LORAN for steering, the helmsman must face aft. Simply placing a LORAN repeater in front of the helmsman would not only provide another set of eyes for searching, but also make it much easier for the helmsman to stay on track.
References:


APPENDIX A

THIS IS AN EXAMPLE OF A DATA FILE. IT CONTAINS SAP HUMAN FACTORS DATA FOR A GIVEN SPU (CUTTER, HELO, UTI) FOR THAT DAY. THERE ARE 51 COLUMNS OF DATA WHICH ARE EXPLAINED ON THE FOLLOWING PAGES. COLUMNS 2-6 (NAME) HAVE BEEN DELETED FOR PRESENTATION IN THIS REPORT.

<table>
<thead>
<tr>
<th>2</th>
<th>1</th>
<th>BMCM///012202080332165120306510</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>SA 00200000001600150102120100072165120306710</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>MK2 000001100104800430113045092175120201110</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>MKC 013001260530046046211260172175120201710</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>SA ///01222010002175120399910</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>SN 0050009004900410012170202175120399910</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
<td>SA ///111123500043175120399910</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>SA ///11212030043175120399910</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>SA ///11412010002175120301510</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>SA ///116120900102175120301610</td>
</tr>
<tr>
<td>12</td>
<td>1</td>
<td>SA ///11712010002175120301610</td>
</tr>
<tr>
<td>13</td>
<td>0</td>
<td>SN ///110112400222175120399910</td>
</tr>
<tr>
<td>14</td>
<td>1</td>
<td>SA ///119120100012175120302110</td>
</tr>
<tr>
<td>15</td>
<td>1</td>
<td>SN ///11611300082175120301310</td>
</tr>
<tr>
<td>16</td>
<td>0</td>
<td>MK2 ///301120850112165120299910</td>
</tr>
<tr>
<td>17</td>
<td>0</td>
<td>BMCM///411130650112165120399910</td>
</tr>
<tr>
<td>18</td>
<td>1</td>
<td>MK2 ///302120300012165120201010</td>
</tr>
<tr>
<td>19</td>
<td>0</td>
<td>SS2 0010065003600280194112800153165120/99910</td>
</tr>
<tr>
<td>20</td>
<td>0</td>
<td>MK2 ///306120850232165120299910</td>
</tr>
<tr>
<td>21</td>
<td>1</td>
<td>SS2 ///10511300093165120/09910</td>
</tr>
<tr>
<td>22</td>
<td>1</td>
<td>SS2 ///107113400103165120/01410</td>
</tr>
<tr>
<td>23</td>
<td>0</td>
<td>SN ///103112500043175120399910</td>
</tr>
<tr>
<td>24</td>
<td>0</td>
<td>BMCM ///411032500043175120399910</td>
</tr>
<tr>
<td>25</td>
<td>0</td>
<td>BMCM ///426032000153165120399910</td>
</tr>
</tbody>
</table>
## APPENDIX A

### FIELD DEFINITIONS OF DATA BASE

<table>
<thead>
<tr>
<th>Columns</th>
<th>Item</th>
<th>Code or Entry Method</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hit or Miss</td>
<td>Hit = 1</td>
<td>Hit - Lookout detected target</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Miss = 0</td>
<td>Miss - Lookout did not detect target</td>
</tr>
<tr>
<td>2-7</td>
<td>Name</td>
<td>First six letters of last name</td>
<td>Lookout's rank or rating</td>
</tr>
<tr>
<td>8-11</td>
<td>Rating/Rank</td>
<td>LT, BM3, etc</td>
<td>Four tests:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Two hidden figure tests</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Two hidden pattern tests</td>
</tr>
<tr>
<td>12-27</td>
<td>Test Scores</td>
<td>Add leading zero to all scores 100, i.e., 50.4 entered 0504</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Experience</td>
<td>Years of experience on SRU type</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Code</td>
<td>.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>.5  - 0.9 &lt;1.0</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 - 3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;3</td>
<td>4</td>
</tr>
<tr>
<td>29-30</td>
<td>Hrs on watch</td>
<td>Add leading zero to all values &lt;1.0, i.e., .4 entered 04; 2.5 entered 25</td>
<td>Elapsed time on watch at time of sighting</td>
</tr>
<tr>
<td>31</td>
<td>Visual aid</td>
<td>Yes = 1</td>
<td>Were visual aids used, i.e., binoculars</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No = 0</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Lookout</td>
<td>SRU Code</td>
<td>Posit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>UTB Port</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ctr Side</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Helo Port</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Scanner 1</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX A (Cont.)

FIELD DEFINITIONS OF DATA BASE

<table>
<thead>
<tr>
<th>Columns</th>
<th>Item</th>
<th>Code or Entry Method</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>UTB Stbd</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ctrl Side</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Helo Stbd</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>UTB Helm</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ctrl OOD</td>
<td></td>
</tr>
<tr>
<td>A.1</td>
<td>33-35 Relative</td>
<td>Three Digits i.e. 075</td>
<td>For Hits - Relative Bearing at which target was sighted</td>
</tr>
<tr>
<td></td>
<td>Bearing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>For Misses - Last relative bearing in lookouts zone of responsibility (see SRU templates in appendix)</td>
</tr>
<tr>
<td>36-38</td>
<td>Lateral Range</td>
<td>Add one leading zero to all values &lt; 10 and two zeros to all values &lt; 1 i.e. 6.3 entered 063 .7 entered 007</td>
<td>Distance in nautical miles from SRU to target when target is abeam SRU</td>
</tr>
</tbody>
</table>
### APPENDIX A (Cont.)

### FIELD DEFINITIONS OF DATA BASE

<table>
<thead>
<tr>
<th>Columns</th>
<th>Item</th>
<th>Code or Entry Method</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>39</td>
<td>Target Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>16' White Boat</td>
<td>Code 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Orange Canopy Raft</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>16' Blue Boat</td>
<td>Code 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Orange Raft</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Black Raft</td>
<td>Code 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>41' UTB</td>
<td>Code 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PIW (Person in water) (used mannequins)</td>
<td>Code 5</td>
<td></td>
</tr>
<tr>
<td>40-42</td>
<td>Wind Speed</td>
<td></td>
<td>Wind speed in knots</td>
</tr>
<tr>
<td></td>
<td>Add leading zero to value 10</td>
<td></td>
<td>i.e. 9.0 entered 090 12.0 entered 120</td>
</tr>
<tr>
<td>43-45</td>
<td>Visibility</td>
<td></td>
<td>Meteorological visibility in nautical miles</td>
</tr>
<tr>
<td></td>
<td>Add leading zero to values 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>Sleep</td>
<td>Hrs.</td>
<td>Hours of sleep lookout</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Code 1</td>
<td>had in last 24 hours</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-6</td>
<td>Code 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>Code 3</td>
</tr>
<tr>
<td>47-49</td>
<td>Sighting Range</td>
<td></td>
<td>Distance in Nautical Miles</td>
</tr>
<tr>
<td></td>
<td>Add one leading zero to all values 10 and two leading to all values 1</td>
<td></td>
<td>For Hits - Range at which target was sighted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>For Misses - Range of target at last opportunity for sighting in lookout's zone of responsibility (see templates in Appendix H)</td>
</tr>
</tbody>
</table>
APPENDIX A (Cont.)

FIELD DEFINITIONS OF DATA BASE

<table>
<thead>
<tr>
<th>Columns</th>
<th>Item</th>
<th>Code or Entry Method</th>
<th>Explanation</th>
</tr>
</thead>
</table>
| 50-51   | Cloud Cover | Add leading zero to values Tenths of sky covered by clouds  
          |              | <10 i.e. 5 entered 05  
          |              | 10 entered 10 |
| 51      | SRU Type    | Type                | Code |
|         |             | Cutter              | 1    |
|         |             | UTB                 | 2    |
|         |             | Helo                | 3    |

Missing Data for any item is denoted by a slant bar (/). An individual's test scores are listed only once per file. Thereafter slant bars are entered in those columns.
APPENDIX B
HUMAN FACTORS PROGRAMS FLOWCHART

START

"INPUT" INPUT OF DATA

MORE THAN ONE FILE?

YES

"JOIN" JOIN FILES

OPERATOR INTERVENTION ELIMINATE TEST SCORE REDUNDANCY

CHISQ ANALYSIS?

NO

"CUMSCR" CREATES FILE OF TEST SCORES

KEY STATISTICS INFO INTO CHISQD

HEWLETT PACKARD STATISTICS PROGRAM

REPORT

"CHISQD" PERFORMS CHI SQUARE ANALYSIS

REPORTS

NO
APPENDIX B
FLOWCHART LEGEND

COMPUTER PROGRAMS

KEYING OPERATIONS

DECISIONS

DOCUMENTS
APPENDIX C

"INPUT" PROGRAM

This program builds a file on Human Factors in SAR from the keyboard using symbols defined offline. The output is a file which represents the data for one SRU for one day.
10 ! THIS PROGRAM IS CALLED "INPUT"
20 ! THIS PROGRAM BUILDS A FILE OF DATA ON HUMAN FACTORS IN SAR FROM
30 ! THE KEYBOARD USING SYMBOLS DEFINED OFFLINE.
40 ! THE OUTPUT IS A FILE WHICH REPRESENTS THE DATA FOR ONE SPN FOR ONE DAY.
50 DIM O$(300)[52]
60 DIM line$(52)
70 DIM E$(52)
80 ! Fname$=" "
90 PRINT PAGE
100 PRINT PAGE
110 PRINT "DO YOU WANT TO CORRECT OR ADD TO AN EXISTING FILE? (C OR A)"; Res$ 
120 INPUT "DO YOU WANT TO CORRECT OR ADD TO AN EXISTING FILE? (C OR A)"; Res$ 
130 IF (Res$="C") OR (Res$="A") THEN GOTO 170
140 IF (Res$="N") THEN GOTO 230
150 PRINT "PLEASE RESPOND WITH A 'C' FOR CORRECT OR AN 'A' FOR ADDITION.
160 GOTO 100
170 PRINT PAGE
180 PRINT LINE(14)
190 EDIT "ENTER THE NAME OF THE FILE THAT YOU WANT TO MODIFY.", Fname$ 
200 Fname$=Fname$+".T14"
210 IF (Res$="C") OR (Res$="A") THEN GOTO 330
220 ASSIGN #1 TO Fname$ 
230 EDIT "- DATE OF SEARCH=", Dates$ 
240 INPUT "NEW FILENAME (???)?", Fname$ 
250 INPUT "HOW MANY RECORDS IN THE FILE???", Rn 
260 CREATE Fname$="T14", Rn, 60 
270 IF LEN(Dates$)=7 THEN GOTO 360 
280 PRINTER IS 16 
290 PRINT PAGE 
300 PRINT LINE(14) 
310 BEEP 
320 BEEP 
330 BEEP 
340 PRINT "INCORRECT DATA INPUT. PLEASE CORRECT IT.
350 GOTO 230 
360 EDIT "- SEARCH UNITS NAME (10 CHPS MAX): = ", Uname$ 
370 IF (LEN(Uname$)<>1) AND (LEN(Uname$)<10) THEN GOTO 450 
380 PRINT PAGE 
390 PRINT LINE(14) 
400 BEEP 
410 BEEP 
420 BEEP 
430 PRINT "INCORRECT DATA INPUT. PLEASE CORRECT IT.
440 GOTO 360 
450 EDIT "- SEARCH UNIT TYPE (1=Cutter, 2=Helco, 3=Boat) = ", Uttyp$ 
460 IF (Uttyp$="1") OR (Uttyp$="2") OR (Uttyp$="3") THEN GOTO 540 
470 PRINT PAGE 
480 PRINT LINE(14) 
490 BEEP 
500 BEEP 
510 BEEP 
520 PRINT "INCORRECT DATA INPUT. PLEASE CORRECT IT.
530 GOTO 450 
540 Rn=1 
550 PRINTER IS 16 
560 PRINT PAGE 
570 PRINT LINE(14) 
580 PRINT "---------------------------------------------
590 PRINT "YOU MAY NOW:
600 PRINT "- ENTER A NEW DATA LINE.
610 PRINT "- ENTER 'C' TO CORRECT A LINE.
620 PRINT "REMEME TO PRESS STOP WHEN YOU'RE PAHISHED." 
PRINT "ENTER 'F' TO END THE DATA INPUT."
680 PRINT "ENTER 'R' TO RESTART A DATA FILE."
700 PRINT "DO YOU EVER LUCKY, MARK!!!!"
720 EDIT "-----------------------------", line$
730 Hom$=line$(1,1)
740 IF Hom$="F" THEN GOTO 2070
750 IF Hom$="C" THEN GOTO 910
760 IF Hom$="R" THEN GOTO 1110
770 IF Hom$="L" THEN GOTO 1130
780 INPUT "ENTER THE OPPORTUNITY NUMBER OF THE LINE YOU WANT LISTED. ", Ln
790 IF Ln<Rn THEN GOTO 2290
800 PRINT PAGE
810 PRINT LIN(14)
820 PRINT "THE LINE YOU HAVE SPECIFIED HAS NOT BEEN ENTERED YET."
830 GOTO 760
840 PRINT PAGE
850 PRINT "LINE #:Ln:="
860 PRINT "-----------------------------"
870 PRINT O$(Ln+1)
880 Iline$="" line$
890 PRINT LIN(2)
900 GOTO 540
910 PRINT PAGE
920 PRINT LIN(14)
930 Srn=Rn
940 PRINT "HIT STOP WHEN FINISHED CORRECTING !!!"
950 INPUT "ENTER THE # OF THE LINE TO BE CORRECTED. ", Rn
960 IF Srn>Rn THEN GOTO 950
970 PRINT "THE LINE YOU HAVE SPECIFIED HAS NOT BEEN ENTERED YET."
980 GOTO 910
990 PRINT PAGE
1000 PRINT LIN(14)
1010 PRINT "MAKE CORRECTIONS THEN HIT 'CONT'."
1020 ASSIGN #1 TO Fname$
1030 Rn=Rn+1
1040 READ #1,Rn;O5$;Rn)
1050 PRINT O$(Rn)
1060 EDIT O$(Rn)
1070 PRINT O$(Rn)
1080 PAUSE
1090 PRINT #1,Rn;O5$;Rn
1100 GOTO 940
1110 PRINT PAGE
1120 PRINT LIN(14)
1130 INPUT "ENTER NEXT LINE TO BE INPUTED",Rs
1140 ASSIGN #1 TO Fname$
1150 READ #1,Rs
1160 Rn=Rs
1170 GOTO 590
1180 IF (Hom$="I") OR (Hom$="O") THEN E$=" "
1190 IF (Hom$="I") AND (Hom$="O") THEN E$="E"
1200 E$=E$" "
1210 E$=E$" "
1220 IF line$(12..15)=" " THEN GOTO 1250
1230 T1=VAL(line$(12..15)
1240 GOTO 1260
1250 T1=50
1260 IF (T1<1000) AND (T1>0) THEN E$=E$" "
1270 IF (T1<1000) OR (T1>0) THEN E$=E$" EEEE"
1280 IF line$(16..19)=" " THEN GOTO 1310
1290 T2=VAL(line$(16..19)
1300 GOTO 1320
1310 T2=50
1320 IF (T2<1000) AND (T2>0) THEN E$=E$" "
1310 IF (T2 > 1000) OR (T2 < 0) THEN ES = E$"EEE" "
1320 IF [Line$[26, 28]] = "" THEN GOTO 1370
1330 T3 = VAL([Line$[26, 28]])
1340 GOTO 1350
1350 T4 = 50
1360 IF (T4 = 1000) AND (T4 < 0) THEN ES = E$"EEE" "
1370 IF (T4 > 1000) OR (T4 < 0) THEN ES = E$"EEE" "
1380 IF [Line$[24, 27]] = "" THEN GOTO 1490
1390 T4 = VAL([Line$[24, 27]])
1400 GOTO 1440
1410 T4 = 50
1420 IF (T4 < 1000) AND (T4 < 0) THEN ES = E$"EEE" "
1430 IF (T4 > 1000) OR (T4 < 0) THEN ES = E$"EEE" "
1440 IF [Line$[29, 29]] = "" THEN GOTO 1490
1450 Exp = VAL([Line$[29, 29]])
1460 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1470 IF (Exp < 1) OR (Exp > 0) THEN ES = E$"EEE" "
1480 IF (Exp < 4) OR (Exp > 0) THEN ES = E$"EEE" "
1490 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1500 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1510 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1520 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1530 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1540 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1550 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1560 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1570 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1580 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1590 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1600 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1610 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1620 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1630 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1640 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1650 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1660 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1670 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1680 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1690 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1700 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1710 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1720 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1730 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1740 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1750 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1760 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1770 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1780 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1790 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1800 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1810 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1820 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1830 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1840 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1850 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1860 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1870 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1880 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1890 IF (Exp < 0) OR (Exp > 0) THEN ES = E$"EEE" "
1900 PRINT PAGE
1910 PRINT LINE(12)
1920 PRINT "INCORRECT DATA INPUT. PLEASE CORRECT THE INDICATED MISTAKES."
1930 PRINT
1940 PRINT "-------------------------------------------------------------------------------------------------
1950 PRINT [Line$]
1960 PRINT ES
1970 BEEP
1980 BEEP
1990 BEEP
2000 GOTO 720
2010 Rn=Rn+1
2020 O$(Rn)=Iline$
2030 Iline$=""
2040 IF Srn<0 THEN Fn=Srn
2050 Srn=0
2060 GOTO 558
2070 IF (Re$="C") OR (Re$="R") THEN GOTO 2300
2080 PRINTER IS 0
2090 PRINT LIN(5)
2100 PRINT Date$,Unamex,"TYPE=",";Typex","OPTS= ";Rn-1
2110 PRINT
2120 PRINT "FILENAME=";Fname$[1,4]
2130 ASSIGN #1 TO Fname$";T14"
2140 PRINT #1,1;Fname$,Date$,Nama$,Type$,VAL$(Rn)
2150 FOR X=2 TO Rn
2160 PRINT #1,X;O$(X)
2170 PRINT "*::::=*et:=:*::*==:*****:::**",
2180 PRINT O$(X),X-1
2190 NEXT X
2200 PRINT "*:::::::::::::::::::::::::::::::::::::::::::::::::
2210 PRINT "END OF LISTING"
2220 PRINT LIN(5)
2230 ASSIGN * TO #1
2240 PRINTER IS 16
2250 PRINT PAGE
2260 PRINT LIN(14)
2270 PRINT "FILE NAME = ",Fname$[1,4]
2280 PRINT "END OF LISTING"
2290 GOTO 2300
2300 PRINTER IS 0
2310 FOR X=R$ TO Rn
2320 PRINT #1,X;O$(X)
2330 PRINT "*:::::::::::::::::::::::::::::::::::::::::::::::::
2340 PRINT O$(X),X-1
2350 NEXT X
2360 PRINT "*:::::::::::::::::::::::::::::::::::::::::::::::::
2370 PRINT "END OF LISTING"
2380 END
APPENDIX D

"JOIN" PROGRAM

This program joins a number of raw data files (from "INPUT" program) together and stores the resulting file in a new tape file.
JOIN

This program joins a number of raw data files together and stores the resulting file in a new tape file.

This program was originally the “APPEND” program, written by Don Cundy. It was modified by D. Baird for use in Pod/Sar.

Before running this program the operator must type in following-

- Create "FILE T14", 50 then execute.
- Assign #1 to "FILE T14" then execute.
- After you have the “JOIN” program in memory place the data files tape in T15 and the new tape in T14. This is done before typing in the above CREATE, ASSIGN, and PRINT statements.

10 DIM B$(500):52
110 PRINTOS 0
120 INPUT "ENTER THE FILE NAME", New$
130 INPUT "ENTER FILE NAME TO BE COMBINED", File$
140 ASSIGN #1 TO File$
150 ASSIGN #2 TO New$; T14$
160 BUFFER #2
170 READ #2, I; J
180 I=2
190 ON END #1 GOTO 320
200 READ #1, I; B$(I)
210 PRINT #2, J; B$(I)
220 PRINT I; J; B$(I)
230 I=I+1
240 J=J+1
250 GOTO 260
260 PRINT #2, I; J
270 PRINT #2, J; I
280 I=I+1
290 J=J+1
300 GOTO 260
310 END

320 PRINT #2, I; J
330 REWIND
340 END
APPENDIX E

"CUMSCR" PROGRAM

This program accumulates the Hidden Figures and Hidden Patterns test scores in an array suitable for analysis by the Basic Statistics and Data Manipulation programs.
100 OPTION BASE 1
200 DIM R$(600),C$(52),Name$(40),Tsl(40),Tsl(40),Test1(40),Test2(40),Test3(40),
Test4(90),Test5(90)
300 INPUT "INPUT DATAFILE NAME ?? ??",JoH$
400 CREATE "TEST3",50,8
500 CREATE "TEST4",50,8
600 ASSIGN #1 TO "TEST3":T14"
700 ASSIGN #2 TO "TEST3"
800 ASSIGN #3 TO "TEST4"
900 I=1
100 J=1
110 M1=0
120 M2=0
130 I=I+1
140 ON END I GOTO 440
150 READ #1,I;R$(I)
160 Name$=R$(I)(2,111)
170 Test$=R$(I)(12,27)
180 IF Test$=";" THEN GOTO 190
190 Test1$=R$(I)(12,19)
200 Test2$=R$(I)(20,27)
210 IF Test1$=";" THEN GOTO 290
220 M1=M1+1
230 GOTO 340
240 T1=VAL(R$(I)(12,15))
250 T2=VAL(R$(I)(16,19))
260 PRINT Name$,T1,T2
270 J=J+1
280 IF Test2$=";" THEN GOTO 370
290 M2=M2+1
300 GOTO 190
310 T3=VAL(R$(I)(20,23))
320 T4=VAL(R$(I)(24,27))
330 PRINT Name$,T3,T4
340 T2$(K)=(T3+T4)/10
350 K=K+1
360 GOTO 190
370 MAT Test1=Tsl
380 MAT Test2=Tsl
390 MAT PRINT #2;Test1,END
400 MAT PRINT Test1;
410 PRINT "NUMBER OF SCORES MISSING IN FIELD 1 =";M1
420 PRINT
430 PRINT
440 PRINT
450 PRINT "NUMBER OF SCORES MISSING IN FIELD 2 =";M2
460 END
APPENDIX F

"CHISQO" PROGRAM

This program runs against either single files of joined files and does a Contingency Table Analysis.
10 THIS PROGRAM IS CALLED "CHISCED"
20 THIS IS DESIGNED TO RUN AGAINST EITHER SINGLE FILES OR JOINED FILES
30 AND TO DO A CONTINGENCY TABLE ANALYSIS
40 THIS PROGRAM WAS WRITTEN BY LTG LOUIS MASH, USCG, IN 1982, FOR
50 THE FACTOR PART, OF THE SAF AMD PROJECT AT THE USCG AMD CENTER.
60 THIS VERSION IS FOR ALPHABETIC OR CODE ORDERED FILES ONLY.
70
80 OPTION BASE 1
90 OVERLAP
100 DIM R$(70:10), Col$(20), Scr$(20), Scr$(20)
110 DIM Or(10,10), A(10), B(10)
120 COM Nsub, Lab$(15*40), Pos(4,10), S$, SI$
130 ASSIGN #2 TO "LABRTITIS" ! CONTAINS THE NAMES OF THE SUBJECTS
140 ASSIGN #3 TO "POSITITIS" ! CONTAINS THE POSITIONS OF DIFFERENT
150 SUBJECTS IN THE DATA STRING
160 Nsub=16
170 ! Nsub IS THE NUMBER OF SUBJECTS WHOSE LABELS ARE
180 ! CONTAINED IN Lab$(Nsub), AND STRING POSITIONS
190 ! ONLY Nsub AND THE DIMENSION STATEMENTS NEED TO BE
200 ! CHANGED FOR THE PROGRAM TO HANDLE MORE SUBJECTS
210 FOR I=1 TO Nsub
220 READ #2; Lab$(I)
230 NEXT I
240 FOR I=1 TO Nsub
250 READ #3; Pos$(1:I), Pos$(1:I), Pos$(1:I), Pos$(1:I)
260 NEXT I
270 GOSUB 2250
280 CALL Sublist
290 CALL Input "ENTER CODE FOR SUBJECT FOR COLUMNS", Icol
300 IF (Icol(I)< Icol(Nsub)) THEN 360
310 INPUT "ENTER CODE FOR SUBJECT FOR ROWS", Irow
320 IF (Irow(I)< Irow(Nsub)) THEN 380
330 INPUT "DO YOU WISH TO SCREEN THE DATA?", S$
340 IF (S$<"Y") THEN 470
350 INPUT "ENTER CODE FOR SUBJECT FOR SCREENING", Iscreen
360 IF (Iscreen(I)< Iscreen(Nsub)) THEN 490
370 CALL Bound2, Iscreen, L, Scr$(4), Pos$(1), Pos$(3), Pos$(3), Pos$(4)
380 CALL Bound1, Icol, M, Col$(4), Pos$(1), Pos$(3), Pos$(3), Pos$(4)
390 CALL Bound0, Irow, N, Row$(4), Pos$(1), Pos$(3), Pos$(3), Pos$(4)
400 CALL Bound3, Icol, M, Col$(4), Pos$(1), Pos$(3), Pos$(3), Pos$(4)
410 CALL Bound2, Iscreen, L, Scr$(4), Pos$(1), Pos$(3), Pos$(3), Pos$(4)
420 ! REVIEWS SUBJECTS AND CATEGORIES AND PROVIDES A
430 ! CHANCE TO MAKE CORRECTIONS
440 ! SORTS THE DATA INTO CATEGORIES
450 FOR Irec=2 TO Rec
460 Jstep=Jrec
470 Skip=0
480 CALL Screen(R$, Jstep, Pos$(1), Pos$(3), Pos$(3), Pos$(4), L, Iscreen, Scr$(4))
IF S=0 THEN Exclude
 IF (Icol=1) AND (Icol=2) THEN 730  !IF NO TEST SCORES FOR COLUMNS
 CALL Combine(codes,Colcode,Colpos1,Colpos2,Colpos3,Colpos4,Rec,Jrec,D1)
 IF D1=1 THEN GOTO Missing
 GOTO 770
 CALL Code=Row,Colcode,Colpos1,Colpos2,Colpos3,Colpos4,Rec,Jrec,D1
 IF Colcode[Icol]=" " THEN GOTO Missing
 CALL Convert(codes,Column,Colcode,Icol)
 CALL Sort(M,Colcode,Colcat(1),Jcol)  !SORT DATA INTO COLUMNS
 IF Jcol=4 THEN GOTO Excluded
 IF Skip=1 THEN GOTO Repeat
 IF (Irow=2) AND (Irow=3) THEN 860
 CALL Combine(Rcode,Ppos1,Ppos2,Ppos3,Ppos4,Rec,Jrec,D1)
 IF D2=2 THEN GOTO Missing
 GOTO 900
 CALL Pcode,Rec,Jcol+1
 CALL Sort(N,Rcode,Recat(1),Jrow)
 IF Jrow=4 THEN GOTO Excluded
 D=D1+D2+1
 IF (Icol=2) AND (Icol=3) THEN Normal
 IF (Icol=1) AND (Irow=1) THEN Normal

 Repeat: IF (Irow=2) OR (Irow=3) THEN Skip=1
 IF S=2 THEN 1010
 CALL Screen(F#:Istep,Ppos1,Ppos2,Ppos3,Ppos4,Line,Screen,Scat(1),S)
 IF S=0 THEN Exclude
 O(Irow,Jcol)=O(Irow,Jcol)+1
 Istep=Istep+1
 IF Istep=Istep THEN 1260
 IF Pr(Istep)=1 THEN 1260
 IF P(Istep,1)=Rec THEN 1260
 IF D1=1 THEN 860
 IF D2=1 THEN 730
 IF S=2 THEN 630
 STOP

 Missing: MVP=MVP+1
 IF Skip=1 THEN GOTO 1030
 GOTO 1260

 Excluded: EV=EV+1
 IF Skip=1 THEN GOTO 1030
 GOTO 1260

 Normal: On,Jrow,Jcol=0(O,Jrow,Jcol)+1
 PRINT PAGE
 CALL Table(Rcode,M,On,Ex,EV,Chsq,Df,A(-),B(-),Total)
 PRINT TABLE
1330 PRINT " PRINTER IS 0"
1340 DATA FROM ";F10"
1350 PRINT " "
1360 PRINT USING " "
1370 IF S<"0" THEN 1400
1380 CALL ListOut(1,Screen,L,Form,CA="",J)
1390 CALL ListOut(Q,Col,Coltag="",1)
1400 CALL ListOut(0,Form,Coltag="",0)
1410 M1=M-1
1420 IF M>5 THEN 1710
1430 M1=M-1
1440 IF M>5 THEN 1710
1450 PRINT USING "#15.5A";1"
1460 FOR J=2 TO M
1470 PRINT USING "#11.1D";J
1480 NEXT J
1490 PRINT USING "#5.5A";TOTAL"
1500 FOR I=1 TO N
1510 PRINT USING "#2D.3X;I"
1520 FOR J=1 TO M
1530 PRINT USING "#8X.4D";I,J
1540 NEXT J
1550 PRINT USING "#8X.4D";I,J
1560 PRINT USING "#2D.3X;I"
1570 PRINT USING "#12.5A,4D.D,A";"",E(I,J),"")
1580 FOR J=2 TO M1
1590 PRINT USING "#4X,A,4D.D,A";"",E(I,J),"")
1600 NEXT J
1610 PRINT USING "4X,A,4D.D,A,/>";"",E(I,J),"")
1620 NEXT I
1630 PRINT USING "#5A";TOTAL"
1640 FOR J=1 TO M
1650 PRINT USING "#5X.4D";A(J)
1660 NEXT J
1670 PRINT USING "#6.5A";:;
1680 GOTO 1960
1690 GOTO 1960
1700 PRINT USING "#3X,A";1"
1710 FOR J=2 TO M
1720 PRINT USING "#6X.2D";J
1730 NEXT J
1740 PRINT USING "#6X.2D";J
1750 PRINT USING "#5A";:;
1760 FOR I=1 TO N
1770 PRINT USING "#2D";I
1780 FOR J=1 TO M
1790 PRINT USING "#4X,4D";O(I,J)
1800 NEXT J
1810 PRINT USING "#6X.4D,";B(I)
1820 PRINT USING "#5X,A,4D.D,A";"",E(I,J),"")
1830 FOR J=2 TO M1
1840 PRINT USING "#A,4D.D,A";"",E(I,J),"")
1850 NEXT J
1860 PRINT USING "A,4D.D,A";"",E(I,J),"")
1870 NEXT I
1880 PRINT USING "#5A";TOTAL"
1890 PRINT USING "#3X.4D";A(J)
1900 FOR J=2 TO M
1910 PRINT USING "#3X.4D";A(J)
1920 NEXT J
1930 PRINT USING "3X.4D.";TOTAL"
1940 FOR I=1 TO N
1950 FOR J=2 TO M
1960 IMAGE 5:13A.2X,0000.DDDD
1970 PRINT USING 1960;"CHI SQUARED VALUE = ";CHI:aq
1980 PRINT "NUMBER OF MISSING VALUES = ";M-1
CONSOLIDATE TABLE FOR CHANGES IN ROWS

CONSOLIDATE TABLE FOR CHANGES IN COLUMNS

MAKE CHANGES IN COLUMNS

CONSOLIDATE TABLE FOR CHANGES IN ROWS
2640 O(I,R2)=O(I,R2)+O(I,R1)
2650 NEXT I
2660 Colcat<2+P1=Colcat<2+P1
2670 M1=M1-1
2680 INPUT "DO YOU WISH TO CONSIDER ANY OTHER COLUMNS"?,A$
2690 IF A$="Y" THEN 2650
2700 INPUT "DO YOU WISH TO ELIMINATE ANY COLUMNS"?,B$
2710 IF (B$="G" OR B$="R") AND (A$="G" OR A$="R") THEN 1280
2720 IF B$="Y" THEN 2640
2730 INPUT "ENTER NUMBER OF COLUMN TO BE ELIMINATED",P1
2740 FOR I=1 TO N
2750 E(I)=E(I)+O(I,P1)
2760 O(I,R1)=0
2770 NEXT I
2780 M1=M1-1
2790 INPUT "DO YOU WISH TO REMOVE ANOTHER COLUMN"?,B$
2800 IF B$="Y" THEN 2680
2810 CONSOLIDATE TABLE FOR CHANGES IN COLUMNS
2820 MAT A=CSUM.O:
2830 FOR J=1 TO M1
2840 J1=J
2850 IF A(J1,J1) THEN 2830
2860 J1=J1+1
2870 IF J1=M THEN 2820
2880 M1=J
2890 GOTO 2800
2900 IF J1=J THEN 2890
2910 FOR I=1 TO N
2920 O(I,J)=O(I,J1)
2930 O(I,J1)=0
2940 NEXT I
2950 A(J1)=0
2960 CALL Transfer(J,J1,Colcat-+)
2970 NEXT J
2980 M=M1-1
2990 GOTO 1290
3000 START NEW ANALYSIS
3010 PRINT PAGE
3020 PRINT "YOU NOW HAVE SEVERAL CHOICES"
3030 PRINT "CODE CHOICE"
3040 PRINT "1 END SESSION"
3050 PRINT "2 CHANGE SUBJECTS AND CATEGORIES"
3060 PRINT "3 ENTER NEW DATA AND "CHOOSE CHOOSE 2"
3070 PRINT "4 GET ORIGINAL TABLE BACK"
3080 INPUT "ENTER CODE FOR YOUR CHOICE",Ich
3090 PRINT PAGE
3100 IF Ich<1 OR Ich>4 THEN 3120
3110 Counter=0
3120 ON Ich GOTO 3540,3190,3180,3210
3130 GOSUB 3250
3140 PRINT "ENTER NEW TAPE"
3150 GOSUB 3420
3160 ON Ich GOTO 3540,3190,3180,3210
3170 CALL Asr:nt(r,Gr=+,Ocol,Grw,Orrowcat=++,Orcolat=+),N=eval,O(+),M,N,Rowca t(++,Colcat=+,Eval)
3180 PRINT "YOU NOW HAVE THE ORIGINAL TABLE BACK"
3190 GOTO 2040
3200 PRINT "READS DATA TAPE"
3210 PRINT "INSERT DATA TAPE INTO T14"
3220 INPUT "HIT CONT WHEN READY",I
3230 PRINT PAGE
INPUT "ENTER DATA FILE'S NAME ??",FILE$: 3290
ASSIGN #1 TO FILE$: 3300
ON END #1 GOTO 3320 3310
Rec=2 3320
READ #1,Rec;P=Rec; 3330
GOTO 3320 3350
Rec=Rec+1 3360
OFF END #1 3370
OVERLAP RETURN 3380

CHANGE SUBJECTS AND CATEGORIES

INPUT "DO YOU WISH TO SCREEN THE DATA",S1$ 3420
CALL Review(2,Iscreen,L,Scrncat(*),Spos1,Spos2,Spos3,Spos4) 3440
CALL Review(1,icol1,M,Colcat(*),Cpos1,Cpos2,Cpos3,Cpos4) 3450
CALL Review(0,icol1,M,Rowcat(*),Rpos1,Rpos2,Rpos3,Rpos4) 3460
MAT 0=0 3470  ! INITIALIZE ARRAY
MAT E=0 3480
MAT B=0 3490
MAT A=0 3500
RETURN 3510

PRINT "PLEASE CHECK DATA FOR CORRECT ENTRIES." 3530
BAD DATA

SUB Table(N,M,0,**,E,**,Chisq,DF,**,B,**,Total)
DIM C(10) 3560
FOR J=1 TO M 3580
A(J)=0 3600
FOR I=1 TO N 3620
A(J)=A(J)+C(I,J) 3630
NEXT I 3640
NEXT J 3650
Total=0 3660
FOR I=1 TO N 3670
B(I)=0 3680
FOR J=1 TO M 3690
B(I)=B(I)+C(I,J) 3700
NEXT J 3710
Total=Total+B(I) 3720
NEXT I 3730

IF Total<>0 THEN 3770
PRINT "Total =0 , Chi square not calculated" 3750
SUBEND

FOR I=1 TO N 3770
C(I)=B(I)/Total 3780
NEXT I 3790

Chisq=0 3800
FOR J=1 TO M 3810
FOR I=1 TO N 3820
E(I,J)=A(I,J)-C(I,J) 3830
IF E(I,J)<0 THEN 3870
Chisq=Chisq+0 3840
GOTO 3890 3850
Chisq=Chisq+0 3860
NEXT J 3880
NEXT I 3890

DF=(M-1)*(N-1) 3900
SUBEND

PICK BOUNDARIES FOR CATEGORIES AND INITIALIZES DATA POSITIONS
Z950 SUB Bound: Ind, Isub, M, Bounds = Pos1, Pos2, Pos3, Pos4
3960 COM Nsub, Labu: 1, Pos
3970 PRINT PAGk
3980 CALL Heading: Isub, Ind:
3990 Pos1 = Pos1, Isub:
4000 Pos2 = Pos2, Isub:
4010 Pos3 = Pos3, Isub:
4020 Pos4 = Pos4, Isub:
4030 INPUT "ENTER NUMBER OF CATEGORIES", M
4040 IF M > 10 THEN 4090
4050 PRINT "SORRY, BUT THIS PROGRAM CAN NOT HANDLE MORE THAN 10"
4060 PRINT "CATEGORIES UNTIL THE DIMENSION STATEMENTS ARE CHANGED."
4070 PRINT "UNTIL THEN "
4080 GOTO 4030
4090 PRINT "YOU HAVE CHOsEN TO HAVE "; M; " CATEGoRIES, THEPFoRE"
4100 PRINT "YOU MUST SET THE UPPER UB) AND LOWER (LB) BOUNDARIES"
4110 PRINT "FOR EACH CATEGORY SUCH THAT LB <= X <= UB"
4120 PRINT "ENTER LOWER BOUNDARIES FIRST, THEN UPPER" 
4130 Jcat = 1
4140 FOR J = 1 TO M
4150 Jcat = Jcat + 1
4160 PRINT "CATEGORY ", J
4170 INPUT "LOWER BOUNDARY", Bounds (Jcat)
4180 INPUT "UPPER BOUNDARY", Bounds (Jcat + 1)
4190 CALL Switch (Bounds (Jcat), Bounds (Jcat + 1))
4200 PRINT "LOWER BOUNDARY IS "; Bounds (Jcat), "UPPER BOUNDARY IS "; Bounds (Jcat + 1)
4210 Jcat = Jcat + 1
4220 NEXT J
4230 SUBEND
4240 ! SORTING ROUTINE
4250 SUB Sort (Number, Value, Bounds =, Cat)
4260 Last = 2 * Number
4270 FOR J = 2 TO Last STEP 2
4280 IF (Bounds (J - 1) <= Value) AND (Value <= Bounds (J)) THEN 4340
4290 NEXT J
4300 Cat = Number + 1
4310 SUBEXIT
4320 Cat = INT (J / 2)
4330 SUBEND
4340 SUBEND
4350 !
4360 ! SUB Listcat: Isub, Num, Cat(+), Ind ! PRINT CODE AND CATEGORIES
4370 !
4380 CALL Heading: Isub, Ind ! PRINTS CODES
4390 !
4400 PRINT " CATEGORY LOWER BOUND UPPER BOUND"
4410 FOR J = 1 TO Num
4420 PRINT USING 4450; J, Cat (I), Cat (I + 1)
4430 NEXT J
4440 SUBEND
4450 !
4460 ! SUB Combine: Test, Pos1, Pos2, Pos3, Pos4, Strings, D ! COMBINE TEST SCORES
4470 !
4480 Test1 = Strings [Pos1, Pos2]
4490 Test2 = Strings [Pos3, Pos4]
4500 IF Test1 = "" OR Test2 = "" THEN 4610
4510 Test = VAL (Test1) + VAL (Test2)
4520 D = 1
4530 SUBEND
4540 !
4550 SUB Combine: Test, Pos1, Pos2, Pos3, Pos4, Strings, D ! COMBINE TEST SCORES
4560 !
4570 ! SUB Combine: Test, Pos1, Pos2, Pos3, Pos4, Strings, D ! COMBINE TEST SCORES
4580 !
4590 D = 1
4600 SUBEXIT
4610 D=2
4620 SUBEND
4630
4640
4650 SUB Convert.Code, Codes, Subj
4660 'CONVERTS DATA INTO REAL NUMBERS
4670 INPUTS
4680 Code$ is a alphanumeric string
4690 Subj is the index corresponding to subject
4700 OUTPUTS
4710 Code is numeric value of Code$
4720
4730 ******** WARNING **************
4740 SUBPROGRAM IS DATA SPECIFIC, NEW FORMATS OR DATA REQUIRE CHANGES.
4750 IF (Subj=10) OR (Subj=4) THEN 4810
4760 IF (Subj=6) AND (Subj<5) THEN 4810
4770 IF (Subj=10) OR (Subj=13) THEN 4810
4780 IF Subj=15 THEN 4810
4790 Code=VAL(Codes), 10
4800 SUBEXIT
4810 Code=VAL(Codes)
4820 SUBEND
4830
4840
4850 SUB Helper(Index)
4860
4870 THIS SUBROUTINE PRINTS THE DATA CODE FOR SUBJECT CORRESPONDING TO
4880 Index, PROVIDED THAT IT IS CODED DATA.
4890
4900 ******** WARNING **************
4910 THIS SUBPROGRAM IS DATA SPECIFIC, DIFFERENT DATA FILES, USING DIFFERENT
4920 FORMATS, WILL REQUIRE THAT THIS SUBPROGRAM BE CHANGED.
4930 ***********************************
4940
4950 IF Index<>1 THEN 5010
4960 PRINT " CODE MEANING"
4970 PRINT " 1 HIT"
4980 PRINT " 0 MISS"
4990 PRINT
5000 SUBEXIT
5010 IF Index<>4 THEN 5090
5020 PRINT " CODE YEARS"
5030 PRINT " 1 <= .5"
5040 PRINT " 2 .5 < X <= 1"
5050 PRINT " 3 1 < X <= 3"
5060 PRINT " 4 >3"
5070 PRINT
5080 PRINT
5090 IF Index<>6 THEN 5150
5100 PRINT " CODE VISUAL AID"
5110 PRINT " 0 NOT USED OR USE UNKNOWN"
5120 PRINT " 1 YES"
5130 PRINT
5140 PRINT
5150 IF Index<>7 THEN 5220
5160 PRINT " CODE POSITION"
5170 PRINT " 1 PORT"
5180 PRINT " 2 STARBOARD"
5190 PRINT " 3 BRIDGE/HELM/PILOT"
5200 PRINT
5210 PRINT
5220 IF Index<>10 THEN 5310
5230 PRINT " CODE TYPE"
5240 PRINT " 1 16 WHITE BOAT/ORANGE CANOPY RAFT"
5250 PRINT " 2 16 BLUE BOAT/ORANGE RAFT W/O CANOPY"
5260 PRINT " 3 BLACK RAFT"
5270 PRINT " 4 41 BOAT/RAISBERRY/PAFT  
5280 PRINT " 5 PIW"  
5290 PRINT  
5300 SUBEND  
5310 IF Ind=13 THEN 5360  
5320 PRINT "  CODE HOUR"  
5330 PRINT "  1 4"  
5340 PRINT "  2 4 - 5"  
5350 PRINT "  3 6"  
5360 PRINT  
5370 SUBEND  
5380 IF Ind=15 THEN SUBEND  
5390 PRINT "  CODE SEARCH UNIT TYP"  
5400 PRINT "  1 CUTTER"  
5410 PRINT "  2 UTB"  
5420 PRINT "  3 HELIO"  
5430 PRINT  
5440 SUBEND  
5450  
5460  
5470 SUB Switch(L.U)  
5480 IF L<=U THEN SUBEND  
5490 A=L  
5500 L=U  
5510 U=A  
5520 SUBEND  
5530  
5540  
5550 SUB Transfer(I,J,Cat(+))  
5560 Iu=I+2  
5570 I1=Iu-1  
5580 Ju=J+2  
5590 J1=Ju-1  
5600 Cat(I1)=Cat(J1)  
5610 Cat(Iu)=Cat(Ju)  
5620 SUBEND  
5630  
5640  
5650 SUB Heading(Isub,Ind)  
5660 COM Nsub,Labsub(+)  
5670 Which(="POWS")  
5680 IF Ind=1 THEN Which(="COLUMNS")  
5690 IF Ind=2 THEN Which(="SCREENING")  
5700 PRINT "SUBJECT FOR ":Which(=" ;Labsub(Isub))  
5710 CALL Helper(Isub  
5720 IF Ind<=2 THEN SUBEND  
5730 PRINT "CATEGORIES FOR SCREENING FORM THE DATA BASE FOR ANALYSIS"  
5740 SUBEND  
5750  
5760  
5770 SCREENS THE DATA  
5780 SUB Screen(R$,Spos1,Spos2,Spos3,Spos4,L,Iscreen,Srcat(+),S)  
5790  
5800 RETURNS:  S = 0 IF EXCLUDED OR MISSING  
5810  = 1 IF INCLUDED AND REPEATS SHOULD BE SCREENED  
5820  = 2 " " " " " NOT BE SCREENED  
5830  
5840 COM Nsub,Labsub(+)  
5850  
5860 S=1  
5870 IF S$="Y" THEN SUBEND  
5880 IF Spos1=Spos3 THEN 5920  
5890 CALL Combine(1,Code,Spos1,Spos2,Spos3,Spos4,P$,D)  
5900 S=2  
5910 ON D GOTO 5950,5970  
5920 Sncode$=R$(Spos1,Spos2)
5930 IF Snncode$(1,1)=" " THEN 5970
5940 CALL Convert(Scode,Snncode$,Iscreen)
5950 CALL Sort(L,Scode,Snncat(*),Isrn)
5960 IF Isrn=L THEN SUBEND
5970 S=0
5980 SUBEND
5990 !
6000 !
6010 SUB Sublist;'PRINTS A LIST OF SUBJECT AND INDEX
6020 COM Nsub,Labsub$(*)
6030 PRINT PAGE
6040 PRINT "SUBJECT CODE"
6050 FOR I=1 TO Nsub
6060 PRINT USING "3X,20A,9X,2D";Labsub$(I),I
6070 NEXT I
6080 SUBEND
6090 !
6100 !
6110 REVIEW AND CHANGE SUBJECTS AND CATEGORIES
6120 !
6130 SUB Review(Ind,Isub,Num,Cat(*),Pos1,Pos2,Pos3,Pos4)
6140 COM Nsub,Labsub$(*),Pos(*),S#,S$
6150 !
6160 FOR ROWS: Ind = 0
6170 COLUMNS; Ind = 1
6180 SCREENING; Ind = 2
6190 !
6200 Isub = SUBJECT CODE, & index for Labsub$(*)
6210 Num = NUMBER OF BINS
6220 Cat(*) is array containing boundaries for bins
6230 Pos1,Pos2,Pos3,Pos4 are string positions for subject
6240 !
6250 Nsub is program parameter for maximum number of subjects.
6260 Labsub$(*) is array of subject labels for printing.
6270 Pos(*) is array of string positions for data
6280 S# and S$ are answers to "DO YOU WANT TO SCREEN THE DATA?"
6290 asked at different points
6300 !
6310 PRINT PAGE
6320 IF Ind<>2 THEN 6330
6330 IF (S#>"Y") AND (S$>"Y") THEN SUBEXIT
6340 IF (S#="Y") AND (S$="Y") THEN 6330
6350 S#="Y"
6360 IF S$>"Y" THEN SUBEXIT
6370 GOTO 6430
6380 CALL Listcat(Isub,Num,Cat(*),Ind)
6390 INPUT "DO YOU WISH TO CHANGE ANY PARAMETERS?",As
6400 IF A$="Y" THEN SUBEXIT
6410 INPUT "DO YOU WISH TO CHANGE THE SUBJECT?",As
6420 IF A$>"Y" THEN 6460
6430 CALL Sublist
6440 INPUT "ENTER NEW CODE",Isub
6450 IF (Isub<1) OR (Isub>Nsub) THEN 6440
6460 INPUT "DO YOU WISH TO CHANGE THE CATEGORIES?",A#
6470 IF A$>"Y" THEN SUBEXIT
6480 CALL Bound;Ind,Isub,Num,Cat(*),Pos1,Pos2,Pos3,Pos4
6490 GOTO 6310
6500 SUBEND
6510 !
6520 !
6530 SUB Aswitch(Old(*),Col,Row,Nncat(*),Nccat(*),Sexual,New(*),Ncol,Nrow,Nncat (*),Nccat(*),NSexual)
6540 NSexual=Sexual
6550 Ncol=Col
6560 Nrow=Row
6570 FOR I=1 TO Row
6530 FOR J=1 TO Col
6540 New(I,J)=Old(I,J)
6600 NEXT J
6610 NEXT I
6620 FOR I=1 TO Row-2
6630 NcNat(I)=NcNat(I)
6640 NEXT I
6650 FOR J=1 TO Col+2
6660 NcNat(J)=NcNat(J)
6670 NEXT J
6680 SUBEND
APPENDIX G

HUMAN FACTORS LOOKOUT DATA STORED ON TAPE #1

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>REC/FILE</th>
<th>BYTES/REC</th>
<th>ADDRESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>T15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1001</td>
<td>DATA</td>
<td>15</td>
<td>60</td>
<td>5</td>
</tr>
<tr>
<td>1002</td>
<td>DATA</td>
<td>14</td>
<td>60</td>
<td>9</td>
</tr>
<tr>
<td>1003</td>
<td>DATA</td>
<td>23</td>
<td>60</td>
<td>13</td>
</tr>
<tr>
<td>1004</td>
<td>DATA</td>
<td>19</td>
<td>60</td>
<td>19</td>
</tr>
<tr>
<td>1008</td>
<td>DATA</td>
<td>18</td>
<td>60</td>
<td>24</td>
</tr>
<tr>
<td>1009</td>
<td>DATA</td>
<td>15</td>
<td>60</td>
<td>29</td>
</tr>
<tr>
<td>1007</td>
<td>DATA</td>
<td>27</td>
<td>60</td>
<td>33</td>
</tr>
<tr>
<td>1005</td>
<td>DATA</td>
<td>59</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>1006</td>
<td>DATA</td>
<td>73</td>
<td>60</td>
<td>54</td>
</tr>
<tr>
<td>1010</td>
<td>DATA</td>
<td>31</td>
<td>60</td>
<td>72</td>
</tr>
<tr>
<td>1011</td>
<td>DATA</td>
<td>49</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>1012</td>
<td>DATA</td>
<td>109</td>
<td>60</td>
<td>92</td>
</tr>
<tr>
<td>1013</td>
<td>DATA</td>
<td>125</td>
<td>60</td>
<td>118</td>
</tr>
<tr>
<td>1015</td>
<td>DATA</td>
<td>20</td>
<td>60</td>
<td>148</td>
</tr>
<tr>
<td>1016</td>
<td>DATA</td>
<td>10</td>
<td>60</td>
<td>153</td>
</tr>
<tr>
<td>1014</td>
<td>DATA</td>
<td>21</td>
<td>60</td>
<td>156</td>
</tr>
<tr>
<td>1017</td>
<td>DATA</td>
<td>13</td>
<td>60</td>
<td>161</td>
</tr>
<tr>
<td>1019</td>
<td>DATA</td>
<td>125</td>
<td>60</td>
<td>166</td>
</tr>
<tr>
<td>1042</td>
<td>DATA</td>
<td>27</td>
<td>60</td>
<td>196</td>
</tr>
<tr>
<td>1019</td>
<td>DATA</td>
<td>105</td>
<td>60</td>
<td>426</td>
</tr>
<tr>
<td>1020</td>
<td>DATA</td>
<td>120</td>
<td>60</td>
<td>451</td>
</tr>
<tr>
<td>1021</td>
<td>DATA</td>
<td>110</td>
<td>60</td>
<td>480</td>
</tr>
<tr>
<td>1022</td>
<td>DATA</td>
<td>12</td>
<td>60</td>
<td>506</td>
</tr>
<tr>
<td>1023</td>
<td>DATA</td>
<td>27</td>
<td>60</td>
<td>509</td>
</tr>
<tr>
<td>1024</td>
<td>DATA</td>
<td>15</td>
<td>60</td>
<td>516</td>
</tr>
<tr>
<td>1025</td>
<td>DATA</td>
<td>26</td>
<td>60</td>
<td>520</td>
</tr>
<tr>
<td>1026</td>
<td>DATA</td>
<td>56</td>
<td>60</td>
<td>527</td>
</tr>
<tr>
<td>1027</td>
<td>DATA</td>
<td>13</td>
<td>60</td>
<td>541</td>
</tr>
<tr>
<td>1029</td>
<td>DATA</td>
<td>40</td>
<td>60</td>
<td>545</td>
</tr>
<tr>
<td>1029</td>
<td>DATA</td>
<td>43</td>
<td>60</td>
<td>555</td>
</tr>
<tr>
<td>1030</td>
<td>DATA</td>
<td>95</td>
<td>60</td>
<td>566</td>
</tr>
<tr>
<td>1031</td>
<td>DATA</td>
<td>34</td>
<td>60</td>
<td>589</td>
</tr>
<tr>
<td>1032</td>
<td>DATA</td>
<td>22</td>
<td>60</td>
<td>597</td>
</tr>
<tr>
<td>1033</td>
<td>DATA</td>
<td>18</td>
<td>60</td>
<td>603</td>
</tr>
<tr>
<td>1034</td>
<td>DATA</td>
<td>24</td>
<td>60</td>
<td>608</td>
</tr>
<tr>
<td>1035</td>
<td>DATA</td>
<td>7</td>
<td>60</td>
<td>614</td>
</tr>
<tr>
<td>1036</td>
<td>DATA</td>
<td>9</td>
<td>60</td>
<td>616</td>
</tr>
<tr>
<td>1037</td>
<td>DATA</td>
<td>34</td>
<td>60</td>
<td>619</td>
</tr>
<tr>
<td>1038</td>
<td>DATA</td>
<td>35</td>
<td>60</td>
<td>627</td>
</tr>
<tr>
<td>1039</td>
<td>DATA</td>
<td>21</td>
<td>60</td>
<td>636</td>
</tr>
<tr>
<td>1040</td>
<td>DATA</td>
<td>22</td>
<td>60</td>
<td>641</td>
</tr>
<tr>
<td>1041</td>
<td>DATA</td>
<td>20</td>
<td>60</td>
<td>647</td>
</tr>
</tbody>
</table>

FILES 1001-1015 CONTAIN THE WINTER 1981 CUTTER (WS1CUT) DATA
FILES 1016-1024 CONTAIN THE FALL 1980 CUTTER (FSOCUT) DATA
FILES 1025-1033 CONTAIN THE SPRING 1980 CUTTER (SSOCUT) DATA
FILES 1034-1049 CONTAIN THE WINTER 1981 HELO (WS1HEL) DATA

n-1
<table>
<thead>
<tr>
<th>NAME</th>
<th>PRO TYPE</th>
<th>REC</th>
<th>FILE</th>
<th>BYTES/REC</th>
<th>ADDRESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1S</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1043</td>
<td>DATA</td>
<td>6</td>
<td>60</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>T1044</td>
<td>DATA</td>
<td>5</td>
<td>60</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>T1045</td>
<td>DATA</td>
<td>87</td>
<td>60</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>T1046</td>
<td>DATA</td>
<td>25</td>
<td>60</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>T1047</td>
<td>DATA</td>
<td>13</td>
<td>60</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>T1048</td>
<td>DATA</td>
<td>49</td>
<td>60</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>T1049</td>
<td>DATA</td>
<td>24</td>
<td>60</td>
<td>52</td>
<td></td>
</tr>
<tr>
<td>T1050</td>
<td>DATA</td>
<td>14</td>
<td>60</td>
<td>58</td>
<td></td>
</tr>
<tr>
<td>T1051</td>
<td>DATA</td>
<td>60</td>
<td>60</td>
<td>62</td>
<td></td>
</tr>
<tr>
<td>T1052</td>
<td>DATA</td>
<td>105</td>
<td>60</td>
<td>77</td>
<td></td>
</tr>
<tr>
<td>T1053</td>
<td>DATA</td>
<td>55</td>
<td>60</td>
<td>102</td>
<td></td>
</tr>
<tr>
<td>T1054</td>
<td>DATA</td>
<td>17</td>
<td>60</td>
<td>115</td>
<td></td>
</tr>
<tr>
<td>T1055</td>
<td>DATA</td>
<td>16</td>
<td>60</td>
<td>119</td>
<td></td>
</tr>
<tr>
<td>T1056</td>
<td>DATA</td>
<td>46</td>
<td>60</td>
<td>123</td>
<td></td>
</tr>
<tr>
<td>T1057</td>
<td>DATA</td>
<td>22</td>
<td>60</td>
<td>134</td>
<td></td>
</tr>
<tr>
<td>T1058</td>
<td>DATA</td>
<td>16</td>
<td>60</td>
<td>140</td>
<td></td>
</tr>
<tr>
<td>T1059</td>
<td>DATA</td>
<td>17</td>
<td>60</td>
<td>144</td>
<td></td>
</tr>
<tr>
<td>T1060</td>
<td>DATA</td>
<td>18</td>
<td>60</td>
<td>148</td>
<td></td>
</tr>
<tr>
<td>T1061</td>
<td>DATA</td>
<td>34</td>
<td>60</td>
<td>153</td>
<td></td>
</tr>
<tr>
<td>T1062</td>
<td>DATA</td>
<td>37</td>
<td>60</td>
<td>161</td>
<td></td>
</tr>
<tr>
<td>T1063</td>
<td>DATA</td>
<td>28</td>
<td>60</td>
<td>170</td>
<td></td>
</tr>
<tr>
<td>T1064</td>
<td>DATA</td>
<td>17</td>
<td>60</td>
<td>177</td>
<td></td>
</tr>
<tr>
<td>T1065</td>
<td>DATA</td>
<td>36</td>
<td>60</td>
<td>181</td>
<td></td>
</tr>
<tr>
<td>T1066</td>
<td>DATA</td>
<td>11</td>
<td>60</td>
<td>190</td>
<td></td>
</tr>
<tr>
<td>T1067</td>
<td>DATA</td>
<td>10</td>
<td>60</td>
<td>193</td>
<td></td>
</tr>
<tr>
<td>T1068</td>
<td>DATA</td>
<td>8</td>
<td>60</td>
<td>196</td>
<td></td>
</tr>
<tr>
<td>T1069</td>
<td>DATA</td>
<td>17</td>
<td>60</td>
<td>199</td>
<td></td>
</tr>
<tr>
<td>T1070</td>
<td>DATA</td>
<td>12</td>
<td>60</td>
<td>202</td>
<td></td>
</tr>
<tr>
<td>T1071</td>
<td>DATA</td>
<td>12</td>
<td>60</td>
<td>205</td>
<td></td>
</tr>
<tr>
<td>T1072</td>
<td>DATA</td>
<td>30</td>
<td>60</td>
<td>208</td>
<td></td>
</tr>
<tr>
<td>T1073</td>
<td>DATA</td>
<td>23</td>
<td>60</td>
<td>215</td>
<td></td>
</tr>
<tr>
<td>T1074</td>
<td>DATA</td>
<td>11</td>
<td>60</td>
<td>222</td>
<td></td>
</tr>
<tr>
<td>T1075</td>
<td>DATA</td>
<td>19</td>
<td>60</td>
<td>225</td>
<td></td>
</tr>
<tr>
<td>T1076</td>
<td>DATA</td>
<td>34</td>
<td>60</td>
<td>230</td>
<td></td>
</tr>
<tr>
<td>T1077</td>
<td>DATA</td>
<td>22</td>
<td>60</td>
<td>239</td>
<td></td>
</tr>
<tr>
<td>T1078</td>
<td>DATA</td>
<td>39</td>
<td>60</td>
<td>244</td>
<td></td>
</tr>
<tr>
<td>T1079</td>
<td>DATA</td>
<td>21</td>
<td>60</td>
<td>254</td>
<td></td>
</tr>
<tr>
<td>T1080</td>
<td>DATA</td>
<td>3</td>
<td>60</td>
<td>259</td>
<td></td>
</tr>
<tr>
<td>T1081</td>
<td>DATA</td>
<td>24</td>
<td>60</td>
<td>261</td>
<td></td>
</tr>
<tr>
<td>T1082</td>
<td>DATA</td>
<td>48</td>
<td>60</td>
<td>267</td>
<td></td>
</tr>
</tbody>
</table>

Files 1034-1049 contain the winter 1981 helo (WSHEL) data.
Files 1050-1055 contain the fall 1980 helo (FSHEL) data.
Files 1056-1061 contain the winter 1981 utb (W81UTB) data.
Files 1059-1063 contain the fall 1980 utb (FSOUTB) data.
Files 1069-1072 contain the spring 1980 helo (SSHEL) data.
Files 1073-1082 contain the spring 1980 utb (SSOUTB) data.
APPENDIX G (cont)

HUMAN FACTORS LOOKOUT DATA STORED ON TAPE #3

<table>
<thead>
<tr>
<th>NAME</th>
<th>PRO TYPE</th>
<th>REC/FILE</th>
<th>BYTES/REC</th>
<th>ADDRESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>T15</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>F30CUT</td>
<td>DATA</td>
<td>550</td>
<td>60</td>
<td>5</td>
</tr>
<tr>
<td>W81CUT</td>
<td>DATA</td>
<td>980</td>
<td>60</td>
<td>134</td>
</tr>
<tr>
<td>S30CUT</td>
<td>DATA</td>
<td>340</td>
<td>60</td>
<td>364</td>
</tr>
<tr>
<td>W81HEL</td>
<td>DATA</td>
<td>390</td>
<td>60</td>
<td>444</td>
</tr>
<tr>
<td>F80HEL</td>
<td>DATA</td>
<td>255</td>
<td>60</td>
<td>536</td>
</tr>
<tr>
<td>S80HEL</td>
<td>DATA</td>
<td>85</td>
<td>60</td>
<td>596</td>
</tr>
<tr>
<td>W31UTB</td>
<td>DATA</td>
<td>85</td>
<td>60</td>
<td>616</td>
</tr>
<tr>
<td>F30UTB</td>
<td>DATA</td>
<td>180</td>
<td>60</td>
<td>636</td>
</tr>
<tr>
<td>S30UTB</td>
<td>DATA</td>
<td>230</td>
<td>60</td>
<td>679</td>
</tr>
</tbody>
</table>

HUMAN FACTORS LOOKOUT DATA STORED ON TAPE #4

<table>
<thead>
<tr>
<th>NAME</th>
<th>PRO TYPE</th>
<th>REC/FILE</th>
<th>BYTES/REC</th>
<th>ADDRESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>T15</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CUTTER</td>
<td>DATA</td>
<td>1450</td>
<td>60</td>
<td>5</td>
</tr>
<tr>
<td>HELOS</td>
<td>DATA</td>
<td>750</td>
<td>60</td>
<td>345</td>
</tr>
<tr>
<td>UTBS</td>
<td>DATA</td>
<td>520</td>
<td>60</td>
<td>521</td>
</tr>
</tbody>
</table>

CUTTER CONTAINS W81CUT + F80CUT + S30CUT DATA COMBINED
HELOS CONTAINS W81HEL + F80HEL + S80HEL DATA COMBINED
UTBS CONTAINS W31UTB + F30UTB + S30UTB DATA COMBINED

HUMAN FACTORS LOOKOUT DATA STORED ON TAPE #5

<table>
<thead>
<tr>
<th>NAME</th>
<th>PRO TYPE</th>
<th>REC/FILE</th>
<th>BYTES/REC</th>
<th>ADDRESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>T15</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>SARWAR</td>
<td>DATA</td>
<td>2700</td>
<td>60</td>
<td>5</td>
</tr>
</tbody>
</table>

SARWAR CONTAINS CUTTER + HELOS + UTBS DATA COMBINED
THIS FILE CONTAINS ALL THE TOTAL COMBINED DATA FOR THIS PROJECT
APPENDIX G (cont)

HUMAN FACTORS LOOKOUT DATA STORED ON TAPE #6

<table>
<thead>
<tr>
<th>NAME</th>
<th>PRO</th>
<th>TYPE</th>
<th>REC/F</th>
<th>BYTES/REC</th>
<th>ADDRESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEST3</td>
<td>DATA</td>
<td>155</td>
<td>8</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>TEST4</td>
<td>DATA</td>
<td>155</td>
<td>8</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>CSCUT1</td>
<td>DATA</td>
<td>90</td>
<td>8</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>CSCUT2</td>
<td>DATA</td>
<td>90</td>
<td>8</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>CSHEL1</td>
<td>DATA</td>
<td>35</td>
<td>8</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>CSHEL2</td>
<td>DATA</td>
<td>35</td>
<td>8</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>CSUTB1</td>
<td>DATA</td>
<td>35</td>
<td>8</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>CSUTB2</td>
<td>DATA</td>
<td>35</td>
<td>8</td>
<td>27</td>
<td></td>
</tr>
</tbody>
</table>

THESE FILES WERE CREATED BY THE CUNSCR PROGRAM AND THEN USED WITH THE HEWLETT PACKARD GENERAL STATISTICS PROGRAM

TEST3 CONTAINS HIDDEN FIGURES TEST SCORES FROM THE SARWAP FILE
TEST4 CONTAINS HIDDEN PATTERNS TEST SCORES FROM THE SARWAP FILE
CSCUT1 CONTAINS HIDDEN FIGURES TEST SCORES FROM THE CUTTER FILE
CSCUT2 CONTAINS HIDDEN PATTERNS TEST SCORES FROM THE CUTTER FILE
CSHEL1 CONTAINS HIDDEN FIGURES TEST SCORES FROM THE HELOS FILE
CSHEL2 CONTAINS HIDDEN PATTERNS TEST SCORES FROM THE HELOS FILE
CSUTB1 CONTAINS HIDDEN FIGURES TEST SCORES FROM THE UTBS FILE
CSUTB2 CONTAINS HIDDEN PATTERNS TEST SCORES FROM THE UTBS FILE
APPENDIX H

Templates depicting zones of responsibility for various lookout positions on cutters, Helos, and UTBs.
<table>
<thead>
<tr>
<th>POSITION</th>
<th>AREA OF RESPONSIBILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>HELM</td>
<td>300-060</td>
</tr>
<tr>
<td>OOD</td>
<td></td>
</tr>
<tr>
<td>QMOW</td>
<td></td>
</tr>
<tr>
<td>POSITION</td>
<td>AREA OF RESPONSIBILITY</td>
</tr>
<tr>
<td>------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>PORTSIDE LOCKOUT</td>
<td>240-020</td>
</tr>
<tr>
<td>STBD SIDE LOCKOUT</td>
<td>340-120</td>
</tr>
</tbody>
</table>
TEMPATE USED TO DETERMINE ZONES OF RESPONSIBILITY FOR HELPS

<table>
<thead>
<tr>
<th>POSITION</th>
<th>AREA OF RESPONSIBILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>PORT SCANNER</td>
<td>240-300</td>
</tr>
<tr>
<td>STBD SCANNER</td>
<td>030-150</td>
</tr>
</tbody>
</table>

RELATIVE BEARINGS
# Template Used to Determine Zones of Responsibility for Helos'

<table>
<thead>
<tr>
<th>Position</th>
<th>Area of Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot</td>
<td>000-120</td>
</tr>
<tr>
<td>Copilot</td>
<td>240-000</td>
</tr>
</tbody>
</table>

![Diagram showing relative bearings and zones of responsibility for pilot and copilot]
END
DATE
FILMED
9-82
DTIC