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COAST GUARD RESEARCH AND DEVELOPMENT CENTER GROTON CT

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A PILOT STUDY OF HUMAN FACTORS IN SAR.(U)

MAY 82 D I REMONDINI, M LIGHT, M L EVERSON

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16. Abstract 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 (WPBs), 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.			
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METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
AREA				
sq in	square inches	6.5	square centimeters	cm ²
sq ft	square feet	0.09	square meters	m ²
sq yd	square yards	0.8	square meters	m ²
sq mi	square miles	2.6	square kilometers	km ²
acres	acres	0.4	hectares	ha
MASS (weight)				
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
VOLUME				
cup	cup	6	milliliters	ml
1/2 cup	1/2 cup	16	milliliters	ml
1 cup	1 cup	30	milliliters	ml
1/2 cup	1/2 cup	0.24	liters	l
1 cup	1 cup	0.47	liters	l
1/2 cup	1/2 cup	0.96	liters	l
1 cup	1 cup	3.8	liters	l
1/2 cup	1/2 cup	0.83	cubic meters	m ³
1 cup	1 cup	0.76	cubic meters	m ³
TEMPERATURE (exact)				
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

* Use 2.54 inches per foot for other exact conversions and more detailed tables, see NBS Mon. Publ. 280, Guide to Weights and Measures, Print 12-76, 30 Circular No. C13, 10-78.

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
km	kilometers	1.1	yards	yd
		0.6	miles	mi
AREA				
cm ²	square centimeters	0.16	square inches	in ²
m ²	square meters	1.2	square yards	yd ²
km ²	square kilometers	0.4	square miles	mi ²
ha	hectares (10,000 m ²)	2.5	acres	acres
MASS (weight)				
g	grams	0.036	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	short tons
VOLUME				
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	1.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m ³	cubic meters	35	cubic feet	ft ³
m ³	cubic meters	1.3	cubic yards	yd ³
TEMPERATURE (exact)				
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F

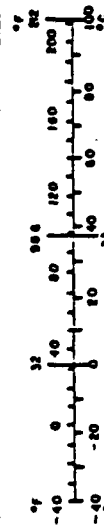


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EXECUTIVE SUMMARY

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 (SRU) 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 aids used, e.g. sunglasses, relative bearing and lateral range of the target, target 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 (χ^2), and to determine the probability associated with that value by using the standard chi square table.

$$\chi^2 = \sum_{i=1}^{i=r} \sum_{j=1}^{j=k} \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

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

$$\sum_{i=1}^r \sum_{j=1}^k \quad \text{directs one to sum over all rows (r) and all columns (k) i.e. over all cells}$$

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 $d.f. = (rows - 1)(columns - 1)$.

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 1: TEST SCORES STATISTICS

HIDDEN FIGURE TEST	MEAN	S.D.	RANGE	25 th	50 th	PERCENTILE 75 th	99 th	MAX. POSSIBLE SCORE	TOTAL N
UTRS	13.7 + 1.4	7.6	0 - 27	5.0	10.0	17.0	26.0	32	31
HELOS	18.5 + 1.7	10.0	1 - 32	10.0	19.5	26.0	32.0	32	34
CUTTERS	12.4 + 0.9	8.2	0 - 32	5.0	12.0	16.0	31.0	32	83
TOTAL	13.7 + 0.7	8.9	0 - 32	5.5	12.0	20.5	32.0	32	148

HIDDEN PATTERN TEST	MEAN	S.D.	RANGE	25 th	50 th	PERCENTILE 75 th	99 th	MAX. POSSIBLE SCORE	TOTAL N
UTRS	71.4 + 6.4	31.2	16 - 120	53.0	82.0	88.0	107.0	200	23
HELOS	103.7 + 4.3	25.0	55 - 171	87.0	102.0	107.0	161.0	200	34
CUTTERS	79.9 + 2.6	23.9	18 - 141	64.0	81.0	92.0	131.0	200	82
TOTAL	84.3 + 2.4	27.8	16 - 171	67.0	86.0	102.0	150.0	200	139

TABLE 2: DETECTION OF ALL TARGETS BY ALL SRUs vs. HIDDEN FIGURE TEST

PERCENTILES					
	0 - 25	26 - 50	51 - 75	76 - 100	Total
HITS	82 (73.7)	80 (87.3)	92 (81.9)	104 (115.2)	358
MISSES	312 (320.3)	387 (379.7)	346 (356.1)	512 (500.8)	1557
TOTAL	394	467	438	616	1915

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

PERCENTILES					
	0 - 25	26 - 50	51 - 75	76 - 100	Total
HITS	90 (77.7)	78 (86.6)	85 (92.3)	93 (89.4)	346
MISSES	320 (332.3)	379 (370.4)	402 (394.7)	379 (382.6)	1480
TOTAL	410	457	487	472	1826

CHI SQUARED VALUE = 4.34
 DEGREES OF FREEDOM = 3
 PROBABILITY = $.2 < P < .3$
 (Expected Value)

The highly significant probability associated with the χ^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

HIDDEN FIGURE TEST					
PERCENTILE					
	0 - 25	26 - 50	51 - 75	76 - 100	Total
0 - 25	19 (8.4)	8 (8.4)	7 (7.9)	0 (9.2)	34
26 - 50	9 (8.7)	14 (8.7)	9 (8.2)	3 (9.5)	35
51 - 75	3 (8.9)	8 (8.9)	10 (7.4)	15 (9.7)	36
76 - 100	3 (7.9)	4 (7.9)	6 (7.5)	19 (8.6)	32
TOTAL	34	34	32	37	137

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 χ^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

	CUTTERS	UTBs	HELOS	TOTAL
HITS	244 (240.8)	91 (81.2)	107 (120.1)	442
MISSES	1186 (1189.2)	391 (400.8)	606 (592.9)	2183
TOTAL	1430	482	713	2625

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

	PORT LOOKOUT	STARBOARD LOOKOUT	BRIDGE/HELM	TOTAL
HITS	99 (69.3)	90 (69.1)	55 (105.6)	244
MISSES	307 (336.7)	315 (335.9)	564 (513.4)	1186
TOTAL	1430	482	713	2625

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

(B) UTB's

	PORT LOOKOUT	STARBOARD LOOKOUT	BRIDGE/HELM	TOTAL
HITS	34 (33.7)	30 (30.9)	26 (25.4)	90
MISSES	146 (146.3)	135 (134.1)	110 (110.6)	391
TOTAL	180	165	136	481

CHI SQUARED VALUE = 0.05
DEGREES OF FREEDOM = 2
PROBABILITY = $0.95 < P < 0.98$
(Expected Value)

TABLE 6: POSITION vs. DETECTION

(C) HELOS

	PORT LOOKOUT	STARBOARD LOOKOUT	BRIDGE/HELM	TOTAL
HITS	10 (14.0)	26 (27.1)	71 (66.0)	107
MISSES	83 (79.0)	154 (152.9)	368 (373.0)	605
TOTAL	93	180	439	712

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.

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TOTAL	1430	482	713	2625

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

(B) UTB's

	PORT LOOKOUT	STARBOARD LOOKOUT	BRIDGE/HELM	TOTAL
HITS	34 (33.7)	30 (30.9)	26 (25.4)	90
MISSES	146 (146.3)	135 (134.1)	110 (110.6)	391
TOTAL	180	165	136	481

CHI SQUARED VALUE = 0.05
 DEGREES OF FREEDOM = 2
 PROBABILITY = $0.95 < P < 0.98$
 (Expected Value)

TABLE 6: POSITION vs. DETECTION

(C) HELOS

	PORT LOOKOUT	STARBOARD LOOKOUT	BRIDGE/HELM	TOTAL
HITS	10 (14.0)	26 (27.1)	71 (66.0)	107
MISSES	83 (79.0)	154 (152.9)	368 (373.0)	605
TOTAL	93	180	439	712

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

	YEARS OF EXPERIENCE				TOTAL
	<.5	.5 - .9	1 - 3	>3	
HITS	63 (47.1)	62 (53.2)	43 (56.5)	68 (79.2)	236
MISSES	217 (232.9)	254 (262.8)	293 (279.5)	403 (391.8)	1167
TOTAL	280	316	336	471	1403

CHI SQUARED VALUE = 14.02
 DEGREES OF FREEDOM = 3
 PROBABILITY = .001 < P < 0.01
 (Expected Value)

(B) UTBs

	YEARS OF EXPERIENCE				TOTAL
	<.5	.5 - .9	1 - 3	>3	
HITS	7 (13.7)	22 (16.9)	30 (38.9)	19 (8.5)	78
MISSES	72 (65.3)	75 (80.1)	194 (185.1)	30 (40.5)	371
TOTAL	79	97	224	49	449

CHI SQUARED VALUE = 24.00
 DEGREES OF FREEDOM = 3
 PROBABILITY = P < .001
 (Expected Value)

(C) HELOS

TABLE 7: EXPERIENCE vs. DETECTION

	YEARS OF EXPERIENCE				TOTAL
	<.5	.5 - .9	1 - 3	>3	
HITS	1 (2.7)	4 (1.1)	23 (31.8)	79 (71.4)	107
MISSES	17 (15.3)	3 (5.9)	189 (180.2)	397 (404.6)	606
TOTAL	18	7	212	476	713

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

	<u>HITS</u>				<u>MISSES</u>				<u>Total</u>	<u>χ^2</u>	<u>df</u>	<u>P</u>
	<u><.5</u>	<u>.5 - .9</u>	<u>1 - 3</u>	<u>>3</u>	<u><.5</u>	<u>.5 - .9</u>	<u>1 - 3</u>	<u>>3</u>				
CUTTERS	63	62	43	68	217	254	293	403	1167	14.02	3	<.001
UTBs	7	22	30	19	72	75	194	30	371	24.00	3	<.001
HELOS	1	4	23	79	17	3	189	397	606	14.82	3	.01 - .001
(Sum of 3 CHI Square values)												
POOLED	71	88	96	166	306	332	676	730	1144	52.84	9	
										30.70	3	

	<u>df</u>	<u>χ^2</u>	<u>P</u>
Sum	9	52.84	<.001
Pooled	3	30.70	<.001
Homogeneity	6	22.14	.001 < P < .01

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.

(A) CUTTERS

TABLE 8: HOURS on WATCH vs. DETECTION

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

CHI SQUARED VALUE = 22.41
 DEGREES OF FREEDOM = 4
 PROBABILITY = $P < .001$
 (Expected Value)

(B) UTBs

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

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

(C) HELOS

Hours on Watch				
	<1	1 - 1.9	2 - 2.9	TOTAL
HITS	63 (66.3)	34 (34.7)	10 (6.0)	107
MISSES	379 (375.7)	197 (196.9)	30 (34.0)	606
TOTAL	442	231	40	713

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

	<u>HITS</u>						<u>MISSES</u>						χ^2	dF	P
	<u><1</u>	<u>1 - 1.9</u>	<u>2 - 2.9</u>	<u>3 - 3.9</u>	<u>>4</u>	<u>TOTAL</u>	<u><1</u>	<u>1 - 1.9</u>	<u>2 - 2.9</u>	<u>3 - 3.9</u>	<u>>4</u>	<u>TOTAL</u>			
CUTTERS	161	56	21	2	4	244	601	365	136	53	31	1186	22.41	4	<.001
UTBs	35	27	16	4	9	91	121	90	77	43	60	391	7.64	4	.1 - .2
HELOS	63	34	10	0	0	107	379	197	30	0	0	606	3.34	2	.1 - .2
									(Sum of 3 CHI Square values)				33.39	10	
POOLED	259	117	47	6	13	442	1101	652	243	96	91	2183			

	dF	χ^2	P
Sum	10	33.39	<.001
Pooled	4	14.72	.001 - .01
Homogeneity	6	18.67	.001 - .01

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

	Hours of Sleep			TOTAL
	<4	4 - 6	>6	
HITS	20 (25.1)	47 (42.0)	120 (119.9)	187
MISSES	134 (128.9)	211 (216.0)	606 (617.1)	962
TOTAL	154	258	737	1149

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

(B) UTBs

Hours of Sleep				
	<4	4 - 6	>6	TOTAL
HITS	1 (3.8)	25 (25.7)	65 (61.5)	91
MISSES	19 (16.2)	111 (110.3)	261 (264.5)	391
TOTAL	20	136	326	482

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

(C) HELOS

Hours of Sleep				
	<4	4 - 6	>6	TOTAL
HITS	1 (1.2)	14 (15.8)	92 (90.0)	107
MISSES	7 (6.8)	91 (89.2)	508 (510.0)	606
TOTAL	8	105	600	713

CHI SQUARED VALUE = 0.32
DEGREES OF FREEDOM = 2
PROBABILITY = $.8 < P < .9$
(Expected Value)

TABLE 9D: TEST FOR HOMOGENEITY OF ALL SRUS PRIOR SLEEP vs DETECTION OF TARGETS

	<u>HITS</u>			<u>MISSES</u>			χ^2	dF	P
	<u><4</u>	<u>4 - 6</u>	<u>>6</u>	<u>TOTAL</u>	<u><4</u>	<u>4 - 6</u>	<u>>6</u>		
CUTTERS	20	47	120	187	134	211	617	1.94	2 .3 - .5
UTBs	1	25	65	91	19	111	261	2.78	2 .2 - .3
HELOS	1	14	92	107	7	91	508	0.32	2 .8 - .9
							(Sum of 3 CHI Square values)	5.04	9
POOLED	22	86	277	385	160	413	1386	2.80	2

	dF	χ^2	P
Sum	6	5.04	.5 - .7
Pooled	2	2.80	.05 - .10
Homogeneity	4	2.24	.5 - .7

Table 10: DETECTION OF ALL TARGETS BY ALL SRUs vs SLEEP

	HOURS OF SLEEP			
	<4	4 - 6	>6	TOTAL
HITS	22 (29.9)	86 (82.0)	277 (273.1)	385
MISSES	160 (152.1)	413 (417.0)	1386 (1389.9)	1959
TOTAL	182	499	1663	2344

CHI SQUARED VALUE = 2.82
 DEGREES OF FREEDOM = 2
 PROBABILITY = $.2 < P < .3$
 (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 be made 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:

1. Edwards, Jr., N.C., Osmer, S.R., Mazour, T.J., and Hover, G.L. 1981. Factors Affecting Coast Guard SAR Unit Visual Detection Performance. Interim Report CG-D-09-82, U.S. Department of Transportation, U.S. Coast Guard Office of Research and Development, Washington, D.C. 20593
2. Edwards, Jr., N.C., Osmer, S.R., Mazour, T.J. and Hover, G.L. 1980. Analysis of Visual Detection Performance for 16-foot Boat and Life Raft Targets. Interim Report CG-D-24-80, U.S. Department of Transportation, U.S. Coast Guard Office of Research and Development, Washington, D.C. 20593.
3. Woolf, Charles M. 1968. Principles of Biometry. D. Van Nostrand Co., Inc. Princeton, New Jersey.
4. Bucklin, Bruce, L. 1971. Field Dependence and Visual Detection Ability. Technical Report 4137, U.S. Army Research and Development Center, Picatinny Arsenal, Dover, New Jersey 07801.

APPENDIX A

THIS IS AN EXAMPLE OF A DATA FILE. IT CONTAINS SAR HUMAN FACTORS DATA FOR A GIVEN SRU (CUTTER, HELO, UTE) 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.

2 1	BMCM	//////////400130200032165120300510
3 1	SA	0020000001800150102120100072165120300710
4 1	MK2	0000011004800440301130450092175120201110
5 1	MKC	0130012005300460402112600172175120201710
6 0	SA	//////////108120800082175120399910
7 0	SN	0060009004900410102112700202175120399910
8 0	SA	//////////111123500043175120399910
9 1	SA	//////////112120300043175120300510
10 1	SA	//////////114120100062175120301510
11 1	SA	//////////116120900102175120301010
12 1	SA	//////////117120100002175120301010
13 0	SN	//////////110112400222175120399910
14 1	SA	//////////119120100012175120302110
15 1	SN	//////////116113000122175120301310
16 0	MK2	//////////301120850112165120299910
17 0	BMCM	//////////411130850112165120399910
18 1	MK2	//////////302120300012165120201010
19 0	SS2	0010005003600280104112800153165120799910
20 0	MK2	//////////306120850232165120299910
21 1	SS2	//////////105113000093165120700910
22 1	SS2	//////////107113400103165120701410
23 0	SN	//////////103113500043175120399910
24 0	BMCM	//////////411033500043175120399910
25 0	BMCM	//////////426032800153165120399910

APPENDIX A

FIELD DEFINITIONS OF DATA BASE

<u>Columns</u>	<u>Item</u>	<u>Code or Entry Method</u>	<u>Explanation</u>
1	Hit or Miss	Hit = 1 Miss = 0	Hit - Lookout detected target Miss - Lookout did not detect target
2-7	Name	First six letters of last name	
8-11	Rating/Rank	LT, BM3, etc	Lookout's rank or rating
12-27	Test Scores	Add leading zero to all scores 100, i.e., 50.4 entered 0504	Four tests: Two hidden figure tests Two hidden pattern tests
28	Experience	Yrs Code .5 1 .5 - .9 2 1 - 3 3 > 3 4	Years of experience on SRU type
29-30	Hrs on watch	Add leading zero to all values < 1.0, i.e., .4 entered 04; 2.5 entered 25	Elapsed time on watch at time of sighting
31	Visual aid	Yes = 1 No = 0	Were visual aids used, i.e., binoculars
32	Lookout	SRU Posit Code UTB Port 1 Ctr Side Helo Port Scanner 1	Position of lookout in SRU

APPENDIX A (Cont.)

FIELD DEFINITIONS OF DATA BASE

<u>Columns</u>	<u>Item</u>	<u>Code or Entry Method</u>	<u>Explanation</u>
33-35	Relative Bearing	UTB Stbd	For Hits - Relative Bearing at which target was sighted
		Ctr Side 2	
		Helo Stbd	
		Scanner 2	
		UTB Helm	
36-38	Lateral Range	QMOW	For Misses - Last relative bearing in lookouts zone of responsibility (see SRU templates in appendix)
		Ctr 000 3	
		Helo Pilot 3 Copilot	
33-35	Relative Bearing	Three Digits i.e. 075	For Hits - Relative Bearing at which target was sighted
			For Misses - Last relative bearing in lookouts zone of responsibility (see SRU templates in appendix)
<u>Columns</u>	<u>Item</u>	<u>Code or Entry Method</u>	<u>Explanation</u>
36-38	Lateral Range	Add one leading zero to all values <10 and two zeros to all values <1 i.e. 6.3 entered 063 .7 entered 007	Distance in nautical miles from SRU to target when target is abeam SRU

APPENDIX A (Cont.)

FIELD DEFINITIONS OF DATA BASE

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

APPENDIX A (Cont.)

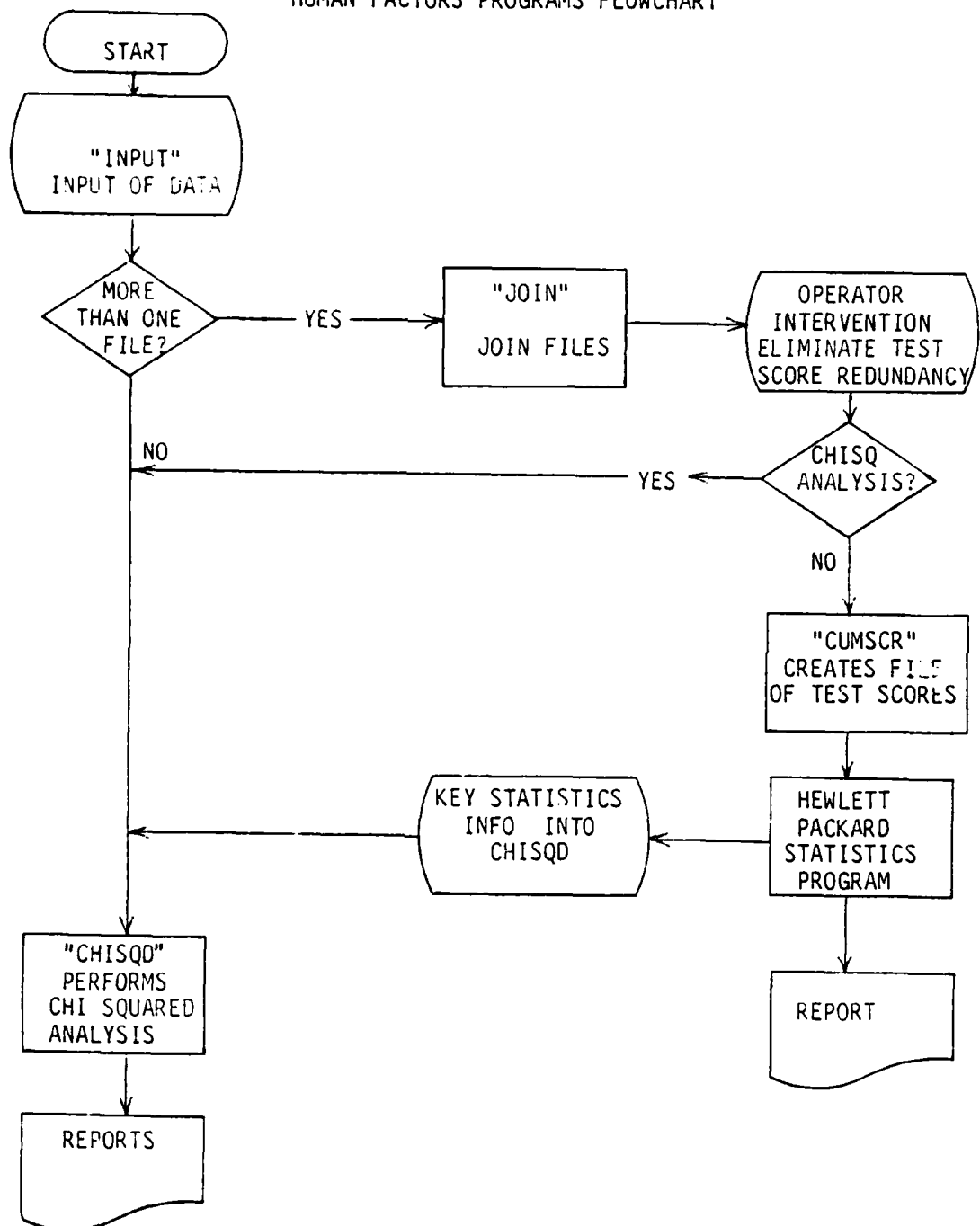
FIELD DEFINITIONS OF DATA BASE

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



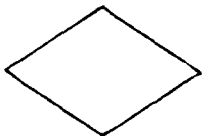
APPENDIX B
FLOWCHART LEGEND



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 SRU FOR ONE DAY.
50 DIM O$(300)(52)
60 DIM Iline$(52)
70 DIM E$(52)
80 ! Fname$=" "
90 PRINTER IS 16
100 PRINT PAGE
110 PRINT LIN(14)
120 INPUT "DO YOU WANT TO CORRECT OR ADD TO AN EXISTING FILE?(C OR A)",Re$
130 IF (Re$="C") OR (Re$="A") THEN GOTO 170
140 IF Re$="N" THEN GOTO 230
150 PRINT "PLEASE RESPOND WITH A 'C' FOR CORRECT OR AN 'A' FOR ADDITION."
160 GOTO 100
170 PRINT PAGE
180 PRINT LIN(14)
190 EDIT "ENTER THE NAME OF THE FILE THAT YOU WANT TO MODIFY.",Fname$
200 Fname$=Fname$0":T14"
210 IF (Re$="C") OR (Re$="A") THEN GOTO 580
220 ASSIGN #1 TO Fname$
230 EDIT "- DATE OF SEARCH=",Date$
240 INPUT "NEW FILENAME ????",Fname$
250 INPUT "HOW MANY RECORDS IN THE FILE????",Rn
260 CREATE Fname$0":T14",Rn,60
270 IF LEN(Date$)=7 THEN GOTO 360
280 PRINTER IS 16
290 PRINT PAGE
300 PRINT LIN(14)
310 BEEP
320 BEEP
330 BEEP
340 PRINT "INCORRECT DATA INPUT. PLEASE CORRECT IT."
350 GOTO 230
360 EDIT "- SEARCH UNITS NAME (10 CHRS MAX)= ",Uname$
370 IF (LEN(Uname$)<11) AND (LEN(Uname$)>3) THEN GOTO 450
380 PRINT PAGE
390 PRINT LIN(14)
400 BEEP
410 BEEP
420 BEEP
430 PRINT "INCORRECT DATA INPUT. PLEASE CORRECT IT."
440 GOTO 360
450 EDIT "- SEARCH UNIT TYPE (1=Cutler, 2=Helo, 3=Boat)= ",Utype$
460 IF (Utype$="1") OR (Utype$="2") OR (Utype$="3") THEN GOTO 540
470 PRINT PAGE
480 PRINT LIN(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 LIN(14)
580 PRINT "-----"
590 PRINT
600 PRINT "YOU MAY NOW:"
610 PRINT
620 PRINT "- ENTER A NEW DATA LINE."
630 PRINT
640 PRINT "- ENTER 'C' TO CORRECT A LINE."
650 PRINT "(REMEMBER TO PRESS 'STOP' WHEN YOU'RE FINISHED)"
660 PRINT

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```

670 PRINT "-- ENTER 'F' TO END THE DATA INPUT,"
680 PRINT
690 PRINT "--ENTER 'R' TO RESTART A DATA FILE."
700 PRINT
710 PRINT "BOY ARE YOU EVER LUCKY, MARK!!!!!"
720 EDIT "=====Iline$
730 Hom$=Iline$(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 1180
780 INPUT "ENTER THE OPPORTUNITY NUMBER OF THE LINE YOU WANT LISTED.",Ln
790 ! IF Ln<Rn THEN GOTO 820
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$(Ln+1)
880 ! Iline$=""
890 ! PRINT LIN(2)
900 ! GOTO 540
910 PRINT PAGE
920 PRINT LIN(14)
930 Snn=Rn
940 PRINT "HIT STOP WHEN FINISHED CORRECTING !!!"
950 INPUT "ENTER THE # OF THE LINE TO BE CORRECTED.",Pn
960 ! IF Snn>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;O$(Rn)
1050 PRINT O$(Rn)
1060 EDIT O$(Rn)
1070 ! PRINT O$(Rn)
1080 ! PAUSE
1090 PRINT #1,Rn;O$(Rn)
1100 GOTO 940
1110 PRINT PAGE
1120 PRINT LIN(14)
1130 INPUT "ENTER NEXT LINE TO BE INPUTED",Rs
1140 ASSIGN #1 TO Fname$
1150 READ #1,Rs
1160 Rn=Rs
1170 GOTO 580
1180 IF (Hom$="1") OR (Hom$="0") THEN E$=" "
1190 IF (Hom$<>"1") AND (Hom$<>"0") THEN E$="E"
1200 E$=E$&" "
1210 E$=E$&" "
1220 IF Iline$(12,15)="" THEN GOTO 1250
1230 T1=VAL(Iline$(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 Iline$(16,19)="" THEN GOTO 1310
1290 T2=VAL(Iline$(16,19))
1300 GOTO 1320
1310 T2=50
1320 IF (T2<=1000) AND (T2>=0) THEN E$=E$&" "

```

```

1330 IF (T2>1000) OR (T2<0) THEN E$=E$+"EEEE"
1340 IF Iline$(20,23)="/" THEN GOTO 1370
1350 T3=VAL(Iline$(20,23))
1360 GOTO 1360
1370 T3=50
1380 IF (T3<=1000) AND (T3>=0) THEN E$=E$+" "
1390 IF (T3>1000) OR (T3<0) THEN E$=E$+"EEEE"
1400 IF Iline$(24,27)="/" THEN GOTO 1430
1410 T4=VAL(Iline$(24,27))
1420 GOTO 1440
1430 T4=50
1440 IF (T4<=1000) AND (T4>=0) THEN E$=E$+" "
1450 IF (T4>1000) OR (T4<0) THEN E$=E$+"EEEE"
1460 IF Iline$(28,28)="/" THEN GOTO 1490
1470 Exp=VAL(Iline$(28,28))
1480 GOTO 1500
1490 Exp=1
1500 IF (Exp=1) OR (Exp=2) OR (Exp=3) OR (Exp=4) THEN E$=E$+" "
1510 IF (Exp<>1) AND (Exp<>2) AND (Exp<>3) AND (Exp<>4) THEN E$=E$+"E"
1520 How=VAL(Iline$(29,30))
1530 IF (How<=70) AND (How>=0) THEN E$=E$+" "
1540 IF (How>70) OR (How<0) THEN E$=E$+"EE"
1550 IF (Iline$(31,31)="1") OR (Iline$(31,31)="0") THEN E$=E$+" "
1560 IF (Iline$(31,31)<>"1") AND (Iline$(31,31)<>"0") THEN E$=E$+"E"
1570 Pos=VAL(Iline$(32,32))
1580 IF (Pos=1) OR (Pos=2) OR (Pos=3) THEN E$=E$+" "
1590 IF (Pos<>1) AND (Pos<>2) AND (Pos<>3) THEN E$=E$+"E"
1600 Rb=VAL(Iline$(33,35))
1610 IF (Rb<=360) AND (Rb>=0) THEN E$=E$+" "
1620 IF (Rb>360) OR (Rb<0) THEN E$=E$+"EEE"
1630 Lr=VAL(Iline$(36,38))
1640 IF (Lr<=250) AND (Lr>=0) THEN E$=E$+" "
1650 IF (Lr>250) OR (Lr<0) THEN E$=E$+"EEE"
1660 Type=VAL(Iline$(39,39))
1670 IF (Type<6) AND (Type>0) THEN E$=E$+" "
1680 IF (Type>5) OR (Type<1) THEN E$=E$+"E"
1690 Wind=VAL(Iline$(40,42))
1700 IF (Wind<=250) AND (Wind>=0) THEN E$=E$+" "
1710 IF (Wind>250) OR (Wind<0) THEN E$=E$+"EEE"
1720 Vis=VAL(Iline$(43,45))
1730 IF (Vis<=250) AND (Vis>=0) THEN E$=E$+" "
1740 IF (Vis>250) OR (Vis<0) THEN E$=E$+"EEE"
1750 IF Iline$(46,46)="/" THEN GOTO 1780
1760 Sleep=VAL(Iline$(46,46))
1770 GOTO 1790
1780 Sleep=1
1790 IF (Sleep=1) OR (Sleep=2) OR (Sleep=3) THEN E$=E$+" "
1800 IF (Sleep<>1) AND (Sleep<>2) AND (Sleep<>3) THEN E$=E$+"E"
1810 Sr=VAL(Iline$(47,49))
1820 IF (Sr<=250) AND (Sr>=0) THEN E$=E$+" "
1830 IF (Sr<>999) AND (Sr>250) OR (Sr<0) THEN E$=E$+"EEE"
1840 IF Sr=999 THEN E$=E$+" " ! 999 DENOTES ABSENCE OF DATA. D.B.7/16/81
1850 Cc=VAL(Iline$(50,51))
1860 IF (Cc<=10) AND (Cc>=0) THEN E$=E$+" "
1870 IF (Cc>10) OR (Cc<0) THEN E$=E$+"EE"
1880 IF LEN(Iline$)<>51 THEN E$=RPT$("L",LEN(Iline$))
1890 IF E$=RPT$(" ",51) THEN GOTO 2010
1900 PRINT PAGE
1910 PRINT LINK(12)
1920 PRINT "INCORRECT DATA INPUT. PLEASE CORRECT THE INDICATED MISTAKES."
1930 PRINT
1940 PRINT "*****"
1950 PRINT Iline$
1960 PRINT E$
1970 BEEP
1980 BEEP

```

```

1990 BEEP
2000 GOTO 720
2010 Rn=Rn+1
2020 O$(Rn)=Iline$
2030 Iline$=""
2040 IF Snn>0 THEN Rn=Snn
2050 Snn=0
2060 GOTO 550
2070 IF (Re$="C") OR (Re$="A") THEN GOTO 2300
2080 PRINTER IS 0
2090 PRINT LIN(5)
2100 PRINT Date$,Uname$,"TYPE= ";Utype$,"OPTS= ";Rn-1
2110 PRINT
2120 PRINT "FILENAME= ";Fname$[1,4]
2130 ASSIGN #1 TO Fname$":T14"
2140 PRINT #1,1;Fname$,Date$,Uname$,Utype$,VAL$(Rn)
2150 FOR X=2 TO Rn
2160 PRINT #1,X;O$(X)
2170 PRINT "*****"
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 2380
2300 PRINTER IS 0
2310 FOR X=Rn 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.

```

10      !      JOIN
20      !      THIS PROGRAM JOINS A NUMBER OF RAW DATA FILES TOGETHER AND STORES
30      !      THE RESULTING FILE IN A NEW TAPE FILE.
40      !      THIS PROGRAM WAS ORIGINALLY THE "APPEND" PROGRAM ,WRITTEN
50      !      BY DON CUNDY. IT WAS MODIFIED BY D. BAIRD FOR USE IN POD/SAR
60      !      ON THE HUMAN FACTORS DATA.      8/4/81.....D.BAIRD
70      !      BEFORE RUNNING THIS PROGRAM THE OPERATOR MUST TYPE IN FOLLOWING-
80      !      CREATE "file :T14",____,60 THEN EXECUTE
90      !      ASSIGN #1 TO "file :T14" THEN EXECUTE
100     !      PRINT #1,1;2 THEN EXECUTE
110     !      AFTER YOU HAVE THE "JOIN" PROGRAM IN MEMORY PLACE THE DATA FILES
120     !      TAPE IN T15 AND THE NEW TAPE IN T14. THIS IS DONE BEFORE TYPING
130     !      IN THE ABOVE CREATE,ASSIGN, AND PRINT STATEMENTS.
140     !
150     !
160     DIM B$(500)(52)
170     PRINTER IS 0
180     INPUT "ENTER THE NEW FILE NAME",New$
190     INPUT "ENTER FILE NAME TO BE COMBINED",File$
200     ASSIGN #1 TO File$
210     ASSIGN #2 TO New$&" :T14"
220     BUFFER #2
230     READ #2,1;J
240     I=2
250     ON END #1 GOTO 320
260     READ #1,I;B$(I)
270     PRINT #2,J;B$(I)
280     PRINT I;J;B$(I)
290     I=I+1
300     J=J+1
310     GOTO 260
320     PRINT #2,1;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.

```

10 ! THIS PROGRAM IS CALLED "COMSOR" BECAUSE IT ACCUMULATES THE TEST
20 ! SCORES IN AN ARRAY SUITABLE FOR ANALYSIS BY THE BASIC STATISTICS
30 ! AND DATA MANIPULATION PROGRAMS. IT USES THE OUTPUT FROM "JOIN".
40 ! IT MUST BE MODIFIED FROM THE KEYBOARD SO THAT A SCORE APPEARS
50 ! ONCE AND ONLY ONCE FOR EACH INDIVIDUAL.
60 OPTION BASE 1
70 DIM R$(500)(52),Test$(40),Name$(40),Ts1(40),Ts2(40),Test1(40),Test2(40),Te
st1$(8),Test2$(8)
80 INPUT "INPUT DATAFILE NAME ????",Join$
90 CREATE "TEST3",50,8
100 CREATE "TEST4",50,8
110 ASSIGN #1 TO Join$:T14"
120 ASSIGN #2 TO "TEST3"
130 ASSIGN #3 TO "TEST4"
140 I=1
150 J=1
160 K=1
170 M1=0
180 M2=0
190 I=I+1
192 ON END #1 GOTO 440
200 READ #1,I;R$(I)
210 Name$=R$(I)(2,11)
220 Test$=R$(I)(12,27)
230 IF Test$="/////////////////" THEN GOTO 190
240 Test1$=R$(I)(12,19)
250 Test2$=R$(I)(20,27)
260 IF Test1$<>"/////////////////" THEN GOTO 290
270 M1=M1+1
280 GOTO 340
290 T1=VAL(R$(I)(12,15))
300 T2=VAL(R$(I)(16,19))
310 PRINT Name$,T1,T2
320 Ts1(J)=(T1+T2)/10
330 J=J+1
340 IF Test2$<>"/////////////////" THEN GOTO 370
350 M2=M2+1
360 GOTO 190
370 T3=VAL(R$(I)(20,23))
380 T4=VAL(R$(I)(24,27))
390 PRINT Name$,T3,T4
400 Ts2(K)=(T3+T4)/10
410 K=K+1
430 GOTO 190
440 !
450 MAT Test1=Ts1
460 MAT Test2=Ts2
470 MAT PRINT #2;Test1,END
480 MAT PRINT Test1;
490 PRINT "NUMBER OF SCORES MISSING IN FIELD 1=";M1
491 PRINT
492 PRINT
493 PRINT
500 MAT PRINT #3;Test2,END
510 MAT PRINT Test2;
520 PRINT "NUMBER OF SCORES MISSING IN FIELD 2=";M2
530 END

```

APPENDIX F

"CHISQD" PROGRAM

This program runs against either single files of joined files and does a Contingency Table Analysis.

```

10 ! THIS PROGRAM IS CALLED "CHISQD"
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 LTJG LOUIS NASH,USCG , IN 1982, FOR
50 ! HUMAN FACTOR PART,OF THE SAR POD PROJECT AT THE USCG POD CENTER.
60 !
70 ! THIS VERSION IS FOR ALPHABETIC OR CODE ORDERED FILES ONLY.
80 !
90 OPTION BASE 1
100 OVERLAP
110 DIM R$(2700)(531,Rowcat(20),Colcat(20),Scrncat(20))
120 DIM O$(10,10),E$(10,10),A$(10),B$(10)
130 DIM Or$(10,10),Onrowcat(20),Oncolcat(20)
140 COM Nsub,Labsub$(16)(401,Pos(4,16),S$,S1$
150 ASSIGN #2 TO "LABRAY:T15" !CONTAINS THE NAMES OF THE SUBJECTS
160 ASSIGN #3 TO "POSITH:T15" !CONTAINS THE POSITIONS OF DIFFERENT
170 ! SUBJECTS IN THE DATA STRING
180 !
190 Nsub=16 ! Nsub IS THE NUMBER OF SUBJECTS WHOSE LABELS ARE
200 ! CONTAINED IN Labsub$(Nsub) , AND STRING POSITIONS
210 ! IN Pos(4,Nsub)
220 ! ONLY Nsub AND THE DIMENSION STATEMENTS NEED TO BE
230 ! CHANGED FOR THE PROGRAM TO HANDLE MORE SUBJECTS
240 FOR I=1 TO Nsub
250 READ #2;Labsub$(I)
260 NEXT I
270 !
280 FOR I=1 TO Nsub
290 READ #3;Pos(1,I),Pos(2,I),Pos(3,I),Pos(4,I)
300 NEXT I
310 !
320 GOSUB 3250
330 !
340 CALL Sublist
350 !
360 INPUT "ENTER CODE FOR SUBJECT FOR COLUMNS",Icol
370 IF (Icol<1) OR (Icol>Nsub) THEN 360
380 INPUT "ENTER CODE FOR SUBJECT FOR ROWS",Inow
390 IF (Inow<1) OR (Inow>Nsub) THEN 380
400 INPUT "DO YOU WISH TO SCREEN THE DATA? ",S$
410 S1$=S$
420 IF S$(0)"Y" THEN 470
430 INPUT "ENTER CODE FOR SUBJECT FOR SCREENING",Iscreen
440 IF (Iscreen<1) OR (Iscreen>Nsub) THEN 400
450 !
460 CALL Bound(2,Iscreen,L,Scrncat(*),Spos1,Spos2,Spos3,Spos4)
470 CALL Bound(1,Icol,M,Colcat(*),Cpos1,Cpos2,Cpos3,Cpos4) !SET CATEGORIES
480 CALL Bound(0,Inow,N,Rowcat(*),Rpos1,Rpos2,Rpos3,Rpos4)
490 !
500 GOSUB 3440 !REVIEWS SUBJECTS AND CATEGORIES AND PROVIDES A
510 ! CHANCE TO MAKE CORRECTIONS
520 Exval=0
530 D1=D2=0
540 Mval=0
550 Counter=0
560 PRINT PAGE
570 PRINT "THANKYOU, PLEASE STAND BY"
580 !
590 ! SORTS THE DATA INTO CATEGORIES
600 !
610 FOR Jrec=2 TO Rec
620 Jstep=Jrec
630 Skip=0
640 !
650 CALL Screen(R$(Jstep),Spos1,Spos2,Spos3,Spos4,L,Iscreen,Scrncat(*),S)
660 !

```

```

670 IF S=0 THEN Excluded
680 IF (Icol<>2) AND (Icol<>3) THEN 730 !IF NO TEST SCORES FOR COLUMN
690 CALL Combine(Ccode,Cpos1,Cpos2,Cpos3,Cpos4,P$(Jrec),D1)
700 IF D1=1 THEN GOTO Missing
710 GOTO 770
720 !
730 Colcode$=P$(Jstep,Cpos1,Cpos2) !START SORTING FOR NONE TEST SCORES
740 IF Colcode$(1,11)=" " THEN GOTO Missing
750 CALL Convert(Ccode,Colcode$,Icol)
760 !
770 CALL Sort(N,Ccode,Colcat(+),Jcol) !SORT DATA INTO COLUMNS
780 IF Jcol>N THEN GOTO Excluded
790 IF Skip=1 THEN GOTO Repeat
800 !
810 IF (Inow<>2) AND (Inow<>3) THEN 860
820 CALL Combine(Rcode,Rpos1,Rpos2,Rpos3,Rpos4,P$(Jrec),D2)
830 IF D2=2 THEN GOTO Missing
840 GOTO 900
850 !
860 Rowcode$=P$(Jstep,Rpos1,Rpos2) !START SORTING NON TEST SCORES FOR ROWS
870 IF Rowcode$(1,11)=" " THEN GOTO Missing
880 CALL Convert(Rcode,Rowcode$,Inow)
890 !
900 CALL Sort(N,Rcode,Rowcat(+),Jrow)
910 IF Jrow>N THEN GOTO Excluded
920 D=D1+D2+1
930 IF (D>2) AND (Skip>2) THEN Normal
940 IF (Icol<>1) AND (Inow>1) THEN Normal
950 !
960 !
970 Repeat: IF (Inow=2) OR (Inow=3) THEN Skip=1
980 IF S=2 THEN 1010
990 CALL Screen(R$(Jstep),Spos1,Spos2,Spos3,Spos4,L,Iscreen,Screenat(+),S)
1000 IF S=0 THEN Excluded
1010 O(Jrow,Jcol)=O(Jrow,Jcol)+1
1020 !
1030 Jstep=Jstep+1
1040 IF Jstep>Rec THEN 1260
1050 IF R$(Jstep)(2,11)>P$(Jrec)(2,11) THEN 1260
1060 !
1070 IF D1=1 THEN 860
1080 IF D2=1 THEN 730
1090 IF S=2 THEN 680
1100 STOP
1110 !
1120 !
1130 Missing:Mval=Mval+1
1140 IF Skip=1 THEN GOTO 1030
1150 GOTO 1260
1160 !
1170 !
1180 Excluded:Exval=Exval+1
1190 IF Skip=1 THEN GOTO 1030
1200 GOTO 1260
1210 !
1220 !
1230 Normal:O(Jrow,Jcol)=O(Jrow,Jcol)+1
1240 !
1250 !
1260 NEXT Jrec
1270 !
1280 PRINT PAGE
1290 CALL Table(N,M,O(+),E(+),ChiSq,Df,A(+),B(+),Total)
1300 !
1310 PRINT TABLE
1320 !

```

```

1330 PRINTER IS 0
1340 !
1350 PRINT "                                DATA FROM ";File#
1360 PRINT USING "!"
1370 IF S#0="Y" THEN 1400
1380 !
1390 CALL Listcat(Iscreen,L,Screenat+7,2)
1400 CALL Listcat(Icol,M,Colcat+7,1)
1410 CALL Listcat(Irow,N,Rowcat+7,0)
1420 !
1430 M1=M-1
1440 IF M>5 THEN 1710
1450 !
1460 PRINT USING "#,16X,A";"1"
1470 FOR J=2 TO M
1480   PRINT USING "#,11X,D";J
1490   NEXT J
1500 PRINT USING "9X,5A,/<";"TOTAL"
1510 FOR I=1 TO N
1520   PRINT USING "#,2D,3X";I
1530   FOR J=1 TO M
1540     PRINT USING "#,8X,4D";O(I,J)
1550     NEXT J
1560     PRINT USING "8X,4D,/<";B(I)
1570     PRINT USING "#,12X,A,4D,D,A";"(",E(I,1),")"
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,M),")"
1620       NEXT I
1630 PRINT USING "#,5A";"TOTAL"
1640 FOR J=1 TO M
1650   PRINT USING "#,8X,4D";A(J)
1660   NEXT J
1670 PRINT USING "8X,4D,/<";Total
1680 GOTO 1960
1690 !
1700 !
1710 PRINT USING "#,9X,A";"1"
1720 FOR J=2 TO M
1730   PRINT USING "#,6X,2D";J
1740   NEXT J
1750 PRINT USING "4X,5A,/<";"TOTAL"
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 "4X,4D,/<";B(I)
1820     PRINT USING "#5X,A,4D,D,A";"(",E(I,1),")"
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,M),")"
1870       NEXT I
1880 PRINT USING "#,5A";"TOTAL"
1890 PRINT USING "#,2X,4D";A(1)
1900 FOR J=2 TO M
1910   PRINT USING "#,3X,4D";A(J)
1920   NEXT J
1930 PRINT USING "3X,4D,/<";Total
1940 !
1950 !
1960 IMAGE 5X,19A,2X,0000.0000
1970 PRINT USING 1960;"CHI SQUARED VALUE =";ChiSq
1980 PRINT "NUMBER OF MISSING VALUES = ";Mval

```

```

1990 PRINT "NUMBER OF ENCLOSED DATA = ";Exval
2000 PRINT "Degrees of Freedom = ";Df
2010 !
2020 PRINTER IS
2030 !
2040 INPUT "DO YOU WISH TO MODIFY THE TABLE ?",A$
2050 IF A$(1,1)="" THEN 3050
2060 IF Counter=0 THEN 2090
2070 CALL Switch(Df=M,N,Rowcat=*,Colcat=*,Exval,On(*),Ocol,Onrow,Onrowcat(*),
Oncolcat=*,Nequal=
2080 Counter=1
2090 N1=N
2100 INPUT "DO YOU WISH TO COMBINE ANY ROWS ?",A$
2110 IF A$(1,1)="" THEN 2220
2120 INPUT "ENTER THE PAIR OF ADJACENT ROWS TO BE COMBINED",R1,R2
2130 CALL Switch(R1,R2)
2140 FOR J=1 TO M
2150   O(R1,J)=O(R1,J)+O(R2,J)
2160   O(R2,J)=0
2170 NEXT J
2180 Rowcat(2+R1)=Rowcat(2+R2)
2190 N1=N1-1
2200 INPUT "DO YOU WISH TO COMBINE ANY OTHER ROWS ?",A1$
2210 IF A1$(1,1)="" THEN 2120
2220 INPUT "DO YOU WISH TO ELIMINATE ANY ROWS ?",B$
2230 IF (B$(1,1)="" OR (B$(1,1)="" AND (A$(1,1)="" THEN 2570
2240 IF B$(1,1)="" THEN 2360
2250 INPUT "ENTER NUMBER OF ROW TO BE ELIMINATED.",R1
2260 FOR J=1 TO M
2270   Exval=Exval+O(R1,J)
2280   O(R1,J)=0
2290 NEXT J
2300 N1=N1-1
2310 INPUT "DO YOU WISH TO REMOVE ANOTHER ROW ?",B$
2320 IF B$(1,1)="" THEN 2250
2330 !
2340 ! CONSOLIDATE TABLE FOR CHANGES IN ROWS
2350 !
2360 MAT B=RSUM(0)
2370 !
2380 FOR I=1 TO N1
2390   I1=I
2400   IF B(I1)>0 THEN 2450
2410   I1=I1+1
2420   IF I1=N THEN 2400
2430   N1=I
2440   GOTO 2560
2450   IF I1=I THEN 2520
2460   FOR J=1 TO M
2470     O(I,J)=O(I1,J)
2480     O(I1,J)=0
2490   NEXT J
2500   B(I1)=0
2510   CALL Transfer(I,I1,Rowcat=*)
2520 NEXT I
2530 !
2540 ! MAKE CHANGES IN COLUMNS
2550 !
2560 N=N1
2570 M1=M
2580 INPUT "DO YOU WISH TO COMBINE ANY COLUMNS ?",A$
2590 IF A$(1,1)="" THEN 2700
2600 INPUT "ENTER THE PAIR OF ADJACENT COLUMNS TO BE COMBINED",R1,R2
2610 CALL Switch(R1,R2)
2620 FOR I=1 TO N
2630   O(I,R1)=O(I,R1)+O(I,R2)

```

```

2640 O(I,R2)=0
2650 NEXT I
2660 Colcat(2+P1)=Colcat(2+P2)
2670 M1=M1-1
2680 INPUT "DO YOU WISH TO COMBINE ANY OTHER COLUMNS?",A1$
2690 IF A1$(1,1)="Y" THEN 2600
2700 INPUT "DO YOU WISH TO ELIMINATE ANY COLUMNS?",B$
2710 IF (B$(1,1)="Y") AND (A$(1,1)!="Y") THEN 1290
2720 IF B$(1,1)="Y" THEN 2840
2730 INPUT "ENTER NUMBER OF COLUMN TO BE ELIMINATED",P1
2740 FOR I=1 TO N
2750   Exval=Exval+O(I,P1)
2760   O(I,P1)=0
2770 NEXT I
2780 M1=M1-1
2790 INPUT "DO YOU WISH TO REMOVE ANOTHER COLUMN?",B$
2800 IF B$(1,1)="Y" THEN 2730
2810 !
2820 !   CONSOLIDATE TABLE FOR CHANGES IN COLUMNS
2830 !
2840 MAT A=CSUM(0)
2850 FOR J=1 TO M1
2860   J1=J
2870   IF A(J1)=0 THEN 2920
2880   J1=J1+1
2890   IF J1=M THEN 2870
2900   M1=J
2910   GOTO 3000
2920 IF J1=J THEN 2990
2930 FOR I=1 TO N
2940   O(I,J)=O(I,J1)
2950   O(I,J1)=0
2960 NEXT I
2970 A(J1)=0
2980 CALL Transfer(J,J1,Colcat(1))
2990 NEXT J
3000 M=M1
3010 GOTO 1290
3020 !
3030 !   START NEW ANALYSIS
3040 !
3050 PRINT PAGE
3060 PRINT "YOU NOW HAVE SEVERAL CHOICES"
3070 PRINT "  CODE      CHOICE"
3080 PRINT "    1      END SESSION"
3090 PRINT "    2      CHANGE SUBJECTS AND CATEGORIES"
3100 PRINT "    3      ENTER NEW DATA AND FOR CHOICE 2"
3110 PRINT "    4      GET ORIGINAL TABLE BACK"
3120 INPUT "ENTER CODE FOR YOUR CHOICE",Ich
3130 PRINT PAGE
3140 IF (Ich<1) OR (Ich>4) THEN 3120
3150 Counter=0
3160 ON Ich GOTO 3540,3190,3180,3210
3170 !
3180 GOSUB 3250           ! ENTER NEW TAPE
3190 GOSUB 3430           ! REVIEW SUBJECTS AND CATEGORIES
3200 GOTO 520
3210 CALL Assign(Onr(1),Ocol,Onw,Onrowdat(1),Oncolcat(1),Nexval,O(1),M,N,Rowda
t(1),Colcat(1),Exval)
3220 PRINT "YOU NOW HAVE THE ORIGINAL TABLE BACK"
3230 GOTO 2040
3240 !
3250 PRINT PAGE           ! READS DATA TAPE
3260 PRINT "INSERT DATA TAPE INTO T14"
3270 INPUT "HIT 'CONT' WHEN READY",I
3280 PRINT PAGE

```

```

3290 INPUT "ENTER DATA FILE'S NAME ???",File#
3300 ASSIGN #1 TO File#":T14"
3310 ON END #1 GOTO 3360
3320 Rec=2
3330 READ #1,Rec:R#1:Rec+
3340 Rec=Rec+1
3350 GOTO 3330
3360 Rec=Rec-1
3370 OFF END #1
3380 OVERLAP
3390 RETURN
3400 !
3410 !           CHANGE SUBJECTS AND CATEGORIES
3420 !
3430 INPUT "DO YOU WISH TO SCREEN THE DATA",S1#
3440 CALL Review(2,Iscreen,L,Scndcat(*),Spos1,Spos2,Spos3,Spos4)
3450 CALL Review(1,Icol,M,Colcat(*),Cpos1,Cpos2,Cpos3,Cpos4)
3460 CALL Review(0,Irow,N,Rowcat(*),Rpos1,Rpos2,Rpos3,Rpos4)
3470 MAT O=(0)           ! INITIALIZE ARRAY
3480 MAT E=(0)
3490 MAT B=(0)
3500 MAT A=(0)
3510 RETURN
3520 !
3530 PRINT "PLEASE CHECK DATA FOR CORRECT ENTRIES."   !BAD DATA
3540 END
3550 !
3560 ! CALCULATES CONTINGENCY TABLES"
3570 !
3580 SUB Table(N,M,O(=),E(=),Chisq,Df,A(=),B(=),Total)
3590 DIM C(10)
3600 FOR J=1 TO M
3610   A(J)=0
3620   FOR I=1 TO N
3630     A(J)=A(J)+O(I,J)
3640   NEXT I
3650   NEXT J
3660   Total=0
3670   FOR I=1 TO N
3680     B(I)=0
3690     FOR J=1 TO M
3700       B(I)=B(I)+O(I,J)
3710     NEXT J
3720     Total=Total+B(I)
3730   NEXT I
3740 IF Total<>0 THEN 3770
3750 PRINT "Total =0 , Chisquare not calculated"
3760 SUBEXIT
3770 FOR I=1 TO N
3780   C(I)=B(I)/Total
3790 NEXT I
3800 Chisq=0
3810 FOR J=1 TO M
3820   FOR I=1 TO N
3830     E(I,J)=A(I,J)+C(I)
3840     IF E(I,J)<>0 THEN 3870
3850     Chisq=Chisq+O(I,J)^2
3860     GOTO 3880
3870     Chisq=Chisq+O(I,J)-E(I,J)^2+E(I,J)
3880   NEXT I
3890   NEXT J
3900 Df=(M-1)*(N-1)
3910 SUBEND
3920 !
3930 ! PICK BOUNDARIES FOR CATEGORIES AND INIALIZES DATA POSITIONS
3940 !

```

```

3950 SUB Bounds(Ind,Isub,M,Bounds(=),Pos1,Pos2,Pos3,Pos4)
3960 COM Nsub,Labsub(=),Pos(=)
3970 PRINT PAGE
3980 CALL Heading(Isub,Ind)
3990 Pos1=Pos(1,Isub)
4000 Pos2=Pos(2,Isub)
4010 Pos3=Pos(3,Isub)
4020 Pos4=Pos(4,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, THEREFORE"
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 BOUNDARY FIRST, THEN UPPER"
4130 Jcat=1
4140 FOR J=1 TO M
4150   Jcat1=Jcat+1
4160   PRINT "CATEGORY ",J
4170   INPUT "LOWER BOUNDARY",Bounds(Jcat)
4180   INPUT "UPPER BOUNDARY",Bounds(Jcat1)
4190   CALL Switch(Bounds(Jcat),Bounds(Jcat1))
4200 PRINT "LOWER BOUNDARY IS ";Bounds(Jcat),"UPPER BOUNDARY IS ";Bounds(Jcat1)
4210   Jcat=Jcat+2
4220 NEXT J
4230 SUBEND
4240 !
4250 ! SORTING ROUTINE
4260 !
4270 SUB Sort(Number,Value,Bounds(=),Cat)
4280 Last=2*Number
4290 FOR J=2 TO Last STEP 2
4300   IF (Bounds(J-1)<=Value) AND (Value<=Bounds(J)) THEN 4340
4310   NEXT J
4320 Cat=Number+1      !only if Value is out of bounds
4330 SUBEXIT
4340 Cat=INT(J/2)
4350 SUBEND
4360 !
4370 !
4380 SUB Listcat(Isub,Num,Cat(=),Ind)      ! PRINT CODE AND CATEGORIES
4390 !
4400 !
4410 CALL Heading(Isub,Ind)      !PRINTS CODES
4420 I=1
4430 PRINT "  CATEGORY      LOWER BOUND    UPPER BOUND"
4440 FOR J=1 TO Num
4450   IMAGE 5X,2D,10X,3D,2D,9X,3D,2D,/
4460   PRINT USING 4450;J,Cat(I),Cat(I+1)
4470   I=I+2
4480 NEXT J
4490 PRINT
4500 SUBEND
4510 !
4520 !
4530 SUB Combine(Test,Pos1,Pos2,Pos3,Pos4,String$,D) !COMBINE TEST SCORES
4540 !
4550 Test1$=String$(Pos1,Pos2)
4560 Test2$=String$(Pos3,Pos4)
4570 IF (Test1$(1,1)="" ) OR (Test2$(1,1)="" ) THEN 4610
4580 Test=(VAL(Test1$)+VAL(Test2$))/10
4590 D=1
4600 SUBEXIT

```

```

4610 D=2
4620 SUBEND
4630 !
4640 !
4650 SUB Convert(Code,Code$,Subj)      !CONVERTS DATA INTO PEARL NUMBERS
4660 !
4670     INPUTS
4680         Code$ 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=1) OR (Subj=4) THEN 4810
4760 IF (Subj>=6) AND (Subj<=8) THEN 4810
4770 IF (Subj=10) OR (Subj=13) THEN 4810
4780 IF Subj=15 THEN 4810
4790 Code=VAL(Code$)+10
4800 SUBEXIT
4810 Code=VAL(Code$)
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 SUBEXIT
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 SUBEXIT
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 SUBEXIT
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/RASBERRY RAFT"
5280 PRINT "          5          PIW"
5290 PRINT
5300 SUBEXIT
5310 IF Index=13 THEN 5380
5320 PRINT "          CODE          HOURS"
5330 PRINT "          1          74"
5340 PRINT "          2          4 - 6 "
5350 PRINT "          3          16"
5360 PRINT
5370 SUBEXIT
5380 IF Index=16 THEN SUBEXIT
5390 PRINT "          CODE          SEARCH UNIT TYPE"
5400 PRINT "          1          CUTTER"
5410 PRINT "          2          UTB"
5420 PRINT "          3          HELD"
5430 PRINT
5440 SUBEND
5450 !
5460 !
5470 SUB Switch(L,U)
5480 IF L<=U THEN SUBEXIT
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) (PRINTS TITLE
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$;" IS ";Labsub$(Isub)
5710 CALL Helper(Isub)
5720 IF Ind=2 THEN SUBEXIT
5730 PRINT "CATEGORIES FOR SCREENING FORM THE DATA BASE FOR ANALYSIS"
5740 SUBEND
5750 !
5760 ! SCREENS THE DATA
5770 !
5780 SUB Screen(R$,Spos1,Spos2,Spos3,Spos4,L,Iscreen,Srncat(+),S)
5790 !
5800 ! RETURNS:      S = 0      IF EXCLUDED OR MISSING
5810 !              = 1      IF INCLUDED AND REPEATS SHOULD BE SCREENED
5820 !              = 2      " " " " " " " " NOT BE SCREENED
5830 !
5840 COM Nsub,Labsub$(+),Pos(+),S$
5850 !
5860 S=1
5870 IF S$>"Y" THEN SUBEXIT
5880 IF Spos1=Spos3 THEN 5920
5890 CALL Combine(Scode,Spos1,Spos2,Spos3,Spos4,R$,D)
5900 S=2
5910 ON D GOTO 5950,5970
5920 Srncode$=R$(Spos1,Spos2)

```

```

5930 IF Srrncode$(1,1)="" THEN 5970
5940 CALL Convert(Scode,Srrncode$,Iscreen)
5950 CALL Sort(L,Scode,Srrncat(+),Isrrn)
5960 IF Isrrn=L THEN SUBEXIT
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$(+),Pos(+),S$,S1$
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 S1$ are answers to "DO YOU WANT TO SCREEN THE DATA?"
6290 !       asked at different points
6300 !
6310 PRINT PAGE
6320 IF Ind<>2 THEN 6380
6330 IF (S$<>"Y") AND (S1$<>"Y") THEN SUBEXIT
6340 IF (S$="Y") AND (S1$="Y") THEN 6380
6350 S$=S1$
6360 IF S1$<>"Y" THEN SUBEXIT
6370 GOTO 6430
6380 CALL Listcat(Isub,Num,Cat(+),Ind)
6390 INPUT "DO YOU WISH TO CHANGE ANY PARAMETERS?",A$
6400 IF A$<>"Y" THEN SUBEXIT
6410 INPUT "DO YOU WISH TO CHANGE THE SUBJECT?",A$
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,Oldcat(+),Oldcat(+),Oexual,New(+),Ncol,Nrow,Nrcat
(+),Nccat(+),Nexual)
6540 Nexual=Oexual
6550 Ncol=Col
6560 Nrow=Row
6570 FOR I=1 TO Row

```

```
6580 FOR J=1 TO Col
6590 New(I,J)=Old(I,J)
6600 NEXT J
6610 NEXT I
6620 FOR I=1 TO Row+2
6630 Nrcat(I)=Ordcat(I)
6640 NEXT I
6650 FOR J=1 TO Col+2
6660 Nccat(J)=Occat(J)
6670 NEXT J
6680 SUBEND
```

APPENDIX G

HUMAN FACTORS LOOKOUT DATA STORED ON TAPE #1

NAME	PRO	TYPE	REC/FILE	BYTES/REC	ADDRESS
T15		2			
1001		DATA	15	60	5
1002		DATA	14	60	9
1003		DATA	23	60	13
1004		DATA	19	60	19
1008		DATA	18	60	24
1009		DATA	15	60	29
1007		DATA	27	60	33
1005		DATA	59	60	40
1006		DATA	73	60	54
1010		DATA	31	60	72
1011		DATA	49	60	80
1012		DATA	109	60	92
1013		DATA	125	60	118
1015		DATA	20	60	148
1016		DATA	10	60	153
1014		DATA	21	60	156
1017		DATA	13	60	161
1018		DATA	125	60	166
1042		DATA	27	60	196
1019		DATA	105	60	426
1020		DATA	120	60	451
1021		DATA	110	60	480
1022		DATA	12	60	506
1023		DATA	27	60	509
1024		DATA	15	60	516
1025		DATA	26	60	520
1026		DATA	56	60	527
1027		DATA	13	60	541
1028		DATA	40	60	545
1029		DATA	43	60	555
1030		DATA	95	60	566
1031		DATA	34	60	589
1032		DATA	22	60	597
1033		DATA	18	60	603
1034		DATA	24	60	608
1035		DATA	7	60	614
1036		DATA	9	60	616
1037		DATA	34	60	619
1038		DATA	35	60	627
1039		DATA	21	60	636
1040		DATA	22	60	641
1041		DATA	20	60	647

FILES 1001-1015 CONTAIN THE WINTER 1981 CUTTER (W81CUT) DATA
 FILES 1016-1024 CONTAIN THE FALL 1980 CUTTER (F80CUT) DATA
 FILES 1025-1033 CONTAIN THE SPRING 1980 CUTTER (S80CUT) DATA
 FILES 1034-1049 CONTAIN THE WINTER 1981 HELO (W81HELO) DATA

APPENDIX G (cont)

HUMAN FACTORS LOOKOUT DATA STORED ON TAPE #2

NAME	PRO TYPE	REC/FILE	BYTES/REC	ADDRESS
T15		2		
1043	DATA	6	60	5
1044	DATA	6	60	7
1045	DATA	87	60	9
1046	DATA	25	60	30
1047	DATA	13	60	36
1048	DATA	49	60	40
1049	DATA	24	60	52
1050	DATA	14	60	58
1051	DATA	60	60	62
1052	DATA	105	60	77
1053	DATA	55	60	102
1054	DATA	17	60	115
1055	DATA	16	60	119
1056	DATA	46	60	123
1057	DATA	22	60	134
1058	DATA	16	60	140
1059	DATA	17	60	144
1060	DATA	18	60	148
1061	DATA	34	60	153
1062	DATA	37	60	161
1063	DATA	28	60	170
1064	DATA	17	60	177
1069	DATA	36	60	181
1070	DATA	11	60	190
1065	DATA	10	60	193
1066	DATA	8	60	196
1067	DATA	17	60	198
1071	DATA	12	60	202
1068	DATA	12	60	205
1072	DATA	30	60	208
1073	DATA	23	60	216
1074	DATA	11	60	222
1075	DATA	19	60	225
1076	DATA	34	60	230
1077	DATA	22	60	238
1078	DATA	39	60	244
1079	DATA	21	60	254
1080	DATA	8	60	259
1081	DATA	24	60	261
1082	DATA	48	60	267

FILES 1034-1049 CONTAIN THE WINTER 1981 HELO (WS1HEL) DATA
 FILES 1050-1055 CONTAIN THE FALL 1980 HELO (F80HEL) DATA
 FILES 1056-1058 CONTAIN THE WINTER 1981 UTB (WS1UTB) DATA
 FILES 1059-1068 CONTAIN THE FALL 1980 UTB (F80UTB) DATA
 FILES 1069-1072 CONTAIN THE SPRING 1980 HELO (S80HEL) DATA
 FILES 1073-1082 CONTAIN THE SPRING 1980 UTB (S80UTB) DATA

APPENDIX G (cont)

HUMAN FACTORS LOOKOUT DATA STORED ON TAPE #3

NAME	PRO	TYPE	REC/FILE	BYTES/REC	ADDRESS
T15		2			
F80CUT		DATA	550	60	5
W81CUT		DATA	980	60	134
S80CUT		DATA	340	60	364
W81HEL		DATA	390	60	444
F80HEL		DATA	255	60	536
S80HEL		DATA	85	60	596
W81UTB		DATA	85	60	616
F80UTB		DATA	180	60	636
S80UTB		DATA	230	60	679

HUMAN FACTORS LOOKOUT DATA STORED ON TAPE #4

NAME	PRO	TYPE	REC/FILE	BYTES/REC	ADDRESS
T15		2			
CUTTER		DATA	1450	60	5
HELOS		DATA	750	60	345
UTBS		DATA	520	60	521

CUTTER CONTAINS W81CUT + F80CUT + S80CUT DATA COMBINED
 HELOS CONTAINS W81HEL + F80HEL + S80HEL DATA COMBINED
 UTBS CONTAINS W81UTB + F80UTB + S80UTB DATA COMBINED

HUMAN FACTORS LOOKOUT DATA STORED ON TAPE #5

NAME	PRO	TYPE	REC/FILE	BYTES/REC	ADDRESS
T15		2			
SARWAR		DATA	2700	60	5

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

NAME	PRO	TYPE	REC/FILE	BYTES/REC	ADDRESS
T15		2			
TEST3		DATA	155	8	5
TEST4		DATA	155	8	10
CSCUT1		DATA	90	8	15
CSCUT2		DATA	90	8	18
CSHEL1		DATA	35	8	21
CSHEL2		DATA	35	8	23
CSUTB1		DATA	35	8	25
CSUTB2		DATA	35	8	27

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

TEST3 CONTAINS HIDDEN FIGURES TEST SCORES FROM THE SARWAR FILE
 TEST4 CONTAINS HIDDEN PATTERNS TEST SCORES FROM THE SARWAR 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.

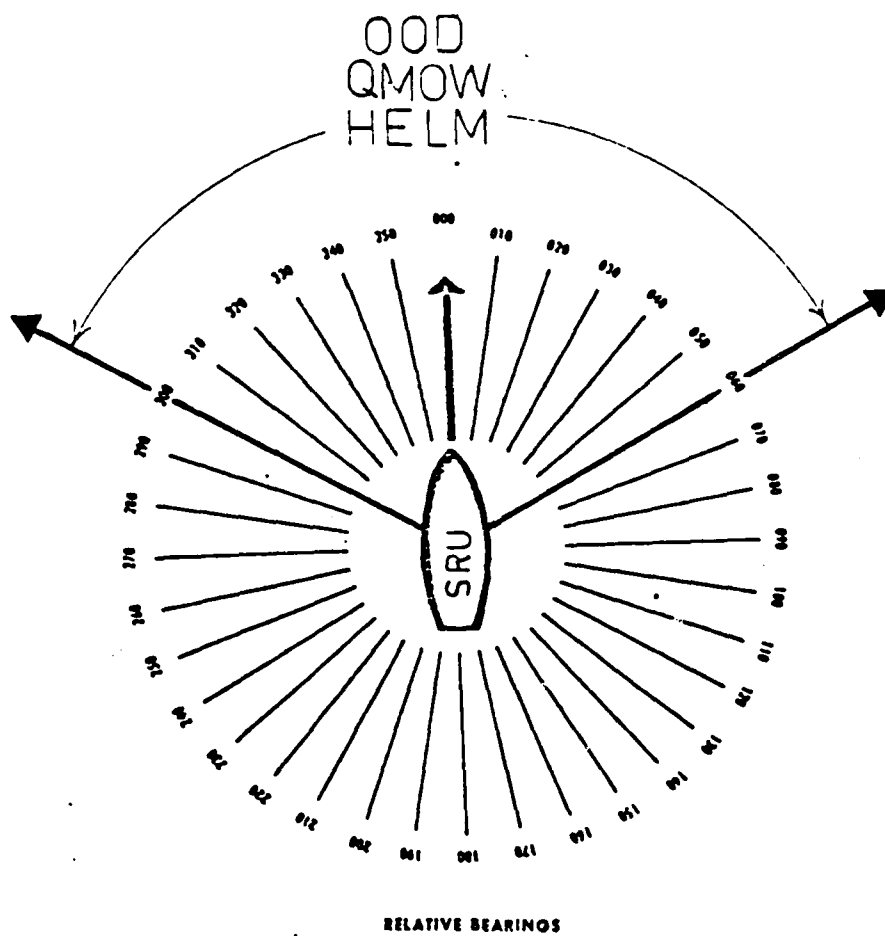
TEMPLATE USED TO DETERMINE ZONES OF RESPONSIBILITY FOR CUTTERS AND UTBS

POSITION

AREA OF RESPONSIBILITY

HELM
OOD
QMOW

300-060



TEMPLATE USED TO DETERMINE ZONES OF RESPONSIBILITY FOR CUTTERS AND UTBS

POSITION

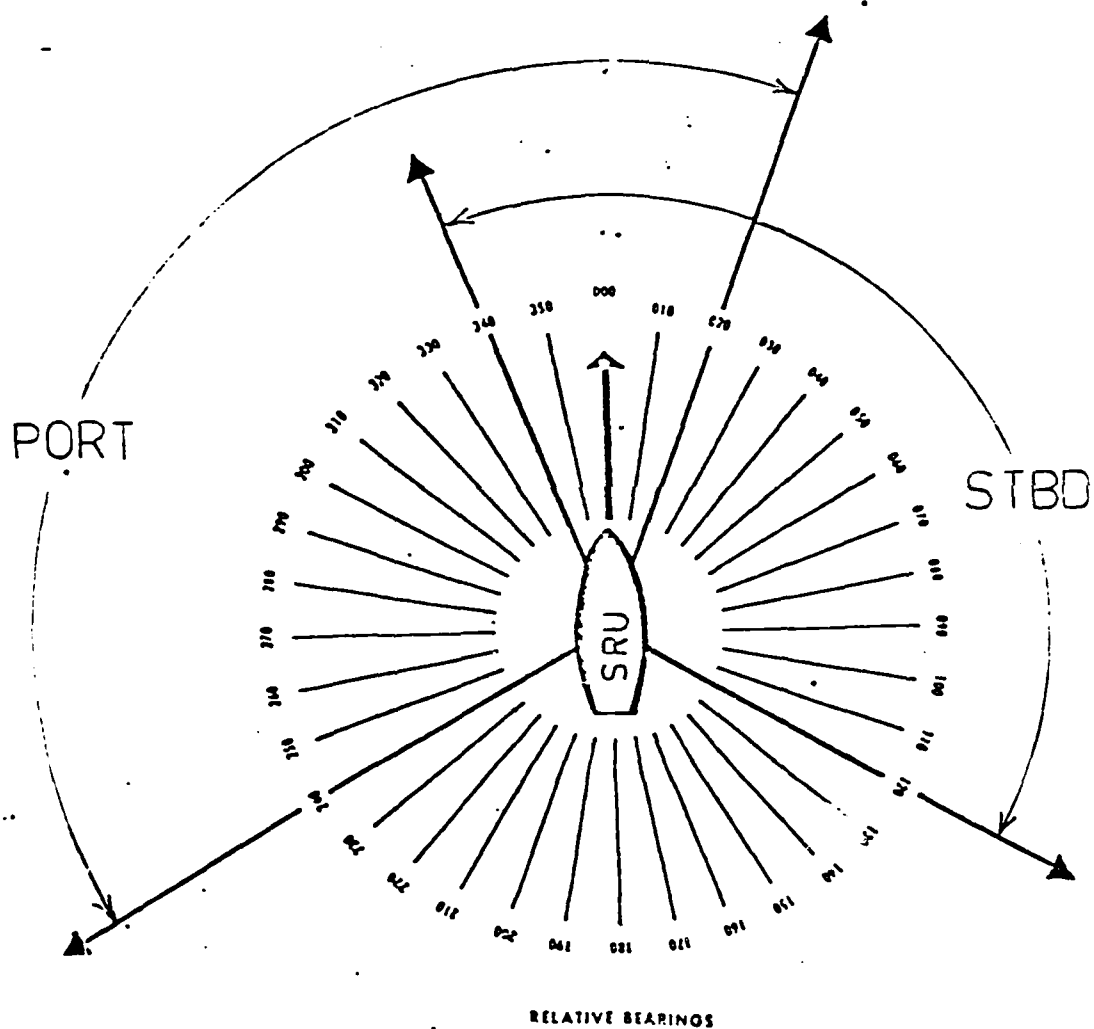
AREA OF RESPONSIBILITY

PORTSIDE
LOCKOUT

240-020

- : STBD SIDE
LOCKOUT

340-120



TEMPLATE USED TO DETERMINE ZONES OF RESPONSIBILITY FOR HELOS

POSITION

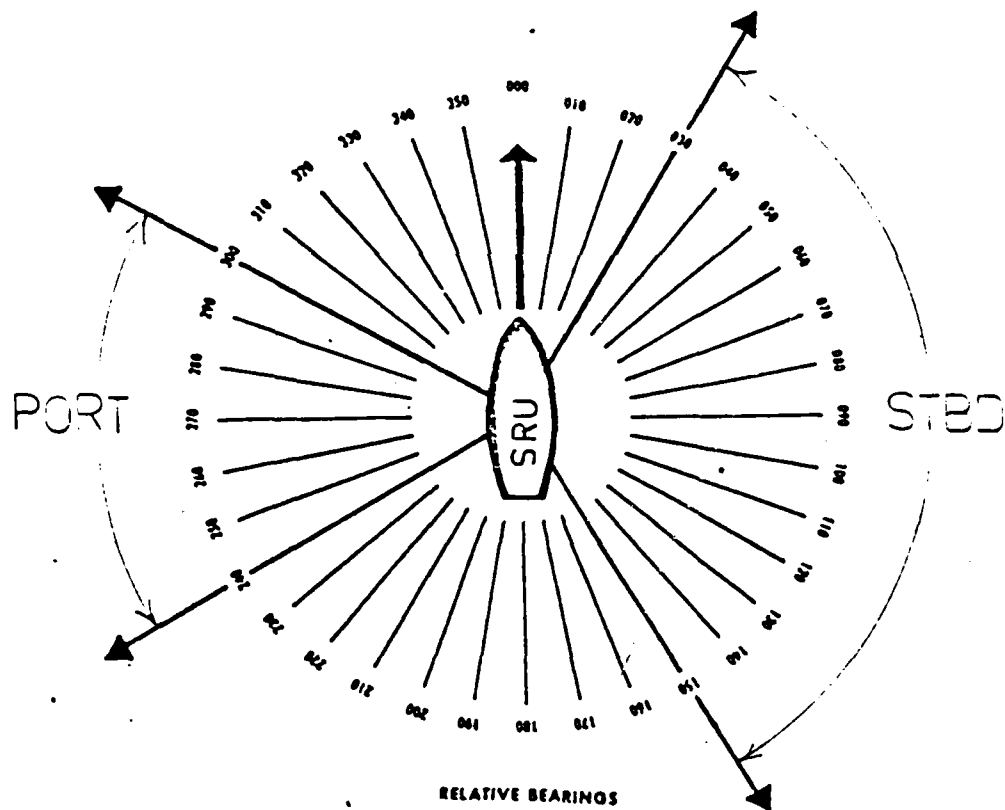
AREA OF RESPONSIBILITY

PORT
SCANNER

240-300

STBD
SCANNER

030-150

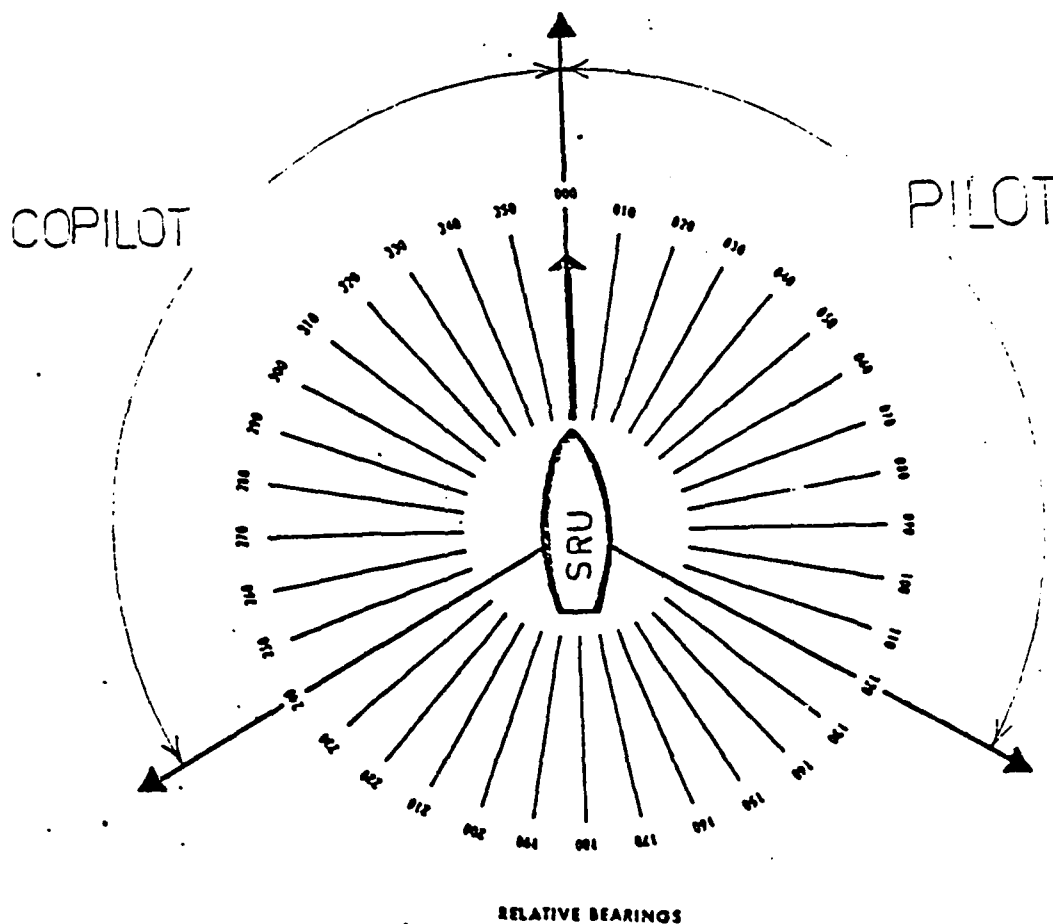


TEMPLATE USED TO DETERMINE ZONES OF RESPONSIBILITY FOR HELOS

<u>POSITION</u>	<u>AREA OF RESPONSIBILITY</u>
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PILOT	000-120
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COPILOT	240-000
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END

DATE
FILMED

9-82

DTIC