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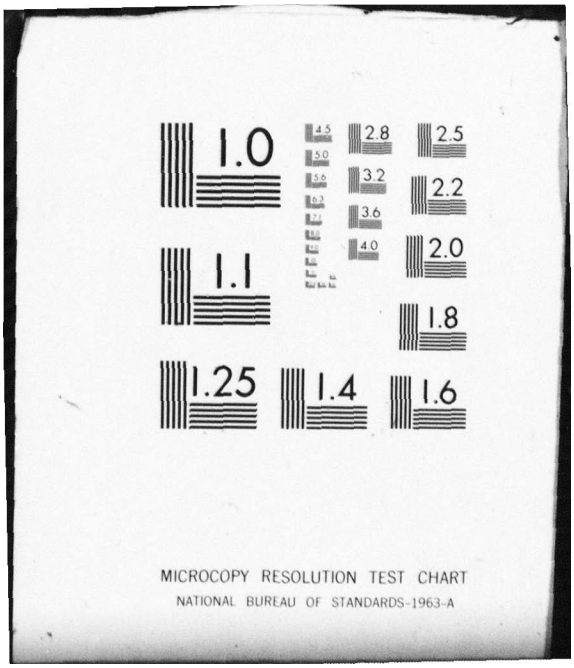
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REPORT NO. CG-D-14-80

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AN ASSESSMENT OF THE INFLUENCE OF EMERGING SOCIAL AND ECONOMIC TRENDS ON THE PEOPLE AND MANAGEMENT OF THE COAST GUARD

LEVEL III

Forecasting International, Ltd.
1001 North Highland Street
Arlington, Virginia 22210

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December 1979

FINAL REPORT

Volume 2

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PREPARED FOR

U.S. DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD
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16. Abstract

The objective of this project is to explore the impacts of the emerging social and economic trends and events that are most likely to affect the people and management of the United States Coast Guard during the time period 1979 to 2004. The study utilizes two computerized models, KSIM and Cross-Impact, to develop projections of fifteen representative trends and 22 events. Cross-relevance and cross-support analyses are then utilized to assess the impact of these forecasts on critical components of the four major Coast Guard resource management areas: manpower, funds, material and information. The critical elements represent those points at which a change in the external environment or an internal policy, procedure or system could alter the resource flow pattern. Areas appropriate for policy action, either to take advantage of an opportunity or to address a potential problem, are identified and the appropriate action option formulated for each.

Volume I presents the basic report.
Volume II provides relevant appendices.

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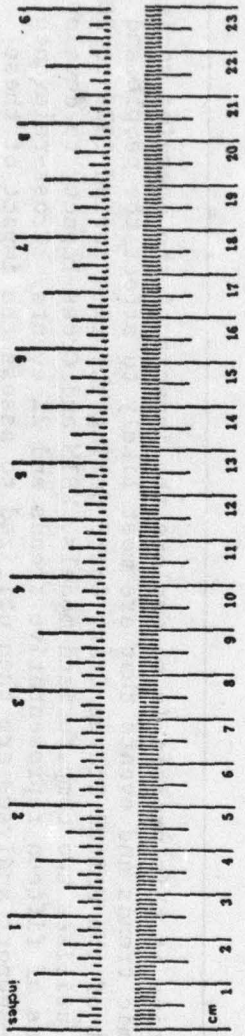
AB

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

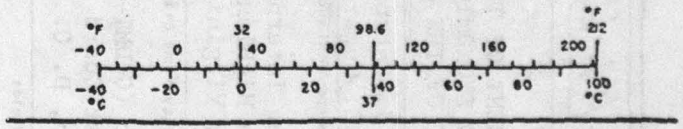
Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	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		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.



Approximate Conversions from Metric Measures

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
m	meters	1.1	yards	yd
km	kilometers	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	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	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



METRIC CONVERSION FACTORS

APPENDIX A

METHODOLOGY

1. Introduction

Many different forecasting tools have been developed in an effort to improve our ability to make accurate predictions. In designing and conducting this study, Forecasting International, Ltd. (FI) utilized a number of advanced analytical and structural techniques. These were selected and applied in view of the type and quality of known data and the information needed from the analysis. The use of a variety of techniques, rather than a single method, provided a higher quality analysis and output. It also permitted the structured analysis to be conducted using both "hard" (quantitative) and "soft" (qualitative or perceived) data.

The paragraphs that follow contain detailed descriptions of each analytical technique and its application in this study. An overview of the entire process is provided immediately below as a framework for the discussion of the methodology. While reading this material, the reader should bear in mind the purpose of the study: to assess the influence of emerging social and economic trends on the people and management of the Coast Guard and to identify policy options and recommend actions available to the Coast Guard in dealing with future change.

2. Overview of the Approach

There were six major pieces of work to be completed during the project:

- Identify and collect relevant information (i.e. trends, events, areas of concern).

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- Analyze key trends.
- Analyze key events.
- Analyze areas of concern.
- Determine impact of trends and events on USCG areas of concern.
- Formulate policy options and make recommendations.

While the list of major tasks above implies a sequential order, it should be noted that this was an iterative process. Throughout the study various pieces of work were in process concurrently and definitions, data collection and structuring decisions were reevaluated continuously.

Table A-1 indicates the techniques utilized to accomplish each task. Each of these is described briefly below. Detailed discussions of the analytical techniques and their applications in this study are included in Sections 3 through 9 of this appendix.

2.1 Data Collection

FI has done considerable previous work with the Coast Guard and the study team members were conversant with much of the broad data of interest in this study. The study team utilized this expertise and the findings of previous studies performed by FI and other organizations as a starting point. In addition, a literature search was conducted to fill gaps and broaden the scope of the trends and events to be examined. In the very early phases of the study, a questionnaire and interviews were utilized to assist the study team in identifying the current and future perceived problems, and the factors which might trigger these management problems. The information obtained was utilized throughout the study.

2.2 Trend Analysis

In assessing the trends and their impacts on each other, KSIM, a computer simulation technique, was employed

TABLE A-1. ANALYTICAL TECHNIQUES EMPLOYED

Work Done	Technique Used
Identify and collect relevant information	Questionnaire Interviews Literature Search
Analyze Key Trends	KSIM (computer simulation model)
Analyze Key Events	Cross-Impact (computer simulation model)
Analyze Areas of Concern	Cross-Support Analysis
Determine Impacts of Trends and Events on Areas of Concern	Cross-Relevance Analysis
Develop Policy Options	Discussion

This model can utilize both quantitative and qualitative data and was of great value in the early stages of the study to facilitate the structuring of the system being studied and to produce projections of trend values based upon the predicted interactions of trends.

2.3 Event Analysis

The study team utilized Cross-Impact Analysis as a tool for evaluating the effects of events on the trend system. Cross-Impact analysis is a computer simulation technique in which the impacts of events on projected baseline trends are evaluated to generate new projected trend values. In this study, the trend projections derived from the KSIM exercise provided the baseline for the Cross-Impact Analysis.

2.4 Analysis of Areas of Concern

By examining the current USCG management structure and resource flows and analyzing the information from the interviews, the study team identified four major areas of concern and the elements of each of these. A quantitative determination of the relative supportiveness was made and a weighting factor derived for each element of each area of concern. This was accomplished using cross-support analysis. Cross-support analysis employs a matrix as a structuring device and requires the analysts to specify explicitly and quantitatively the relationships among elements of a set.

2.5 Impacts on the U.S. Coast Guard

Cross-relevance analysis was utilized to assess the impacts of the projected trends on the U.S. Coast Guard by area of concern. Cross-relevance is a matrix technique designed to facilitate the quantitative assessment of the effects of elements in one set (e.g. trends) on elements in another set (e.g. areas of concern). High cell values indicate critical impact (or problem) areas and total scores provide an indication of the relative importance of trends in the future environment.

2.6 Policy Options

The study team as a group derived the policy options based upon the descriptions of the problem and impact areas identified above.

3. Questionnaire

One of the first efforts undertaken was the circulation of a relatively brief questionnaire soliciting opinions of Coast Guard managers on emerging trends and events and their potential degree of impact on the Coast Guard. The questionnaire covered a broad range of issues including: changes in the international environment, problems in environmental management, demographic patterns, social problems, organizational structure, the role of government, work patterns, changing values, inflation and capital shortages, changing lifestyles, energy, and the availability and applications of various types of technologies. The exercise was conducted by the Coast Guard and the raw data provided to FI without identification of the participants in order to preserve anonymity. We received 30 questionnaire responses from 18 offices selected by the USCG. The offices responding are listed in Annex 1 to this appendix. The results were tabulated and the study team utilized this background information in the selection of trends and events.

4. Interviews

A second major information-gathering exercise was also initiated early in the study using a structured or guided interview technique. The purpose of the interviews were two-fold: to determine the actual organization structure and decision-making mechanism so that the comparison between it and the organizational chart could be made, and to determine what were perceived by Coast Guard managers as the major current and future management and manpower issues. The study team members conducting the interviews had an agenda of several broad questions which were designed to assure that the key points regarding management and resource allocation decisions and processes were raised. A copy of these questions is included in Annex 2 to this appendix and a list

of the individuals participating in the interviews is included in Annex 3.

5. KSIM

5.1 General Description

KSIM (Kane's Simulation, named after its creator, Julius Kane) was utilized in this study to identify and structure key trends which might affect USCG management and personnel policies and allocations over the next 25 years. The KSIM panel included members of the FI staff with expertise in a wide variety of fields and familiarity with the Coast Guard. The KSIM analysis was modified and reiterated several times and particular emphasis was placed on selecting an appropriate set of trends.

KSIM is a cross-impact simulation model which is used in the early stages of a project to facilitate the processes of problem definition, identification of key factors of relevance, and assessment of dynamic interactions among these key factors. This analytical tool utilizes a small group of knowledgeable individuals and a computer model. A major advantage it offers over other computer simulation techniques is that "soft" (qualitative) as well as "hard" (quantitative) data may be evaluated and both types of data may be analyzed together. The output of the model may be either numerical forecasts or graphics which illustrate changes in the key variables. The projections may be associated with a time scale or be time independent depending upon the input data. While the printed output of KSIM is valuable, the process of analyzing and modeling the problem and analyzing KSIM output are extremely valuable as well.

KSIM was selected for use in this study because it allows for the quantification of interrelationships among key variables (e.g. trends), incorporates subjective judgments and qualitative data quite well, and provides a dynamic, rather than static, output. In this particular application, the incorporation of "soft" data was critical since the primary factors which will affect USCG management in the

future include perceived attitudes toward work and toward the military, changing life styles and value systems, expectations and many other "soft" variables.

5.2 Operation of the KSIM Exercise

In executing a KSIM analysis there are five major steps. In most cases, the team may iterate a number of times, thus repeating the sequence of steps when refinements are perceived as needed. These major steps are:

- Formulate the problem.
- Identify key variables.
- Define key variables.
- Structure the relationships.
- Execute the program and interpret output.

5.2.1 Formulate the Problem

After participants are selected, the first step of the analysis is to discuss, define and scope the problem. The discussion is an invaluable step and should not be omitted. The exchange of ideas was critical to the establishment of a common understanding of the issues and the underlying assumptions of the analysis. During the discussion, the timeframe and scope of the study were clarified. Scope definition, for example, included a decision on which international, national, regional or local factors would be considered in the analysis.

In this study the panel consisted of FI staff members with considerable expertise in a wide range of disciplines including political, social, technological, and economic fields. Resumes of FI staff members participating in this exercise are included in Annex 4. As a result of the discussion, it was determined that the analysis would focus on applicable national trends over the next twenty-five years. The panel also agreed that social issues and technological developments would be particularly important in shaping the future management and manpower problems and opportunities of the U.S. Coast Guard.

5.2.2 Identify Key Variables

After the team has discussed and defined the problem and the scope of the analysis, the next step is to identify the key variables which are central to the problem. This particular step of the analysis can be accomplished using any number of approaches from open discussion to "brainwriting." The purpose is to identify a limited number of key variables (less than 20) which reflect the system or environment of the problem.

In this study, the project team was striving to identify the major trends which would shape the future environment in which Coast Guard resource management decisions would have to be made. The project leader and the research assistants developed a list of possible trends prior to the exercise. In open discussions, the panel debated the suggested list and added other candidates. The study team finally agreed upon fifteen trends, listed in Table A-2 with their KSIM abbreviations, which would be major influences on the future of the Coast Guard and the resource management issues especially. Some of these trends, particularly some of the social trends, are representative in nature, including a range of more specific trends. For example, trend 10 on Workers' Expectations for More Rewarding Work represents a wide range of issues including flexible work schedules, the role of work in one's life, education supported by employers, job content and job enrichment, etc. As another example, the trend on Reliability of the Workforce is representative of other issues such as drug use and drug abuse, alcoholism, and other value and lifestyle changes.

5.2.3 Define Key Variables

After the team has reached consensus on the key variables, decisions must be made as to definitions of these variables. In developing the definitions for use in the KSIM model, more than the traditional prose definition is required. The three aspects of the definition are:

TABLE A-2. TRENDS ANALYZED IN KSIM EXERCISE

Trend #	Trend Name	KSIM Abbreviation
1	Veteran's Compensation and Pension Benefits	VET$
2	Military Annual Pay Rate (Basic pay plus allowances)	MPAY
3	Total U.S. Population Ages 18-24 Years Old	YPOP
4	Gross National Product (In constant 1978 dollars)	GNP
5	Defense Spending (In constant 1978 dollars)	DEF$
6	Unemployment Rate	UERT
7	Reputation of the Coast Guard	RPTA
8	U.S. Public's Attitude Toward the Military	AMIL
9	Demand for USCG Services	DMND
10	Workers Expectations for More Rewarding Work	RWRK
11	Quality of Education in the U.S.	EDUC
12	Reliability of the U.S. Workforce	RELI
13	Attitude of the U.S. Public Toward Formal Authority	AUTH
14	Expectations of Higher Living Standards (U.S. Public)	LSTD
15	Evolution from Authoritarian Management to Group Decision-making in U.S.	GRPD

- How to measure each variable.
- Maximum and minimum values for each variable.
- Starting point for each variable.

Decisions must be made as to how each variable is to be measured, since one or two aspects of a variable may be of more interest than others. For example if "the state of the economy" were a key variable, there are many different indicators which could be used to measure this variable. The study team must decide which indicator(s) to consider. In this study, total Gross National Product (GNP) was included as an indicator of the state of the economy.

As mentioned above, requisite to the performance of KSIM is the determination, by the analysts of the maximum and minimum values the variable can assume during the time horizon of the study. Each variable is then normalized by setting the maximum equal to 1 and the minimum equal to 0. That is, KSIM does not utilize raw data, such as GNP in constant 1978 dollars; these real numbers must be normalized to values between 0 and 1.

After the relevant indicators have been agreed upon, the maximum and minimum values for each variable must be determined. Although KSIM does not require historical data as an input, the FI study team developed the historical data base for each key variable selected for inclusion in the analysis. Graphic displays of the historical data were made for variables measured by quantitative data. For variables which could be assessed only by examining qualitative data, concise summaries of the literature were prepared. The analysis of past behavior became particularly important in setting the maximum and minimum values for qualitative trends since without a sound understanding of the patterns of attitudinal shifts over the last thirty or forty years, the team would not have been able to place current attitudes in perspective and identify the starting points for the KSIM analysis. Thus, an extensive literature search was undertaken to identify past levels of trend indicators. All team members

employed this material and their own experience in developing the definition of the maximum and minimum values for the qualitative variables, e.g. Attitude Toward the Military or Demand for Satisfying Work.

After reviewing the data, and considerable discussion, the study team selected the maximum and minimum values for each trend and calculated (or estimated) the "current" or starting value. The normalized 1977 data point was used as the starting point since it was the most recent year for which data existed on all trends of interest. This information is included in Table A-3.

5.2.4 Structure Relationships

The next step in the analysis is the structuring of relationships among the variables. This is accomplished by completing an impact matrix. The following steps describe the procedure the panel follows in completing this matrix:

- Decide on the range the entries will span.
- Fill out the impact matrix, or matrices.

The panel may select any range of values for assessing the entries to the cells of the matrix. In this case, the study team elected to use a +3 to -3 scale, one which has been used and shown effective in other applications.[1] In order to utilize KSIM, an impact matrix must be developed in which the long-term relationships between the elements are assessed. In filling out each cell of the matrix, the participants must determine:

- Is there a relationship between the two variables? If the answer is yes, proceed to the questions b and c. If the answer is no, enter zero in the cell and proceed to the next cell.
- Is the relationship positive or negative?
- What is the magnitude of the relationship?

Open discussions were important in completing this matrix. All voters shared their thoughts and ideas and votes were reevaluated in light of new ideas. Free exchange and

TABLE A-3. STARTING VALUES FOR TRENDS EVALUATED IN THE KSIM EXERCISE

Trend	Initial Value*
Veterans' Compensation and Pension Benefits	0.45
Military Annual Pay Rate (Basic pay rate plus allowances)	0.44
Total U.S. Population Ages 18-24 Years	0.70
Gross National Product (In constant 1978 dollars)	0.10
Defense Spending (In constant 1978 dollars)	0.24
Unemployment Rate	0.28
Reputation of the Coast Guard	0.70
U.S. Public's Attitude Toward the Military	0.30
Demand for USCG Services	0.80
Workers' Expectations for More Rewarding Work	0.75
Quality of Education in the U.S.	0.30
Reliability of the Workforce	0.60
Attitude of the U.S. Public Toward Formal Authority	0.50
Expectations of Higher Living Standards	0.80
Evolution from Authoritarian Management to Group Decision Making in the U.S. (Quality of Worklife)	0.40

*On a 0 to 1 scale, this was the value of the trend in 1977 as calculated or estimated by the study team.

encouragement of all members resulted in the most useful application of the knowledge and experience of the panel members. Often, however, in the process of answering these questions, it was realized that the variable should be redefined for clarity or as a result of a basic change in understanding of the system. This was very important for, in developing a system, it is necessary to keep refining the meaning of the variables.

For most cells in this impact matrix, the value entered will be constant, that is, the impact of Variable A on Variable B is +2 for all values of Variable A. However, there may be cases where the relationship between variables is conditional. The panel may say, "as A grows, B does too--up to a point--and then it decreases." By drawing out of the panel information about the "point", the rate of growth and so on, a simple function can be formulated that fits the description. As a simple example from this study, consider the impact of the Quality of Education on the Attitude Toward Formal Authority. As the Quality of Education improves, respect for formal authority increases, up to a point, after which the increase in the Quality of Education leads to a decrease in respect for formal authority.[2]

In this study, the project team worked together to develop the entries for the impact matrix and to define conditional relationships. Table A-4 includes the input data for the impact matrix. As noted earlier, the study team used a +3 to -3 scale in developing the entires in the impact matrix. Initial trials of KSIM using this scale, however, yielded distorted results, especially in the relationships between qualitative trends and the economic trends. Thus the study team adjusted the scale used and eventually utilized a magnitude estimation scale to develop these inputs. The review of scales is a normal procedure in using the KSIM technique. Table A-5 contains the input data defining conditional relationships identified by the project team.

After the cell values have been specified, KSIM will

TABLE A-4. KSIM INPUT VALUES FOR IMPACT MATRIX

CROSS-IMPACT SIMULATION (KSIM3): ENTERED DATA

ECONOMIC/SOCIAL TRENDS FOR COAST GUARD

ALPHA VALUES

	VET$	MPAY	YPOP	GNP	DEF$	UERT	RPTA	AMIL	DMND	RWRK	EDUC	RELI	AUTH	LSTD	GRPD	EXOG
VET$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MPAY	0.75	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.03	0.00	0.00
YPOP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GNP	0.00	0.00	0.00	0.00	0.00	-0.50	0.00	0.00	0.00	0.03	0.00	0.01	0.00	0.07	0.07	0.00
DEF$	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UERT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	-0.07	0.00	0.04	0.00	-0.07	-0.02	0.00
RPTA	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.03	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AMIL	0.02	0.07	0.00	0.00	0.07	0.00	0.01	0.11	0.00	0.00	0.00	0.00	0.00	0.00	-0.07	0.00
DMND	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RWRK	0.00	0.01	0.00	0.00	0.00	0.01	0.00	-0.14	0.00	0.00	0.00	-0.07	0.00	0.14	0.07	0.00
EDUC	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.07	0.00	0.00	0.14	0.14	0.00
RELI	0.00	0.00	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.07	0.00
AUTH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.21	0.07	0.00	-0.14	0.00
LSTD	0.03	0.01	0.00	0.00	0.07	0.01	0.00	-0.07	0.00	0.14	0.00	0.00	0.00	0.07	0.00	0.00
GRPD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.14	0.00	0.14	0.00	0.14	0.00	0.07	0.03	0.00
EXOG	0.50	0.50	0.00	0.00	0.00	-0.50	0.00	-0.14	0.00	0.14	0.14	-0.07	0.00	0.14	0.00	0.00

TABLE A-5. CONDITIONAL RELATIONSHIPS INPUT TO KSIM MODEL

INITIAL YEAR: 1977.00 FINAL YEAR: 2004.00 DELTA TIME: 3.00

VALUE OF AN IMPACTED (COLUMN) VARIABLE AS A FUNCTION OF DATE
IMPACT OF DATE ON YPOP STARTING DATE: 1977 INDEX: 2028

1980.00	0.70
1983.00	0.65
1986.00	0.58
1989.00	0.50
1995.00	0.50
1998.00	0.48

GROWTH RATE OF AN IMPACTED (COLUMN) VARIABLE AS A FUNCTION OF DATE
IMPACT OF DATE ON GNP STARTING DATE: 1977 INDEX: 2704

1977.00	0.12
1989.00	0.12
2004.00	0.12

ALPHA VALUE AS A FUNCTION OF AN IMPACTED (COLUMN) VARIABLE
IMPACT OF RWRK ON RWRK STARTING DATE: 1977 INDEX: 1560

0.00	0.14
0.10	0.14
0.10	0.00
0.14	0.00

ALPHA VALUE AS A FUNCTION OF AN IMPACTING (ROW) VARIABLE
IMPACT OF AUTH ON RWRK STARTING DATE: 1977 INDEX: 985

0.00	0.00
0.04	0.00
0.04	0.07
0.10	0.07
0.14	-0.07

ALPHA VALUE AS A FUNCTION OF AN IMPACTING (ROW) VARIABLE
IMPACT OF ELOC ON AUTH STARTING DATE: 1977 INDEX: 938

0.00	0.00
0.05	0.00
0.05	0.14
0.10	0.14
0.10	-0.07
0.14	-0.07

ALPHA VALUE AS A FUNCTION OF AN IMPACTING (ROW) VARIABLE
IMPACT OF GRPD ON AUTH STARTING DATE: 1977 INDEX: 1038

0.00	-0.14
0.04	0.00
0.04	0.01
0.08	0.01
0.14	-0.43

GROWTH RATE OF AN IMPACTED (COLUMN) VARIABLE AS A FUNCTION OF DATE
IMPACT OF DATE ON DEF$ STARTING DATE: 1977 INDEX: 2730

1981.00	0.09
1985.00	0.09

project the changes in the variables. To forecast the changes in the variables, the concept of the model is that a variable will grow and increase in value if the net impact of the other variables in the system is positive. If the net impact of the other variables is negative, the variable will decline or decrease in value. When the net impact is zero, the value of the variable remains constant.

As noted above, KSIM can be used simply for structuring without regard to timing, or timing can be incorporated into the analysis. In the exercises performed in this study, it was deemed useful to utilize the ability to project changes in trends in association with a time scale. In order to forecast the changes in the variables and to associate these changes to a time scale, additional information must be provided.

This requisite information concerns the effects of the range of cell entry values used in the impact matrix. That is, if a range of entry values is +3 to -3, and Variable A affects Variable B with an impact +3, what change in the value of Variable B is implied? Determination of this effect is called "scaling". Where historical growth rate patterns are available or estimable, this scaling factor can be utilized with the cross-impact values to link the projections to a timeframe and the rate of change (or growth) associated with these impacts. In this study, the desired output consisted of projected trends linked to a time scale. Therefore the study team developed a scaling factor. This was done by conducting correlation analysis for various quantitative trends including GNP and Unemployment Rate to determine relative historical growth rates.

Readers interested in the mathematics of deriving and incorporating this "scaling factor" are referred to the two sources listed below:

- KSIM COMPUTER MANUAL

  P. Kruzic & R. Sandys, Technical Note CRES TN 16, SRI, 24 Jan 77.

- "A PRIMER FOR A NEW CROSS-IMPACT LANGUAGE -- KSIM"

  Julius Kane, Technological Forecasting and Social Change, v4, 129-142 (1972).

5.2.5 Execute Program and Interpret Output

Once the input information has been developed by the panel, the simulation can be executed by the computer. The output consists of tabular values for each trend over time (or some number of scenes) and a graphic display of these data. It is often necessary, after a KSIM model is run for the first time, to study the outputs and make revisions to the orginal input. In this study, a number of revisions and modifications were made as the study team expanded and contracted the trends considered, and reassessed impact values and "scaling factors".

The final product of the KSIM analysis is displayed in Tables A-6 and Figure A-1. Table A-6 shows the tabular projection of the values of the trends between 1977 and 2004. Figure A-1 displays these projections graphically. It should be noted that these projections reflect interactions among the trends only; events are not accommodated in KSIM. The trends, as projected by the KSIM analysis, served as baseline input for the trend/event analysis done through the Cross-Impact Simulation discussed below.

6. Cross-Impact Analysis

Analysis of the impacts and implications of the occurrence of events on a system has been a persistent problem in forecasting. Various types of cross-impact techniques have been developed over the past ten years as tools to facilitate this analysis. In FI's opinion, one of the best cross-impact models is the one developed by Selwyn Enzer and his colleagues at the University of Southern California. Because this model is flexible and is specifically geared toward the analysis of trend/event interactions, Enzer's cross-impact model was utilized in this study.

TABLE A-6. TABULAR KSIM OUTPUT

CROSS-IMPACT SIMULATION (KSIM3): RUN RESULTS

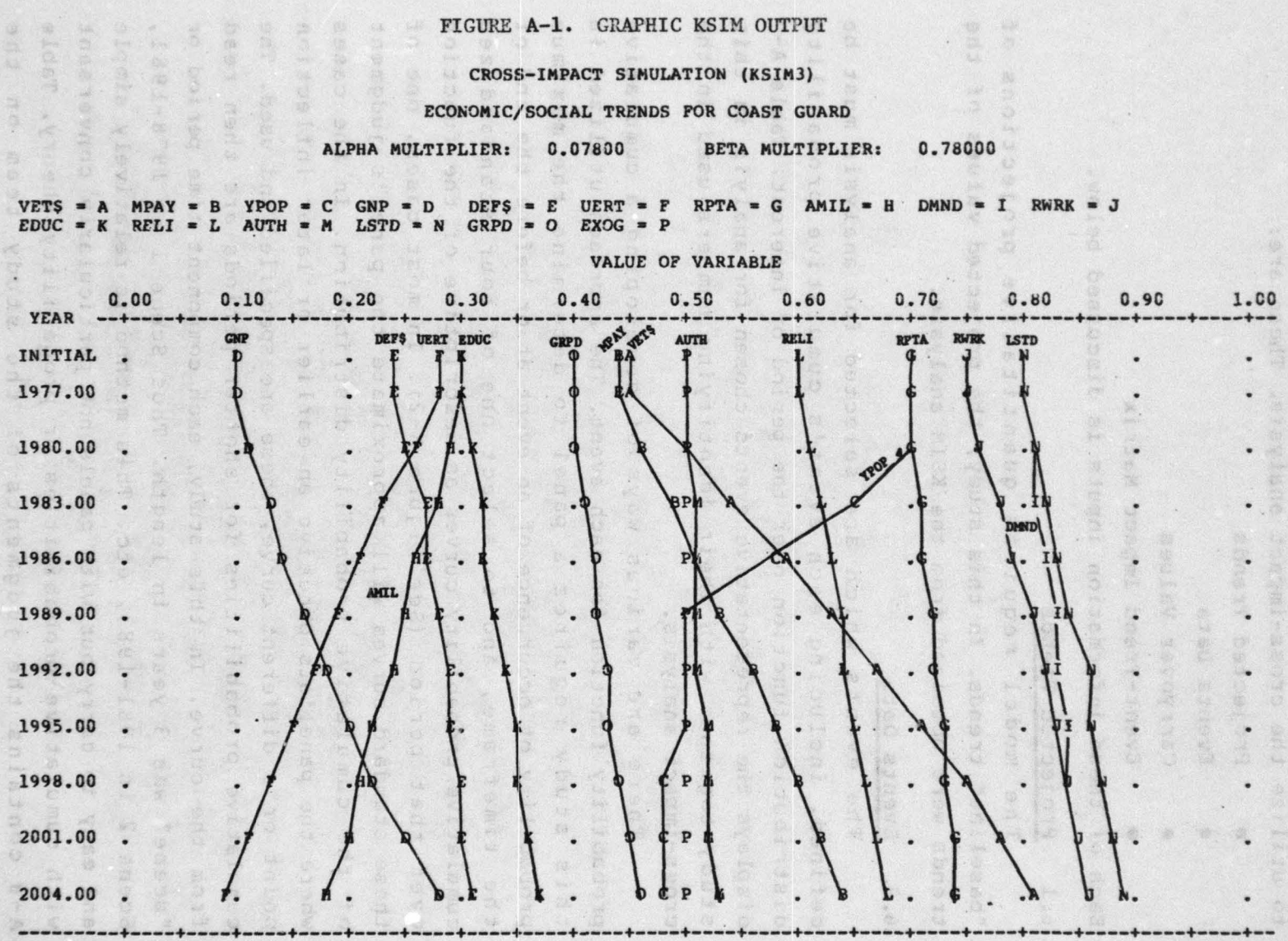
ECONOMIC/SOCIAL TRENDS FOR COAST GUARD

ALPHA MULTIPLIER: 0.07800

VARIABLES

YEAR	VETS	MPAY	YPOP	GNP	DEF$	UERT	RPTA	AMIL	DMND	RWRK	EDUC	RELI	AUTH	LSTD	GRPD	EXOG
INITIAL	0.45	0.44	0.70	0.10	0.24	0.28	0.70	0.30	0.80	0.75	0.30	0.60	0.50	0.80	0.40	0.50
1977.00	0.45	0.44	0.70	0.10	0.24	0.28	0.70	0.30	0.80	0.75	0.30	0.60	0.50	0.80	0.40	0.50
1980.00	0.50	0.46	0.70	0.11	0.25	0.26	0.70	0.29	0.81	0.76	0.31	0.61	0.50	0.81	0.40	0.50
1983.00	0.54	0.49	0.65	0.13	0.27	0.23	0.71	0.28	0.81	0.78	0.32	0.62	0.51	0.82	0.41	0.50
1986.00	0.59	0.51	0.58	0.14	0.27	0.21	0.71	0.26	0.82	0.79	0.32	0.63	0.51	0.83	0.42	0.50
1989.00	0.63	0.53	0.50	0.16	0.28	0.19	0.72	0.25	0.83	0.81	0.33	0.64	0.51	0.84	0.42	0.50
1992.00	0.67	0.56	0.50	0.18	0.29	0.17	0.72	0.24	0.83	0.82	0.34	0.64	0.51	0.86	0.43	0.50
1995.00	0.71	0.58	0.50	0.20	0.29	0.15	0.73	0.22	0.84	0.83	0.35	0.65	0.52	0.86	0.43	0.50
1998.00	0.75	0.60	0.48	0.22	0.30	0.13	0.73	0.21	0.84	0.84	0.35	0.66	0.52	0.87	0.44	0.50
2001.00	0.78	0.62	0.48	0.25	0.30	0.11	0.74	0.20	0.85	0.85	0.36	0.67	0.52	0.88	0.45	0.50
2004.00	0.81	0.64	0.48	0.28	0.31	0.09	0.74	0.18	0.86	0.86	0.37	0.68	0.53	0.89	0.46	0.50

FIGURE A-1. GRAPHIC KSIM OUTPUT



There are four types of information required in order to utilize the cross-impact analysis. These are:

- Projected Trends
- Events Data
- Carryover Values
- Event-Trend Impact Matrix

Each of these information inputs is discussed below.

6.1 Projected Trends

The model requires quantitative projections of "baseline" trends. In this study, the projected values of the trends were obtained from the KSIM analysis.

6.2 Events Data

The events which are selected for analysis must be defined, including each event's cumulative probability distribution function over the period of interest. Table A-7 displays the representative events chosen for analyis in this study together with their identifying numbers used in the cross-impact analysis.

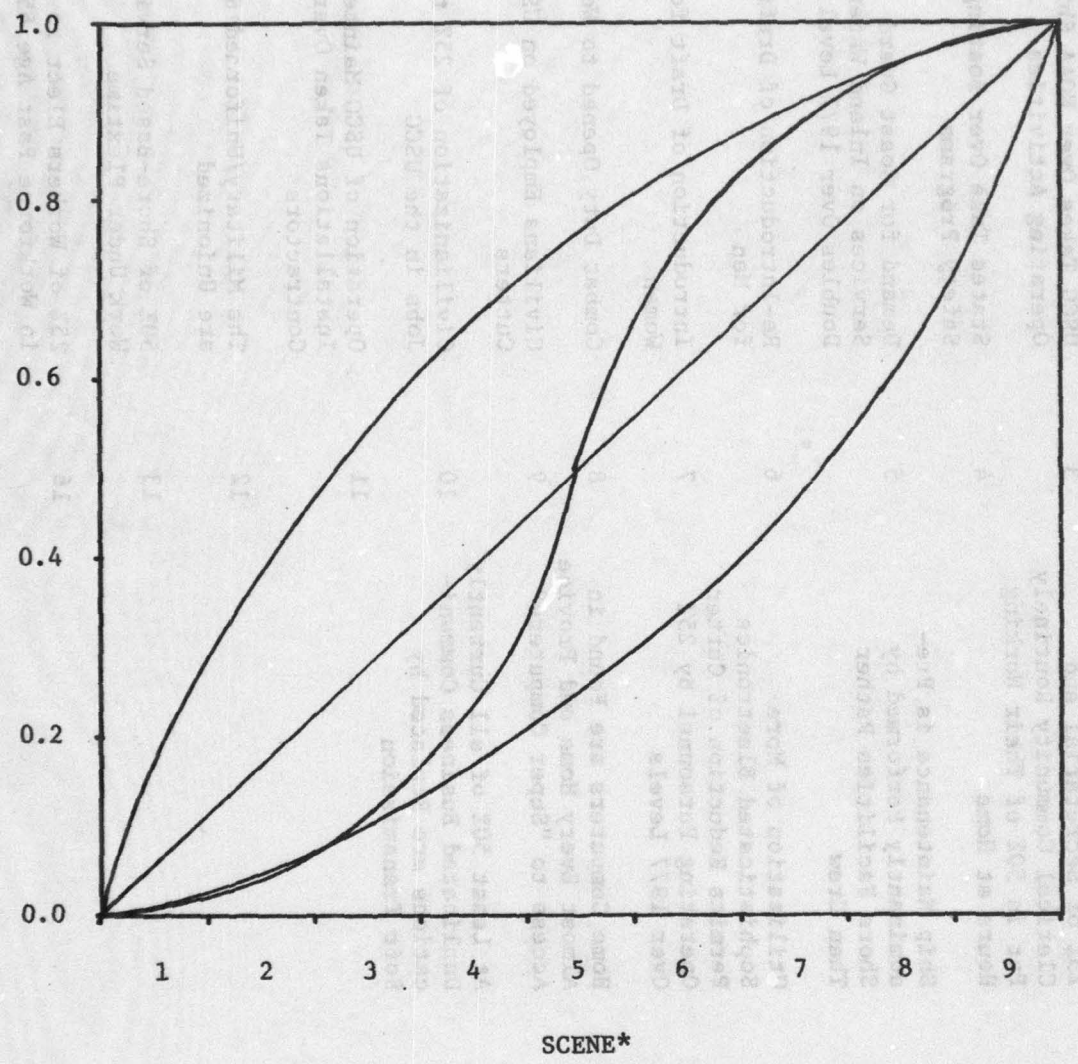
There are various ways of developing a cumulative probability function for each event. The approach utilized in this study requires a panel to determine the maximum probability of occurrence of an event at or before the end of the timeframe, and to select one of four standardized cumulative probability curves as descriptive of the function over that period (See Figure A-2). In most cases, one of these standard curves will approximate the panel's judgment of the cumulative probability distribution. In the cases where the panelists perceive an earlier or later inflection point or a different curve, these are specified and used. The cumulative probabilities for shorter periods are then read from the curve. In this study, each component time period or "scene" was 3 years in length. Thus Scene 1 is 1978-1981, Scene 2 is 1981-1983, etc. This method is relatively simple and easy to carry out with panels not particularly conversant with cumulative probabilities or probability theory. Table A-8 contains the judgments of the study team on the

TABLE A-7. REPRESENTATIVE EVENTS USED IN CROSS-IMPACT MODELING

Event #	Technological
14	15% of the Technical, Professional and Management Community Routinely Put in 30% of Their Working Hours in an Office in Their Home
15	25% of Secretarial and Clerical Community Routinely Put in 50% of Their Working Hours at Home
17	Ship Maintenance is Predominantly Performed by Shore Facilities Rather Than Crew
18	Utilization of More Sophisticated Electronics Permits Reduction of Cutter Operating Personnel by 25% Over 1977 Levels
19	Home Computers are Found in Almost Every Home and Provide Access to "Super Computers"
22	At Least 50% of all Currently Duplicated Business Communications are Replaced by Soft Transmission

Event #	Non-Technological
1	Establishment of a 200-Mile Economic Zone
2	Consolidation of U.S. Ocean-Related Agencies
3	USCG Takes Over NOAA Ship Operating Activities
4	States Take Over Boating Safety Programs
5	Demand for Coast Guard Services on Inland Waterways Doubles Over 1977 Level
6	Re-Introduction of Draft for Men
7	Introduction of Draft for Women
8	Combat Duty Opened to Women
9	Civilians Employed on USCG Cutters
10	Civilianization of 25% the Jobs in the USCG
11	Operation of USCG Maintenance Installations Taken Over by Contractors
12	The Military/Uniformed Services are Unionized
13	50% of Shore-Based Services Work Under Flextime
16	25% of Workers Elect to Remain in Workforce Past Age 65
20	Job Security and Salary are the Main Requirements for Job Satisfaction
21	Workers Place a High Premium on Interesting Work

FIGURE A-2. STANDARDIZED ESTIMATE OF CUMULATIVE DISTRIBUTION FUNCTION (CDF)



*Note: In this study each scene was three years in length.

TABLE A-8. CUMULATIVE PROBABILITY DISTRIBUTION FOR EACH EVENT

INPUT CUMULATIVE PROBABILITIES

EVENT	SCENE 1	2	3	4	5	6	7	8	9
1	0.280	0.450	0.580	0.670	0.770	0.830	0.880	0.920	0.950
2	0.010	0.040	0.080	0.160	0.340	0.420	0.460	0.490	0.500
3	0.020	0.040	0.060	0.100	0.150	0.200	0.260	0.360	0.500
4	0.340	0.700	0.900	0.910	0.920	0.950	0.960	0.980	0.990
5	0.010	0.050	0.120	0.230	0.470	0.580	0.640	0.690	0.700
6	0.010	0.040	0.100	0.200	0.400	0.500	0.550	0.590	0.600
7	0.010	0.020	0.030	0.040	0.060	0.070	0.080	0.090	0.100
8	0.010	0.020	0.030	0.040	0.060	0.070	0.080	0.090	0.100
9	0.010	0.020	0.030	0.040	0.060	0.070	0.080	0.090	0.100
10	0.060	0.110	0.160	0.220	0.280	0.330	0.380	0.440	0.500
11	0.020	0.060	0.090	0.150	0.210	0.280	0.370	0.500	0.700
12	0.030	0.070	0.100	0.130	0.160	0.200	0.230	0.260	0.300
13	0.050	0.200	0.440	0.590	0.690	0.770	0.840	0.880	0.900
14	0.080	0.150	0.230	0.310	0.380	0.460	0.540	0.620	0.700
15	0.080	0.150	0.230	0.310	0.380	0.460	0.540	0.620	0.700
16	0.020	0.040	0.060	0.100	0.150	0.200	0.260	0.360	0.500
17	0.020	0.060	0.090	0.150	0.210	0.280	0.370	0.500	0.700
18	0.020	0.060	0.100	0.160	0.220	0.300	0.400	0.530	0.750
19	0.020	0.060	0.140	0.260	0.540	0.660	0.740	0.780	0.800
20	0.220	0.350	0.460	0.530	0.610	0.650	0.700	0.730	0.750
21	0.020	0.040	0.060	0.100	0.150	0.200	0.260	0.360	0.500
22	0.100	0.200	0.300	0.400	0.500	0.600	0.690	0.790	0.900

probability of occurrence and the curve representing the cumulative probability for each event.

The second item of information required is an assessment of the impact of the occurrence of one event on the probabilities of occurrence of the other events. This estimate is made using an "odds multiplier" since the cross-impact program converts probability data to odds data. The question the panel must answer in each case is: "If Event i occurs, how much more (or less) likely is the occurrence of Event j?"

If the answer is that Event j is more likely, then the panel selects a value greater than 1 as a measure of the increase in likelihood. (eg., If the occurrence of event j is 20% more likely, the multiplier is 1.2). If Event j is less likely to occur the panel selects a value less than one and greater than or equal to 0. (eg., If Event j is 50% less likely to occur then the multiplier is 0.5). If the occurrence of Event i has no impact on the probability of occurrence of Event j, then the response is 1. Table A-9 contains the panel's judgments on the multiplier for each event-event interaction.

6.3 Event-Trend Impact Matrix

The third major piece of information which must be provided is a completed event-trend impact matrix. The events are arrayed down the side of the matrix and the trends head the columns. A panel then assesses the impact of Event i on Trend A, Trend B, etc. The question is answered in terms of the percentage change in the trend if the event occurs. The response will be positive if the event occurrence will cause the trend value to increase, or negative if the trend value will decrease in response to the event occurrence. In this application, the study team conducted the evaluations of the effect of each event on each trend. The study team's assessments are shown in Table A-10.

6.4 Carryover Values

The final item of information required to run the

TABLE A-9. MATRIX OF IMPACT OF EVENTS ON EVENTS*

INPUT LRO VALUES

EVENT	EVENT 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	1.00	1.25	1.00	1.10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.10	1.20	1.00	1.00	1.00	1.00
2	1.00	1.00	10.00	1.20	1.00	1.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	1.00	1.20	1.00	1.00	1.25	1.00	1.00	1.00	2.00	1.00	1.10	1.00	1.00	1.00	1.00	1.00	1.50	1.00	1.00	1.00	1.00	1.00
4	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
6	1.00	1.00	1.00	1.00	1.00	1.00	1.50	1.00	0.80	1.00	1.00	1.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
7	1.00	1.00	1.00	1.00	1.00	99.99	1.00	5.00	0.80	1.00	1.00	1.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
8	1.00	1.00	1.00	1.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
9	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.50	1.50	1.00	1.00	1.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00
10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.20	1.00	1.00	1.00	1.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
11	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.20	1.00	1.00	0.90	1.00	1.00	1.00	1.00	1.50	1.00	1.00	1.00	1.00	1.00
12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.20	0.80	1.00	1.00	1.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.30	1.30	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	10.00	1.00	5.00	1.50	1.00	1.00	1.50	1.00	1.00	2.00
15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	15.00	1.50	1.00	2.00	1.00	1.00	1.50	1.00	1.00	2.00
16	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.50	1.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.20	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
18	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50	0.80	1.00	1.00	1.00	1.00	1.00	1.00	4.00	1.00	1.00	1.00	1.00	1.00
19	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	5.00	5.00	1.00	1.00	1.00	1.00	1.00	0.00	3.00
20	1.00	1.00	1.00	1.00	1.00	0.50	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.20	1.00
21	1.00	1.00	1.00	1.00	1.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.20	1.00	1.00
22	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.10	10.00	10.00	1.00	1.00	1.00	2.00	1.00	1.00	1.00

*If the events in the rows occur, the odds of occurrence of the events in the columns would be multiplied by the factors shown within the matrix.

TABLE A-10. EVENT-TREND IMPACT MATRIX

TREND CROSS-IMPACT

EVENT	TREND 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	-1.00	0.00	-1.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	-0.50	0.00	0.00	0.00	-5.00	0.00	0.00	-2.00	-5.00	-2.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	5.00	0.00	0.00	2.00	0.00	-2.00	-5.00	0.00	1.00	0.00	0.00	-5.00	1.00	2.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	1.00	0.00	2.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	1.00	1.00	2.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	1.00	1.00	2.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	2.00	0.00	0.00	2.00	0.00
20	0.00	0.00	0.00	0.00	1.00	-1.00	0.00	5.00	0.00	-2.00	0.00	5.00	3.00	0.00	-1.00
21	0.00	0.00	0.00	0.00	0.00	1.00	2.00	-2.00	0.00	10.00	0.00	-1.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

cross-impact simulation is a factor called the carryover value. The carryover value is used to express the proportion of impact that continues to affect the trend over time. That is, some events have an impact only for a short period of time and result in a temporary dislocation; other events have a continuing effect and the changes they cause are "permanent". The carryover value permits the users to express this concept and incorporate it into the simulation.

When the input information has been generated, the computer model may be executed. In this study, the study team developed the input data in consultation with other members of the FI staff as needed. The model produces projected trend values over time which reflect the impacts of events on the trend values. Because the projected trend values derived from KSIM were utilized as the baseline for this cross-impact analysis, the final projections obtained reflect trend/trend interactions and the impacts of events on these trends. Table A-11 contains the projected trend values derived from the cross impact analysis while Table A-12 shows the forecast event occurrences.

7. Cross-Support Matrix Analysis

The cross-support matrix was developed to facilitate the quantitative assessment of the relationships among items in one set, e.g. trends. In utilizing the cross-support matrix, the first step is to determine the factors or elements to be examined. As is the case with KSIM, described above, these elements must be distinctly defined. Then a square matrix is constructed, with rows and columns corresponding to the elements to be evaluated. The intersection of each row and column is termed a cell. The cells along the diagonal are blanked out (e.g. the intersection of Element A with Element A). For the remaining cells, (e.g. Element A and Element B) the question is asked: "To what extent does Element A contribute to or support Element B?"

In determining the answer to this question for each cell, a panel of individuals with appropriate knowledge and

TABLE A-11. TREND VALUES OUTPUT FROM CROSS-IMPACT ANALYSIS

AVERAGE TREND VALUES FOR 100 ITERATIONS

TREND	SCENE 1	2	3	4	5	6	7	8	9	10
1	45.0	50.0	54.0	59.0	63.0	67.0	71.0	75.0	78.0	81.0
2	44.0	46.2	49.3	51.8	54.1	57.2	59.3	61.4	63.7	66.1
3	70.0	70.0	65.0	58.0	50.0	50.0	50.0	48.0	48.0	48.0
4	10.0	11.0	13.0	14.0	16.0	18.0	20.0	22.0	25.0	28.0
5	24.0	25.1	27.1	27.2	28.1	29.1	29.1	30.0	30.1	31.1
6	28.0	26.0	23.0	20.9	19.0	17.0	15.0	13.0	11.0	9.0
7	70.0	70.0	70.9	70.9	72.1	72.2	73.1	73.0	73.9	73.9
8	30.0	28.9	27.9	25.6	24.6	23.7	21.8	20.8	19.7	17.4
9	80.0	80.6	80.3	81.5	82.5	82.9	83.9	84.4	85.7	86.6
10	75.0	75.9	77.7	78.9	81.1	81.9	82.9	84.0	85.0	86.1
11	30.0	31.0	32.0	32.0	33.1	34.0	35.1	35.1	36.1	37.1
12	60.0	61.0	62.1	63.1	64.1	64.1	65.1	66.1	67.1	67.9
13	50.0	49.9	50.8	50.6	50.7	50.9	51.9	51.9	51.7	52.6
14	80.0	81.1	82.0	82.9	84.1	86.1	85.8	87.0	88.3	89.1
15	40.0	40.2	41.0	42.4	42.4	43.2	43.2	44.2	45.4	46.4

TABLE A-12. EVENT OCCURRENCES OUTPUT FROM CROSS-IMPACT ANALYSIS

DISPLAY OF ALL OCCURRENCES

EVENT	SCENE 1	2	3	4	5	6	7	8	9	TOTAL
1	24	15	17	8	14	4	10	2	2	96
2	2	1	8	10	20	6	1	1	1	50
3	1	3	4	1	7	5	7	14	12	54
4	31	34	26	1	0	6	1	0	1	100
5	2	4	3	16	15	12	11	4	1	68
6	1	4	13	6	17	13	6	5	0	65
7	2	0	0	1	1	0	0	1	1	6
8	0	0	1	1	1	2	0	0	0	5
9	0	0	2	2	4	1	1	1	1	12
10	9	6	8	10	5	5	6	6	5	60
11	3	4	4	5	5	7	12	7	23	70
12	6	4	9	0	0	3	3	7	5	37
13	3	14	32	10	7	13	9	3	0	91
14	11	6	11	10	3	9	9	6	9	74
15	11	4	16	6	4	8	7	14	7	77
16	1	3	2	3	5	3	9	16	7	49
17	3	5	2	10	2	7	14	11	22	76
18	3	6	2	6	8	4	12	9	22	72
19	3	3	9	17	24	13	11	4	1	85
20	22	14	11	7	8	4	4	3	0	73
21	0	2	3	4	4	6	6	9	15	49
22	11	9	10	10	2	11	10	11	13	87

experience is used, since in most cases there are no "hard" data on which to base an answer. In responding to the question, a quantitative rating scale is used. Each element of the rating scale has an associated prose descriptor. FI has found a logarithmic scale particularly useful in this case and the literature supports this scale based on the observation that human judgment employs geometric comparisons more naturally than arithmetic ones.[3] The scale used is as follows:

Major Contribution	= 8
Considerable Contribution	= 4
Some Contribution	= 2
Negligible Contribution	= 1

The contribution of one element to another may be beneficial (positive) or detrimental (negative). Thus the participants must identify the magnitude and the direction of effect for each cell.

When all cells have been filled (except those on the diagonal), the entries across each row are summed. These figures provide a relative measure of the significance or contribution of each member of the set within the total set. The quantities are then normalized to lie in the range (0,1), to facilitate conceptualization of relative merit.

In this study, the cross-support matrix was used to facilitate the analysis of the areas of concern and their elements. These are:

Area of Concern: Manpower

Elements:
- Long-Range Planning and Programming
- Manning
- Recruiting and Reenlistment
- Training - Initial
- Training - Continuing
- Command and Supervision

Area of Concern: Funds

Elements:
- Long-Range Planning and Programming
- Short-Term Budgeting

Area of Concern: Material

Elements:
- Long-Range Planning and Programming
- Design
- Acquisition
- Deployment
- Repair and Maintenance

Area of Concern: Information

Elements:
- Long-Range Planning and Programming
- Systems Acquisition
- Processing and Storage
- Dissemination

In the cross-support matrix shown in Table A-13, the purpose was to assess the relationship among the critical components of the areas of concern. Essentially the sensitive components indicate the management and resource issues within the organization. Thus the focus of this analysis was to measure the interrelationship among the elements of the system. The study team also examined the cross-support relationships between the elements of the area of concern to determine which were most supported elements. These results of the supportiveness analysis, shown in Table A-14, were utilized in the cross-relevance analysis of trends to elements of the areas of concern, discussed below.

8. Cross-Relevance Matrix Analysis

The cross-relevance matrix technique is similar to cross-support but was designed for assessing the relationships between items in two sets. In this study cross-relevance analysis was used to analyze the relevance of trends to areas of concern. See Table A-15 for a table showing the cross-relevance analysis conducted in this study. Note that each cell is divided diagonally into two parts; for the moment, we will consider only the lower right portion of each cell, which is filled in response to a question similar to that posed in the cross support analysis. That is, "to what extent does Trend A contribute to (affect) Area of Concern X?" The same scale as before ($\pm$8,4,2,1) is used to assess the extent of the interconnection, and the value is entered into the lower portion of the intersecting cell.

TABLE A-13

CROSS-SUPPORT MATRIX: AREAS OF CONCERN

		Manpower								Funds					Material				Information							
	CONCERNS	Long-Range Planning and Programming	Manning	Recruiting and Re-Enlistment	Training - Initial	Training - Continuing	Command and Supervision	Long-Range Planning and Programming	Short-term Budgeting	Long-Range Planning and Programming	Design	Acquisition	Deployment	Repair and Maintenance	Long-Range Planning and Programming	Systems Acquisition	Processing and Storage	Dissemination	TOTAL	NORMAL	RANK
Manpower	Long-Range Planning and Programming		4	4	4	4		8	4	2	1	1			2				34	4.8	11
	Manning				4	8		2	8	1			8	4			2	1	38	5.4	9
	Recruiting and Re-Enlistment	2	8		8	4	4	2	1	1									30	4.2	12
	Training - Initial	1		2		8	4	1					1	2			2		21	3.0	15
	Training - Continuing	2	4	4	8		8	1					2	4			2		35	5.0	10
	Command and Supervision			4	4	4												2	14	2.0	17
Funds	Long-Range Planning and Programming	8	1	4	2	2			2	8	2	8	2	8	8	8	2		65	9.3	3
	Short-term Budgeting	1	8	2	1	1		2		1		8	8	8	8	8	8	4	68	9.7	2
Material	Long-Range Planning and Programming	8			4	4		8	1		8	8	2	2	8	8	2		63	9.0	4
	Design	4	8	2	8	8	4	2		8		8	4	8	2	1	2	2	71	10.1	1
	Acquisition	4	8					4	4	8			4	8	4	4			48	6.8	5
	Deployment	1	8	2		2		1	4	2	2			4	2	1			29	4.1	14
	Repair and Maintenance	2	4		2	2		2	4	4	4	1	4			1			30	4.2	12
Information	Long-Range Planning and Programming	2	1	1		2		2	1	4	4	2		2		4	8	8	42	6.0	7
	Systems Acquisition	2	4	2	1	2		4	4	2	1	2	1	1	4		8	4	42	6.0	7
	Processing and Storage	1	1					2	1	1	2			2	4	2		4	20	2.8	16
	Dissemination	4		2	2	4	2	4	4	4	4	1	4	4	4	1	4		48	6.8	5
	TOTAL	42	59	29	49	55	22	45	38	46	28	39	40	57	46	38	40	25	698	99.2	
	NORMAL	6.0	8.5	4.2	7.0	7.9	3.2	6.4	5.4	6.6	4.0	5.6	5.7	8.2	6.6	5.4	5.7	3.5		99.9	
	RANK	8	1	14	4	3	17	7	12	5	15	11	9	2	5	12	9	16			

TABLE A-14. CROSS-SUPPORT AMONG ELEMENTS OF THE AREAS OF CONCERN
(In Decreasing Order)

	Supporting Areas	Value		Supported Areas	Value
1.	Material Design	10.2	1.	Manning	8.5
2.	Short-Term Budgeting	9.7	2.	Material Repair & Maintenance	8.2
3.	Fund Planning & Programming	9.3	3.	Manpower Training-Continuing	7.9
4.	Material Planning & Programming	9.0	4.	Manpower Training-Initial	7.0
5.	Material Acquisition	6.8	5.	Material Planning & Programming	6.6
5.	Information Dissemination	6.8	5.	Information Planning & Programming	6.6
6.	Information Planning & Programming	6.0	6.	Funds Planning & Programming	6.4
6.	Information Systems Acquisition	6.0	7.	Manpower Planning & Programming	6.0
7.	Manning	5.4	8.	Material Acquisition	5.7
8.	Manpower Training - Continuing	5.0	8.	Information Processing & Storage	5.7
9.	Manpower Planning & Programming	4.8	9.	Material Acquisition	5.4
10.	Manpower Recruiting & Re-enlistment	4.2	9.	Short-Term Budgeting	5.4
10.	Material Repair & Maintenance	4.2	9.	Information Systems Acquisition	5.4
11.	Material Deployment	4.1	10.	Manpower Recruiting & Re-enlistment	4.2
12.	Manpower Training - Initial	3.0	11.	Material Design	4.0
13.	Information Processing & Storage	2.8	12.	Information Dissemination	3.6
14.	Manpower Command & Supervision	2.0	13.	Manpower Command & Supervision	3.2

TABLE A-15

CROSS-RELEVANCE MATRIX: TRENDS VS COMPONENTS OF AREAS OF CONCERN

AREAS OF CONCERN

		MANPOWER						FUNDS		MATERIAL					INFORMATION						
TRENDS	WT	L.R. PLANNING & PROGRAMMING	MANNING	RECRUITING & RE-ENLISTMENT	TRAINING (INITIAL)	TRAINING (CONTINUING)	COMMAND AND SUPERVISION	L.R. PLANNING & PROGRAMMING	SHORT-TERM BUDGETING	L.R. PLANNING & PROGRAMMING	DESIGN	ACQUISITION	DEPLOYMENT	REPAIR AND MAINTENANCE	L.R. PLANNING & PROGRAMMING	SYSTEMS ACQUISITION	PROCESSING AND STORAGE	DISSEMINATION	TOTAL	NORMAL	RANK
		5	5	4	3	5	2	10	9	9	10	7	4	4	6	6	3	7	99		
VETERANS' BENEFITS	1	0 0	0 0	4 16	0 0	0 0	0 0	4 40	4 36	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	92	3	11
MILITARY PAY & ALLOWANCES	1	4 20	2 10	8 32	0 0	0 0	2 4	8 80	8 72	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	218	8	3
US POPULATION AGES 18-24	1	8 40	4 20	8 32	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	92	3	11
GROSS NAT'L PRODUCT	1	4 20	2 10	4 16	0 0	0 0	0 0	4 40	4 36	4 36	0 0	0 0	0 0	0 0	4 24	0 0	0 0	0 0	182	7	6
DEFENSE SPENDING	1	4 20	2 10	2 8	2 6	4 20	0 0	4 40	4 36	4 36	4 40	2 14	4 16	0 0	0 0	0 0	0 0	0 0	246	9	2
UNEMPLOYMENT RATE	1	8 40	2 10	8 32	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	82	3	11
COAST GUARD REPUTATION	1	2 10	0 0	8 32	2 6	2 10	2 4	0 0	0 0	2 18	0 0	0 0	0 0	0 0	2 12	0 0	0 0	0 0	92	3	11
ATTITUDE TOWARD MILITARY	1	4 20	0 0	8 32	2 6	0 0	4 8	2 20	0 0	2 18	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	104	4	9
DEMAND FOR USCG SERVICES	1	8 40	8 40	4 16	4 12	8 40	0 0	8 80	4 36	8 72	8 80	4 28	8 32	4 16	8 48	4 24	2 6	4 28	598	23	1
REWARD'G WORK EXPECTATIONS	1	4 20	4 20	4 16	4 12	4 20	4 8	0 0	0 0	2 18	4 40	0 0	0 0	0 0	4 24	0 0	0 0	4 28	206	8	3
QUALITY OF US EDUCATION	1	8 40	2 10	4 16	8 24	4 20	8 16	0 0	0 0	2 18	2 20	0 0	0 0	0 0	4 24	0 0	0 0	4 28	216	8	3
WORKFORCE RELIABILITY	1	8 40	4 20	2 8	2 6	4 20	8 16	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	110	4	9
ATTITUDE RE AUTHORITY	1	2 10	0 0	2 8	4 12	4 20	8 16	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	66	2	15
LIVING STDS EXPECTATIONS	1	4 20	0 0	8 32	0 0	0 0	0 0	0 0	0 0	4 36	4 40	4 28	0 0	0 0	0 0	0 0	0 0	0 0	156	6	8
EVOL TO GRP DECISION-MKG	1	8 40	4 20	2 8	4 12	4 20	8 16	0 0	0 0	0 0	0 0	0 0	0 0	0 0	4 24	0 0	0 0	8 56	196	7	6
TOTAL	15	380	170	304	96	170	88	300	216	252	220	70	48	16	156	24	6	140	2656	98	
NORMAL		14	6	11	4	6	3	11	8	9	8	3	2	1	6	1	0	5		98	
RANK		1	7	2	11	7	12	2	5	4	5	12	14	15	7	15	17	10			

When all cells have been completed, a further step is necessary in order to provide a valid ranking of the elements of set A (the trends) in terms of their potential contribution or importance to the areas of concern (set B). A simple summation of the cell entries would reflect the assumption that a contribution to any member of set B is equally valuable. In the cross-support analysis previously performed, the study team had obtained a ranking of the components of the areas of concern in terms of their mutual dependence. The impact of any trend on a highly ranked component would be more significant than an impact on a lower ranked element. This aspect was taken into account by multiplying the raw cell entries by the appropriate weighting factors derived from the cross-support analysis, prior to summation of the cell entries across the row. This product of the impact times the area of concern weight is shown in the upper half of the cell.

The row sums were then normalized, as before, to yield a ranking of the trends. The columns were also summed to determine which elements of the areas of concern are most sensitive to the trends. In addition, the cell entries provide information on high impact intersections and highlight key interaction (or problem) areas to be considered in prose descriptions of the matrix output and in conducting the policy analysis.

The matrices provided the linkages between the foregoing analysis and the areas of concern. Key problem areas for each area of concern were identified and provided the basis for the development of policy options which was accomplished by group discussion and debate among the study team members.

9. Conclusions

The preceeding discussion provides a fairly detailed discussion of the methodology and analytical tools utilized in this study. A variety of techniques was employed, but all shared the characteristics of being quantitative and

structured. The analysis was selected on the basis of appropriateness to solving the problem given the quality of data available and desired output.

The techniques employed are particularly valuable because they permit the structured use of "soft" as well as "hard" data. As the analysis has indicated, social and attitudinal factors will play a major role in the utilization and allocation of resources in the Coast Guard. In all cases, the best available data and information have been incorporated to produce the projections of the future environment and its impact on Coast Guard management functions.

APPENDIX A FOOTNOTES

1. Enzer, Selwyn, Richard Drobnick and Steven Alter, Neither Feast Nor Famine (Lexington, MA: D. C. Heath and Company, 1978).

2. For a more detailed discussion of the use of conditional interaction see QSIM 2--A Low Budget Heuristic Approach to Modeling and Forecasting, Wayne Wakeland, Systems Science Department, Portland State University, Portland, Oregon, 97292.

3. See for example S. S. Stevens, Psychophysics: Introduction to Its Perceptual, Neural and Social Prospects (New York: John Wiley and Sons, 1975).

APPENDIX A/ANNEX 1

RESPONDENTS TO QUESTIONNAIRE

The offices listed below responded to the questionnaire distributed by the Coast Guard:

G-BP/TP42
G-CMA/83
G-CPA-3/84
G-CPE/83
G-DD/TP53
G-DP-2/TP54
G-EP/64
G-FP/72
G-H/83
G-K-1/63
G-L-1/84
G-MP/82
G-OP/74
G-P/62
G-PO/3/72
G-R/81
G-WP/73
G-DMT-3

APPENDIX A/ANNEX 2

INTERVIEW PROTOCOL

UNITED STATES GOVERNMENT

Memorandum

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD
G-DSA-3/TP44
3919
Ser: 1434

DATE:

SUBJECT: People Organization Study, Interviews for

FROM: Chief, Safety and Advanced Technology Division (G-DSA)

TO

1. The purpose of this memo is to provide background for the interview scheduled by the Conservation and Advanced Technology Branch (G-DSA-3).

2. The Conservation and Advanced Technology Branch (G-DSA-3) is conducting a study of the Influence of Emerging Technologies and Other Factors on the People and Management of the Coast Guard. Forecasting International, Ltd. (FI), of Arlington, Virginia, is under contract to complete the work.

3. An essential preliminary task of this study is to review the management systems used within the Coast Guard in order to describe the flow of resources and the effects of management systems on those resources. These descriptions will be the basis for selecting areas of concern in the evaluation of the impacts of predicted trends and events. The analysis of the management system is being performed through a literature search defining how the system is designed to work and through this series of interviews describing the way in which it actually operates.

4. Enclosure (1) contains preliminary topics for your interivew and Enclosure (2) is the time plan for the interview. You will be interviewed by a project team representative of Forecasting International. During your interview, feel free to discuss other areas of management which may be of interest to you.

5. Contact for these interviews is LT T.J. Marhevko, G-DSA-3, X61050. Your help with study is greatly appreciated.

H. M. VEILLETTE

Enclosure (1) Preliminary Interview Topics
(2) Interview Information

DEPT. OF TRANSP., USCG, CG-4914 (3-73)

PRELIMINARY INTERVIEW TOPICS

General Questions

1. Please describe the function of your office.

2. We are reviewing the management systems of the Coast Guard in order to describe the flow of resources within the Coast Guard and to pinpoint "control" and decision points.

   a. What is the role of your office in the management of the following resources?

      - o Manpower - Officers
        - Enlisted
        - Civilian
      - o Funds
      - o Information
      - o Materiel
      - o Authority

   b. What problems and/or conflicts do you see in the management of these resources?

Specific Issue Questions

1. Management Issues

   a. What changes should be made in the Headquarters organization, if any? Are all offices appropriately placed and structured? Should any of the functions now present in Headquarters be moved to the field or vice versa?

   b. Should the organization at the District level mirror the Headquarters organization?

   c. Should there be any change in the District structure or number of districts?

   d. How is effectiveness of performance of functions measured in the USCG? Is this measurement adequate?

2. Manpower Issues

a. Is the productivity of the Coast Guardsman decreasing?

b. Should the assignment procedure be changed to reduce rapid turnover in billets requiring expertise in a specialty?

c. Should officers be given more sea duty over the course of their career? More broadly, should all officers be qualified as Seamen?

INTERVIEW INFORMATION

Date:
Time:

Forecasting International representatives(s) conducting this interview:

Person to be interviewed:

(Enclosure 2)

APPENDIX A/ANNEX 3

INTERVIEW PARTICIPANTS

Study of the Influence of Emerging Technologies
and Other Factors on the People and
Management of the Coast Guard

USCG HEADQUARTERS INTERVIEWS

Office of the Commandant	
G-CV/84 Vice Commandant	VADM Robert H. Scarborough
Office of the Chief of Staff	
G-CCS/84 Chief of Staff	RADM J. P. Stewart
G-CPA-3/84 Programs Division, Manpower Utilization Branch, Chief	CDR Joseph T. Bronough
G-CPE/83 Plans Evaluation Division, Plans Branch, Chief	Al Temin
(G-CPE Representative Robert Anthony also participated).	
G-CPE/83 Plans Evaluation Division, Systems Branch Chief	Reynold J. Matthews
G-CAS-5/81 Administrative Services Division, Headquarters Civilian Personnel Branch, Chief	Richard A. Santelli
Office of Boating Safety	
G-Bd/TP42 Deputy Chief	CAPT E. Delaney
Office of Research and Development	
G-DD/TP53 Deputy Chief	CAPT R. T. Platt
G-DP-2/TP54 Planning and Evaluation Staff, Program Analysis	Julius Feldman
G-DOE/TP54 Operations and Environmental Technology Division, Chief	CAPT T. C. Lutton

G-DSA/TP44 Safety and Advanced Technology Division, Chief	CAPT H. M. Veillette
Office of Engineering	
G-Ea/64 Deputy Chief	CAPT G. Mann
G-EEE/63 Electronics Engineering Division, Chief	CAPT William F. Roland
Office of the Comproller	
G-FIS-84 Information Systems Division, Chief	CDR M. Sites
Office of Chief Counsel	
G-L-1/84 Deputy Chief	Rue B. Helsel
Office of Merchant Marine Safety	
G-M/82 Deputy Chief	CAPT W. D. Markle
Office of Operations	
G-OP/74 Plans and Programs Staff, Chief	CAPT W. S. Black
G-OP/74 Plans and Programs Staff	CDR Adam Shirvinsky
G-OP/74	CAPT P. M. Jacobsen
G-ON/74 Navy Liaison Officer	CAPT John R. Kearney
G-000/74 Ocean Operations Division, Assistant Chief	CDR Larry E. Telfer
G-000/74 Budget/Planning Coordinator	LT R. C. Cook and Steve Wehner
Office of Personnel	
G-P-1/2/62 Psychological Research Branch	Richard S. Lanterman
G-P-1/4/62 Financial Management Branch, Chief	CDR Alfred F. Parker

G-PO-2/72 Personnel Services Division, Officer Assignment Branch, Chief	CDR John G. Schmidtman

Office of Marine Environment and Systems

G-WP/73 Plans and Evaluation Staff, Chief	CAPT Charles S. Niederman

Study of the Influence of Emerging Technologies
and Other Factors on the People and
Management of the Coast Guard

USCG FIELD INTERVIEWS

Atlantic Area

Chief of Staff	CAPT D. L. Muir
Operations Division, Chief	CAPT M. W. Hallock
Readiness Division, Chief	CAPT M. Abarbanell
Telecommunications Management Division Chief	CAPT Volkle
Information Systems Division, Chief	CAPT MacDonald

District Three

Operations Division, Chief	CAPT R. L. Jacobs
District Planning Officer	CDR Lauther
Personnel Division, Chief	CDR Bradley

APPENDIX A/ANNEX 4

PANEL PARTICIPANTS' RESUMES

(In Alphabetical Order)

fi **FORECASTING INTERNATIONAL, Ltd.**

STAFF RESUME

ETHELYN F. BISHOP

Senior Research Associate

Education: B. A. (magna cum laude with honors) in Economics, Allegheny College; M.B.A., Harvard University Graduate School of Business Administration; Phi Beta Kappa.

Summary: Primary fields of interest include:

(1) The application of scientific management techniques to the design and development of management information systems and organizational structures.

(2) The application of classic economic principles and modern marketing research techniques to the dissemination of scientific and technical information.

PROFESSIONAL EXPERIENCE

Forecasting International, Ltd. Since joining FI, Ms. Bishop's efforts have focused on the application of market research techniques to the dissemination of scientific and technical information, and on the study of the effect of technological innovations on cost-benefit methodologies for scientific and technical communication.

Computer Command and Control Company (1969-1973). As a Research Analyst, Ms. Bishop was a member of a team which analyzed and evaluated the RDT&E Administration and Control System of the U. S. Marine Corps. She then prepared the system design and user's manual for an information system for Marine Corps RDT&E. She also participated in the definition of the information requirements of the Office of the Secretary of Transportation (OST). During the initial systems study, she analyzed the areas of OST Financial Management and Planning, Programming and Budgeting, determining information requirements and the manner in which they could be satisfied as part of an overall OST Management Information System. The final product of this effort was a five-year phased plan for the practical implementation of the OST Management Information System. Among her other efforts, Ms. Bishop participated in the design and implementation of automated Grants Management and Personnel Information systems for the OST, and in the development of a forms retrieval system for the Office of Education.

ETHELYN F. BISHOP

Department of the Navy, Office of Information Systems Planning and Development (1968-1969). Ms. Bishop initially joined OISPD as a member of the Navy Management Intern Program. Among her rotational assignments as an intern, she carried out a survey of the state-of-the-art in management information system networking, and analyzed the information modes employed by the Navy's Office of Program Analysis.

As a program analyst, she was directly involved in structuring and implementing the first financial review of Department of Navy information systems and ADP requirements. This review included analyzing each major information system proposed within the Navy and recommending appropriate budgetary action to the Special Assistant to the Secretary of the Navy.

Department of the Navy, Special Projects Office (1967-1968). Ms. Bishop served as branch analyst for Manpower Branch of the Special Projects Office. Her duties included preparing the manpower budget for the Fleet Ballistic Missile System and staffing various management studies.

Representative Publications:

An Application of Market Research Techniques to the Dissemination of Scientific and Technical Information - Interim Report, Ethelyn F. Bishop and Norman Nisenoff, Forecasting International, Ltd., February 1977 (to be published by NTIS).

"Impacts of Fee for Service and Other Technical Innovations", Audrey Clayton and Ethelyn Bishop. Presented at the Engineering Foundation Conference, Easton, Maryland, August 1976.

Marine Corps RDT&E Administration and Control System: Analysis and Evaluation, Report 153-1, CCCC, February 29, 1972.

U. S. Office of Education Data-Collection Instrument Analysis System: Description of the System, User's Guide and Thesaurus, Report 147-4, CCCC, September 1971.

Department of Transportation Personnel Query System: User's Guide and Systems Documentation, Report No. 136-9, CCCC, March 1971.

A Management Information System for the Office of the Secretary of Transportation, Volume IV-Financial Management Information System, Report 136-5, CCCC, January 9, 1970.

ETHELYN F. BISHOP

A Management Information System for the Office of the Secretary of Transportation, Volume V-Planning, Proramming and Budgeting Information System, Report 136-5, CCCC, January 9, 1970.

Relevant Reports Under Subcontract:

Bishop, Ethelyn and Audrey Clayton (Forecasting International, Ltd.) "User Values of Information Service Characteristics", Working Paper 703-76-7; Atlanta: Metrics, Inc., July, 1976.

Bishop, Ethelyn, Audrey Clayton, and Norman Nisenoff (Forecasting International, Ltd.), "Impacts of Technologies on IAC-User System", Working Paper 703-76-8, Atlanta: Metrics, Inc., July, 1976.

FORECASTING INTERNATIONAL, Ltd.

STAFF RESUME

MARVIN J. CETRON

President

Education - B.S. in Industrial Engineering, Pennsylvania State University. M.S. in Production Management, Columbia University. Ph.D. in Research and Development Management, American University.

Summary - Dr. Cetron is the founder and president of Forecasting International. A pioneer and expert in the areas of technological forecasting and technology assessment, he has structured FI so that it may provide industry and government with the benefits and insights of an international group of experts in the fields of management techniques; technological forecasting; corporate strategic planning; technology assessment; R&D planning; project slection; resource allocation; economics; marketing and the behavioral sciences. Dr. Cetron is the principal investigator at FI and has had extensive experience with government agencies, foreign governments and industry.

PROFESSIONAL EXPERIENCE

Forecasting International, Ltd. (Since June 1971). Dr. Cetron contributes to and provides continuing guidance and supervision to the majority of FI studies. Some specific areas in which he has contributed and directed operations are: aviation, "How Technology Transfer Affects the Competitive Position of the U. S. in the Aviation Market"; communications, "The Impact of Bidirectional Broadband Communications on the Urban Environment" and "Potential Impacts of Telecommunications Technology on U. S. Cities 1973-2000"; electronics, "Analysis of the Implications of Electronic Funds Transfer on Selected Social Parameters"; housing, "Public Housing Management: A Synopsis and State-of-the-Art Bibliographies"; medical, "A Medical and Health Care Scenario of the Future"; energy conservation, "A Resource Allocation Model" for the ERDA Conservation Program; environment, "Development of a Management Tool to Aid in the Allocation of Resources"; energy, "Societal and Political Implications of the Energy Crisis," "A Technological Forecast of the Coal Industry," and "Energy and the European Economic Community"; technology assessment, "State-of-the-Art and Bibliography of Available Forecastings" and "Pre-definition Phase Study of How a Technology Assessment Might be Run for the EEC"; marine, "Development of a Program Assessment Model for the U. S. Coast Guard"; management, "A Study of Political Improvements to the U. S. Army Materiel Command's Product Improvement Program"; future environment, "Europe in the Year 2000", "Problems, Crises and Issues in the Future Environment"; consumerism, "Sweden as a Precursor Nation".

MARVIN J. CETRON

U. S. Navy (19 years). Dr. Cetron completed a career in R&D planning and forecasting with the U. S. Navy, both in its laboratories as Assistant to the Technical Director at the Applied Science Laboratory and Head of Planning at the Marine Engineering Laboratory, and as Head of Planning for Exploratory Development at Headquarters, Naval Material Command in Washington. During his work with the Navy, he was in charge of the design, development and implementation of the most comprehensive technological forecast in the United States.

Consulting Experience. He has been a consultant to First National City Bank, General Motors, B&W Tobacco, Colgate, Clorox, GT&E, Union Carbide, Xerox, IBM, Mead-Johnson, the U. S. National Academy of Engineering, the Royal Swedish Academy of Engineering Science, National Science Foundation, UNESCO, OECD, the Common Market, and to many foreign governments, including most recently, the Brazilian Ministry of Planning, Kenyan Ministry of Finance, and the Yugoslavian Ministry of Economics.

Professorial Experience. Dr. Cetron is Adjunct Professor at American University and teaches graduate courses at MIT, Georgia Tech, and George Washington University. In addition, he has lectured extensively throughout the world on technological forecasting, technology assessment, and R&D planning.

Publications:

Along with numerous articles, papers and publications, he has authored, coauthored, or edited ten books on quantitative R&D planning:

Technological Forecasting: A Practical Approach, Gordon and Breach, 1969.

Technical Resource Management: Quantitative Methods, MIT Press, 1970.

The Science of Managing Organized Technology, (4 Vols.), Gordon and Breach, 1971.

Industrial Applications of Technological Forecasting: Its Use in R&D Management, John Wiley and Sons, Inc., 1971.

The Navy Technological Forecast, 1968, 1969, and 1970.

MARVIN J. CETRON

Technology Assessment in a Dynamic Environment, Gordon and Breach, 1972.

The Methodology of Technology Assessment, Gordon and Breach, 1972.

Quantitative Decision-aiding Techniques for R&D Management , Gordon and Breach, 1972.

Proceedings of the NATO Advanced Study Institute on Technology Transfer, Nordhoff Press, Holland, 1974.

Industrial Technology Transfer, Nordhoff Press, Holland, 1977.

The first two of these books were awarded the ARMED FORCES MANAGEMENT LITERARY AWARDS in 1969 and 1970, respectively.

He is also Editor-in-Chief of the Technology Assessment Journal and on the Editorial Advisory Board of Technological Forecasting and Social Change and the IEEE Transactions on Engineering Management. He is also a member of the Coast Guard R&D Advisory Committee.

STAFF RESUME

AUDREY CLAYTON

Vice President
Senior Scientist

EDUCATION: B.Sc. Hons. (1st class) in Pure Mathematics, Manchester University, England; M.Sc. in Mathematical Logic, Manchester University, England.

SUMMARY: Following post-graduate work with A.M. Turing and F.C. Williams, key researchers in the development of the first electronic computers in England, Ms. Clayton has worked in most areas of computer design, specification and application, as well as producing technical reports, books, proposals and monographs on related subjects over a period of 20 years. Since joining FI, she has undertaken a wide variety of technological forecasting, technology assessment and resource allocation studies. Ms. Clayton has been selected for inclusion in the 1979 Editions of Who's Who in Technology Today and Technology Transfer Directory.

PROFESSIONAL EXPERIENCE:

Forecasting International, Ltd. (Since 1974). Ms. Clayton has played a leading role in a set of complementary studies in the area of scientific and technical communication, investigating probable future developments and their impact in military, academic and commerical applications. She was senior team-member in a three year project to utilize Swedish social, economic and legislative experience as a precursor to the United States in various areas of consumer affairs. Other recent efforts of major significance include the conceptual design of advanced publication systems; a prediction of Navy aviation logistics requirements in the period 1985-1995 under various scenarios; and the preparation of technology forecasts and system conceptualizations for the U.S. Army for the time-frame 1990-2000. Ms. Clayton is a member of the FI Management Council and in this capacity assists in the assignment of personnel to current and projected studies. She has also served as Corporate Secretary since 1976.

Computer Command and Control Company (1969-72). Ms. Clayton worked on several projects involving systems analysis and technical report preparation. One major effort for the Assistant Secretary of Research and Technology in the Department of Transportation required her to survey the R&D management information systems used by other governmental agencies, develop criteria, evaluate the findings and prepare a final report.

Melpar Incorporated (1959-60). As a Senior Engineer, Ms. Clayton was engaged in the design, analysis and evaluation of a large-scale special purpose data-processing system for a classified military application. She also collaborated in the formulation of the

AUDREY CLAYTON

preliminary specifications and design for the translator component required to link a modified Burroughs 220 computer with the rest of the system.

National Cash Register Company (1957-59). As a Systems Analyst at the Electronics Division in California, and later as Senior Research Specialist in the Research Division in Ohio, Ms. Clayton was chiefly occupied in the preparation of proposals for special-purpose computer systems, and in their design and analysis, including the area of self-organizing systems.

Alwac Corporation (formerly Logistics Research Corporation) (1956-57). First as staff mathematician and senior programmer, and later as the assistant head of the Applications Department, Ms. Clayton was resonsible for drawing up specifications for new systems, and instructions for the use of current systems. Her duties included giving training courses for customer personnel and she spent some time in Sweden as advisor to the sales agent for the Alwac computer.

University of Toronto, Computation Center (1953-56). When a Ferranti computer was installed, Ms. Clayton left Ferranti Ltd. to occupy the position of Technical Librarian for the Computation Center, and to assist in training and support programs connected with the computer.

Ferranti Ltd. (1951-53). The Computer Group at Ferranti Ltd. worked in close association with the staff of the University of Manchester in the design and later production of the first electronic computers. Ms. Clayton worked with them first as a graduate student, later as a programmer and instructor to new staff. She was also co-author and editorial assistant for a definitive book on computers: B. V. Bowden (ed.), "Faster Than Thought," Sir Isaac Pitman, 1951.

PUBLICATIONS AND PRESENTATIONS:

"Renewable and Non-Renewable Resources" with Marvin J. Cetron. Presentation at the National Workshop on Future Challenges in Renewable Natural Resources, Rosslyn, Virginia, January 22, 1979.

The Impact of Future Communications Technologies on the Printing and Publishing Industry, with Norman Nisenoff (Arlington, Va.: Forecasting International, Ltd., January 1979).

"The Privacy of Computerized Records -- The Swedish Experience and Possible U.S. Policy Impacts" with Norman Nisenoff and Ethelyn Bishop, Information Processing and Management (Publication pending).

STAFF RESUME

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"Investigating Potential Value Changes" with M. J. Cetron, in Futures Research: New Directions (Reading, Mass.: Addison Wesley, 1977).

Potential Impacts of Automation and User Fees Upon Technical Libraries, with Norman Nisenoff, NTIS publication PB 271 418/6WL (Springfield, Va.: National Technical Information Service, 1977).

"Impacts of Fee for Service and Other Technical Innovations" with Ethelyn Bishop. Presented at the Engineering Foundation Conference, Easton, Maryland, August 1976.

"Consumerism: The Swedish Experience as a Forerunner". Presented at the Engineering Foundation Conference, Henniker, New Hampshire, July 1976.

A Forecast of Technology for the Scientific and Technical Information Communities with Norman Nisenoff, NTIS publication PB 253-937 (Springfield, Va.: National Technical Information Service, 1976).

The Influence of Technology Upon Future Alternatives to the Scientific and Technical Journal with Norman Nisenoff, (Arlington, Va.: Forecasting International, Ltd., 1975).

"Social Forecasting: A Practical Approach" with M. J. Cetron, in Andrew A. Spekke (ed.), The Next 25 Years (Washington, D. C.: The World Future Society, 1975).

The Future of the Scientific Journal: Potential Alternatives 1974-2000 with Norman Nisenoff, and Sue Gardner (Arlington, Va.: Science and Technology Publishers, 1974).

State-of-the-Art and Bibliography of Available Forecastings with Marvin J. Cetron, and Sue Gardner (Arlington, Va.: Science and Technology Publishers, 1974).

"Military-Type Computers", Military Systems Design. 1961.

Co-author, Faster Than Thought, ed. B. V. Bowden (London, England: Sir Isaac Pitman, 1951).

Forecasting International, Ltd. Internal Reports

The Implications for R&D in Electro-Technology of the President's Budget for Fiscal Year 1980, February 20, 1979.

STAFF RESUME

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Funding of Research and Development, January 1979.

Forecasting the Effects of Events on Consumer Affairs: Phase II Final Report, September 1978.

Technology Forecast and Systems Conceptualizations for the Battlefield of the Year 2000. August 1978.

A Prediction of Naval Aviation Logistics Requirements, 1985-1995. May 1978.

Statement to the Senate Subcommittees on Science, Technology and Space; and International Finance, Concerning U.S. High Technology - Impacts on U.S. Policy Affecting World Markets, May 16, 1978.

Costs and Benefits of Some Alternative Information Delivery Systems of 1985. March 1977.

Technology Assessment of the Impact of Two Innovations Upon Technical Libraries. March 1977.

Forecasting the Effects of Events on Consumer Affairs: Phase I Final Report, October 12, 1976.

A Series of Eight Questionnaires on Scientific and Technical Communication, in the Areas of:

Computer Hardware
Mini-Computers and Micro-Computers
Auxiliary Storage
Software
Input-Output
Communication
Scientific and Technical Information Handling
Publication and Distribution

Prepared and Distributed for the National Science Foundation, April 1975.

A Questionnaire in the Area of Scientific and Technical Information Handling. Prepared for ASIS 37th Annual Meeting, March 1975.

A Report of the State-of-the-Art in Technological Forecasting and Which Forecasts are Available for Use. October 1, 1974.

A State-of-the-Art Report on Alternatives to the Scientific and Technical Journal. September 1974.

AUDREY CLAYTON

Computer Command and Control Co. Internal Reports

Analysis of 13 Federal R&D Management Information Systems. June 1972.

Design of a Nationwide Telecommunications System for Monitoring and Control of Transport Vehicles. October 1971.

STAFF RESUME

CHARLES F. McFADDEN

SENIOR RESEARCH ANALYST

Education: B.S. (Engineering), U. S. Coast Guard Academy; Graduate, Armed Forces Staff College; M.S. (Technology of Management - Operations Research), The American University.

Summary: Throughout his career Mr. McFadden has been involved with management planning, analysis and support, including extensive experience as an officer in the U. S. Coast Guard in ranks of Ensign through Commander, in assignments with emphasis on administration, training, research, and practical and quantitative problem-solving.

PROFESSIONAL EXPERIENCE

Forecasting International, Ltd. (Since 1976). Mr. McFadden contributes management and analytical skills in the marine area tempered by personal at-sea experience.

Systems Consultants, Inc. (1976). Systems Analyst assigned to the DDG-47 destroyer project for the Naval Sea Systems Command (PMS 389), engaged in work breakdown structure development and other aspects of the project's business management system.

U.S. Coast Guard Headquarters, Plans and Programs Staff (3 years). Responsible for program analysis, studies and projects related to seven operating programs, and development of operational requirements for new vessels. Assistant Staff Chief.

Contributed to development of a method for quantifying relative utility among program objectives, and performed the analysis for five programs; the resulting ranking is used as a tool for top management budgetary decision-making in the Coast Guard.

Managed a manning structure project for a new ship class having sophisticated and integrated command control features and equipment. The project successfully culminated in explicit descriptions of support functions and billets which might be transfered ashore, thereby providing a basis for modernizing traditional on-board/ashore support and manning concepts.

Developed, in conjunction with other project members, a comprehensive procedure for defining operational requirements for new ship classes, and considering alternatives and trade-offs in the early design phases of the ship acquisition process. Subsequently applied this innovative procedure to the development of designs for two new ship classes.

STAFF RESUME

CHARLES F. McFADDEN

Supreme Allied Commander Atlantic, General Plans Section (2 years). Responsible for developing, analyzing and revising various plans and documents for emergency control of shipping. Shipping Staff Officer.

Successfully planned and managed the development of a worldwide census and display of merchant ships (by characteristics, voyage and cargo information), including training an inexperienced team in data collection, coordinating with data processing and graphics groups, prescribing output formats and rules for hypothetical ship movements, and writing textual portions of the resulting publication.

Ninth Coast Guard District Headquarters, Readiness Branch (4 years). Responsible for development of emergency plans and for readiness and operational evaluation of field activities. Branch Chief.

Publications:

Mr. McFadden has authored or contributed significantly to the following recent publications:

"Evaluation of the Maritime Administration Research and Development Responsibilities in the Future World Environment," Forecasting International, Ltd., April 1979.

"A Study of USCG Surveillance Requirements Over the Next 25 Years and Development of a Surveillance R&D Program," Forecasting International, Ltd., April 1979.

"Report on the Feasibility of Mission Module/Cutter Configurations for Performance of Coast Guard Missions in the Coastal Zone in the 1985-2000 Period," Forecasting International, Ltd., October 1978.

"A Methodology for Utilizing the Experience and Knowledge of Coast Guard Flag Officers as Major Inputs into Policy Formulation for the Coast Guard," Forecasting International, Ltd., September 1978.

"U.S. Army Metrication: Analysis and Recommendations for DA Implementation Plan," Forecasting International, Ltd., June 1978.

"Impacts of Future Trends and Events on the Coast Guard and a Future Marine Environment Scenario," Forecasting International, Ltd., March 1977.

"An Analysis of the Relevant Factors and Forecast of Events Affecting U.S. Offshore Management and Security in the 200-Mile Zone", Forecasting International, Ltd., December 1976.

"WMEC-270 Manning Analysis", U.S. Coast Guard, March 1976.

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STAFF RESUME

NORMAN NISENOFF

Vice President
Director of Energy Research and
Telecommunications Analysis

Education - B.S. in Electrical Engineering, Purdue University; Masters degree in Electrical Engineering, Rutgers University.

Summary - Primary fields of interest include:

(1) Technological forecasting and assessment investigations for government and industrial organizations in the areas of energy utilization, production and telecommuniction analysis.

(2) Management structuring, operations and the design of systems to support management, both from an operational and executive standpoint.

(3) The total design, evaluation and utilization of communications teleprocessing and electronic data processing systems incorporating hardware, software, applications and usage requirements.

PROFESSIONAL EXPERIENCE

Forecasting International, Ltd. - Since joining FI, Mr. Nisenoff has been involved in a broad spectrum of projects, particularly in the areas of communications (human and mechanized) as well as in the areas of "high" technology and their effects upon the social, political and economic fabric of a nation, region or a segment of society. The projects range from an investigation into the social/political affects of the application of advanced telecommunication technologies upon the inner city, to an analysis of viable alternatives to the Scientific Journal in the year 2000, an evaluation of Anti-Submarine Warfare techniques and their relationship to Navy goals, and an evaluation of the energy crises in the EEC.

Virginia Research, Inc. - At VRI, Mr. Nisenoff served as Director of the Management Systems Division. In this capacity, he was concerned with the design of a Mangement Information System for the United States Postal Service and the development of a rational and realistic approach to performing economic analyses for a component of the U. S. Navy.

Computer Command & Control Company - Mr. Nisenoff joined Computer Command and Control Company in September 1967, was appointed Technical Director in May 1968, and became Vice President in November of the same year. His responsibilities included project management, proposal supervision, and development of new areas of business for the company. During his employment at CCCC, he was directly involved in, among many other programs:

(1) The design of a large nationally distributed computer/communications system;

(2) The performance of an anti-submarine warfare study;

(3) The specification, design and implementation of a Management Information System for the Office of the Secretary of Transportation;

(4) The identification and design of an administrative management system (involving both manual and automated components) for the U. S. Marine Corps.

Earlier Experience - Prior to joining CCCC, Mr. Nisenoff was employed by Honeywell for five and one-half years. He was responsible for technical planning in the Engineering Division, served as the Principal Engineering Consultant to the Marketing Division, and was the manager of the Advanced Systems Department. During that time, he directed the MILDATA study project for the U. S. Army Electronics Command. MILDATA was concerned with design of the Field Computer system to be employed in the time from 1975-1985.

From 1957 to 1962, Mr. Nisenoff was employed by the National Cash Register Company as the Head of the Research Analysis Department. He was responsible for initiating and directing advanced programs in both hardware and systems. Prior to that, he was directly involved in the development of digital computers and data processing systems. Of particular note was the fact that Mr. Nisenoff was the project engineer in the procurement of the DYSEAC computer in 1953-1954. The DYSEAC was the world's first mobile, truck-mounted modern electronic digital computer. From 1954 through 1957, he directed the conceptual phases of the FIELDATA project, and procured the MOBIDIC computer system. The FIELDATA system was the first system designed which incorporated the use of several structured central processors, capable of inter-communicating. These processors were so designed that programs prepared for the smaller units could be run on larger members of the family.

NORMAN NISENOFF

Professional Activities - Mr. Nisenoff has published many articles and reports, primarily in the areas of advanced systems, hardware implementation and technological forecasting. He is a member of the IEEE and has been active both at the local and national level. He is currently a member of the IEEE Awards Committee and a member of the Systems Committee of the IEEE Computer Group. In addition, he has served as chairman of the Technology Subcommittee of the IEEE Computers and Communications Committee from November 1968 to May 1971. In December 1972, Mr. Nisenoff was appointed to the Technology Assessment and Forecasting Committee, where he is leading a group concerned with the future of the computer industry. Mr. Nisenoff has also served as an assistant program chairman of the spring COMP-CON 74, where he presided at the tutorial session. He has also chaired two sessions concerning Technological Forecasting in the Computer Field during the fall COMP-CON 74, and conducted a session at the COMP-CON 75.

Selected Publications

1. Nisenoff, N., "Policy Capturing: A Technique for Obtaining Consensus Judgments", to be published in Technological Forecasting and Social Change.

2. Nisenoff, N., "The Engineer in the Information Environment of 2000 AD", to be published in Proceeding of EASTCON 1976, Sept. 1976.

3. Nisenoff, N., and A. Clayton, "A Forecast of Technology for the Scientific and Technical Information Communities", Forecasting International, Ltd., Four Volumes, May 1976.

4. Nisenoff, N., and A. Clayton, "The Influence of Technology Upon Future Alternatives to the Scientific and Technical Journal", Forecasting International, Ltd., Three Volumes, October 1976.

5. Nisenoff, N., and G. Foster, "Development and Implications of a Technique for Quantifying Technology", Paper presented at the NATO Advanced Study Institute on Industrial Technology Transfer, July 1975.

6. Nisenoff, N., "Negative Consequences of Technology", Second General assembly of the World Future Society, Washington, D.C., June 1975.

NORMAN NISENOFF

7. Nisenoff, N., and M.J. Cetron, "Technology Forecasting and Assessment in the Telecommunications Field", IEEE Manpower Report 1974, New York, N.Y., IEEE, 1974, pp. 2-1 thru 2-44.

8. Nisenoff, N., "The Curent State-of-the-Art and Future trends in Computer/Communications Systems in the United States", Invited Paper, JEIDA Computer conference, Tokyo, Japan, October 3-5, 1973. This paper has been published in the "Processing of the tutorial on computer Peripherals", COMP-CON 74, February 25, 1974.

9. Nisenoff, N., "The Use of Management Information Systems for Police Operations", 12th American Conference, TIMS, Detroit, Michigan, October 1, 1971, 26 pp.

10. Nisenoff, N., "Design of Distributed communications System - A Case Study", Fall Joint Computer Conference, 1969, 17 pp.

11. Nisenoff, N., "Hardware for Information Processing Systems: Today and in the Future", Proceedings of the IEEE, Vol. 54, No. 12, December 1966, 16 pp.

12. Nisenoff, N., "Scratchpad Memories at Honeywell: Past, Present and Future", Proceedings of the FJCC 1965, Vol. 27, pp. 679-688.

FORECASTING INTERNATIONAL, Ltd.

STAFF RESUME

SHARON E. SUGAREK

Vice President

EDUCATION: BA in Biology from Rice University, with minor in Economics. Graduate courses in Business Administration, Accounting and Management Science at George Washington University.

PROFESSIONAL EXPERIENCE:

Forecasting International, Ltd. (1975 to date). Ms. Sugarek has considerable expertise in the development of resource allocation models, scenario generation, and socio-political, economic and technological impact analysis. Currently, she is the Principal Investigator on a study of future environmental legislative and regulatory constraints and their implications for U.S. Army environmental R&D. Recently she has served as Principal Investigator on major corporate-sponsored projects to develop alternative scenarios of the office of the future and of consumer products markets.

She has participated in several major studies for the U.S. Coast Guard including a forecast of the future marine environment, development of a methodology to utilize senior personnel inputs in the planning process and an analysis of personnel and management options in the future. She has worked on the development of resource allocation models for several government agencies including ERDA and FDA.

Ms. Sugarek has also been a principal contributor to FI studies dealing with Zero Population Growth, The Future Environment of the Food and Drug Administration, and the Problems, Crises and Issues of the Future World Environment. She has utilized the Delphi technique to ascertain future developments in periodontal technology and substitution analysis to project product market shares. Her most recent work in comparative analysis has been the development and application of a technique for evaluating the relative business attractiveness of overseas locations for corporate clients. Ms. Sugarek is a member of the FI Management Council and in this capacity she participates in the firm's resource allocation and corporate development decisions.

Journal for the International Society for Technology Assessment (1975 - 1978). Ms. Sugarek served as Associate/Managing Editor for the ISTA Journal. Her responsibilities in this capacity included overseeing the day-to-day operations involved in publishing this professional Journal. She served as the liaison between authors and the Society and between the publishers and the editorial board and coordinated all work with guest editors. In addition, she wrote the "Under the Cover" column and editorials.

SHARON E. SUGAREK

M.D. Anderson Hospital & Tumor Institute (1973 - 1975). Ms. Sugarek designed and conducted all phases of pharmacology research on experimental anti-tumor agents. She designed the research approach, planned and conducted the background literature search, prepared interim and final research reports, prepared and edited grant proposals, designed and conducted laboratory work and evaluated and prepared data for publication. She also supervised students doing summer research projects.

U.S. Peace Corps, The Gambia, West Africa (1971 - 1973). As a junior secondary school science teacher, Ms. Sugarek taught all aspects of science including tropical applications and topics. She wrote a 4-year curriculum proposal for the school system, which the National Department of Education adopted in part and developed teaching plans for special topics, which were used throughout the country. She supervised in-service teacher training workshops for local teachers and developed and implemented various segments of training programs for new volunteers.

PUBLICATIONS:

System Stability and Business Attractiveness of Selected Latin American Countries: Projections to 1995, 1979.

Technological Forecast of the Future Environment and Its Effects on the Tobacco Industry (update of the 1976 study), 1978.

Three Alternative Scenarios for the Office of the Future, 1978.

Methodology Utilizing the Experience and Knowledge of Coast Guard Flag Officers as Major Inputs into Policy Formulation for the Coast Guard, 1978.

U.S. Army Metrication: Analysis and Recommendations for DA Implementation Plan, 1978.

A Technological Forecast of the Future Environment and Its Effects on a Laundry Products Manufacturer, 1977.

An Assessment of the Attractiveness of Selected Northern European Countries for Consumer Financial Services, 1977.

An Assessment of the Attractiveness of Selected Southern European Countries for Consumer Financial Services, 1977.

SHARON E. SUGAREK

PUBLICATIONS:

Description of the Future (1985 - 2000) Marine Environment and Its Implications for Coast Guard Long Range Planning, 1977.

A Technological Forecast of the Future Environment and Its Effects on the Tobacco Industry, 1976.

Competitive Position of the U.S. Aviation Industries in the World Market, August 1976.

Energy Conservation Program Resource Allocation Scoring Model, 1976.

An Analysis of the Policy Implications of Zero Population Growth, 1976.

Delphi Study on Periodontal Disease, 1976.

Problems, Crises and Issues in the Future Resources, Population and Food, Environmental, Economic and Social Arenas, 1975.

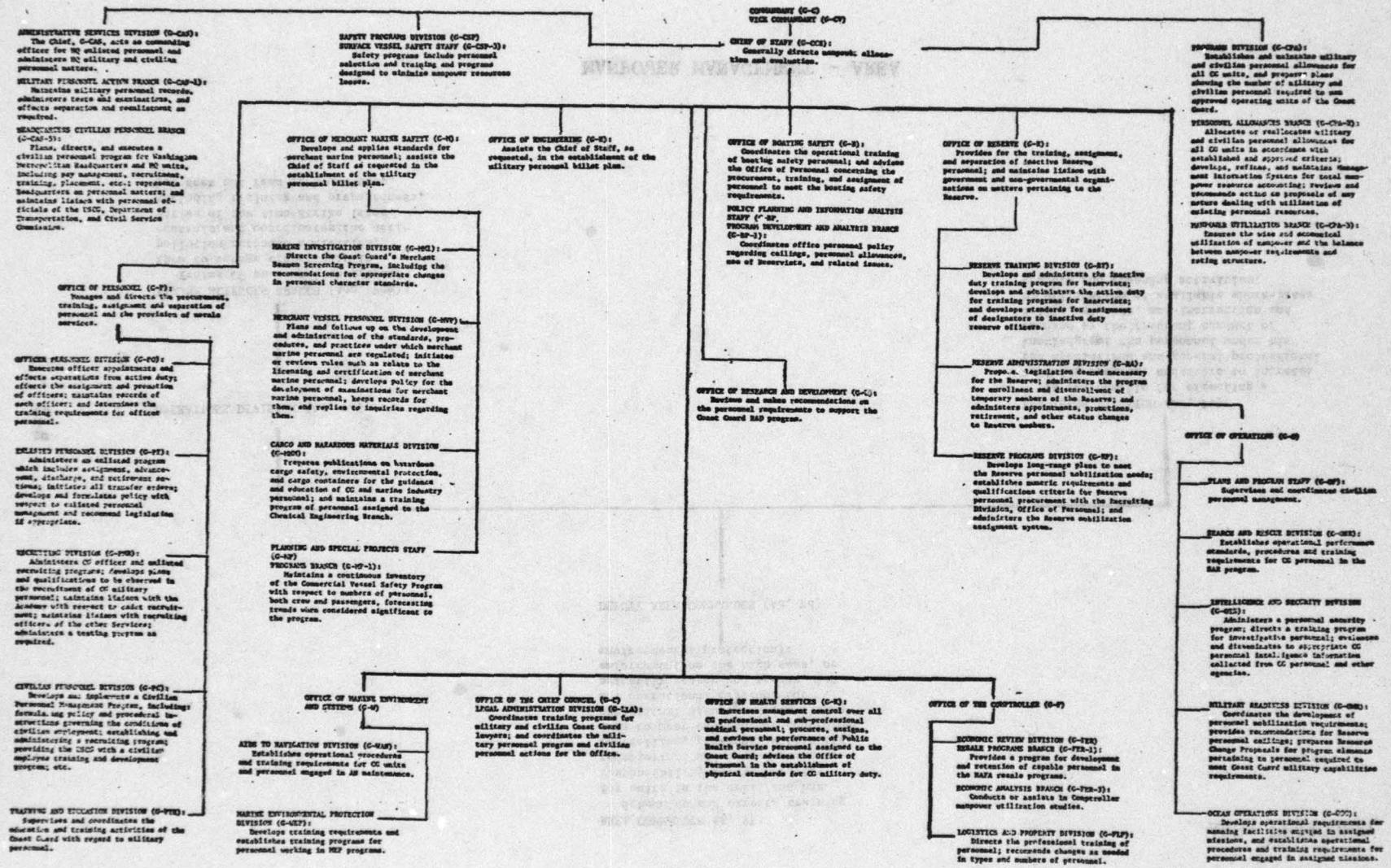
A Detailed Technological Forecast of Events in the Human Foods Area, Prepared for the U.S. Food and Drug Administration, 1975.

APPENDIX B

U. S. COAST GUARD
RESOURCE MANAGEMENT FLOW DIAGRAMS

Spring 1979 Working Papers

(Abbreviated Versions)



MANPOWER MANAGEMENT - HEADQUARTERS

AREA COMMANDER (A, P):
Schedules and directs training for units in the area; and has responsibility for temporarily redeploying, and coordinating or controlling, personnel within the Area to meet emergent or contingent operational situations (involving any operational mission, but primarily search and rescue, law enforcement on the high seas, or environmental protection).

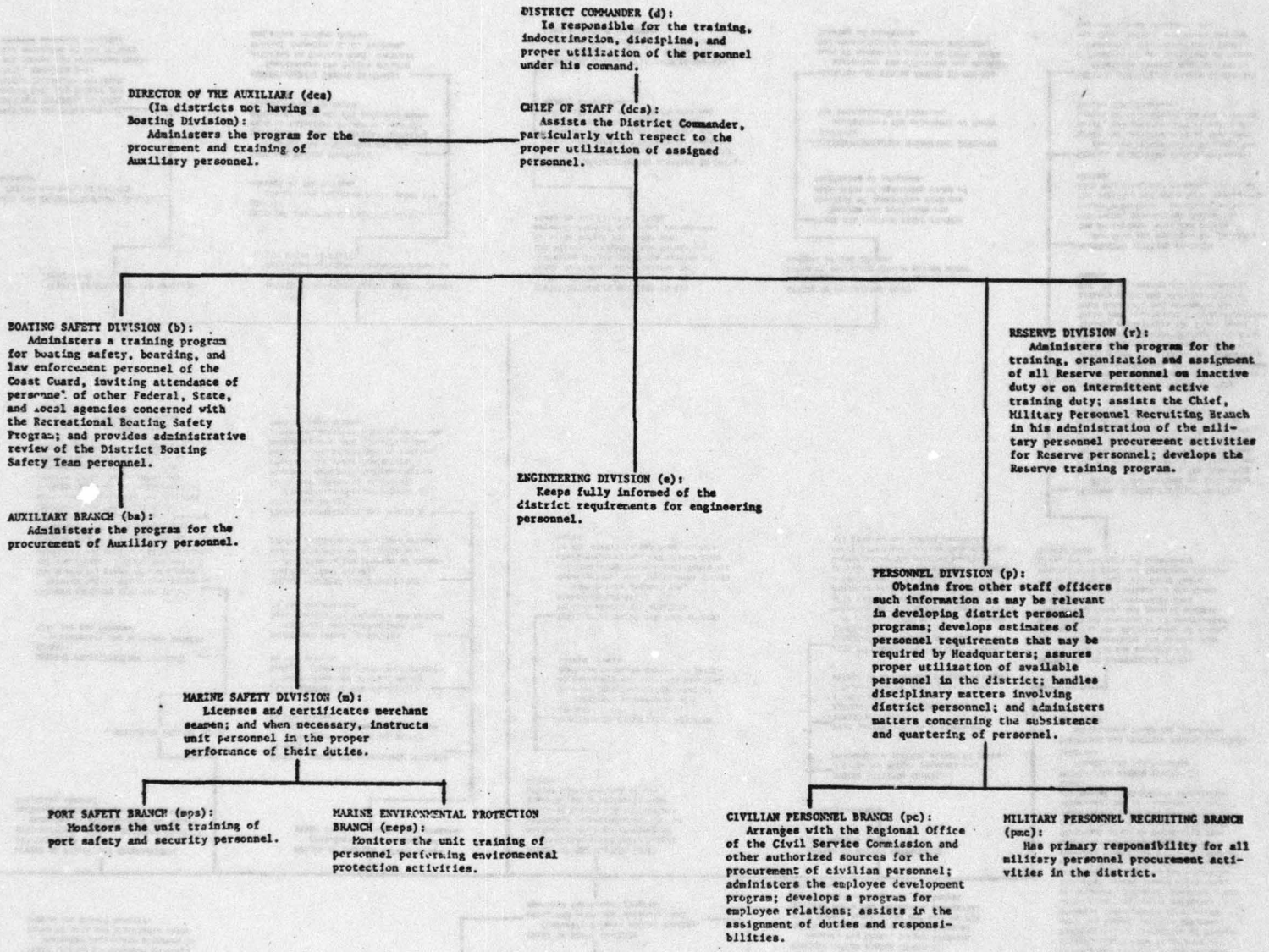
DEPUTY AREA COMMANDER (Ad, Pd)

OPERATIONS DIVISION (Ao, Po)

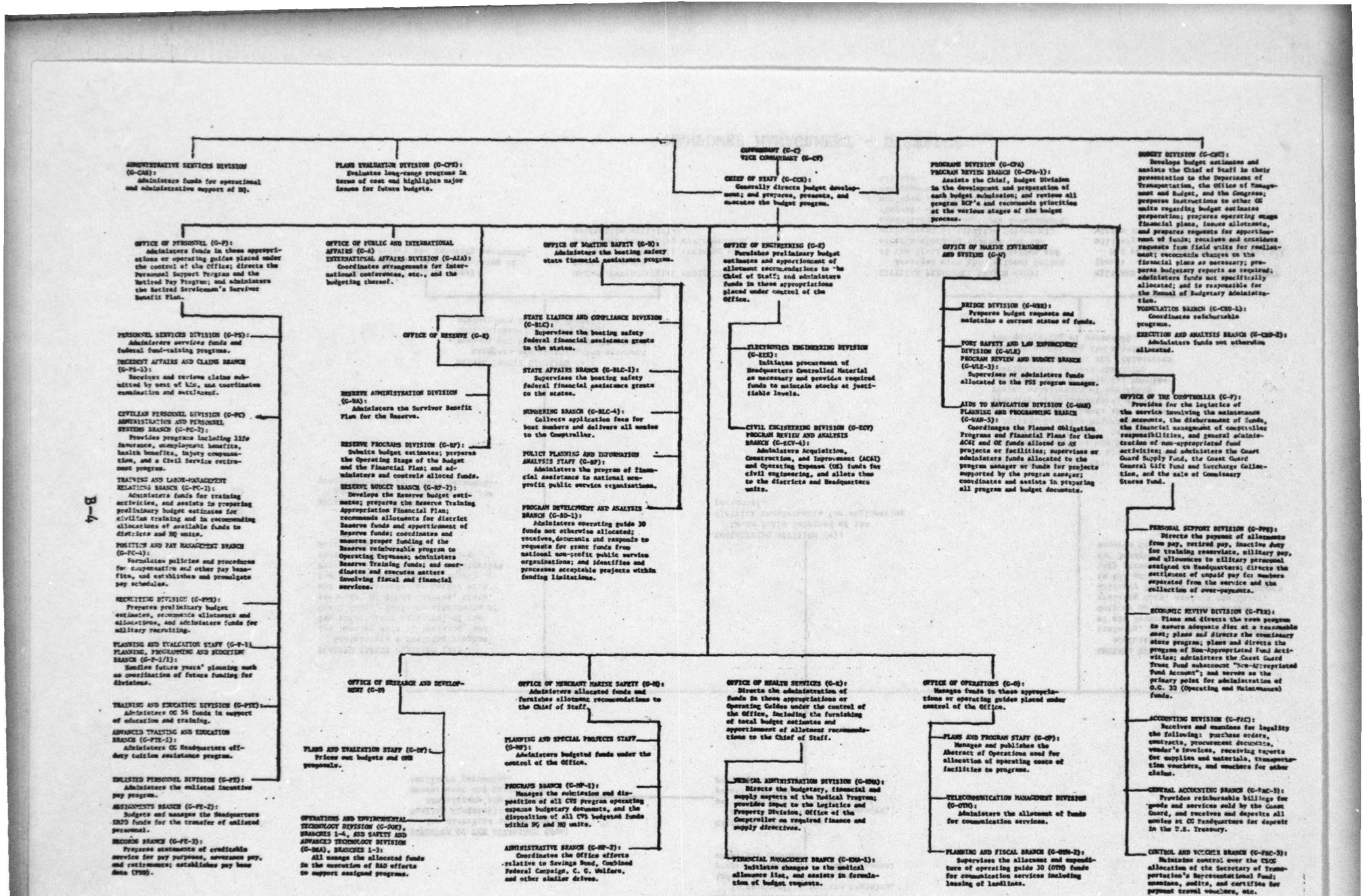
MARINE SCIENCES BRANCH (Aom, Pom):
Trains CG personnel to prepare them to engage effectively in pollution response activities; controls and coordinates the activities of the Area Strike Teams, including training and preparedness, but does not feed or house them.

READINESS DIVISION (Ar, Pr):
Is responsible for effecting a training program; endeavors to increase the specialized and general professional knowledge of the personnel under his command by the frequent conduct of drills, classes, and instruction and by utilization of available shore-based schools and training activities.

MANPOWER MANAGEMENT - AREA



MANPOWER MANAGEMENT - DISTRICT



FUNDS MANAGEMENT - HEADQUARTERS

DISTRICT COMMANDER (d)

CHIEF OF STAFF (dcs):
Supervises and coordinates the District budgetary program and assures the efficient management and utilization of District funds.

BOATING SAFETY DIVISION (b):
Administers the Boating Grant-In Aid Program and plans a long-range budget in response to arising District needs.

AUXILIARY BRANCH (ba):
Coordinates funds through districts to support the CG Auxiliary.

MARINE SAFETY DIVISION (m):
Monitors the district commercial vessel safety, port safety and security, and maritime environmental protection programs to develop budgetary requirements and resource needs.

PORT SAFETY BRANCH (mps):
COMMERCIAL VESSEL SAFETY BRANCH (mvs):
Both process and review funding and resource requirements and planning proposals for district units performing functions for each branch.

RESERVE DIVISION (r):
Administers allocated funds as prescribed in current directives; and collaborates and maintains effective liaison with concerned divisions regarding such fiscal and financial service as may be required for the successful conduct of the Reserve program.

COMPTROLLER DIVISION (f):
Acts as financial advisor to staff officers; coordinates and consolidates budgetary estimates; administers funds alloted to the District Commander, responsibility for which is charged by the District Commander or the Commandant to the Comptroller; supervises administration of non-appropriated fund activities; and conducts the district program for the sale of U.S. Savings Bonds.

PERSONAL SUPPORT BRANCH (fpa):
Is responsible for payment and matters pertaining to payment of personnel, including pay, travel allowances and claims as authorized by Coast Guard HQ; and for the Budget and Review Branch, if authorized to deviate from standard organization.

BUDGET AND REVIEW BRANCH (fbr):
Coordinates, evaluates, audits, analyzes, and assists budget estimate and preparation.

ACCOUNTING BRANCH (fac):
Is responsible for the preparation of financial and operating statements; the review of all obligation documents for the availability of funds; the control of all collections from any source intended for deposit to the credit of the U.S. Treasurer; preparing monthly transaction statements and financial reports; receiving and handling vouchers for payments other than travel; and the Personal Support Branch, if authorized to deviate from standard organization.

ENGINEERING DIVISION (e):
Supervises the preparation of fund requests for work programs that carry out the engineering activities in the district; reviews all requisitions, contracts, etc. which are chargeable to funds for engineering work; furnishes preliminary budget estimates and fund allocations to the Comptroller; and administers allocated funds.

CIVIL ENGINEERING BRANCH (ecv):
ELECTRONICS ENGINEERING BRANCH (eee):
NAVAL ENGINEERING BRANCH (ene):
All review requests chargeable to funds for each branch; request the Chief, Procurement Branch to make purchases; prepare preliminary budget estimates and fund allocation recommendations; administer allocated funds; and provide the Chief, Comptroller Division with detailed information of all actions which will result in expenditures or other transfer of funds.

OPERATIONS DIVISION (o):
Carries out program budgeting and manages funds allocated to the Division.

SEARCH AND RESCUE BRANCH (oar):
Prepares preliminary budget estimates, makes fund allocation recommendations, and administers allocated funds.

AIDS TO NAVIGATION BRANCH (oan):
Prepares, when required, a justification for the use of official funds to implement recommended changes in the AN system.

The Area Commander, in any Area controlled operation, conforms to the logistic policy of the parent District. In an operation which incurs or anticipates excess expenses, the parent District Commander is kept fully advised by the unit involved. His desires in regard to logistic support will receive all possible consideration by the Area Commander, commensurate with the operational situation.

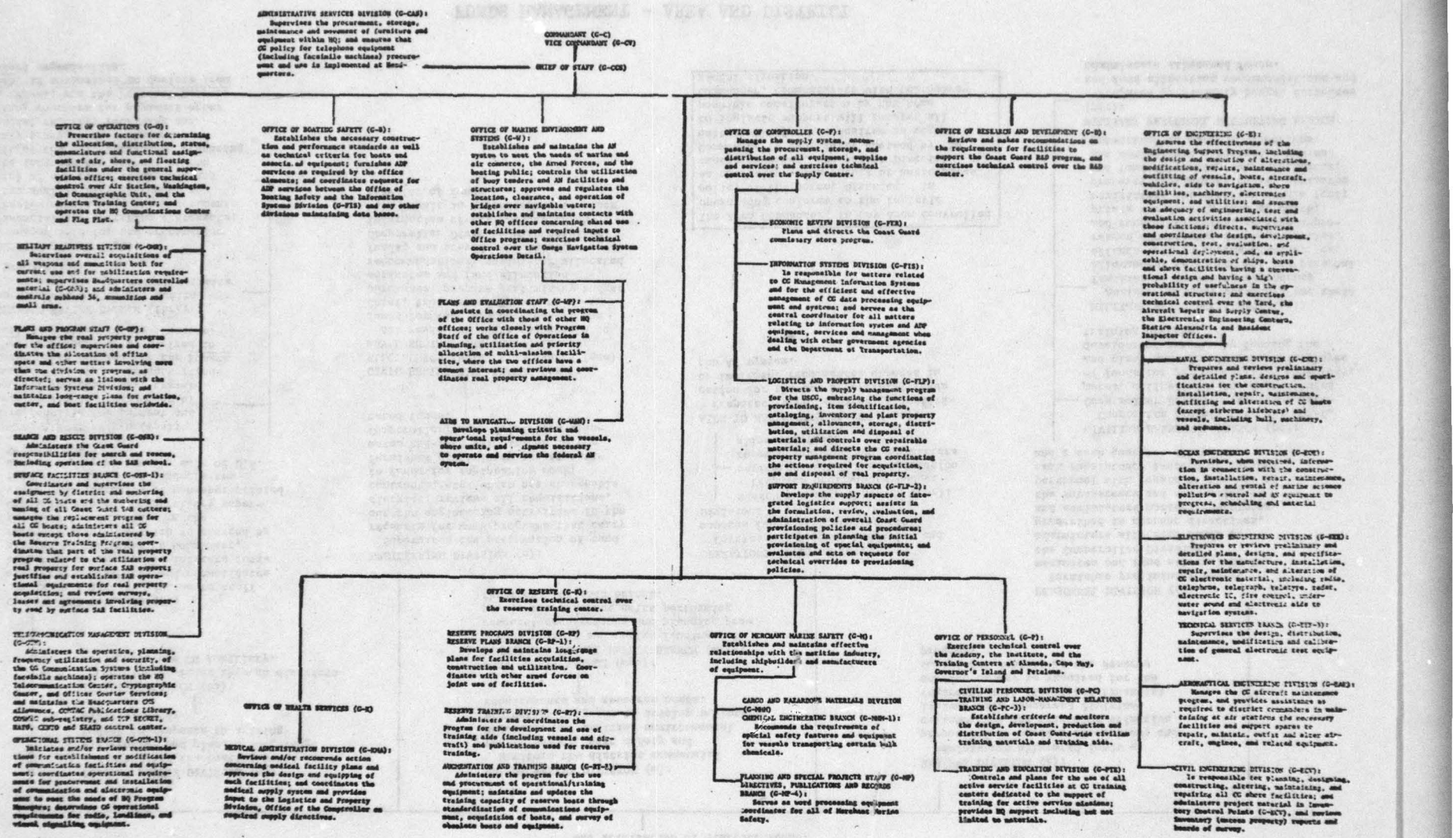
PERSONNEL DIVISION (p):
Furnishes preliminary budget estimates and fund allocations to the Comptroller Division, administers allocated funds as prescribed in current directives, and administers matters concerning the subsistence and quartering of personnel with regard to the use of cash subsistence instead of rations and a cash quarters allowance.

CIVILIAN PERSONNEL BRANCH (pc):
Cooperates closely with the Chief, Comptroller Division regarding estimates, obligations, and expenditures of funds for pay of civilian employees; and plans and administers the employee development program by funding the training program.

MILITARY PERSONNEL BRANCH (pp):
Assists military personnel and their families in obtaining dependency allowances, reimbursement for personal effects lost in marine disasters or rescue operations, death gratuities, and funeral expenses; renders appropriate services in case of death; administers the district morale fund; prepares preliminary budget estimates and fund allocation recommendations; and administers allocated funds as prescribed in current directives.

MILITARY PERSONNEL RECRUITING BRANCH (pmr):
Prepares preliminary budget estimates and fund allocation recommendations and administers allocated funds.

FUNDS MANAGEMENT - AREA AND DISTRICT



MATERIAL MANAGEMENT - HEADQUARTERS

AREA COMMANDER (A, P):
Keeps the Commandant advised concerning search and rescue requirements within the area and the most effective utilization of CG facilities for this purpose; when it is determined that an assistance case is of such magnitude as to require participation of more than one district in an area, coordinates and controls overall operations, utilizing the facilities of any district he so designates within the jurisdiction.

DEPUTY AREA COMMANDER (Ad, Pd)

READINESS DIVISION (Ar, Pr):
Provides technical services to assist units in selected fields in maintaining optimum material condition of installed systems.

TRAINING BRANCH (Prt):
Provides for training of all cutters and selected shore stations; develops and promulgates operational training and material standards for ASW and EEM systems and personnel; provides technical assistance to district staffs and appropriately equipped vessels.

NAVY VESSEL TRAINING BRANCH (Arp):
Provides for the training of vessels 180' and over by coordinating educational availabilities for ships at Navy Fleet Training Centers.

TECHNICAL ASSISTANCE BRANCH (Ara):
Directs the operations of the ASW, EEM and Ordnance Technical Assistance Team so as to provide technical assistance to vessels appropriately equipped and to provide support to district staffs responsible for supervising the maintenance of such equipment; develops, evaluates, and promulgates material standards for ASW and EEM systems in Atlantic Area and ordnance systems throughout the USCG.

INFORMATION SYSTEMS DIVISION (Ai):
Ensures that optimum utilization of Electronic Data Processing (EDP) equipment is achieved consistent with limitations imposed by higher authority.

AUTOMATED MUTUAL-ASSISTANCE VESSEL RESCUE (AMVER) SYSTEM BRANCH (Aaa):
Develops and establishes detailed procedures for application of EDP equipment to obtain optimum utility, reliability, accuracy and speed in output of such equipment; and is responsible for the operation and maintenance of other operational systems utilizing EDP equipment placed in operation for service-wide use.

OPERATIONS ANALYSIS BRANCH (Aso):
Develops, analyzes, programs, tests, and, when so directed by proper authority, places in operation those systems which utilize EDP equipment designed to provide the necessary information and other data which may be required in CG operations service-wide.

TELECOMMUNICATIONS MANAGEMENT DIVISION (Atm, Ptm):
Plans, coordinates, and supervises the overall inter-district system control aspects of communications and Loran-C operations within the area.

COMMUNICATIONS BRANCH (Atmc, Ptmc):
Makes recommendations to the Commandant concerning redistribution of communication resources within the area to effect maximum resource utilization.

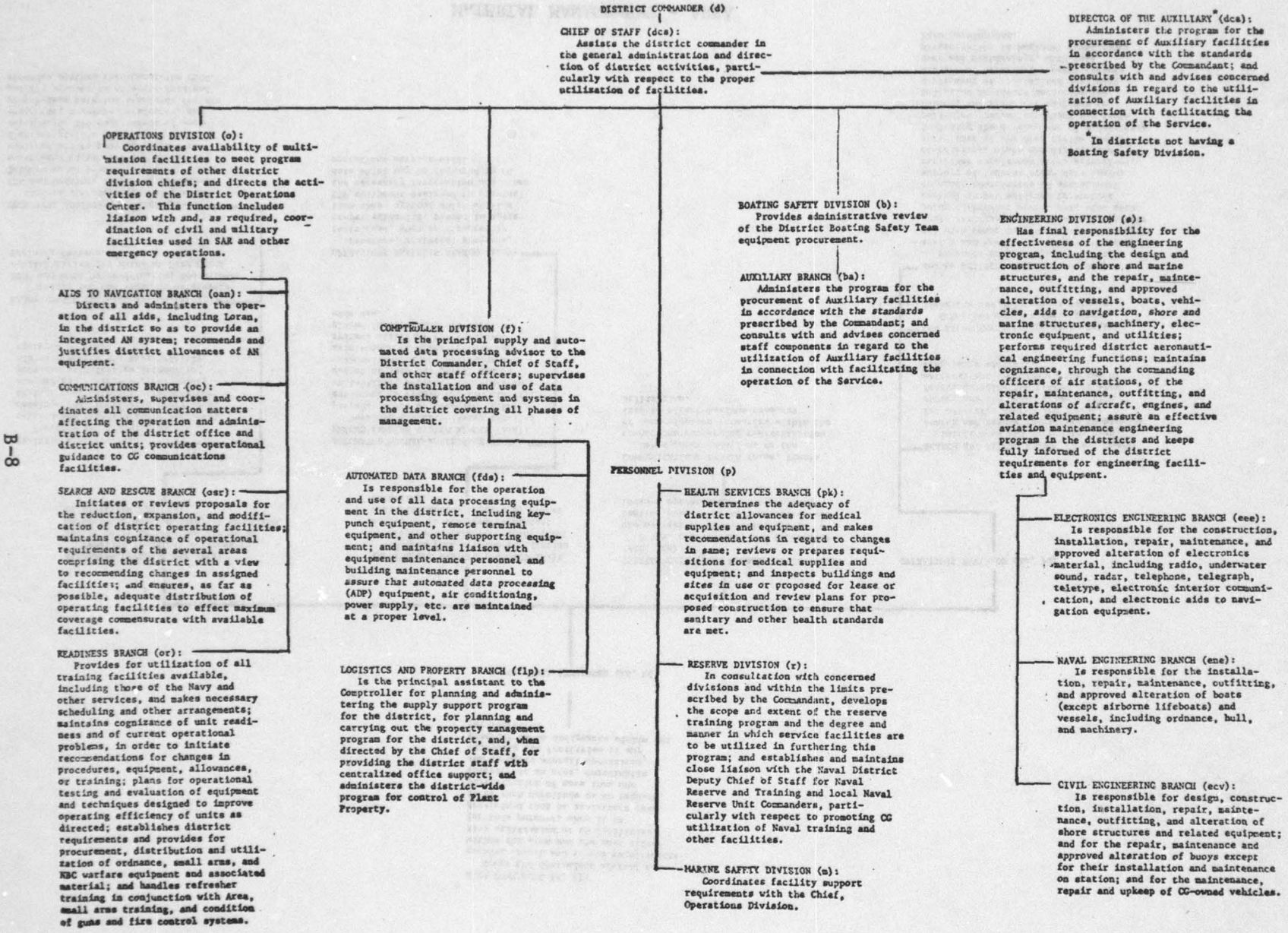
OPERATIONS DIVISION (Ao, Po)

SEARCH AND RESCUE BRANCH (Aosr, Posr):
Coordinates and supervises area search and rescue facilities to provide for effective search and rescue; supervises the Joint Area-District Rescue Coordination Center for area matters; and coordinates the use of long-range aircraft.

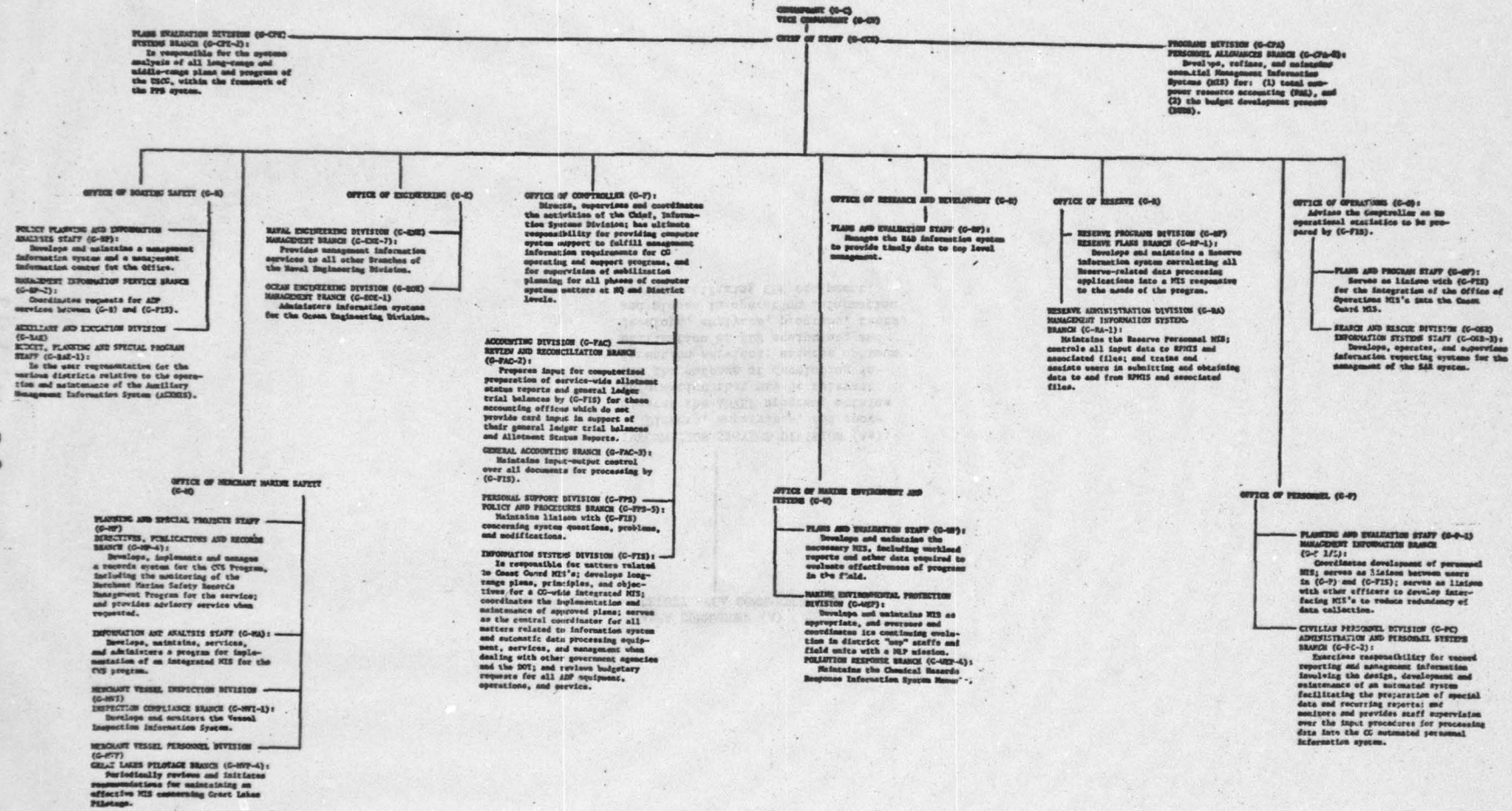
LAW ENFORCEMENT BRANCH (Aol, Pol):
Schedules cutters for offshore fisheries law enforcement patrols.

MARINE SCIENCES BRANCH (Aom, Pom):
Provides oceanographic technical advice and assistance to vessels equipped with Coast Guard-owned oceanographic gear; exercises operational control over polar icebreaker operations, when such control is not assigned to another command; coordinates CG operational support of federal ocean data buoys; exercises cognizance over, supervises, coordinates, plans and directs the activities of the Area Strike Teams, including the development of specialized pollution removal equipment and techniques; and plans for response to pollution incidents including the deployment of specialized equipment and use of effective removal techniques and methodology, with full participation in Regional Contingency Plan development.

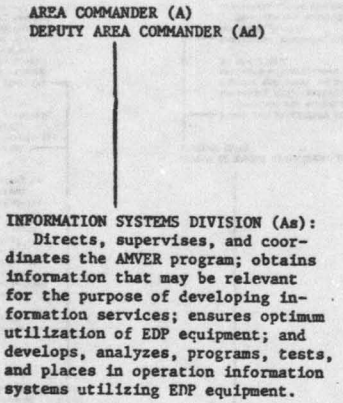
MATERIAL MANAGEMENT - AREA



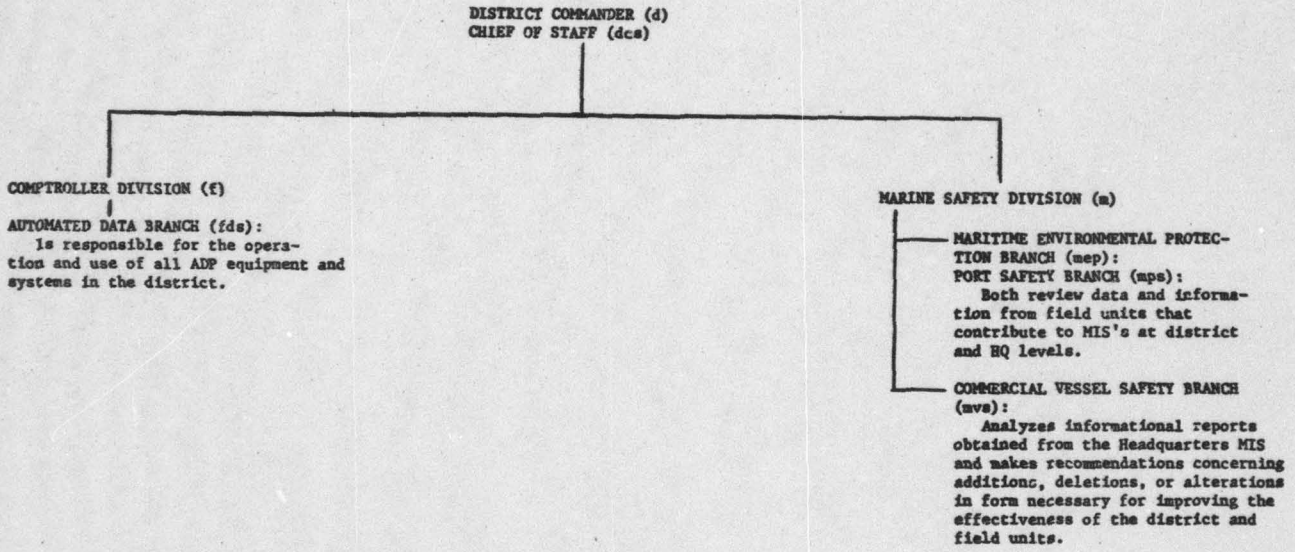
MATERIAL MANAGEMENT - DISTRICT



INFORMATION SYSTEMS MANAGEMENT - HEADQUARTERS



INFORMATION SYSTEMS MANAGEMENT - AREA



INFORMATION SYSTEMS MANAGEMENT - DISTRICT

APPENDIX C

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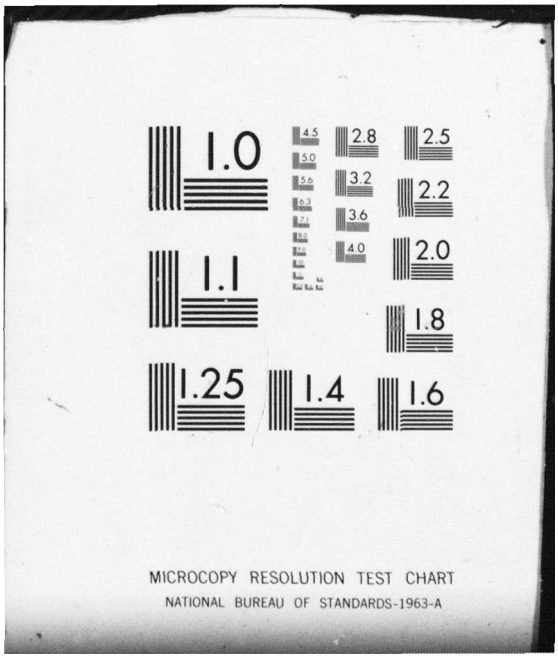
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