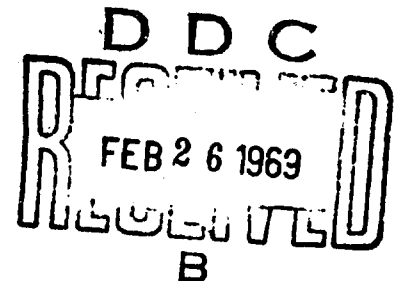


AD 682514



**COMPUTER PROGRAMS
FOR
NATIONAL DATA BUOY SYSTEMS
SIMULATION AND COST MODELS**

by

**Earl L. Davis
Project Scientist**

and

**Bernard J. Erickson
Edward R. Sweeton**

October 1968

**TRC Report 7493-333
Prepared for the U.S. Coast Guard
Under Contract No. DOT-BG-82504-A**

**E. J. Aubert
G. M. Northrop
Principal Investigators**

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This study was conducted in support of the U.S. Coast Guard National Data Buoy Systems Designated Project Office under Contract DOT-CG-82504-A.

Views or conclusions contained in this study report should not be interpreted as official opinion or policy of the Federal Government.

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FOREWORD

Contract Number DOT-DG-82504-A between the U.S. Coast Guard and The Travelers Research Center, Inc. (TRC) consists of five parallel activities. The five final reports stemming from these activities are entitled:

- (1) Applicability of National Data Buoy Systems to Refined National Requirements for Marine Meteorological and Oceanographic Data.
- (2) Characteristics of National Data Buoy Systems: Their Impact on Data Use and Measurement of Natural Phenomena.
- (3) Cost Effectiveness Sensitivity of National Data Buoy Systems: An Essay.
- (4) Computer Programs for National Data Buoy Systems Simulation and Cost Models.
- (5) An Analysis of Cruise Strategies and Costs for Deployment of National Data Buoy Systems.

Each of these five reports is complete in itself, but it must be recognized that in all instances the other four activities both influenced and contributed to the results presented in each individual report.

The present USCG/TRC contract is an outgrowth of a study of the feasibility of national data buoy systems performed by TRC and Alpine Geophysical Associates for the USCG during 1967. Need was evident for investigation, research, and analysis in greater depth in several areas to support the concept formulation and deployment planning efforts of the newly-formed U.S. Coast Guard National Data Buoy System Designated Project Office (NDBS DPO). This report and the other four cited above satisfy some of those needs.

All five TRC reports have benefited from the close cooperation and guidance afforded by the USCG NDBS DPO staff: Capt. J. Hodgeman (Project Manager), Cmdr. V. Rinehart, J. Wesler, E. Parker, P. Morrill, and Lt. Cmdr. W. Merlin (Contract Monitor).

PREFACE

This document is divided into three sections to logically present a different level for three sets of readers. Section 1, General Descriptions of Buoy Computer Programs and Data, provides a comprehensive summary of the computer programs and data developed by The Travelers Research Center, Inc. (TRC). This section is primarily for a management overview and is intended to present computer program capabilities and data descriptions with a minimum of the related details. Included in Section 1 is a description of the:

- (1) Integrated Buoy Deployment Cost Model Program
- (2) Procurement, Maintenance, and Replacements--Cost Model Program
- (3) 10-year TDP Financial Plan Program
- (4) Buoy Component Characteristics Data File
- (5) Fleet Numerical Weather Central Depth Data.

Section 2, Computer Programs Operating Instructions, is for those persons desiring another level of detail about the programs. This section presents the information necessary to prepare data card decks and operate the computer programs. It is assumed that the reader of this section is familiar with basic automatic data processing.

Section 3 is the Maintenance Programmer's Manual for the programs and data described. This section is for an experienced FORTRAN programmer and is supplemented with appropriate flow diagrams, compilation listings and tape dumps in Appendixes A through N.

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1.0 GENERAL DESCRIPTIONS OF NATIONAL DATA BUOY SYSTEMS AUTOMATED MODELS AND DATA

Part of the 1968 TRC contractual effort for the U.S. Coast Guard National Data Buoy Systems Designated Project Office (NDBS DPO) was directed toward automating a selected set of manual simulation and cost models. These models were developed in the 1967 TRC Study of the Feasibility of National Data Buoy Systems and are used to determine the deployment, maintenance and replacement cost characteristics for alternative data buoy system configurations. A corollary objective, under the task of buoy model automation, was to prepare the 1967 buoy components data base for further automated processing. A computer model was also developed to assist in the analysis of the funding schedules considered in the development of a Technical Development Plan.

This report describes all the features of the computer models and programs and presents the information necessary to operate and maintain the programs. A detailed study based on the data buoy system deployment cost model is found in a companion report.¹

1.1 Integrated Buoy Deployment Cost Model

1.1.1 Introduction

Early in the 1967 TRC study of the feasibility of NDBS, cost models were developed to estimate the cost of buoy deployments, maintenance, replacements and spares. These were manual models and their scope and detail were quite limited. As some of these problems associated with a NDBS were to be studied in greater depth, it was apparent that an automated buoy deployment cost model would be essential to provide the data necessary for trade-off studies of some of the variables involved in buoy deployment and maintenance. Therefore, TRC developed an integrated buoy deployment simulation and cost model computer program that computes the times, distance, and costs associated with the deployment of specified buoy systems and deployment strategies.

1.1.2 Program Function

The basic purpose of the buoy deployment cost model is to compute the time and costs required to deploy a specified buoy system. The input information must include

¹ Northrop, G. M., 1968: An Analysis of Costs and Cruise Strategies for Deployment of National Data Buoy Systems, Report 7493-337, The Travelers Research Center, Inc., Hartford, October.

data for all of the items listed in Table 1-1. To do this, the user defines the ship cruises necessary to deploy all the buoys. The program computes the great circle distance between the prescribed points and converts this distance to the sailing time required for each of eight ship speeds. To each of these sailing times are added the total time required to implant the buoys for each of four buoy implanting times. This sum is the total ship sea days required for each ship and buoy implanting time. The number of port days for each cruise is computed as a function of the ship buoy-carrying capacity and the number of buoys on-loaded. The algorithm used is:

$$\text{Port Days} = \text{Min. Port Days} + \left[\frac{(\text{Buoys On-Loaded})}{(\text{Max. Buoy Capacity})} \times (\text{Max. Port Days} - \text{Min. Port Days}) \right] \quad (1-1)$$

The sum of all ship sea days and port days is the minimum possible ship days for that deployment.

Costs for the number of ship sea days, port days and distance traveled as a function of ship speed is computed using three different basic ship sea-day costs. The minimum time and cost values are also multiplied by a safety factor (typically 4/3) to provide a "reasonable" upper limit to be used with the minimum time and cost values. The average deployment cost per buoy, the number of buoys that can be deployed in a ship work year and the total buoy hardware cost as a function of water depth are also computed.

1.1.3 Program Output

The output of the deployment model is a printed listing of the results of the run. The various types of output pages, in the order in which they are produced, are as follows:

Constants Page. All input variables used during a computer run are listed with the output. The majority of these variables are presented on a Constants Page as illustrated in Fig. 1-1. Notice in Fig. 1-1 that there are specified desired and maximum sea days per cruise. The program is designed to output a message if a cruise will require a greater number of sea days than the specified desired value, although it will continue to deploy buoys. However, the program will terminate if a cruise will require more time than the specified maximum sea days per cruise.

TABLE 1-1
USER-SPECIFIED INPUT VARIABLES FOR THE DEPLOYMENT MODEL

A. Buoy Data

1. Latitude, longitude and water depth for each buoy.
2. Buoy hardware cost: basic buoy, mooring line, oceanographic sensor package.
3. Mooring scope.

B. Ship Port and Buoy Depot

1. Latitude and longitude for both port and depot.
2. Minimum and maximum allowed days in port.

C. Ship Characteristics

1. Ship buoy-carrying capacity.
2. Ship speeds (8 speeds per run).
3. Basic costs per ship sea day (3 values).
4. Ship "maintenance" cost per sea day as a function of speed and size.
5. Cost per nautical mile travelled.
6. Hours required to implant a buoy (4 values).
7. Maximum allowed sea days for a cruise.
8. Days per year the ship is not available (overhaul).

D. Additional Data

1. Navigation points to route around islands and peninsulas.
2. A safety factor used to multiply all computations in order to obtain a "reasonable" upper boundary on costs, cruise times, etc.

RUN NBK 110 DATE 4 OCT 68

WEST PACIFIC MDZ FOR THE 375 TOTAL BUOY LOCATIONS MAP
INCLUDES NEW SHIP SEA-DAY AND PORT-DAY COST COMPUTATIONS

STARTING DEPLOYMENT DATE = 1 JAN 69

CONSTANTS USED FOR THIS DEPLOYMENT

PORT

NAME = HONOLULU, HA
LAT = 21.3N
LONG = 157.8W

DEPOT

NAME = HONOLULU, HA
LAT = 21.3N
LONG = 157.8W

SHIP

NAME =
AVERAGE CRUISING SPEED, KTS = 9.0
MAXIMUM BUOY CAPACITY = 12
OVERALL SAFETY FACTOR = 1.33
HOURS TO IMPLANT 1 BUOY = 12.0
DESIRED SEA DAYS PER CRUISE = 30.0
MAXIMUM SEA DAYS PER CRUISE = 99.0
MAXIMUM PRT DAYS PER CRUISE = 10.0
MINIMUM PRT DAYS PER CRUISE = 4.0

LOAD/CRUISE

10 8 12 12

NAV POINTS/CRUISE

0 2 0 0

BUOY COSTS

BUOY W/O S/S SENSORS OR MOORING = \$ 158000.
SUBSURFACE SENSOR PACKAGE, EACH = \$ 7000.
MOORING LINE PER 1000 FT = \$ 1750.
MOORING SCOPE = 1.00

Fig. 1-1. Data Buoy Deployment Constants Page.

The entries in Fig. 1-1 under LOAD/CRUISE are the number of buoys to be carried on each cruise. The entries under NAV POINTS/CRUISE are the number of navigation points required for each cruise.

Buoy Hardware Cost and Order Page. Figure 1-2 is a listing of a set of buoys in the order in which they were deployed. Buoy location, water depth, the number of subsurface sensor packages required for each buoy and total hardware cost is also shown. It is possible to specify different basic buoy costs for individual buoys, although the costs are all the same in Fig. 1-2. Buoy numbers are an arbitrary assignment of four alphanumeric characters. Normally, they are chosen to facilitate their location on a plotted buoy map. Water depths may be input either in feet or meters; all depths are converted to feet for output on this page.

Cruise Deployment Summary Page. This page contains the highlights of the calculations performed after each cruise is completed; it is illustrated in Fig. 1-3. The distance between successive points is presented in the fourth column and is the distance between buoys in the order in which they are deployed. The calendar dates presented are based on the starting deployment date, a 30-day month, and the elapsed deployment days until each event is completed. Cost values on this page are computed only for the slowest ship speed, the shortest implanting time and the middle ship sea-day cost value.

The printing of the cruise deployment summary page is optional and is usually by-passed if there is a large number of cruises to be made.

System Deployment Summary Page. Significant cruise and system totals are presented on the system deployment summary page as shown in Fig. 1-4. The entries on this page are self-explanatory.

Deployment Test Summary Page. The test summary pages are a presentation of all of the critical time and cost values for the deployment just completed. An example of this type of output page is shown in Fig. 1-5. The critical constants used and the critical values calculated are listed in the first ten lines of output. Of particular importance among these constants are

- (a) The ship buoy-carrying capacity,
- (b) The base cost per sea day,
- (c) The ratio of the cost per port day to cost per sea day,

RUN NBR 110 DATE 4 OCT 68

WEST PACIFIC MDZ FOR THE 375 TOTAL BUOY LOCATIONS MAP
INCLUDES NEW SHIP SEA-DAY AND PORT-DAY COST COMPUTATIONS

	BUOYS - IN ORDER DEPLOYED					
NBR	DEGS LAT	DEGS LONG	DEPTH (FT)	BASIC COST	S/S PKGS	TOTAL COST
EP10	30.0N	161.2W	18045	\$158000.	20	\$329579.00
EP 5	40.0N	165.0W	18045	\$158000.	20	\$329579.00
EP 2	50.0N	180.0W	21000	\$158000.	20	\$334750.00
EP 1	60.0N	180.0W	6561	\$158000.	17	\$288482.00
WP 3	50.0N	166.0E	18045	\$158000.	20	\$329579.00
WP 6	41.5N	167.0E	19685	\$158000.	20	\$332449.00
EP 4	40.0N	180.0W	18045	\$158000.	20	\$329579.00
EP 8	32.4N	177.5E	16404	\$158000.	20	\$326707.00
EP 9	30.0N	169.6W	16800	\$158000.	20	\$327400.00
EP33	24.0N	164.0W	14764	\$158000.	20	\$323837.00
WP 8	36.7N	158.8E	12000	\$158000.	19	\$312000.00
WP 5	40.0N	153.5E	14700	\$158000.	20	\$323725.00
WP 4	40.0N	139.0E	3280	\$158000.	15	\$268740.00
WP 7	33.0N	143.2E	22966	\$158000.	20	\$338191.00
WP11	30.0N	155.5E	19029	\$158000.	20	\$331301.00
WP28	25.0N	165.0E	19685	\$158000.	20	\$332449.00
WP17	23.0N	171.0E	19200	\$158000.	20	\$331600.00
EP14	20.0N	168.5W	16404	\$158000.	20	\$326707.00
EP13	20.0N	180.0W	14764	\$158000.	20	\$323837.00
WP18	20.0N	158.8E	19685	\$158000.	20	\$332449.00
WP16	23.0N	146.0E	19685	\$158000.	20	\$332449.00
WP10	27.0N	135.0E	14764	\$158000.	20	\$323837.00
WP 9	20.0N	126.4E	656	\$158000.	9	\$222148.00
WP13	20.0N	116.0E	3280	\$158000.	15	\$268740.00
WP14	20.0N	126.7E	16404	\$158000.	20	\$326707.00
WP15	20.0N	137.0E	16404	\$158000.	20	\$326707.00
WP24	14.0N	153.0E	19685	\$158000.	20	\$332449.00
WP26	15.0N	170.0E	16200	\$158000.	20	\$326350.00
EP12	10.0N	179.0E	14764	\$158000.	20	\$323837.00
EP19	10.0N	170.8W	16404	\$158000.	20	\$326707.00
WP25	10.0N	158.3E	18045	\$158000.	20	\$329579.00
WP29	11.0N	145.0E	15000	\$158000.	20	\$324250.00
WP23	10.0N	137.7E	16404	\$158000.	20	\$326707.00
WP22	10.0N	127.0E	22966	\$158000.	20	\$338191.00
WP21	10.0N	114.5E	492	\$158000.	8	\$214861.00
WP19	0.1N	123.2E	1312	\$158000.	11	\$237246.00
WP20	0.1N	134.0E	14108	\$158000.	19	\$315689.00
WP12	0.1N	144.2E	13123	\$158000.	19	\$313965.00
WP 2	0.1N	154.8E	8202	\$158000.	18	\$298354.00
WP 1	0.1N	165.5E	16404	\$158000.	20	\$326707.00
WP27	0.1N	176.0E	13800	\$158000.	19	\$315150.00
EP28	0.1N	173.7W	16404	\$158000.	20	\$326707.00

TOTAL BUOY HARDWARE COST (W/O SPARES) \$ 13250314.00

TOTAL NBR OF BUOYS TO BE DEPLOYED = 42

Fig. 1-2. Data Buoy Hardware Cost and Deployment Order Page.

RUN NBR 110 DATE 4 OCT 68

WEST PACIFIC MDZ FOR THE 375 TOTAL BUOY LOCATIONS MAP
INCLUDES NEW SHIP SEA-DAY AND PORT-DAY COST COMPUTATIONS

CRUISE DEPLOYMENT SUMMARY

CRUISE 1

ON-LOADED 10 BUOYS AT HONOLULU, HA
SHIP UNDERWAY 1 JAN 69 AT 800 HRS, SEADAYS = 0.0

BUOYS IMPLANTED IN FOLLOWING ORDER

BUOY NBR	DEGS LAT	DEGS LONG.	N MI RTWN	N MI TO PORT	DATE	SEA DAY	DPLYMT DAY
EP10	30.0N	161.2W	554	554	4 JAN	3.1	3.1
EP 5	40.0N	165.0W	629	1183	7 JAN	6.5	6.5
EP 2	50.0N	180.0W	873	2020	12 JAN	11.0	11.0
EP 1	60.0N	180.0W	601	2510	15 JAN	14.3	14.3
WP 3	50.0N	166.0E	767	2428	19 JAN	18.4	18.4
WP 6	41.5N	167.0E	512	2152	22 JAN	21.2	21.2

EXCEEDED DESIRED SEA DAYS TO IMPLANT ABOVE BUOY

EP 4	40.0N	180.0W	598	1597	25 JAN	24.5	24.5
EP 8	32.4N	177.5E	472	1478	28 JAN	27.2	27.2
EP 9	30.0N	169.6W	678	825	2 FEB	30.8	30.8
EP33	24.0N	164.0W	468	380	4 FEB	33.5	33.5

SHIP RETURNED TO HONOLULU, HA ON 6 FEB 69 AT 1400 HRS

N MILES STEAMED THIS CRUISE = 6536

BUOYS IMPLANTED THIS CRUISE = 10

TOTAL BUOY IMPLANTED TO DATE = 10

BUOYS REMAINING TO BE DPLYD = 32

MINIMUM PSBL SEA DAYS FOR THIS CRUISE = 35.3

MINIMUM REQUIRED PORT DAYS = 9.0

MINIMUM PSBL DEPLOYMENT DAYS TO DATE = 44.3

MIN DPLYMT DAYS X SAFETY FACTOR = 58.9

----- AT \$ 5600.00 PER SEA DAY -----

MINIMUM SHIP COST FOR THIS CRUISE \$ 282627.00

MIN SHIP COST X SAFETY FACTOR \$ 375893.00

TOTAL MINIMUM SHIP COST TO DATE \$ 282627.00

TOTAL MIN COST X SAFETY FACTOR \$ 375893.00

Fig. 1-3. The Cruise Deployment Summary Page.

RUN NBR 110 DATE 4 OCT 68

WEST PACIFIC MDZ FOR THE 375 TOTAL BUOY LOCATIONS MAP
INCLUDES NEW SHIP SEA-DAY AND PORT-DAY COST COMPUTATIONS

SYSTEM DEPLOYMENT SUMMARY

STARTING DATE = 1 JAN 69 AT 800 HRS

CRUISE NBR	BUOYS DPLYD	N MILES STEAMED	MIN SHIP SEA DAYS	MIN SHIP PRT DAYS	TOTAL MIN DPLY DAYS	MIN X SAFETY
1	10	6536	35.3	9.0	44.3	53.9
2	8	7520	38.8	9.0	45.8	62.3
3	12	10531	54.9	10.0	64.8	86.1
4	12	11189	57.8	10.0	67.8	90.2
4	42	35778	186.6	37.0	223.6	297.4

----- AT \$ 5600.00 PER SEA DAY -----
MINIMUM SHIP COST FOR THIS DEPLOYMENT \$ 1446756.00
MINIMUM SHIP COST X SAFETY FACTOR \$ 1924185.00

TOTAL COST FOR BUOY HARDWARE DEPLOYED \$ 13250314.00

TOTAL FEET OF MOORING REQUIRED = 623613
TOTAL S/S SENSOR PACKAGES DPLYD = 789

AVERAGE DEPTH PER BUOY IN MDZ = 14847
AVERAGE NBR OF S/S PKGS PER BUOY IN MDZ = 18

AVERAGE HARDWARE COST PER BUOY IN MDZ \$ 315484.00

AVERAGE DISTANCE TRAVELED PER BUOY DEPLOYED = 851 N MI

SUMMARY OF CONSTANTS USED FOR THIS DEPLOYMENT

SHIP AVERAGE SPEED = 9.0
SHIP MAX BUOY CAPACITY = 12
HRS TO IMPLANT 1 BUOY = 12.0

MAXIMUM GEOGRAPHICAL LOCATIONS

WEST	NORTH	EAST	SOUTH
50.0N 180.0W	60.0N 180.0W	10.0N 179.0E	0.1N 123.2E

THE SHORTEST MOORING WAS 492 FEET AT 10.0N 116.5E
THE DEEPEST MOORING WAS 22966 FEET AT 33.0N 143.2E

Fig. 1-4. System Deployment Summary Page.

DEPLOYMENT TEST SUMMARY

WEST PACIFIC MD7 FOR THE 375 TOTAL BUOY LOCATIONS MAP
INCLUDES NEW SHIP SEA-DAY AND PORT-DAY COST COMPUTATIONS

42 BUOYS DEPLOYED FROM HONOLULU, HA SHIP BUOY CAPACITY = 12
TOTAL DISTANCE, N MI = 35778 MAXIMUM CRUISE, N MI = 11189
BASE COST PER SEA DAY = \$ 2000.00 COST/PORT DAY = 0.94 X SEA DAY

SPEED KN 9.00 12.00 15.00 18.00 21.00 24.00 27.00 30.00
CST/MI \$ 5.78 5.78 5.78 7.01 11.27 16.43 23.37 30.00
ADD/DY \$ 600.00 600.00 600.00 600.00 780.00 980.00 1200.00 1400.00

AVG SHIP SPD	MAX CRSE (DAYS)	MIN SEA DAYS	MIN PORT DAYS	MIN DPLY DAYS	MIN X SAF FCTR	DEPLOYMENT COST, \$K			AVG/BUOY (MIN)	AVG MIN DPLY DAYS PER BUOY	AVG NBR BUOYS DPLY PER SHIP IN 335 DAYS
						MIN DPLY DAYS	X SAF FACTOR				
12 HRS TO IMPLANT A BUOY, TOTAL TIME TO IMPLANT = 21.0 DAYS -----											
9.0	57.8	186.6	37.0	223.6	297.4	782.5	1040.7	18.6	5.3	63	
12.0	44.9	145.2	37.0	182.2	242.4	674.8	897.5	16.1	4.3	77	
15.0	37.1	120.4	37.0	157.4	209.3	610.2	811.6	14.5	3.7	89	
18.0	31.9	103.8	37.0	140.8	187.3	611.2	812.9	14.6	3.4	100	
21.0	29.2	92.0	37.0	129.0	171.6	755.6	1005.0	18.0	3.1	109	
24.0	25.4	83.1	37.0	120.1	159.8	939.2	1249.1	22.4	2.9	117	
27.0	23.7	76.2	37.0	113.2	150.6	1191.3	1584.5	29.4	2.7	124	
30.0	21.5	70.7	37.0	107.7	143.2	1432.0	1904.5	34.1	2.6	131	
24 HRS TO IMPLANT A BUOY, TOTAL TIME TO IMPLANT = 42.0 DAYS -----											
9.0	63.8	207.6	37.0	244.6	325.4	837.1	1113.3	19.9	5.8	58	
12.0	50.9	166.2	37.0	203.2	270.3	729.4	970.1	17.4	4.8	69	
15.0	43.1	141.4	37.0	178.4	237.3	664.8	884.2	15.4	4.2	79	
18.0	37.9	124.8	37.0	161.8	215.2	665.8	885.5	15.9	3.9	87	
21.0	34.7	113.0	37.0	150.0	199.5	814.0	1082.6	19.4	3.6	94	
24.0	31.4	104.1	37.0	141.1	187.7	1001.7	1332.3	23.9	3.4	100	
27.0	29.3	97.2	37.0	134.2	178.5	1258.5	1673.8	30.0	3.2	105	
30.0	27.5	91.7	37.0	128.7	171.2	1503.4	1999.5	35.8	3.1	109	
30 HRS TO IMPLANT A BUOY, TOTAL TIME TO IMPLANT = 52.5 DAYS -----											
9.0	66.8	218.1	37.0	255.1	339.3	864.4	1149.6	20.6	6.1	55	
12.0	53.9	176.7	37.0	213.7	284.3	756.7	1006.4	18.0	5.1	64	
15.0	46.1	151.9	37.0	188.9	251.2	692.1	920.5	16.5	4.5	74	
18.0	40.9	135.3	37.0	172.3	229.2	693.1	921.8	16.5	4.1	82	
21.0	37.2	123.5	37.0	160.5	213.5	843.2	1121.5	20.1	3.8	88	
24.0	34.4	114.6	37.0	151.6	201.6	1033.0	1373.9	24.6	3.6	93	
27.0	32.3	107.7	37.0	144.7	192.5	1292.1	1718.5	30.8	3.4	97	
30.0	30.5	102.2	37.0	139.2	185.1	1539.1	2046.9	36.6	3.3	101	
36 HRS TO IMPLANT A BUOY, TOTAL TIME TO IMPLANT = 63.0 DAYS -----											
9.0	69.8	228.6	37.0	265.6	353.3	891.7	1186.0	21.2	6.3	53	
12.0	56.9	187.2	37.0	224.2	298.2	784.0	1042.8	19.7	5.3	63	
15.0	49.1	162.4	37.0	199.4	265.2	719.4	956.8	17.1	4.7	71	
18.0	43.9	145.8	37.0	182.8	243.2	720.4	958.1	17.2	4.4	77	
21.0	40.2	134.0	37.0	171.0	227.4	872.4	1160.3	20.8	4.1	82	
24.0	37.4	125.1	37.0	162.1	215.6	1064.3	1415.6	25.3	3.9	87	
27.0	35.3	118.2	37.0	155.2	206.4	1325.7	1763.2	31.6	3.7	91	
30.0	33.5	112.7	37.0	149.7	199.1	1574.8	2094.4	37.5	3.6	94	

Fig. 1-5. Buoy Deployment Test Summary Page.

(d) The ship speed table versus the additional cost-per-mile for each ship, and

(e) The ship speed table versus the additional (maintenance) cost that is added to the cost for each ship sea day.

The remaining tabular data in Fig. 1-5 presents the resulting calculations for each ship as a function of its speed and time to implant a buoy.

Minimum sea days and minimum port days (Cols. 3,4) in Fig. 1-5 are added together to give minimum deployment days (Col. 5) which is then multiplied by the safety factor to produce minimum deployment days times safety factor (Col. 6). The minimum deployment cost shown in column 7 is computed by using the minimum number of deployment days in column 6 and the ship cost data presented at the top of the page. Column 8 is obtained by multiplying column 7 by the safety factor. The average cost per buoy planted in column 9 is computed from the costs in column 7. The average minimum number of days required to deploy a buoy is shown in column 10 using the data from column 5. The last column lists the number of buoys that could be implanted by a ship operating at the rate specified in the heading for column 10 (335 days).

Three test summary pages are output for each deployment completed. The difference between the pages is the value used as the base cost per (ship) sea day.

1.1.4 Program Operational Information

The Integrated Buoy Deployment Cost Model is coded in the FORTRAN IV compiler language and has been developed and operated on an IBM 360/40 computer system. The program should operate in any other computer system with a FORTRAN IV compiler and operating system.

Detailed information on how to prepare the data cards and deck for the program is presented in Section 2.1; maintenance programmer details are presented in Section 3.1.

1.2 Procurement, Maintenance, and Replacement-Cost Model Computer Program

1.2.1 Program Function

Another buoy system cost model that was amenable to computer processing was the algorithm used to estimate hardware maintenance and replacement costs as a function of the item's initial procurement cost, expected lifetime and salvage value.

To do this, a series of items are read to describe the hardware and include:

- (a) number of units of each item to be procured,
- (b) cost per unit item,
- (c) expected item lifetime, and
- (d) item salvage value after expected lifetime.

From this information, the program computes the total initial procurement cost of m different items as

$$\text{Total Procurement Cost} = \sum_{1}^m (\text{unit cost}) \times (\text{number of units}). \quad (1-2)$$

The pro-rated cost per year of operation to replace the item after its expected lifetime is computed by

$$\text{Replacement Cost/Year} = \frac{(\text{Procurement Cost}) - (\text{Salvage Value})}{(k) (\text{Lifetime})}, \quad (1-3)$$

where k is an input factor that can be used to test the effect on the cost by changing the lifetimes by a fixed percentage. Using this cost, the annual maintenance cost is computed from the approximation:

$$\text{Maintenance Cost/Year} = 0.5 (\text{Replacement Cost/Year}). \quad (1-4)$$

In addition to the above cost values, the program also computes the number of units to be replaced annually by

$$\text{Replacement/Year} = \frac{(\text{Number of units of an item})}{(k) (\text{Lifetime})}, \quad (1-5)$$

where k is the same lifetime factor described for Eq. (1-3).

1.2.2 Program Output

The output of this program is a listing of the hardware items, their cost characteristics, and the values computed for Eqs. (1-2) through (1-5). An example of this output is shown in Fig. 1-6.

RUN 1 20 JUN 68

TEST WITH LIFETIME FACTORS FROM 0.70 TO 1.30
DATA FROM DWN 51 DEPTH = 5000 M

AVERAGE ANNUAL REPLACEMENTS FOR 1 BUOYS

ITEM	NBR DPLY	LIFE (YR)	COST EACH	SALVAGE VALUE	REPLACEMENTS/YR NBR	COST
40' DISCUS HULL	1	20.0	\$ 80000.	\$ 0.	0.0	\$ 4000.
MOORING/100 FT	165	1.0	\$ 175.	\$ 0.	165.0	\$ 29875.
40' POWER SYSTEM	1	5.0	\$ 10000.	\$ 0.	0.2	\$ 2000.
DATA STORAGE	1	3.0	\$ 10000.	\$ 0.	0.3	\$ 3333.
DATA PROC.-SCAN.	1	4.0	\$ 15000.	\$ 0.	0.3	\$ 3750.
TIME CONTROL	1	5.0	\$ 1000.	\$ 0.	0.2	\$ 200.
BUOY TELEMETRY	1	5.0	\$ 15000.	\$ 0.	0.2	\$ 3000.
S/S SENSOR PKG	20	3.0	\$ 7000.	\$ 0.	6.7	\$ 46667.
AMBIENT NOISE	2	3.0	\$ 1000.	\$ 0.	0.7	\$ 667.
AMBIENT LIGHT	2	3.0	\$ 1700.	\$ 0.	0.7	\$ 1133.
TRANSPARENCY SEN	2	3.0	\$ 1100.	\$ 0.	0.7	\$ 733.
WAVE SENSOR	1	5.0	\$ 6250.	\$ 0.	0.2	\$ 1250.
ATMOS PRESS SNSR	1	5.0	\$ 500.	\$ 0.	0.2	\$ 100.
AIR TEMP SENSOR	1	5.0	\$ 400.	\$ 0.	0.2	\$ 80.
DEW POINT SENSOR	1	3.0	\$ 1300.	\$ 0.	0.3	\$ 433.
WIND VELCTY SNSR	1	2.0	\$ 600.	\$ 0.	0.5	\$ 300.
PRECIP RATE SNSR	1	5.0	\$ 500.	\$ 0.	0.2	\$ 100.
INSOLATION SENSOR	1	5.0	\$ 500.	\$ 0.	0.2	\$ 100.
ATMOS ELEC SNSR	1	5.0	\$ 1000.	\$ 0.	0.2	\$ 200.
FUEL SUPPLY	1	5.0	\$ 200.	\$ 0.	0.2	\$ 40.
MOORING TENSION	1	3.0	\$ 500.	\$ 0.	0.3	\$ 167.
HULL TEMP	1	5.0	\$ 100.	\$ 0.	0.2	\$ 20.
BILGE WATER LVL	1	5.0	\$ 50.	\$ 0.	0.2	\$ 10.
MAG HEADING	1	5.0	\$ 300.	\$ 0.	0.2	\$ 60.
ANCHOR RELEASE	1	3.0	\$ 2500.	\$ 0.	0.3	\$ 833.
ANCHR, CHAIN, ETC	1	1.0	\$ 1000.	\$ 0.	1.0	\$ 1000.
NAV RADIO BEACON	1	5.0	\$ 5000.	\$ 0.	0.2	\$ 1000.
NAV LIGHT/HORN	1	5.0	\$ 500.	\$ 0.	0.2	\$ 100.
TOTAL INITIAL PROCUREMENT COST			\$ 328675.00			
AVERAGE ANNUAL REPLACEMENT COST			\$ 100151.00			
AVERAGE ANNUAL MAINTENANCE COST			\$ 50076.00			
ANNUAL REPLACEMENT & MAINTENANCE			\$ 150227.00			

Fig 1-6. Output Example from the Procurement,
Maintenance and Replacement Program.

1.2.3 Program Operational Information

This computer program is also written in the FORTRAN IV compiler language and has been developed and operated on an IBM 360/40 computer system. The program should operate in any other computer system with a FORTRAN IV compiler and operating system.

Detailed information on the preparation of the data cards and deck for this program are presented in Section 2.2; maintenance programmer information is presented in Section 3.2.

1.3 TDP 10-Year Financial Plan Computer Program

1.3.1 Program Description

One of the more cumbersome tasks encountered in the development of a Technical Development Plan (TDP) is to properly account for the many categories of information applicable to the various line items. For example, an entry for the line item "training ship-board buoy instruments technicians" can apply to such categories as personnel, training, seaborne support, instrumentation, OMN funds, etc. Obviously, with the frequent changes in initiation, scope and funding levels inherent in the preparation of a TDP, the desired summation of funds by categories can best be accomplished by means of a computer program.

The TDP 10-year Financial Plan computer program was developed to present detailed categorized funding information for yearly quarters and totals over a 10-year period. The user defines the "funding categories" applicable to the TDP analysis strategy. The line items in the TDP are collected under a user defined major activity or subactivity. The funding information for each group (subactivity) of line items is then assigned to the various funding categories as are applicable for the TDP analysis being conducted. The program reads in the data, collecting by month the various funding information applicable to each funding category. When finished, the program outputs the line items under their applicable headings and for each defined category, presents the accumulated costs by quarter, year, and for the 10-year period. A bar graph appears with the cost data to illustrate graphically the comparative expenditures for each quarter within a year, or the total expenditure for the year.

1.3.2 Program Input and Output

Basic inputs to the program are the category titles, major activity titles, the titles of subactivities under each major activity, and the line items with their funding schedule. The program lists all input data in the order in which it is used for ease of verifying the input data.

Figure 1-7 is an example of the category definition output page. In this example, 26 different categories were defined. Categories 2 through 23 could be one method of separating individual line item costs for further study. However, most of the line items applicable to categories 2 through 23 will also contribute to the total cost categories 1, 24, 25 and 26.

The input information for a subactivity of four line items is collected and listed as shown in Fig. 1-8. The major activity and subactivity headings that these items fall under are listed along with the funding schedule for each item. The cost allocation vector shown at the bottom is the "switch" used to indicate the categories to which the line items are applicable. In this example, the subactivity line items are applicable to Total Cost, Total Cost MK1, sensors (MK1) and Total Cost MK0 and MK1 (Cat. 1, 16, 17, and 24), as defined in Fig. 1-7.

The accumulated sum for each category is output as illustrated in Fig. 1-9. The bar graph to the right of each quarterly total is used to illustrate the rate of funding for the category for the year.

1.3.3 Additional Information

The main program is written in FORTRAN IV with an IBM 360/40 machine language subroutine to prepare the bar graph output. The program has been developed and tested on an IBM 360/40 system.

Section 2.3 presents further information on the program applicable for preparing data cards and running the job. Section 3.3 is additional information for a maintenance programmer.

1.4 The Buoy Component Characteristics Data File

During the initial phase of the 1967 TRC study of the feasibility of National Data Buoy Systems, an extensive survey was made of existing data buoys. Primarily, the information was collected and used to evaluate the 1967 state-of-the-art in buoy

COST VECTOR DEFINITION TABLE

CATEGORY	DEFINITION
1	TOTAL COST
2	TOTAL MANAGEMENT COST
3	PROJ MAN OFFICE
4	CONSULTANTS
5	TRAINING
6	COORDINATION
7	TOTAL RESEARCH COST
8	SENSORS
9	MAT AND COMPONENTS
10	GT LAKES AND ESTUARINE REQ
11	COOPERATIVE EFFORTS
12	TOTAL COST MK0
13	SENSORS (MK0)
14	HULL AND MOORINGS (MK0)
15	SEABORNE SUPPORT (MK0)
16	TOTAL COST MK1
17	SENSORS (MK1)
18	HULL AND MOORINGS (MK1)
19	SEABORNE SUPPORT (MK1)
20	SHORE SUPPORT (MK1)
21	TOTAL COST MK2
22	SENSORS (MK2)
23	HULL AND MOORINGS (MK2)
24	TOTAL COST MK0 AND MK1
25	TOTAL COST SEABORNE SUPPORT
26	TOTAL COST SHORE SUPPORT

Fig. 1-7. Category and Cost Vector Definition Table.

MAJOR ACTIVITY- MKI

SUB-ACTIVITY- SENSORS

YR PROGRAM

69-140 DEV MKI SENSORS

START MONTH = 9
STOP MONTH = 12
FUNDING = \$ 0K
AVG FUNDING/MONTH = \$ 0K

70- 2T LAB TESTING SENSORS

START MONTH = 14
STOP MONTH = 24
FUNDING = \$ 400K
AVG FUNDING/MONTH = \$ 36K

70-180 FNG DEV MKI SENSORS

START MONTH = 13
STOP MONTH = 28
FUNDING = \$ 1000K
AVG FUNDING/MONTH = \$ 63K

71- 2T LAB TESTING SENSORS

START MONTH = 25
STOP MONTH = 34
FUNDING = \$ 300K
AVG FUNDING/MONTH = \$ 30K

COST ALLOCATION VECTOR -

CATEGORIES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

CATEGORIES	16	17	18	19	20	21	22	23	24	25	26
	1	1	0	0	0	0	0	0	1	0	0

Fig. 1-8. Line Items with Funding Schedule and Activity Headings.

TOTAL COST MKI			\$ 13 MILLIONS													
YEAR	TOTAL (\$K)	QUARTER	QUARTERLY (\$K)	0	1	2	3	4	5	6	7	8	9	10	11	12
1969	900	1	157	.	.	.	.	.	.	.	.	.	.	.	.	.
		2	157	.	.	.	.	.	.	.	.	.	.	.	.	.
		3	277	.	.	.	.	.	.	.	.	.	.	.	.	.
		4	310	.	.	.	.	.	.	.	.	.	.	.	.	.
1970	9233	1	1946													
		2	1680													
		3	1642													
		4	3965													
1971	51592	1	10767													
		2	12061													
		3	14404													
		4	14359													
1972	48660	1	12332													
		2	12582													
		3	12337													
		4	11415													
1973	6230	1	813													
		2	1813													
		3	1813													
		4	1789													
1974	0	1	0	.	.	.	.	.	.	.	.	.	.	.	.	.
		2	0	.	.	.	.	.	.	.	.	.	.	.	.	.
		3	0	.	.	.	.	.	.	.	.	.	.	.	.	.
		4	0	.	.	.	.	.	.	.	.	.	.	.	.	.
1975	0	1	0	.	.	.	.	.	.	.	.	.	.	.	.	.
		2	0	.	.	.	.	.	.	.	.	.	.	.	.	.
		3	0	.	.	.	.	.	.	.	.	.	.	.	.	.
		4	0	.	.	.	.	.	.	.	.	.	.	.	.	.
1976	0	1	0	.	.	.	.	.	.	.	.	.	.	.	.	.
		2	0	.	.	.	.	.	.	.	.	.	.	.	.	.
		3	0	.	.	.	.	.	.	.	.	.	.	.	.	.
		4	0	.	.	.	.	.	.	.	.	.	.	.	.	.
1977	0	1	0	.	.	.	.	.	.	.	.	.	.	.	.	.
		2	0	.	.	.	.	.	.	.	.	.	.	.	.	.
		3	0	.	.	.	.	.	.	.	.	.	.	.	.	.
		4	0	.	.	.	.	.	.	.	.	.	.	.	.	.
1978	0	1	0	.	.	.	.	.	.	.	.	.	.	.	.	.
		2	0	.	.	.	.	.	.	.	.	.	.	.	.	.
		3	0	.	.	.	.	.	.	.	.	.	.	.	.	.
		4	0	.	.	.	.	.	.	.	.	.	.	.	.	.
TOTAL			\$116615	0	1	2	3	4	5	6	7	8	9	10	11	12

Fig. 1-9. Accumulated Cost for a Category (Number 16 in Fig. 1-7).

technology. The resulting data base was presented in a compact code format.² Under the present contract, TRC undertook to standardize these data as much as possible and reformat the data base for subsequent computer processing. The following paragraphs describe the work completed on these data and presents the characteristics of the reformatted data base. (Note: No effort has yet been made to update, or change, the data content from that tabulated in early 1967.)

The data collected were organized into 32 categories of data buoy components as listed in Table 1-2. The variety of individual characteristics required to fully describe these components is listed in Table 1-3. Obviously, any single component can have only a small subset of the 84 characteristics listed in Table 1-3, and it is necessary to have a specific component in mind in order for the entries in Table 1-3 to be applicable. Only the first five characteristics are common to all components except for the meteorological and oceanographic sensors which have eleven common characteristics.

The 1967 data have been processed into a two-dimensional matrix of components versus characteristics with entries in the table elements where the information was applicable and available. The matrix is on magnetic tape and is available for further computer processing use. Section 3.4 describes, in programmer language, the format of this data file. Appendix A is a listing of this data tape.

1.5 Fleet Numerical Weather Central Depth Data

In order to determine the number of subsurface sensor packages and the amount of mooring required for each buoy, it is necessary to have a reasonable estimate of the water depth at each buoy location selected. Routine ocean depth charts present this information, but on rather coarse "grid" for some areas. Another problem with available map data is the possibility for making interpolation errors when reading values. The Fleet Numerical Weather Central (FNWC, formerly Fleet Numerical Weather Facility) has ocean depth data on an approximately 20 n. mi. square grid for most of

²Walden, R. G. and E. J. Aubert, 1967: Buoy and Buoy Components Data Compilation and Analysis, Vol. 1, Part 2, TRC 7485-256, The Travelers Research Center, Inc., Hartford, July.

TABLE 1-2
BUOY COMPONENTS

Hull surface
Hull, subsurface
Pitch and roll sensor
Acceleration sensor
Vibration sensor
Mooring, tether
Mooring, main
Tensiometer sensor
Mooring depth control equipment
Acoustic release sensor
Power system, battery
Power systems, other
Data storage
Data processor
Interrogation
Telemetry
Time control equipment
Sensor scanner
Magnetic sensor
Atmospheric pressure sensor
Air temperature sensor
Dew point sensor
Wind velocity sensor
Precipitation sensor
Solar radiation sensor
Depth sensor
Current velocity sensor
Water temperature sensor
Salinity/conductivity sensor
Acoustic transponder
Acoustic sensor

TABLE 1-3
BUOY COMPONENT CHARACTERISTICS

Buoy identification	Output, direction	Auxillary floats
Data available	Power requirements	Ballast material
Manufacturer	Biological immunity	Ballast weight
Model number	Breaking strength	Modulation type
Cost	Buoyancy material	Band width
Reliability	Carrier frequency	Capacity A/H
Type	Direction reference	Charging system
Range, low	Displacement	Efficiency
Range, high	Electrical integrity	Data rate
Accuracy	Frequency	Draft
Output characteristics	Lateral displacement	Fuel
Size	Medium	Interrogate security
Weight	Resistance to corrosion	Mast height
Diameter	Corrosion protection below	Mast diameter
Length	Stretch to break	Mooring depth control
Height	Time constant	Redundancy
Width	Scope	Storage code
Depth limits	Buoyancy	Storage type
Survivability	Corrosion protection above	Reel capacity
Construction	Power output	Sampling rate
Material	Anchor release	Scan rate
Capacity	Anchor type	Static stability angle
Code type	Anchor weight	Swivels
Accuracy, speed	Anchor cost	Total mooring cost
Accuracy, direction	Anchor chain	Transmit interval
Type, speed	Antenna	Transmit duration
Type, direction	Average time, speed	Power
Output, speed	Average time, direction	Function

the ocean areas. The U.S. Coast Guard requested that FNWC forward their ocean depth data to TRC to make available a numerical tabulation of ocean depth data.

The data received from FNWC were magnetic tapes of packed coded depth* data. These values effectively describe the representative ocean depth within a 20-minute square of latitude and longitude. As received, the data were not in a format that could be easily used for manual processing. For this reason, TRC unpacked, decoded, reformatted and listed the original FNWC depth data. Buoy depth data can now be obtained by looking through the listing for the appropriate representative maximum and minimum depth value for points within a 0.33° latitude-longitude square. Appendix B is the listing of this reformatted data. The most serious limitation of the data is that there are values only for the southwest quarter of the North Atlantic.

*A magnetic tape describing ocean bottom roughness on a 1-degree grid was also received but not used by TRC.

2.0 COMPUTER PROGRAMS OPERATING INSTRUCTIONS

2.1 Integrated Buoy Deployment Cost Model

The buoy deployment program is the required tool for computing the assortment of time and cost values relative to a buoy system deployment. Basically, a buoy network is specified and the great circle distance between significant points are computed. From the total cruise distance traveled, a variety of time and cost values are computed as functions of possible ship capabilities and costs. In gross terms, the program processes the information in a number of independent user-controlled processing cycles, as directed by input control cards. When all processing cycles of the basic data have been completed, new basic data may be read in and another series of processing cycles begun. The program is highly generalized within a deployment oriented framework and allows the user to evaluate almost any "first-generation" buoy deployment strategy. For further general external features of the program, and examples of program outputs, the reader should refer to Section 1.1.

Input to the deployment model is complex due to the variety of information that is needed for each computer run. With this in mind, a concerted effort was made to make the operation of the program as straightforward as possible. A modest degree of success has been achieved toward this goal; however, the program user is cautioned to check carefully the data card punching and the sequence of input data cards.

There are four basic concepts built into the deployment program to reduce the bulk and complexity of the data preparation task. These are:

- (a) Identify all cards by obvious card names that are punched onto the cards.
- (b) Build constant values into the program for routine variables so that the internal constant will be used unless a new value is input.
- (c) Allow the program to recycle through basic data without repeating previously specified data values.
- (d) List all input as part of the output so that subsequent re-runs or corrections can be made easily.

Consonant with item (a), all input cards have given short names and are identified by that name by the program and throughout the remainder of this documentation.

Section 3.1 presents additional information on this computer program that is primarily of interest to a maintenance programmer.

2.1.1 Input Data Cards

The following paragraphs define the format for each program data card. The order in which they are described is not necessarily the order in which the cards are read in by the program.

All data values must be adjusted to the right so that the right-most digit falls into the right-most column of the data field for the variable (except for PORT, DEPOT, and SHIP name). An F, I, or A is given for each variable to define the format of the data. This code is as follows:

F = Data are in floating point and require a decimal point.

I = Data are integers without a decimal point.

A = Data are alphanumeric characters.

Data in capital letters in the "Contents" column mean those exact characters are to be punched on the input card.

As previously mentioned, certain constants have been built into the program, making it unnecessary to input a value for that variable every time the program is run. In describing the card formats, those variables that have a built-in constant are indicated by having the constant value presented in parenthesis following the description of the variable.

Deploy Control (DEPLOY) Card. The first data card indicates that deployment data cards follow. The format is:

<u>Columns</u>	<u>F/I/A</u>	<u>Contents</u>
1-15	A	DEPLOY STARTING
17-18	I	Day to start deployment
20-22	A	Month to start deployment. Characters must agree with one of the first twelve names punched on the next (alpha) card.
24-25	I	Last two digits of the year.
27-28	A	AT
30-33	I	Hour to start deployment, using the 24-hr clock.
35-37	A	HRS
41-54	A	IMPLANT INCR
56-57	I	Δt_1 , in hours,* normally zero
59-60	I	Δt_2 , in hours*
62-63	I	Δt_3 , in hours*
65-66	I	Δt_4 , in hours*

Alpha Input Card. This card provides needed sets of alphabetic characters so the program can recognize subsequent control words.

<u>Columns</u>	<u>F/I/A</u>	<u>Contents</u>
2-48	A	JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
51-55	A	NEWSM
58-68	A	STOPNEXTNEW
70-73	A	NAVP

*The program requires four "time-to-implant-a-buoy" values. The base time, T, is specified on the SHIP card. The four values t_1 to t_4 that are used are computed as follows:

$$t_1 = T + \Delta t_1$$

$$t_3 = t_2 + \Delta t_3$$

$$t_2 = t_1 + \Delta t_2$$

$$t_4 = t_3 + \Delta t_4$$

Ship Speed-Cost (SPCST) Card. The cost per n. mi. steamed by a ship and a maintenance cost to be added to the basic ship sea-day cost must be input for each ship size (buoy capacity) and speed. This is done by the SPCST card.

<u>Columns</u>	<u>F/L/A</u>	<u>Contents</u>
1-5	A	SPCST
7-10	F	Ship Speed
12-13	I	First buoy capacity
16-18	I	Daily additive cost to the basic ship sea-day cost for ship of this speed and buoy capacity.
20-24	F	Cost per n. mi. steamed
26-27	I	Next buoy capacity
29-32	I	Daily additive cost to the basic ship sea-day cost for ship of this speed and buoy-carrying capacity.
34-38	F	Cost per n. mi. steamed.
40-41	I	Next buoy capacity.
43-46	I	Daily additive cost to the basic ship sea-day cost for ship of this speed and buoy-carrying capacity.
48-52	F	Cost per n. mi. steamed.
54-55	I	Next buoy capacity.
57-60	I	Daily additive cost to the basic ship sea-day cost for ship of this speed and buoy-carrying capacity.
62-66	F	Cost per n. mi. steamed.
68-69	I	Last buoy capacity.
71-74	I	Daily additive cost to the basic ship sea-day cost for ship of this speed and buoy-carrying capacity.
76-80	F	Cost per n. mi. steamed.

There must be 8 of the above cards, one for each ship speed to be used. If less than 8 speeds are of interest, the last valid SPCST card can be repeated to complete the set of 8.

The SPCST cards define the possible ship speeds and buoy-carrying capacities that can be used during the run. The buoy-carrying capacity punched on the SHIP card must match a buoy-carrying capacity entered on the SPCST cards.

Run Number Card. This card contains a run number and date by which the output pages can be collected and identified. It also contains an option to suppress the printing of the results for individual ship speeds.

<u>Columns</u>	<u>F/I/A</u>	<u>Contents</u>
1-3	I	Run Number
5-6	I	Day of the run
8-10	A	Month of the run
12-13	I	Year of the run
14-72	A	These columns must be left blank
73	I	Print option code,* ship speed 1
74	I	Print option code,* ship speed 2
75	I	Print option code,* ship speed 3
76	I	Print option code,* ship speed 4
77	I	Print option code,* ship speed 5
78	I	Print option code,* ship speed 6
79	I	Print option code,* ship speed 7
80	I	Print option code,* ship speed 8

The run number is automatically incremented for certain processing cycles.

Heading Cards. There are two heading cards input and printed at the top of each output page. The format of both of the cards is:

<u>Columns</u>	<u>F/I/A</u>	<u>Contents</u>
1-65	A	Any set of alphanumerics
66-80	A	Blank

*Print option code.

1 Do not print calculations
blank Print calculations for that ship speed.

PORT Card. This card specifies the port location for the deployment ship. All cruises will begin and end at this port location.

<u>Columns</u>	<u>F/I/A</u>	<u>Contents</u>
1-4	A	PORT
8-9	I	A consistent port/depot number.
15-26	A	Port name.
29-32	F	Port latitude to the nearest tenth of a degree.
33	A	N or S for port latitude
35-39	F	Port longitude to the nearest tenth of a degree.
40	A	E or W for port longitude
42-43	I	Minimum days the ship must spend in port after each cruise. (4)*
45-46	I	The maximum days a ship can spend in port after each cruise. (10)*
48-49	I	The average number of days per year that the ship will not be available to implant buoys, normally the time the ship is in port for major overhaul. (30)*

DEPOT Card. This card tells the program where it is to on-load buoys. The depot location does not have to be the same as the port. If the two are the same, the port number and the depot number (columns 8-9) must be identical.

<u>Columns</u>	<u>F/I/A</u>	<u>Contents</u>
1-5	A	DEPOT
8-9	I	A consistent port/depot number
15-26	A	Depot name
29-32	F	Depot latitude to the nearest tenth of a degree.
33	A	N or S for depot latitude
35-39	F	Depot longitude to the nearest tenth of a degree.
40	A	E or W for depot longitude.

*Built-in constant.

SHIP Card. The ship card contains the ship constants to be used for a processing cycle. Although there are many constants defined on the card, it is possible to use the program's automatic assignment of values and not include a value for all items. To use a built-in constant value, simply leave that field blank. The value used will be the value shown in the parenthesis following the description of the variable.

<u>Columns</u>	<u>F/I/A</u>	<u>Contents</u>
1-4	A	SHIP
9-20	A	User preferred ship name or identification.
23	I	0 = Do not print cruise summary page 1 = Do print cruise summary page (blank = do not print)
33-34	I	Ship maximum buoy carrying capacity. There is <u>no</u> built-in value for this field.
36-37	I	Desired total number of sea-days per cruise. (30)
39-40	I	Maximum allowed sea-days per cruise. (99)
42-43	I	The minimum time required to implant a buoy. This is the time T used with entires on the DEPLOY control card. (12)
45-48	F	Overall safety factor used to multiply the minimum time and cost computations. (1.33)
55-58	F	The fraction of a ship sea-day cost that is to be used as the ship port-day cost. (0.94)
60-64	I	Minimum base cost, in dollars, for a ship sea-day. (2000)
66-70	I	Second base cost, in dollars, for a ship sea-day. (5000)
72-76	I	Maximum base cost, in dollars, for a ship sea-day. (8000)

The ship buoy-carrying capacity in columns 33-34 must match one of the buoy-carrying capacities included on the SPCST cards:

Buoy Cost (COST) Card. The costs associated with the buoy hardware are specified on this card.

<u>Columns</u>	<u>F/I/A</u>	<u>Contents</u>
1-4	A	COST
7-12	I	Buoy hardware cost except for subsurface sensors and mooring. (158000)
15-19	I	Cost for each buoy subsurface sensor package. (7000)
22-26	I	Cost for mooring per 1000 ft. (1750)
30-33	F	Mooring scope. (1.00)

BUOY Card. The location of each buoy to be deployed is input via a BUOY card.

<u>Columns</u>	<u>F/I/A</u>	<u>Contents</u>
1-4	A	BUOY
6-9	A	Buoy identification characters.
23-26	F	Buoy latitude to the nearest tenth of a degree.
27	A	N or S for the latitude.
29-33	F	Buoy longitude to the nearest tenth of a degree.
34	A	E or W for the longitude.
36-40	I	Water depth in feet or meters.
41	A	Units code for depth value in columns 36-40. M = depth in meters blank = depth in feet
43-48	I	Buoy hardware cost to override the cost on the COST card for this buoy. (If blank, cost is taken from the COST card.)

Navigation Check Point (NAVP) Card. It is sometimes desirable to have the deployment program sail to certain navigation check points. These are necessary to have the deployment ship sail around islands and peninsulas, since distances are computed on a great circle (straight line) basis. These navigation check points are input as follows:

<u>Columns</u>	<u>F/L/A</u>	<u>Contents</u>
1-4	A	NAVP
6-9	A	Point identification.
23-26	F	Latitude to the nearest tenth of a degree.
27	A	N or S for the latitude.
29-33	F	Longitude to the nearest tenth of a degree.
34	A	E or W for the longitude.
50-80	A	Available for comments.

LOAD Card. This card specifies the number of buoys to be deployed per cruise. No entry on the LOAD card can exceed the ship buoy-carrying capacity given on the SHIP card.

<u>Columns</u>	<u>F/L/A</u>	<u>Contents</u>
1-4	A	LOAD
6-7	1	Number of buoys to be deployed on the first cruise.
9-10	1	Number of buoys to be deployed on the second cruise.
12-13	1	Continued as necessary to include the loads for up to the first 25 cruises.
15-16	1	
18-19	1	
...	...	
79-80	1	

If a deployment strategy calls for 25 or more cruises, it is necessary to include a second LOAD card. The second LOAD card does not have the name punched on the card but uses 26 fields of 3 columns each, this allows a maximum of 50 cruises to be specified. (Note: there will always be a blank load field after the last cruise load. This is why a second (blank) card must be used if there are exactly 25 cruises.)

Navigation Points Per Cruise (NPPC) Card. The number of navigation points that must be used for each cruise are specified on this card. There must be an entry on this card(s) for each cruise specified on the LOAD card.

<u>Columns</u>	<u>F/I/A</u>	<u>Contents</u>
1-4	A	NPPC
6-7	I	Number of navigation points for the first cruise.
9-10	I	Number of navigation points for the second cruise.
12-13	I	Continued as necessary to include the first 25 cruises.
15-16	I	
18-19	I	
⋮		
79-80		

If all of the navigation points for each cruise can not be included on a single card (i.e., over 25 cruises), a second NPPC card is punched in the same format as the first.

Stop Buoy Input (STOP) Card. A combined total of up to 200 buoys and navigation cards can be input at one time. However, since the number of cards input is not fixed or specified, it is necessary to flag the end of the BUOY and NAVP cards with the following control card.

<u>Columns</u>	<u>F/I/A</u>	<u>Contents</u>
1-20	A	STOP BUOY/NAVP

Deployment Order (ORDER) Card. The buoy and navigation point cards are stored in an internal array in the order in which they are read. Normally, this order is a sort on the identification in columns 6-9 of the cards. The order in which these buoys are to be deployed generally bears no resemblance to these identification numbers. Therefore, ORDER cards are used to specify the order in which the buoys are to be deployed.

<u>Columns</u>	<u>F/I/A</u>	<u>Contents</u>
1-5	A	ORDER
6-8	I	The <u>input</u> sequence number of the buoy card or navigation point card that is to be used first.
9-11	I	The <u>input</u> sequence number of the buoy card or navigation point card that is to be used second.

<u>Columns</u>	<u>F/I/A</u>	<u>Contents</u>
12-14	I	Third input sequence number, etc.
15-17	I	Continued as necessary to specify up to 25 BUOY and/or NAVP cards input sequence numbers.
18-20	I	
21-23	I	
...		
78-80		

If all BUOY/NAVP cards to be used can not be included on one card, additional ORDER cards are prepared, in the same format, until all points have been specified. Note that a single BUOY or NAVP card can be used as many times as desired.

Next Ship (NEXT) Card. Normally, a set of buoys is deployed using a series of ships, each with a different buoy-carrying capacity. The NEXT ship card is used to indicate that the array of BUOY and NAVP data are to be deployed by a different ship.

<u>Columns</u>	<u>F/I/A</u>	<u>Contents</u>
1-9	A	NEXT SHIP

This card can also be used to indicate just a change in deployment order; however, the deployment ship characteristics must be restated.

New Buoys (NEW) Card. When all deployments on a set of BUOY/NAVP cards have been completed, it is possible to read in another set of cards and repeat the same cycle. This is indicated by the following card.

<u>Columns</u>	<u>F/I/A</u>	<u>Contents</u>
1-9	A	NEW BUOYS

THE END Card. The following card signals the end of all input data.

<u>Columns</u>	<u>F/I/A</u>	<u>Contents</u>
1-12	A	THE END

2.1.2 Data Deck Preparation

Data cards for the deployment model program are prepared from a specified buoy deployment strategy. Generally, the BUOY and NAVP cards are prepared to conform to a desired buoy network configuration, from some form of a buoy location, or cruise map. The ORDER in which the buoys are to be deployed is determined, which also defines the LOAD per cruise and the navigation points per cruise (NPPC). The various ship characteristics are defined and punched for the SHIP card. These cards, combined with the general information and control cards, make up the data deck.

The data cards are read in the order given in Table 2-1. A complete set of each type of data card is read to initiate the program and process a set of data for one ship. After the STOP BUOYS card there must be an option control card. If another ship is to be used, a NEXT SHIP card is followed by the four cards SHIP, LOAD, NPPC and ORDER to define the next deployment strategy. This same sequence is used in just the order in which the buoys are to be deployed is to be changed. When all ship and order strategies have been completed on a set of BUOY and NAVP cards, a new set of these data can be input by giving a NEW BUOYS card, which is followed by the series of cards shown in the last column in Table 2-1.

As can be seen from Table 2-1, the starting deployment date and the hours-to-implant-a-buoy increments input on the DEPLOY card are used for all cycles for that computer run. The ship operation costs input on the 8 SPCST cards are input once and also used for all computations in the run.

The run number is automatically increased by one each time a NEXT SHIP card is read. A new run card is input if new buoys are to be used and thus an opportunity to input a new run number.

The use of NAVP cards is optional. These cards, when included, follow the last BUOY card and precede the STOP BUOYS card. Even if NAVP cards are not used, the right number of (blank) NPPC cards must still be included.

It is not necessary to use all input BUOY and NAVP cards on each ship cycle.

A listing of the data card deck used to generate Figs. 1-1 through 1-5 is presented as Appendix C.

TABLE 2-1
INPUT SEQUENCE FOR REQUIRED DATA CARDS

Card Short Name	For First Ship Processing	To Change Ship and/or Dplymt. Order	Input New Buoys
DEPLOY	Yes		
Alpha	Yes		
SPCST (8 cards)	Yes		
Run	Yes		→ Yes
Heading (Line 1)	Yes		Yes
Heading (Line 2)	Yes		Yes
PORT	Yes		Yes
DEPOT	Yes		Yes
SHIP	Yes	→ Yes	Yes
LOAD	Yes	Yes	Yes
NPPC	Yes	Yes	Yes
ORDER	Yes	Yes	Yes
COST	Yes		Yes
BUOY	Yes		Yes
NAVP (Optional)	Yes		Yes
STOP	Yes		Yes
1 of the next 3 option cards must follow each cycle			
NEXT SHIP	if yes, then ————		
	or		
NEW BUOYS	if yes, then ————		
	or		
THE END	if yes, the program terminates		

2.1.3 Program Input Restrictions

A reasonable limit was necessary on the number of cards of one type that can be input within a processing cycle. These limits, and in some cases the mandatory number, are as follows:

- (1) The maximum number of different times-to-implant-a-buoy is 4.
- (2) The maximum and mandatory number of ship speeds is 8.
- (3) The maximum number of different ship buoy-carrying capacities is 5.
- (4) The maximum and mandatory number of ports is 1.
- (5) The maximum and mandatory number of depots is 1. If the port and depot are the same, their respective identification numbers must be the same.
- (6) The maximum number of basic ship sea-day costs is 3.
- (7) The maximum number of ship cruises per ship is 50.
- (8) The maximum total number of BUOY cards plus NAVP cards is 200 per STOP BUOY card.
- (9) The maximum total number of buoy locations plus navigation points used per ship cycle is 300. For example, if there are 180 BUOY cards and 10 NAVP cards, this is less than 200 and satisfies limit (8). The 10 different navigation points, however, can be used only up to 120 times since the total number of points used ($180 + 120$) cannot exceed 300.

2.1.4 Program Operation

2.1.4.1 Equipment Required

The program is written in FORTRAN IV and was developed and tested using the IBM 360/40 Disk Operating System. A compilation of the program requires about 7 minutes. The program uses about 49,000 bytes of storage and requires a central processor, a card reader and an output printer to be run.

2.1.4.2 Error Message and Aborts

The program has two programmed error messages. If the number of sea days for a cruise exceeds the maximum value input on the SHIP card, the message

EXCEEDED MAX NBR OF SEA DAYS TO IMPLANT BUOY aaxx
REORDER BUOYS AND DO ANOTHER DEPLOYMENT

is output, where naxx is an input BUOY card identification. Following this message, the program aborts. The other error message,

COST VALUES NOT IN COST TABLE FOR SHIP BUOY CAPACITY = ii,
CHECK INPUT CARDS AND TRY AGAIN

occurs if the ship buoy-carrying capacity on the SHIP card does not match with a ship buoy-carrying capacity on the SPCST cards. Further processing is also aborted if this occurs.

The program will abort if the data cards are improperly punched. An abort will also occur if the data deck card sequence is bad and causes the program to attempt to read a data field that is not compatible with the card being read. To locate these types of errors, review the last satisfactory cycle of data. The error is usually obvious as the aborting point is indicated by the termination of the printed output.

2.1.4.3 Recovery Procedures

There are no recovery points in the program. When an abort does occur, recovery is accomplished by restarting the processing cycle at, or prior to, the point where the error occurred.

2.1.4.4 Running Time

The program operates on the IBM 360-40 system at essentially the speed of the printer. Since the minimum output possible is:

- 1 Constants Page,
- 1 Buoys Page,
- 1 System Deployment Summary Page, and
- 3 Deployment Test Summary Pages.

the minimum running time is about 30 seconds regardless of the number of buoys to be deployed. Only a small additional time (of the order of five seconds) is required to read in the data cards and do the computations.

2.1.4.5 Error Checking Procedures

It is sometimes necessary to input a large amount of data to the program. Even after personnel are experienced in preparing the data and the program, the possibility of an error cannot be reasonably discarded until the data and results have been

carefully checked. Experience with the program has indicated the following procedures can help reduce the number of bad computer runs.

(a) Develop a file of correctly punched standard cards, such as SHIP, PORT, DEPOT, etc. Use these cards as much as possible to avoid errors when punching new cards.

(b) Obtain a simple card listing of the data deck when it is considered complete and ready. Use this listing and Table 2-1 to validate the sequence of the data cards.

(c) From the listing made in (b), check the order the buoys are to be deployed against the cruises planned for each ship. At the same time, check the LOAD, NPPC and ORDER cards for the right total number of entries. The number of entries on the order cards must equal the sum of the values on the LOAD and NPPC cards.

(d) Use the listing to verify the correct punching of the BUOY cards. Be sure the BUOY cards are in the order desired. Check the latitude, longitude and depths on the BUOY cards for obvious errors; be sure M follows those depths given in meters. Verify the positions cut on the NAVP cards.

After the run has been made, it is desirable to review the results prior to delivery to the user. The following steps are suggested as part of this review.

(a) Values on the constants page should be verified as those values desired for the run.

(b) The list of buoys in the order they are deployed should be scanned. Investigate large changes in latitude and/or longitude between successive buoys if they do not occur between the end of one cruise and the start of the next. This order can also be verified against the planned cruise map for that ship. Be sure the total number of buoys to be deployed is as planned. Note that navigation points do not appear on this list.

(c) Review the Cruise Summary Pages for strange distances between successive points. Navigation points are listed with this output. Be sure each cruise begins and ends as planned.

(d) The System Deployment Summary Page is used to compare one cruise against the other. Normally, the distance traveled per cruise should be roughly the same. If one cruise is unusually longer or shorter than the others, determine if it was correct, as suggested in (b) and (c) above.

(e) The Deployment Test Summary Pages contain the ship speeds, ship operating costs constants and the four values used as the times to implant a buoy. Validate these constants and check results for reasonableness.

Additional error recovery procedures are presented in Section 2.1.4.3.

2.2 Procurement, Maintenance, and Replacement-Cost Model Computer Program

2.2.1 Introduction

This cost model reads a deck of buoy component data cards that contain the name, number of units, expected lifetime, initial cost, and salvage value for each hardware item to be considered. From these data, the program computes, for each item,

$$\text{Initial Procurement Cost} = (\text{item cost}) \times (\text{number of items}), \quad (2-1)$$

$$\text{Replacement Cost/Year} = \frac{(\text{Int. Proc. Cost}) - (\text{Salvage Value})}{(k) (\text{Lifetime})}, \quad (2-2)$$

$$\text{Maintenance Cost/Year} = 0.5 (\text{Replacement Cost/Year}), \text{ and} \quad (2-3)$$

$$\text{No. of Replacements/Year} = \frac{(\text{Number of units of the item})}{(k) (\text{Item lifetime})}, \quad (2-4)$$

The input factor k in Eqs. (2-2) and (2-4) makes it possible to recycle through a deck of items and compute new values by changing the lifetime of each item by a constant percentage.

2.2.2 Input Cards

All data values are to be adjusted to the right so that the right-most digit falls into the right-most column of the data field for the variable. An F, I or A is given for each variable to define the format code of the data as follows:

F = Data are in floating point and require a decimal point.

I = Data are integers and without a decimal point.

A = Data are alphanumeric characters.

Data in capital letters in the "Contents" column mean those exact characters are to be punched on the input card

Card 1-Option Control Card. The first card in the data card deck must be as follows:

<u>Columns</u>	<u>Contents</u>
1-12	STOPRECYCHAN

This provides the input necessary to detect subsequent program control words.

Card 2-System Specification Card. The next card defines the number of buoys for which to compute costs and the lifetime adjusting factor k for Eqs. (2-2) and (2-4).

<u>Columns</u>	<u>F/I/A</u>	<u>Contents</u>
1-12	A	REPLACEMENTS
14-16	I	Number of buoys for which to compute costs
18-22	A	BUOYS
25-41	F	LIFETIME FACTORS
43-45	F	Lifetime modifying factor k. (If blank, k = 1.0)

Card 3-Run Card. This card identifies the run with a run number and date.

<u>Columns</u>	<u>F/I/A</u>	<u>Contents</u>
1-4	A	RUN
5-6	A	Run number
12-20	A	Day-month-year

Card 4 and 5-Title Cards. Two alphanumeric cards are input to describe the run.

<u>Columns</u>	<u>F/I/A</u>	<u>Contents</u>
1-64	A	Any alphanumeric characters

Card 6-Item Data. This is the card used to input the pertinent data about each hardware item.

<u>Columns</u>	<u>F/I/A</u>	<u>Contents</u>
1-16	A	Item Name
21-24	I	Number of items/buoy. If blank, the number of buoys in the system from card 2 is automatically inserted here.
25-29	F	Expected item lifetime in years
32-39	F	Cost of an item in dollars
42-47	F	Salvage value in dollars

One of these cards is prepared for each hardware item included in the system. The maximum allowed number of these item cards is 50.

Card 7-End-of-Items Card. The following control card must follow the last item card:

<u>Columns</u>	<u>Contents</u>
1-15	STOP ITEM CARDS

Card 8a-Option: Recycle Card. To change the lifetime of the items, the following card is used:

<u>Columns</u>	<u>Contents</u>
1-7	RECYCLE

This card must then be followed by cards 2, 3, 4 and 5

Card 8b-Option: Change Item Cards. This card is used to change the contents of the item deck, and is used in place of card 8a.

<u>Columns</u>	<u>Contents</u>
1-17	CHANGE ITEM CARDS

Cards 9, 6, 2, 3, 4 and 5 must then immediately follow this card.

Card 8c-Option: End Run. The following card is used to terminate the computer run.

<u>Columns</u>	<u>Contents</u>
1-7	THE END

Card 9-Item Modification Control Card. This card is used in conjunction with card 8b to specify changes to the previous item card deck. The format of this card is:

<u>Columns</u>	<u>F/I/A</u>	<u>Contents</u>
1-2	I	Number of item cards to be changed
4-5	I	Sequential number of the first item card to be changed
7-8	I	Sequential number of the second item card to be changed
⋮		
78-80	I	Sequential number of the 26th item card to be changed

If more card changes are needed, continue the sequential numbers on another card, starting in columns 2 and 3. Following the last card 9 must be the number of new item cards (card 6) that is specified in columns 1 and 2 of the first card 9. These modifying item cards must contain a number in columns 21-24 as the automatic number insertion feature is not available at this point in the program. The card immediately following the last new item card must be an option control card 8a, 8b, or 8c. (Note: The original total number of item cards must remain constant through all change cycles.) The data deck used to produce Fig. 1-6 is presented as Appendix D.

2.2.3 Information and Expected Output

The complete program and data deck are assembled as specified for a normal FORTRAN IV input deck. The data cards must be in the order specified in the preceding section.

Output from the program is one page per cost computation cycle. The program requires a central processor, card reader, and printer. The program operates at printer speed, thus requires about four seconds per complete computation cycle.

There are no program error or diagnostic messages. An output data error will be due to either improper punching of the cards or in sequencing the data cards. Recovery from these errors is accomplished by correcting the data and rerunning the program from the last appropriate valid data cycle.

2.3 TDP 10-Year Financial Plan Program

2.3.1 Introduction

This program is a means of assigning the time-phased funded line items in a TDP to applicable user-defined categories. This information is input to the program by means of cards that are of three possible "levels" of information. These levels are: (1) a major activity, (2) a subactivity, and (3) line items under a subactivity. This data structure is illustrated in Fig. 2-1. As the data cards are read, they are collected under their appropriate headings and the cost information allocated to the designated categories. When all input data have been read the accumulated totals for each category are listed by quarterly and yearly totals for the 10-year period.

2.3 Input Data Cards

Prior to the use of the program, it is necessary to structure the TDP data much as outlined in Fig. 2-1. Once this has been accomplished, and the categories defined, the data cards are cut and input essentially as illustrated in Fig. 2-1.

The different types of input cards to the program are defined in Table 2-2. Note that all numbers input are without a decimal point and are right adjusted within a data field. The values for starting and ending months on card 10 is based on a 120-month period; therefore, the first month in the second year is input as month 13, the last month of the tenth year is month 120, etc.

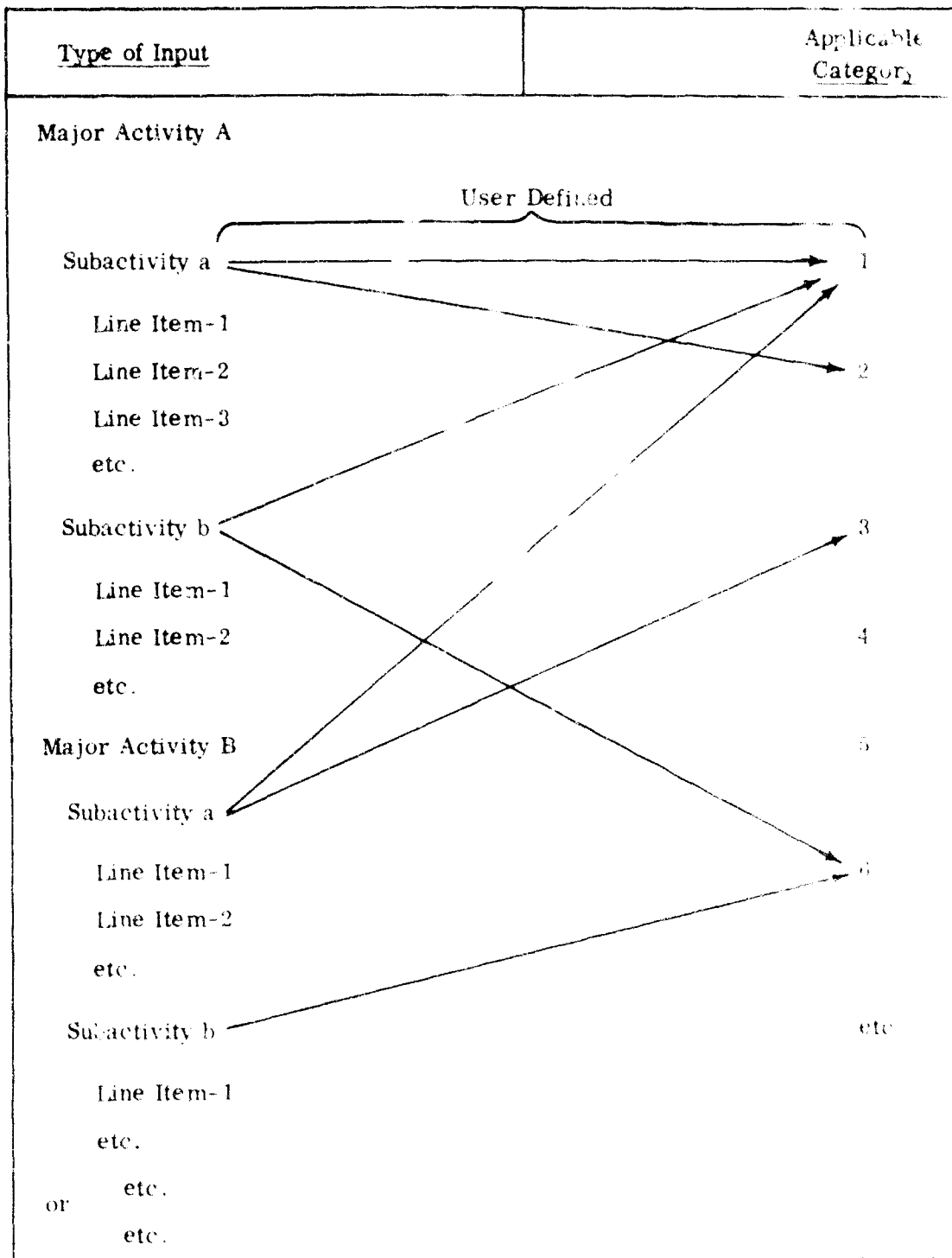


Fig. 2-1. Schematic illustration of the relationship between the program's various levels and type of data.

TABLE 2-2
FORMAT OF THE INPUT CARDS TO
THE TDP 10-YEAR FINANCIAL PLAN PROGRAM

Card	Columns	Contents
1	1-5 10	Total numbers of categories Code as follows: blank Bar graph for quarterly totals 1 Bar graph for yearly total
2	1-80	A category title
3	1-5	Number of major activities
4	1-80	A major activity title
5	1-5	Number of subactivities in a major activity
6	1-80	A subactivity title
7	This card contains the cost allocation codes to indicate to which category the line items within the subactivity are to be applied. Code as follows: 0 Do not allocate the line item(s) in this subactivity to the category 1 Allocate all the line items in the subactivity to the category 2 Code for category 1 4 Code for category 2 . . 54 Code for category 27	
8	1-5	Number of line items in the subactivity
9	1-40	Line item description
10	3-5	Funding schedule starting month number (1 to 120)
	8-10	Funding schedule ending month number (1 to 120)
11*	1-12	Dollars funded for first month of spending
	13-24	Dollars funded for second month of spending

*See text (continued next page)

TABLE 2-2 (Continued)

<u>Card</u>	<u>Columns</u>	<u>Contents</u>
11*	25-36	Dollars funded for third month of spending
	37-48	Dollars funded for fourth month of spending
	49-60	Dollars funded for fifth month of spending
	61-72	Dollars funded for sixth month of spending
11a*	1-12	Dollars funded for seventh month of spending
	.	
	61-72	Dollars funded for twelfth month of spending
11b*	1-12	Dollars funded for thirteenth month of spending
	.	

*See text.

The funding schedule for a line item can be input in one of two modes. The first is to specify a total amount that is to be spent over a fixed period. In this mode, the program divides the total into equal amounts that are assigned to each month in the period. The other method of scheduling funds is to input the amount to be spent for each individual month. This approach requires the use of the optional cards 11, 11a, 11b, etc. Note, however, that if individual monthly amounts are to be used, the dollar value on card 10 must be zero and there must be enough cards 11, 11a, 11b, etc. to include the amount for each month indicated on the card 10.

Table 2-3 is an outline of a data deck showing the order and required quantity for each card listed in Table 2-2. Notice how the values punched on certain cards determine how many of another type of card must be input. Appendix D is a listing of the data card deck used to generate Fig. 1-7 through 1-9.

TABLE 2-3
ORDER AND NUMBER OF REQUIRED INPUT CARDS

Card No. from Table 2-2	Required No. of Cards	Card Description
1	1	Number of categories, N_c
2 } . . 2 }	N_c	Category titles
3	1	Number of major activities, N_a
4	1	Major activity title
5	1	Number of subactivities, N_s
6	1	Subactivity title
7	1	Costs allocation card
8	1	Number of line-items N_i in this subactivity
9 } 10 11* . . . 9 10 11* }	N_i Sets	Line item description and funding schedule
6 to 11	repeated N_s times	
4 to 11	repeated N_a times, including required subactivity cycles	

*Optional.

2.3.3 Additional Information

2.3.3.1 Program Limitation

The September 1968 version of this program will accept up to 27 categories. If a value over 27 is punched on card 1 the result will be a bad program run and probably an abort.

2.3.3.2 Error Messages, Aborts and Recovery

There are no programmed error messages or aborts. The only logical abort occurs if the data cards are mispunched or the data deck is improperly sequenced. These errors result in a normal FORTRAN system abort.

There are no recovery points built into the program. If errors do occur, the program and data should be completely re-run.

2.3.3.3 Equipment Required and Running Time

The program requires a central processor, a card reader and an output printer. The program processes the input data essentially as fast as it is read and is therefore limited by the speed of the output. Since there are two pages of output per subactivity, a rough estimate of the running time, in seconds, is 6 times the total number of subactivities specified.

Section 3.3 presents additional details on the program, primarily for a maintenance programmer.

3.0 M/ TENANCE PROGRAMMER MANUAL

3.1 Integrated Buoy Deployment Cost Model*

3.1.1 Introduction

The purpose of the buoy deployment program is to compute the distance, time and cost required to deploy a given set of buoys from a port and depot. A great circle subroutine computes the distance between the given latitude-longitude points. The program computes the time required to travel this distance for the ship speeds that are specified. From these computed travel times, and other factors, various cost computations are made to determine the time and total deployment costs for each ship speed specified. A clock subroutine is used throughout to record the beginning and ending date for each cruise and the date each buoy is implanted. Another subroutine computes the individual and total system hardware cost for all the buoys deployed.

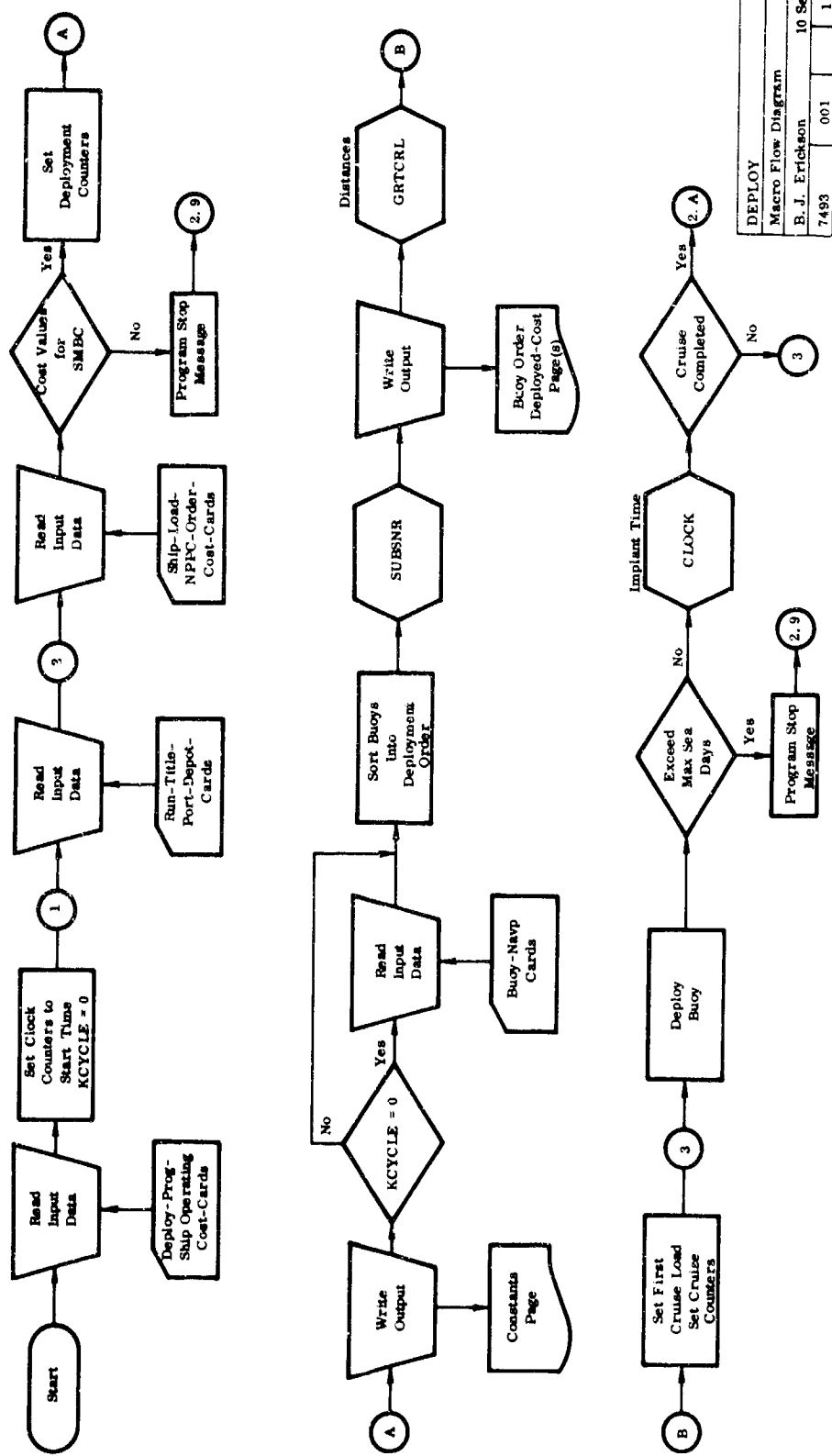
3.1.2 Verbal Flow

Figure 3-1 is a macro flow diagram of the deployment program and should be used in conjunction with the verbal flow that follows. For greater program details, the reader should refer to the program compilation listing in Appendix F and the micro flow diagrams in Appendix G. The program source deck is Appendix H.

Initial input data are read from the DEPLOY card through the COST card (see Table 2-1). The counters to be used in subroutine CLOCK are set to the starting time on the DEPLOY card. A search is made of the ship operating cost table to find the cost values corresponding to size of ship being used. All deployment counters and constants are set and an output page is printed containing the constants to be used.

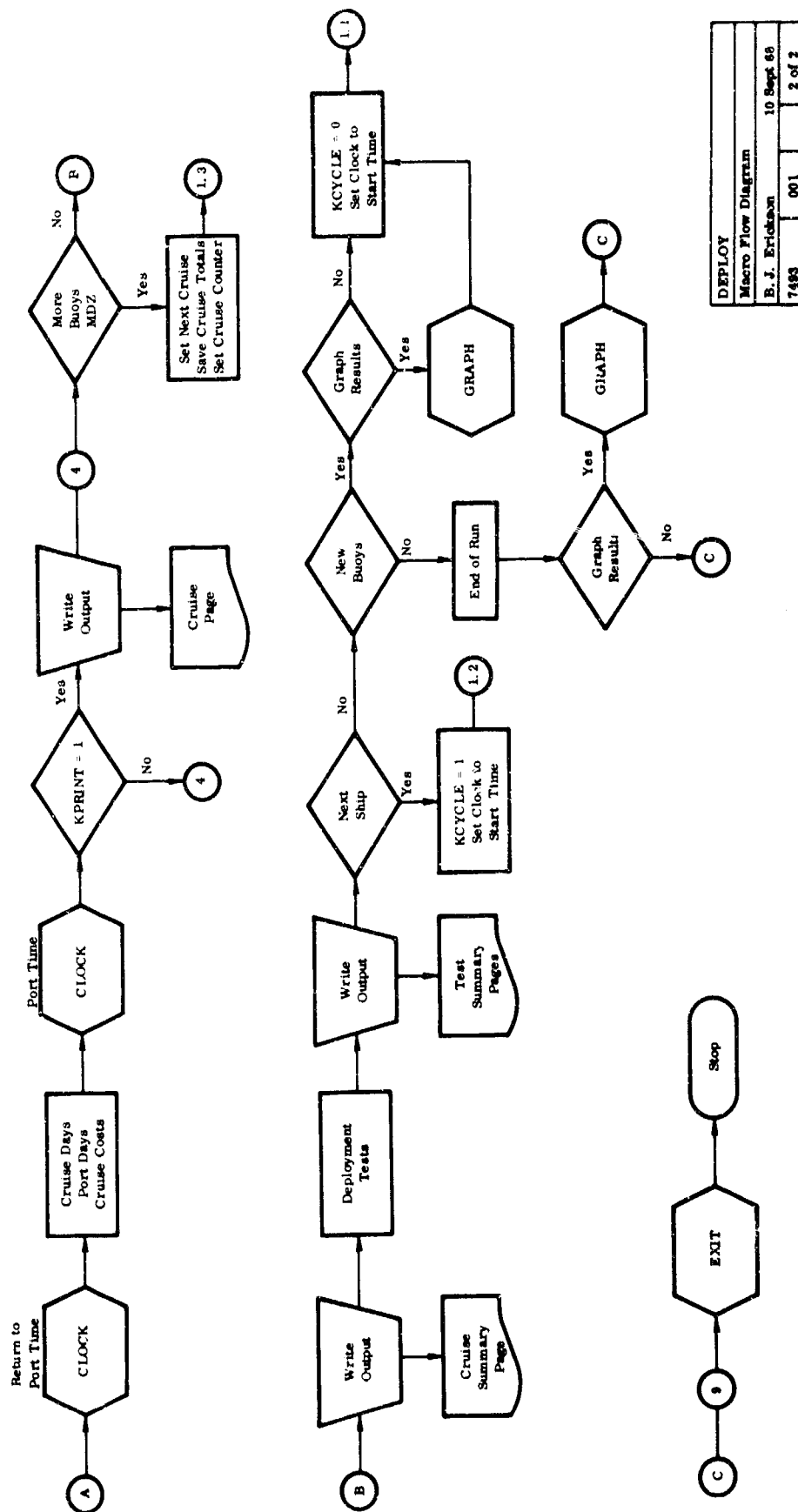
BUOY and NAVP cards containing latitude-longitude locations are read and stored in the order in which they are read. A STOP card signals the end of these input cards which are then sorted into the deployment order specified on the ORDER cards. Subroutine SUBSNR is called to compute the number and cost of the subsurface sensors required and the cost of mooring for each buoy location. Total and average values are also computed for buoy hardware cost, length of mooring required, and subsurface sensors required. The data buoy hardware cost and deployment order page is printed upon return from SUBSNR.

* This computer program was coded, checked out, and maintained by Bernard J. Erickson.



DEPLOY			
Macro Flow Diagram			
B. J. Erickson	10 Sept 68		
7493	001		1 of 2

Fig. 3-1. Micro Flow Diagram of the Buoy Deployment Program (Sheet 1 of 2).



DEPLOY			
Macro Flow Diagram			
E. J. Erickson	10 Sept 88		
7483	001		2 of 2

Fig. 3-1. Micro Flow Diagram of the Buoy Deployment Program (Sheet 2 of 2).

Subroutine GRTCRL is called once to compute all the required distances. A distance is computed from the port to each buoy location and the distance between successive buoy location in the order deployed. If the buoy depot and the port are not the same, the distance between the port and the depot and from the depot to the first buoy deployed on a cruise is also computed.

The first cruise load value is taken from the LOAD card and cruise counters are initialized. The time to deploy a buoy is the time to travel to the buoy location plus the time at the location to implant the buoy. A test is made to determine if the time to deploy the next buoy plus the time required for the ship to return to port exceeds the desired number of days at sea per cruise. If this value is exceeded, a message is printed out but the deployment continues. If the time to deploy the next buoy and return to port exceeds the maximum number of days at sea per cruise, a message is printed out to this effect and all further deployment is terminated. Subroutine CLOCK is called and given the time required to deploy the last buoy. If the cruise is not completed, the next buoy is deployed and the complete procedure is repeated.

When the last buoy for a cruise has been deployed, the ship returns to port and the date is recorded by CLOCK. The total cruise days, port days, and cruise costs are computed. The in-port time is recorded by CLOCK and a cruise summary is output, if that option has been set. If more buoys remain to be deployed, the next load of buoys is determined, completed cruise totals are saved, and the cruise counters set for the next cruise. Program control now goes back to the deployment procedure described in the previous paragraph.

When all buoys have been deployed, appropriate totals are computed. A Cruise System Deployment Summary Page is printed that describes the individual cruises and presents the total deployment cost computations. A series of calculations are made to process the eight different ship speeds for four different buoy implanting times and for three different base costs per sea-day. The results of these computations are printed on three Test Summary Pages, one for each base cost used.

An option card is read and checked to determine if the NEXT ship is to be used, NEW buoys are to be deployed or if the machine run is finished. If the NEXT ship option is to be exercised, necessary SHIP, LOAD, NPPC, and ORDER cards are read and the deployment procedures are repeated. If NEW buoys are to be input, a check is

made to determine if previous results are to be graphed. If graph is requested, subroutine GRAPH is called and selected computations are presented in graphical form (for diagnostic purposes only). Upon completion of GRAPH, clock counters are set to the start time and the program returns to read a new set of cards, starting with the run card. All tests and deployment procedures are repeated for the new buoy data read.

When all input data have been processed, a check is made to determine if the last computed results are to be graphed. If graph is requested, subroutine GRAPH is called as before. Upon completion of GRAPH, subroutine EXIT is called and the machine run is terminated.

3.1.3 Deployment Subroutines

Subsurface Sensors (SUBSNR). The call to this subroutine contains location, depth, hardware unit costs and note of whether the location is for a BUOY or NAVP card. The output of SUBSNR to the main program is the number of subsurface sensor packages required per buoy, the total hardware cost for each buoy, the total number of subsurface sensors required and the total length of mooring needed for all buoys.

The number of subsurface sensors required is determined by comparing the buoy depth, in feet, with the depths listed in Table 3-1. A search is made through Table 3-1 for each buoy location depth, until the depth equals one of the levels or falls between two adjacent levels. If the depth equals a level exactly, the number of sensors required is equal to the level number given in Table 3-1. If the depth falls between two levels, the number of sensors is equal to the lower level number if the difference between the depth and the lower level is equal to or greater than 0.3 of the difference between the two adjacent levels. If the depth exceeds level 20, (16,405 ft) the number of subsurface sensors is set at 20.

The cost of subsurface sensors per location is the number required times the unit cost of a sensor. Cost of mooring is the location depth times the cost of mooring times the mooring scope. Total buoy hardware cost is basic buoy cost plus the cost of the sensors and the cost of the mooring. Total hardware cost for all buoys being deployed is the sum of the individual buoy costs.

If the latitude-longitude location is for a NAVP card, the above procedures are skipped and the next input location is tested until another BUOY card is found or the complete list of inputs has been tested.

TABLE 3-1
DEPTHS AT WHICH SUBSURFACE SENSORS
ARE REQUIRED

Level no.	Depth ft	Level no.	Depth ft
1	0	11	1312
2	33	12	1641
3	66	13	1969
4	98	14	2625
5	164	15	3281
6	246	16	4922
7	328	17	6562
8	492	18	9843
9	656	19	13124
10	984	20	16405

Date-Time Clock (CLOCK). Subroutine CLOCK receives a time input from the main program which may be in hours, days or months. CLOCK maintains a 24-hour day counter, 30-day month counter, and a 12-month year counter. CLOCK is set with the initial starting deployment hour, day, month, year obtained from the DEPLOY card.

When the hour counter equals 24, hour = 0 and day = day + 1. When the day counter equals 31, day = 1 and month = month + 1. When the month counter equals 13, month = 1 and year = year + 1. A set of calendar month names are read in to convert the month value into JAN, FEB, etc. for printed output.

An option to accumulate total days is available in the CLOCK subroutine but is not used since total days are maintained in the main deployment.

Great Circle (GRTCRL). Subroutine GRTCRL calculates the great circle distance between points on the surface of the earth. These points are defined by their latitude and longitude given to the nearest tenth of a degree. Prior to calling GRTCRL, however, all south latitudes and west longitudes are converted to negative values for computational ease and consistency. Also, degrees and tenths are converted to radians before any computations are made.

The great circle distance between two locations is computed by:

$$\cos a = (\sin b \times \sin c) + (\cos b \times \cos c \times \cos A) \quad (3-1)$$

where a is the resulting great circle arc, b and c are the latitudes of the two input locations and A is the absolute value of the smallest difference in longitude between the two points. The arctangent function is used to convert (cos a) into an angle in radians by:

$$\text{angle} = \tan^{-1} \left([1 - (\cos a)^2] / \cos a \right) \quad (3-2)$$

The angle is converted from radians to degrees and multiplied by 60.11031 to obtain distance in International Nautical Miles. The output of GRTCRL is an array of port-to-buoy and buoy-to-buoy distances for all points of interest.

GRAPH Diagnostic Subroutine. This subroutine was incorporated into the deployment program to aid in checking for input errors. The subroutine was never fully checked out and it is not to be used for production runs, although the call to GRAPH and a dummy subroutine are part of the final program. This paragraph is to inform the maintenance programmer of this subroutine's existence in the program, however, development or use of this subroutine must be the complete responsibility of the maintenance programmer.

3.1.4 Input Card Format Statements

Table 3-2 is a list of the FORTRAN format statements that are used to read in the various data cards for the deployment program. A careful check of these formats with the punching instructions given in Section 2.1.1 will show there are additional items read from the run card that are not included in the card or program description. These additional inputs were used during program development to produce summary results that could be input to subroutine GRAPH. This feature was considered to be only a developmental function and was not intended for routine use. However, it was not removed from the program and could be refined by a maintenance programmer if there is a need for such summary output.

TABLE 3-2
DEPLOYMENT INPUT CARDS FORTRAN FORMAT STATEMENTS

Card Name	Format Statement
DEPLOY	16X, I2, A4, I3, 4X, I2, 23X, 4I3
Alpha	12A4, 2X, 5A1, 2X, 4A4
SPCST	8(5X, F5.1, 5 (F3.0, F5.0, F6.2))
Run	2I3, A4, I3, 7X, 2I3, 9F5.1, 1X, 8I1
Heading	2 (20A4)
PORT	6X, I3, 5X, 3A4, F6.1, A1, F6.1, A1, 3F3.0
DEPOT	6X, I3, 5X, 3A4, F6.1, A1, F6.1, A1
SHIP	8X, 3A4, I3, 8X, 4F3.0, 3F5.2, 3F6.0
COST	6X, F6.0, 2X, F5.0, 2X, F5.0 2X, F5.2
BUCY	A4, 1X, A4, 11X, F6.1, A1, F6.1, A1, I6, A1 F7.0
NAVP	
LOAD (1)	4X, 25I3
(2)	26I3
NPPC (1)	4X, 25I3
(2)	4X, 25I3
STOP	A4
ORDER	5X, 25I3
NEXT	A4
NEW	A4
THE END	A4

3.2 Procurement, Maintenance, Replacement-Cost Model Computer Program*

3.2.1 Program Flow

The logic for this program is shown in Fig. 3-2 and in the compilation listing presented as Appendix I. After the identification and control cards have been read, the program builds an array of the input component (item) cards. When all of these have been read, the costs and numbers are computed for Eqs. (2-2) to (2-5). Results are output, the option card is read and control goes to the appropriate part of program. If the item cards are to be changed, the previously stored array is modified according to the new input cards. When all changes have been made, the new values are computed and the next option card is read.

There are no subroutines in this program.

The source deck for this program is presented as Appendix J.

3.2.2 Format Statements

The FORTRAN statements used to read each input card is shown in Table 3-3. The card numbers in Table 3-3 are the same as those used in Section 2.2.2. It may be noted that any set of input control characters may be input as long as they are also used on the option cards. A match for card 5c, THE END card, is not input; the end is assumed if the control characters do not match with any of the three input words on card 1.

3.3 TDP 10-year Financial Plan Program**

3.3.1 Program Description

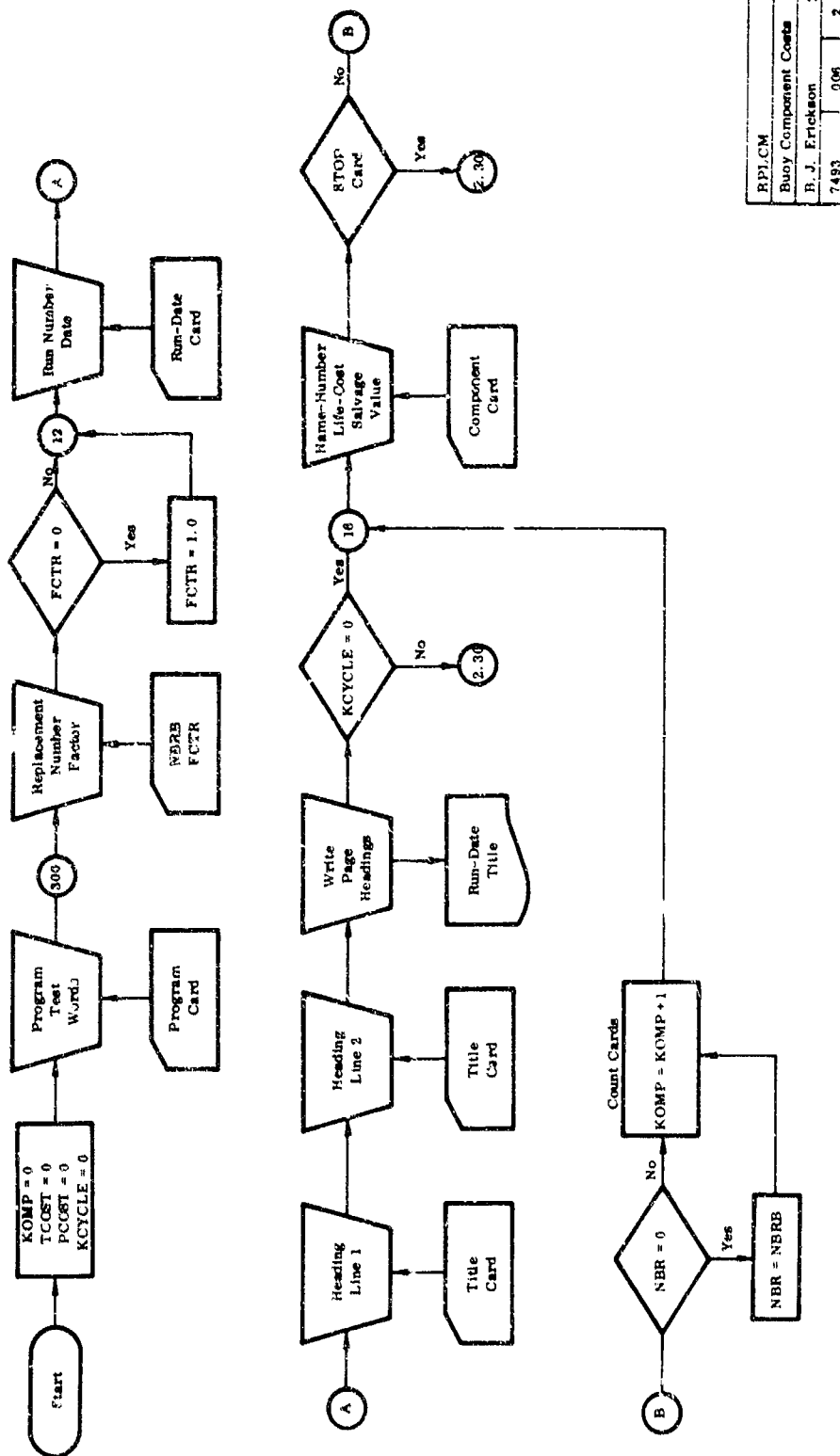
This program accepts a card deck describing line items and their funding schedule from a TDP. Input card information is cyclical and can be easily changed in response to different TDP strategies.

The flow diagram for this program is shown in Fig. 3-3. A compilation listing is presented as Appendix K and the program source cards as Appendix L.

After the category title cards have been stored, the program reads and processes the data cards in cycles. The required number of inputs within a processing cycle is read from a data card preceding the cycle of data. One card tells how many major

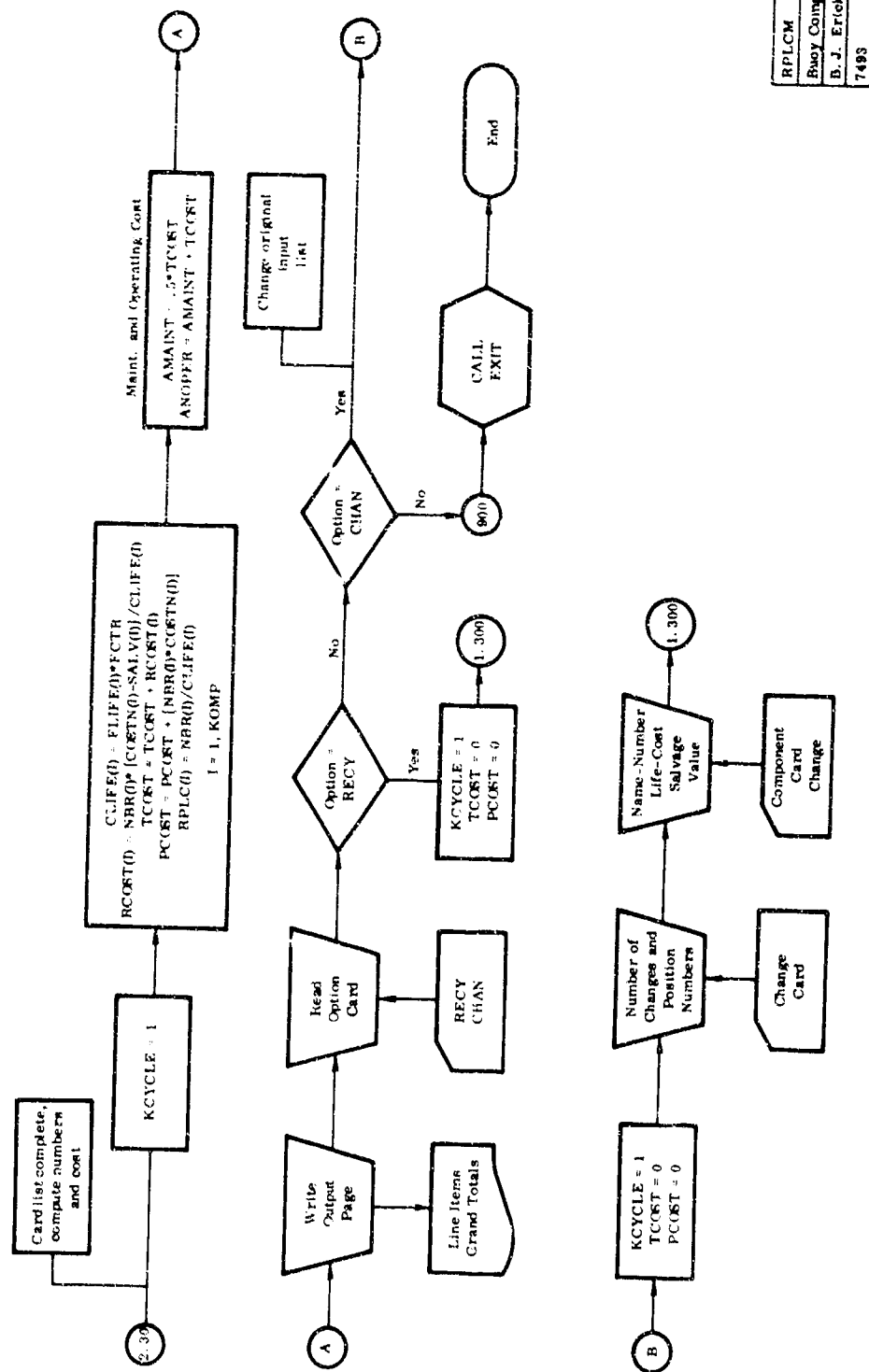
* This program was coded and developed by Bernard J. Erickson.

** This program was coded and maintained by Edward R. Sweeton.



BPLCM			
Buoy Component Costs			
B.J. Erickson			
7493	006	2	1 of 2

Fig. 3-2. Flow Diagram for the Procurement, Maintenance and Replacement Program (Sheet 1 of 2).



RPLCM			
Ruoy Component Costs			
B. J. Erickson	25 June 86		
7493	006	2	2 of 2

Fig. 3-2. Flow Diagram for the Procurement, Maintenance and Replacement Program (Sheet 2 of 2).

TABLE 3-3
 FORTRAN INPUT FORMAT STATEMENTS FOR THE
 PROCUREMENT, MAINTENANCE, REPLACEMENT-COST PROGRAM

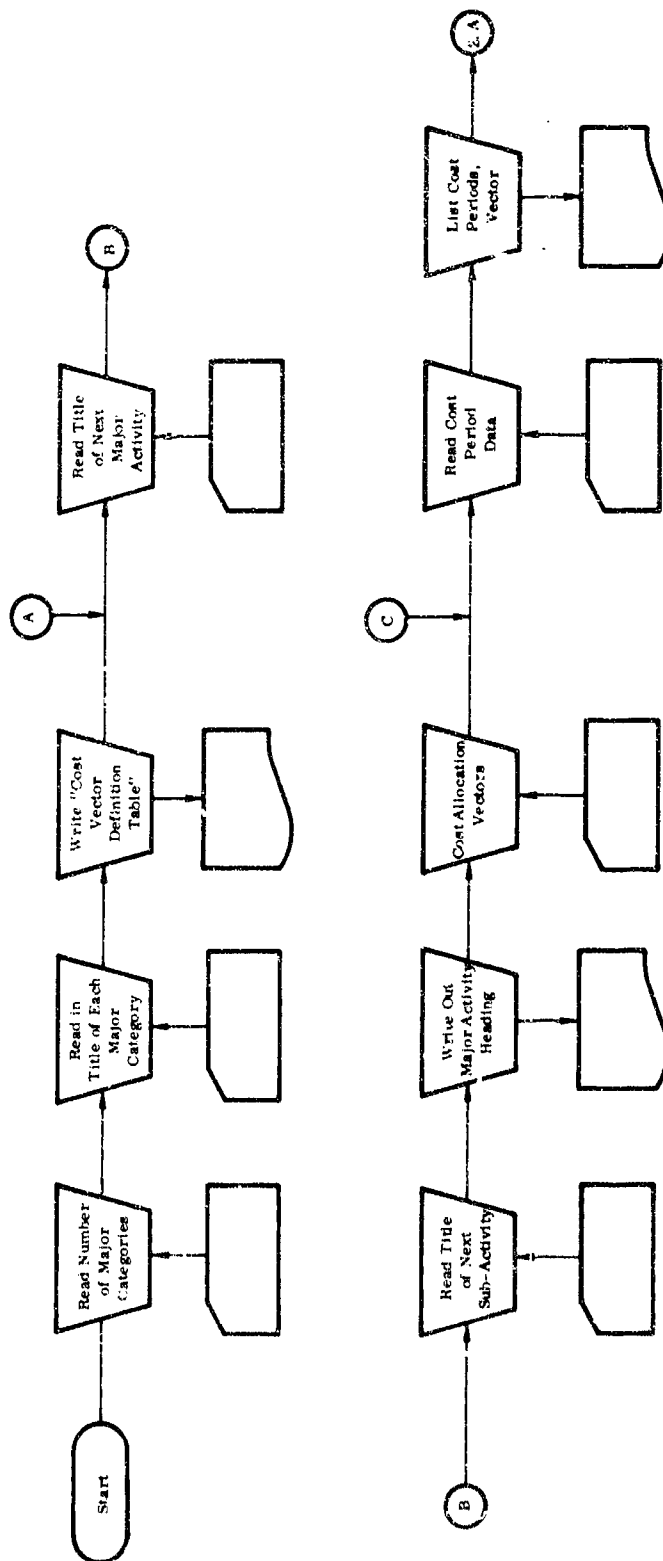
<u>Card</u>	<u>Format Statement</u>
1	3A4
2	13X, 13, 26X, F3.1
3	5A4
4 and 5	16A4
6	4A4, 4X, F4.0, F5.0, 2X, F8.0, 2X, F6.0
7	A4
8a	A4
8b	A4
8c	A4
9	I2, 26I3/24I3

activity cycles there are. Another input gives the number of line items within a sub-activity. Thus, it is easy to see how the program sets up the necessary loops to read in all the input data.

The FORTRAN format statements used to read the various card inputs are presented in Table 3-4.

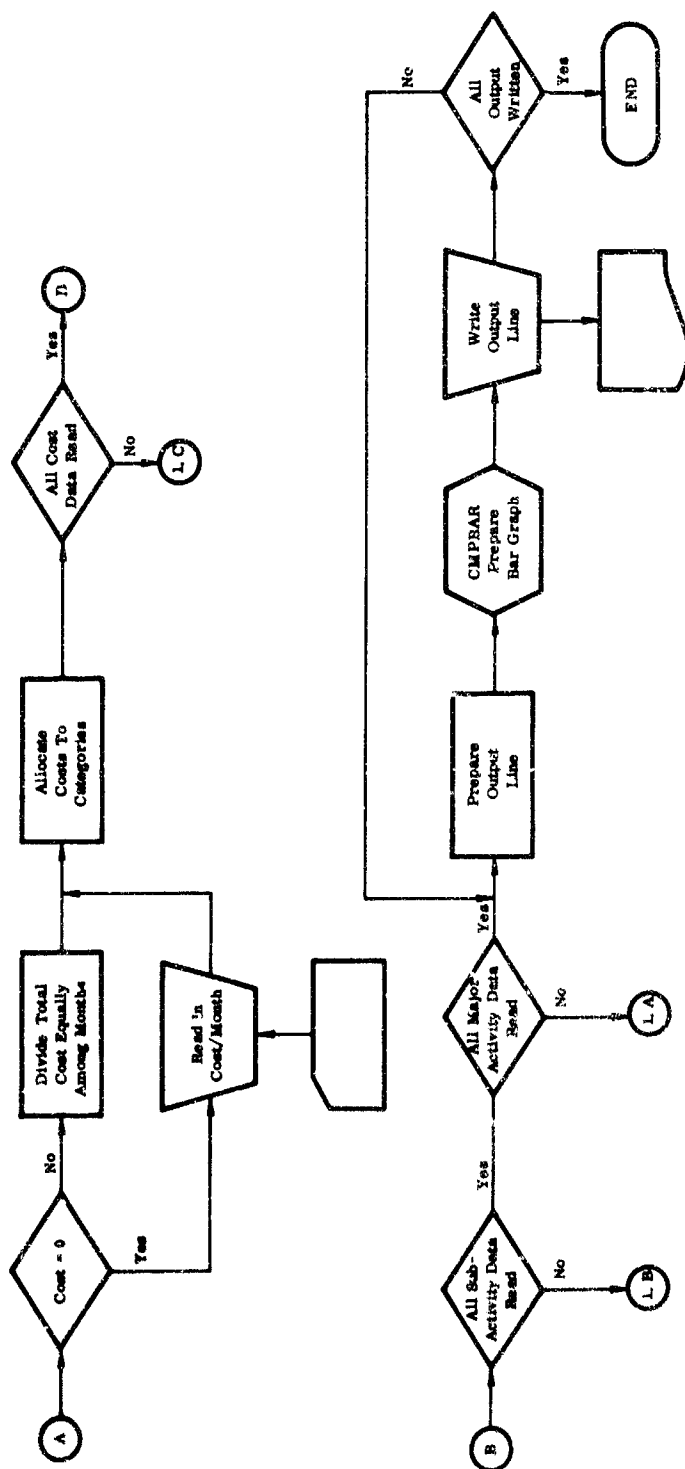
Subroutine CMPBAR is a machine language subroutine used to prepare a bar graph for the funds for each quarter or for the year. The main program determines the appropriate scale to show most clearly the totals in the space allowed. The subroutine processes the data for the four quarters per subroutine entry. The calling sequence arguments to the subroutine are IQTR, NSCL and BAR. IQTR is the array of four quarterly totals and NSCL is the necessary scaling information. The subroutine determines the number of characters and blanks to represent the total for each quarter and prepares an appropriate entry in the return data array BAR. The subroutine exits when the array BAR is completed; this array, as a bar graph, is subsequently written with the other information for the quarter with an A format statement.

The FORTRAN read input card format statements are listed in Table 3-4.



TDPFP			
Program Flow Diagram			
E. R. Swenson	10 Sept 68		
7493	001		4 of 2

Fig. 3-3. Flow Diagram for the 10-Year TDP Financial Plan Program (Sheet 1 of 2).



TDPFP				
Program Flow Diagram				
E. R. Swenson	10 Sept 68			
1433	001			1 of 2

Fig. 3-3. Flow Diagram for the 10-Year TDP Financial Plan Program (Sheet 2 of 2).

TABLE 3-4
FORTRAN INPUT FORMAT STATEMENTS FOR THE
TDP 10-YEAR FINANCIAL PLAN PROGRAM

<u>Card</u>	<u>Format Statement</u>
1	2I5
2	20A4
3	I5
4	20A4
5	I5
6	20A4
7	40I2
8	I5
9	10A4
10	2I5, F12.0
11 11a 11b etc. }	6 F12.0

3.3.2 Possible Program Modifications

The program is set to assign input month 1 the output date of month 1, 1969. This date occurs because item NR in the program is set to 1968. Should a different or variable date be needed for output, the programmer can change the value of NR or make it an input item if desired.

To allow the program to accept over 27 input categories it would be necessary to change the 27 in the DIMENSION statements to the desired new value.

3.4 The Buoy Components Characteristics Data File

3.4.1 Data Card Deck

The data collected on buoy components have been formatted and punched onto cards and these cards read onto magnetic tape. The components defined, the number used to identify the component on the cards and tape, and the number of entries for each component are listed in Table 3-5. For all of these components, there are

TABLE 3-5
BUOY COMPONENT NUMBERS

Component number	Entries	Component name
01	37	Hull, surface
02	22	Hull, subsurface
03	43	Mooring, main
04	46	Power systems, battery
05	28	Telemetry
06	15	Interrogation
07	33	Data storage
08	25	Sensor scanner
09	16	Data processor
10	27	Current velocity sensor
11	24	Wind velocity sensor
12	20	Air temperature sensor
13	36	Water temperature sensor
14	4	Acoustic transponder
15	2	Mooring depth control equipment
16	14	Acoustic release sensor
17	15	Atmospheric pressure sensor
18	3	Solar radiation sensor
19	1	Precipitation sensor
20	2	Dew point sensor
21	7	Salinity/conductivity sensor
22	2	Magnetic sensor
23	18	Depth sensor
24	0	Azimuth sensor
25	3	Acoustic sensor
26	1	Vibration sensor
27	5	Pitch and roll sensor
28	4	Acceleration sensor
29	6	Tensiometer sensor
30	41	Time control equipment
31	43	Mooring, tether
32	46	Power systems, other

84 characteristics of possible interest to the user and six card fields used to further describe the card and tape data. Obviously, only a few of the 84 user-oriented characteristics apply to each component; however, only three are common to all components. A pseudo 32 x 90 matrix is maintained in which to place those data that are available.

The punched card deck requires six consecutive cards to define all of the 90 possible characteristics and data identification card fields. Table 3-6 presents the card and column used for each of these fields. The complete data card deck of component and characteristics is presented as Appendix M.

3.4.2 Card-to-Tape Program

A card-image magnetic tape of the component data was prepared that could be used as the starting point for further development of a data file and the processing of such data. Since all components require less than the six full cards to describe their characteristics, the data on tape is one or two records per item. Record one is the data on cards 1 to 3; a second record was written if there are any data for the component on cards 4, 5 or 6. Thus, the number of cards per component (card 1, column 14) also is the indicator for the number of consecutive records on tape to describe the component as follows:

<u>Column 14</u>	<u>No. of Records on Tape</u>
1 to 3	1
4 to 6	2

The flow diagram for the program to write the card data on tape is presented as Fig. 3-4. A compilation listing of this program is Appendix N and the program source cards are Appendix O. The only input control to this program is a card at the end of the component data deck to signal the end of data. This card has the format

<u>Columns</u>	<u>Contents</u>
10-13	9999
14	0

and is written as the last 3-card record on the data tape.

TABLE 3-6
BUOY COMPONENT CHARACTERISTIC DATA FIELDS

	<u>Columns</u>	<u>Data</u>
Card 1	1-2*	Component number
	3	blank
	4-5	Item number within the component
	6-9	Buoy identification number
	10-13*	Year and month item entered into the data file
	14*	Number of punched cards required to include all characteristics pertinent to the component
	15-20	blank
	21-24	Manufacturer, left adjusted
	25-36	Model number
	37-40	Cost, dollars
	45-48	Reliability
	49-58	Type, left adjusted
	59-63	Range, low
	64-71	Range, high
	72-76	Accuracy
	79-80	blank
Card 2	1-10	Output characteristics, left adjusted
	11-21	Size
	22-23	Weight
	29-34	Diameter
	35-40	Length
	41-44	Height
	45-48	Width
	49-58	Depth Limits
	59-62	Survivability
	63-66	Construction, left adjusted

*Data processed as an I data field, all others are processed as A data fields.

TABLE 3-6 (Continued)

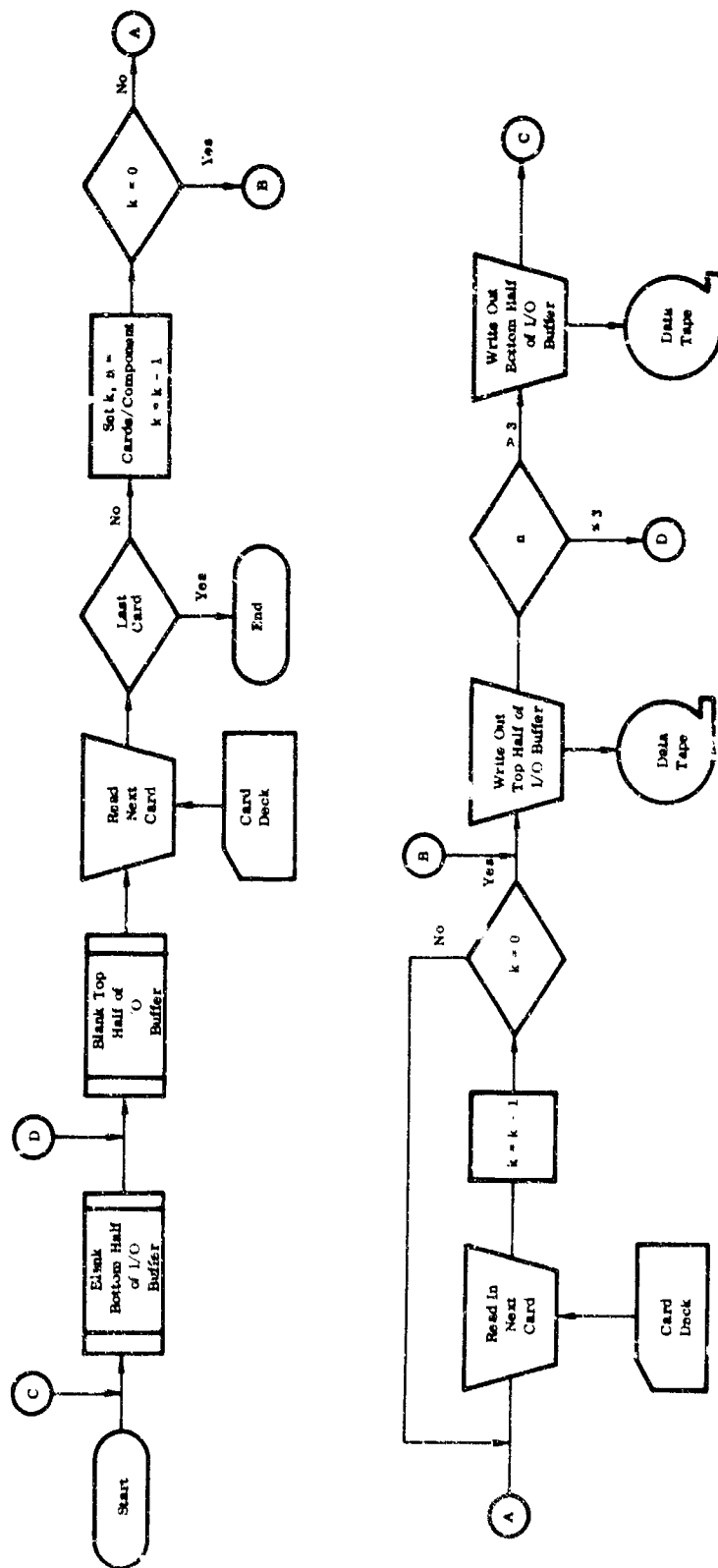
	Columns	Data
Card 2 (Cont.)	67-70	Material
	71-80	Capacity
Card 3	1-10	Code type, left adjusted
	11-16	Accuracy, speed
	17-20	Accuracy, direction
	21-26	Type, speed
	27-32	Type, direction, left adjusted
	33-42	Output, speed, left adjusted
	43-52	Output, direction, left adjusted
	53-58	Power requirements
	59-62	Biological immunity
	63-69	Breaking strength
	70-73	Buoyancy material, left adjusted
	74-77	Carrier frequency, left adjusted
	78-80	Direction reference, left adjusted
Card 4	1-7	Displacement
	8-11	Electrical integrity
	12-17	Frequency
	18-22	Lateral displacement
	22-25	Medium, left adjusted
	26-29	Resistance to corrosion, left adjusted
	30-32	Corrosion protection below, left adjusted
	33-35	Stretch to break
	36-43	Time Constant
	44-48	Scope
	49-55	Buoyancy
	56-58	Corrosion protection above
	59-63	Power output
	64-66	Anchor release (yes-no), left adjusted

TABLE 3-6 (Continued)

	<u>Columns</u>	<u>Data</u>
Card 4 (Cont.)	67-70	Anchor type, left adjusted
	71-75	Anchor weight, pounds
	76-80	Anchor cost, dollars
Card 5	1-4	Anchor chain
	5-7	Antenna
	8-11	Average time, speed
	12-15	Average time, direction
	16-18	Auxiliary floats
	19-23	Ballast material, left adjusted
	24-30	Ballast weight
	31-33	Modulation type, left adjusted
	34-39	Band width
	40-44	Capacity A/H
	45-51	Charging system, left adjusted
	52-55	Efficiency
	56-63	Data rate
	64-67	Draft
	68-73	Fuel, left adjusted
Card 6	74-77	Interrogation security
	78-80	Mast height
	1-3	Mast diameter
	4-6	Mooring depth control
	7-9	Redundancy, left adjusted
	10-13	Storage code, left adjusted
	14-21	Storage type, left adjusted
	22-26	Reel capacity
	27-34	Sampling rate
	35-42	Scan rate
	43-45	Static stability angle

TABLE 3-6 (Continued)

	Columns	Data
Card 6 (Cont.)	46-48	Swivels, left adjusted
	49-54	Total mooring cost
	55-59	Transient interval
	60-64	Transient duration
	65-74	Power
	75-80	Function



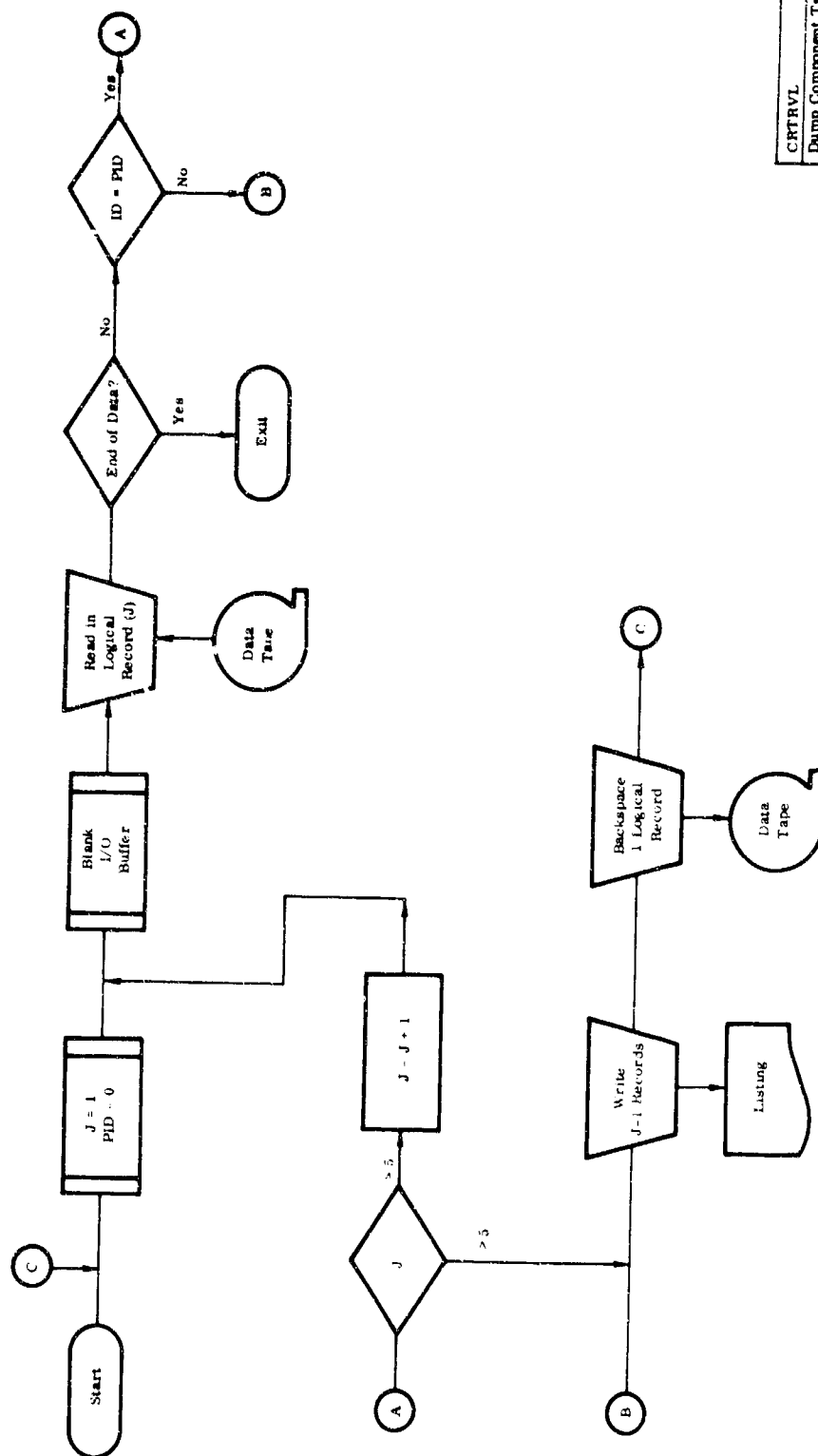
CRDTT				
Comp. Cards-to-Tape				
B. J. Erickson				10 Sept 68
7493	001	1	1	1 of 1

Fig. 3-4. Flow Diagram of the Data File Card-to-Tape Program.

The read and write format statements for the card data can be determined from Table 3-5. Fields read and written as integers are indicated by an asterisk, all other fields are treated as alphanumerics.

3.4.3 Data File Retrieval

When the buoy component data described in the previous section are to be used for further automatic data processing, it will be desirable to have a data file retrieval program. This program would be able to extract from the data file exactly those components, or group of components, and their characteristics that are required for further processing. Since the additional ADP work with these data could not be adequately outlined at this time, it was not desirable to develop such a retrieval program. However, in order to verify the results of the card-to-tape process, and to document the contents of the tape data file, a simple retrieval program was prepared. This program operates as shown in the flow diagram in Fig. 3-5. The compilation listing for this program is presented in Appendix P and the source cards as Appendix Q. The results of running this program against the data file are presented in Appendix A.



CRTTRVL					
Dump Component Tape					
E. Davis				4 Sept 68	
7493	001				1 of 1

Fig. 3-5. Flow Diagram of the Data File Retrieval Print Program.

APPENDIX A
LISTING OF
THE BUOY COMPONENT DATA FILE TAPE

(Limited distribution of this Appendix is under separate cover)

APPENDIX B
REFORMATTED LISTING OF
THE FNWC DEPTH DATA

(Limited distribution of this Appendix is under separate cover)

APPENDIX C
BUOY DEPLOYMENT MODEL SAMPLE
INPUT DATA DECK

CARD COLUMNS

1 2 3 4 5 6 7 8
1234567890123456789012345678901234567890123456789012345678901234567890

// EXEC

DEPLOY STARTING 1 JAN 69 AT 0800 HOURS. IMPLANT INCR = 0 12 6 6

JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC NEWSM STOPNEXTNEW NAVP

COST	9.0	4	246	2.19	6	306	2.75	8	445	2.75	10	600	5.78	12	600	5.78
COST	12.0	4	246	2.19	6	306	2.75	8	445	2.75	10	600	5.78	12	600	5.78
COST	15.0	4	246	2.27	6	306	3.68	8	445	3.68	10	600	5.78	12	600	5.78
COST	18.0	4	306	4.38	6	306	4.38	8	600	7.01	10	600	7.01	12	600	7.01
COST	21.0	4	515	7.51	6	780	11.27	8	780	11.27	10	780	11.27	12	780	11.27
COST	24.0	4	980	16.43	6	980	16.43	8	980	16.43	10	980	16.43	12	980	16.43
COST	27.0	4	1200	23.37	6	1200	23.37	8	1200	23.37	10	1200	23.37	12	1200	23.37
COST	30.0	4	1400	30.00	6	1400	30.00	8	1400	30.00	10	1400	30.00	12	1400	30.00

110 4 OCT 68

WEST PACIFIC MD7 FOR THE 375 TOTAL BUOY LOCATIONS MAP

INCLUDES NEW SHIP SEA-DAY AND PORT-DAY COST COMPUTATIONS

PORT 16 HONOLULU, HA 21.3N 157.8W

DEPOT 16 HONOLULU, HA 21.3N 157.8W

SHIP 1 12

LOAD 10 8 12 12

POPC 2

ORDER 37 36 31 30 03 06 33 34 35 44 08 05 45 04 45 07 11 28 17 39 38 18 16 10 09

ORDER 13 14 15 24 26 32 40 25 29 23 22 21 19 20 12 02 01 27 41

COST

BUOY WP 1	375	BUOY	00.1N	165.5E	16404
BUOY WP 2	375	BUOY	00.1N	154.8E	8202
BUOY WP 3	375	BUOY	50.0N	166.0E	18045
BUOY WP 4	375	BUOY	40.0N	139.0E	3280
BUOY WP 5	375	BUOY	40.0N	153.5E	14700
BUOY WP 6	375	BUOY	41.5N	167.0E	19685
BUOY WP 7	375	BUOY	33.0N	143.2E	22966
BUOY WP 8	375	BUOY	36.7N	158.8E	12000
BUOY WP 9	375	BUOY	30.0N	126.4E	656
BUOY WP10	375	BUOY	27.0N	135.0E	14764
BUOY WP11	375	BUOY	30.0N	155.5E	19029
BUOY WP12	375	BUOY	00.1N	144.2E	13123
BUOY WP13	375	BUOY	20.0N	116.0E	3280
BUOY WP14	375	BUOY	20.0N	126.7E	16404
BUOY WP15	375	BUOY	20.0N	137.0E	16404
BUOY WP16	375	BUOY	23.0N	146.0E	19685
BUOY WP17	375	BUOY	23.0N	171.0E	19200
BUOY WP18	375	BUOY	20.0N	158.8E	19685
BUOY WP19	375	BUOY	00.1N	123.2E	1312
BUOY WP20	375	BUOY	00.1N	134.0E	14108
BUOY WP21	375	BUOY	10.0N	116.5E	492
BUOY WP22	375	BUOY	10.0N	127.0E	22966
BUOY WP23	375	BUOY	10.0N	137.7E	16404
BUOY WP24	375	BUOY	14.0N	153.0E	19685
BUOY WP25	375	BUOY	10.0N	158.3E	18045
BUOY WP26	375	BUOY	15.0N	170.0E	16200
BUOY WP27	375	BUOY	00.1N	176.0E	13800
BUOY WP28	375	BUOY	25.0N	165.0E	19685
BUOY WP29	375	BUOY	11.0N	145.0E	15000
BUOY EP 1	375	BUOY	50.0N	180.0W	6561
BUOY EP 2	375	BUOY	50.0N	180.0W	21000
BUOY EP12	375	BUOY	10.0N	179.0E	14764
BUOY EP 4	375	BUOY	40.0N	180.0W	18045
BUOY EP 8	375	BUOY	32.4N	177.5E	16404

CARD COLUMNS

1 2 3 4 5 6 7 8
1234567890123456789012345678901234567890123456789012345678901234567890

BUOY EP 9 375 BUOY 30.0N 169.6W 16800
BUOY EP 5 375 BUOY 40.0N 165.0W 18045
BUOY EP10 375 BUOY 30.0N 161.2W 18045
BUOY EP13 375 BUOY 20.0N 180.0W 14764
BUOY EP14 375 BUOY 20.0N 160.5W 16404
BUOY EP19 375 BUOY 10.0N 170.8W 16404
BUOY EP28 375 BUOY 00.1N 173.7W 16404
BUOY EP20 375 BUOY 10.0N 160.4W 16404
BUOY EP15 375 BUOY 17.0N 160.5W 16404
BUOY EP33 375 BUOY 24.0N 164.0W 14764
NAVP NV45 41.5N 143.0E

STOP BUOY CARDS
END OF TEST RUN DATA
/*

APPENDIX D

PROCUREMENT, MAINTENANCE AND REPLACEMENT-
COST MODEL SAMPLE INPUT DATA DECK

CARD COLUMNS

1	2	3	4	5	6	7	8
1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890

// EXEC

STOPRECYCOMP

REPLACEMENTS 1 BUOY LIFETIME FACTOR = 1.0

RUN 1 20 JUN 68

TEST WITH LIFETIME FACTORS FROM 0.70 TO 1.30

DATA FROM DWN 51 DEPTH = 5000 M

40' DISCUS HULL	20	80000
-----------------	----	-------

MOORING/100 FT	165	1	175
----------------	-----	---	-----

40' POWER SYSTEM	5	10000
------------------	---	-------

DATA STORAGE	3	10000
--------------	---	-------

DATA PROC.-SCAN.	4	15000
------------------	---	-------

TIME CONTROL	5	1000
--------------	---	------

BUOY TELEMETRY	5	15000
----------------	---	-------

S/S SENSOR PKG	20	3	7000
----------------	----	---	------

AMBIENT NOISE	2	3	1000
---------------	---	---	------

AMBIENT LIGHT	2	3	1700
---------------	---	---	------

TRANSPARENCY SEN	2	3	1100
------------------	---	---	------

WAVE SENSOR	5	6250
-------------	---	------

ATMOS PRESS SNSR	5	500
------------------	---	-----

AIR TEMP SENSOR	5	400
-----------------	---	-----

DEW POINT SENSOR	3	1300
------------------	---	------

WIND VELCTY SNSR	2	600
------------------	---	-----

PRECIP RATE SNSR	5	500
------------------	---	-----

INSOLATION SNSR	5	500
-----------------	---	-----

ATMOS ELEC SNSR	5	1000
-----------------	---	------

FUEL SUPPLY	5	200
-------------	---	-----

MOORING TENSION	3	500
-----------------	---	-----

HULL TEMP	5	100
-----------	---	-----

BILGE WATER LVL	5	50
-----------------	---	----

MAG HEADING	5	300
-------------	---	-----

ANCHOR RELEASE	3	2500
----------------	---	------

ANCHR.CHAIN. ETC	1	1000
------------------	---	------

NAV RADIO BEACON	5	5000
------------------	---	------

NAV LIGHT/HORN	5	500
----------------	---	-----

STOP COMPONENT CARDS

RECYCLE NEW LIFETIME FCTR

REPLACEMENTS 1 BUOY LIFETIME FACTOR = 0.7

RUN 2 20 JUN 68

LIFETIME FACTOR DECREASED 30 PCNT

DATA FROM DWN 51 DEPTH = 5000 M

RECYCLE NEW LIFETIME FCTR

REPLACEMENTS 1 BUOY LIFETIME FACTOR = 1.3

RUN 3 20 JUN 68

LIFETIME FACTOR INCREASED 30 PCNT

DATA FROM DWN 51 DEPTH = 5000 M

COMPONENT CHANGES FOR S/S. MOORING RECYCLE

2 2 8

MOORING/100 FT	20	1	175
----------------	----	---	-----

S/S SENSOR PKG	13	6	7000
----------------	----	---	------

REPLACEMENTS 1 BUOY LIFETIME FACTOR = 1.0

RUN 4 20 JUN 68

TEST WITH LIFETIME FACTOR = 1.0 AND COMPONENT COST CHANGES

DATA FROM DWN 51 DEPTH = 5000 M

RECYCLE NEW LIFETIME FCTR

REPLACEMENTS 1 BUOY LIFETIME FACTOR = 0.7

RUN 5 20 JUN 68

CARD COLUMNS

1 2 3 4 5 6 7 8
 1234567890123456789012345678901234567890123456789012345678901234567890

LIFETIME FACTOR DECREASED 30 PCNT
 DATA FROM DWN S1 DEPTH = 5000 M
 RECYCLE NEW LIFETIME FCTR
 REPLACEMENTS 1 BUOY LIFETIME FACTOR = 1.3
 RUN 6 20 JUN 68
 LIFETIME FACTOR INCREASED 30 PCNT
 DATA FROM DWN S1 DEPTH = 5000 M
 THE END
 /#

APPENDIX E
10-YEAR TDP FINANCIAL PLAN PROGRAM
SAMPLE INPUT DATA DECK

CARD COLUMNS
 1 2 3 4 5 6 7 8
 123456789012345678901234567890123456789012345678901234567890

// EXEC

26 1

TOTAL COST
 TOTAL MANAGEMENT COST
 PROJ MAN OFFICE
 CONSULTANTS
 TRAINING
 COORDINATION
 TOTAL RESEARCH COST
 SENSORS
 MAT AND COMPONENTS
 GT LAKES AND ESTUARINE REQ
 COOPERATIVE EFFORTS
 TOTAL COST MK0
 SENSORS (MK0)
 HULL AND MOORINGS (MK0)
 SEABORNE SUPPORT (MK0)
 TOTAL COST MK1
 SENSORS (MK1)
 HULL AND MOORINGS (MK1)
 SEABORNE SUPPORT (MK1)
 SHORE SUPPORT (MK1)
 TOTAL COST MK2
 SENSORS (MK2)
 HULL AND MOORINGS (MK2)
 TOTAL COST MK0 AND MK1
 TOTAL COST SEABORNE SUPPORT
 TOTAL COST SHORE SUPPORT

MANAGEMENT

PROJECT MANAGEMENT

1 1 1

69- 1M PROJ MAN OFFICE

1 12 400000

70- 1M PROJ MAN OFFICE

13 24 670000

71- 1M PROJ MAN OFFICE

25 36 780000

72- 1M PROJ MAN OFFICE

37 48 780000

73- 1M PROJ MAN OFFICE

49 60 780000

69- 90 DEV CONTR PROCEDURES

1 10 .0001

CONSULTANTS

1 1 1

1

69- 2M CONSULTANT

1 4 130000

TRAINING

1 1 1

6

70- 4T TRAINING CG EVAL TEAM

13 24 120000

72- 2M TRAINING SEA SUPPORT PERSONNEL

39 48 450000

73- 2M TRAINING SEA SUPPORT PERSONNEL

49 60 450000

72- 3M TRAINING SEA SUPPORT PERSONNEL

46 48 150000

73- 3M TRAINING SEA SUPPORT PERSONNEL

49 60 450000

73- 4M FIRST SEA SUPPORT CREW

58 60 50000

COORDINATION

1 1 1

5

69- 8D INTERFACE COORDINATOR

1 12 50000

70- 8D INTERFACE COORDINATOR

13 24 500000

71- 9D INTERFACE COORDINATOR

25 36 400000

72-11D INTERFACE COORDINATOR

37 48 400000

73- 8D INTERFACE COORDINATOR

49 60 250000

RESEARCH

4

SENSORS

1 1 1

5

69-15R ADV SENSOR RESEARCH

9 12 100000

70-19R ADV SENSOR RESEARCH

13 24 700000

71-20R ADV SENSOR RESEARCH

25 36 400000

72-22R ADV SENSOR RESEARCH

37 48 500000

73-20R ADV SENSOR RESEARCH

49 60 300000

MATERIALS AND COMPONENTS

1 1 1

4

70-23R ADV MAT AND COMP RESEARCH

13 24 1000000

71-22R ADV MAT AND COMP RESEARCH

25 36 400000

72-24R ADV MAT AND COMP RESEARCH

37 48 750000

73-22R ADV MAT AND COMP RESEARCH

49 60 300000

GREAT LAKES AND ESTUARINE REQUIREMENTS

1 1 1

5

69-16R STUDY GT LAKES AND ESTUARINE REQ

01 12 100000

70-22R STUDY GT LAKES AND ESTUARINE REQ

13 26 200000

71-21R GT LAKES AND ESTUARINE REQ HOWARE RES

28 36 400000

72-23R GT LAKES AND ESTUARINE REQ HOWARE RES

37 48 500000

73-21R GT LAKES AND ESTUARINE REQ HOWARE RES
49 52 100000

COOPERATIVE EFFORTS

1 1 1
5
69-17R SUPPORT COOPERATIVE RES
1 12 370000
70-24R SUPPORT COOPERATIVE RES
13 24 600000
71-23R SUPPORT COOPERATIVE RES
25 36 400000
72-25R SUPPORT COOPERATIVE RES
37 48 500000
73-23R SUPPORT COOPERATIVE RES
49 60 400000

MKO

SENSORS

1 1 1
2
69- 3T
1 4 200000
69- 4
1 12 225000

HULL AND MOORINGS

1 1 1
12

69- 5T PROCUREMENT MKO FACILITIES

1 12 2500000

69- 6T RESIDENT INSPECTOR

5 12 23000

70- 3D PROCUREMENT MKO FACILITIES

13 23 .0001

70- 5T RES INSPECTOR CG EVAL TEAM

13 24 185000

71- 3T ANAL ENVIRONMENTAL TEST

25 36 300000

71- 4T HOWARE SUPPORT 5MKO PLATFORMS

25 36 350000

71- 5T CONTRACT SUPPORT

25 36 120000

71- 6T RES INSPECTOR CG EVAL TEAM

25 36 185000

72- 4T ANAL ENV'RN TEST RESULTS

37 50 300000

72- 5T HOWARE SUPPORT

37 48 350000

72- 6T CONTRACT MAINT SUPPORT

37 48 120000

72- 7T RES INSPECTOR CG EVAL TEAM

37 48 190000

SEABORNE SUPPORT

1 1 1
5

69- 7T SPEC MOD FOR SERVICE SHIPS

7 12 .0001

70- 6T PROCUREMENT MOD SHIP

13 16 1500000

70- 7T OPERATION SEA SUPPORT

19 23 300000

71- 77 SERVICE SHIP OPERATION
25 36 900000

72- 87 SERVICE SHIP OPERATION
37 48 600000

MKI

4

SENSORS

1

1 1

1

4

69-140 DEV MKI SENSORS

9 12 .0001

70- 27 LAB TESTING SENSORS

14 24 400000

70-180 ENG DEV MKI SENSORS

13 28 1000000

71- 27 LAB TESTING SENSORS

25 34 300000

HULL AND MOORINGS

1

1 1

1

16

69-100 DESIGN STUDY DO MOORINGS

1 12 300000

69-100 CG MOORING TESTS

2 12 .0001

69-110 ANAL MODEL STUDY BUOY TYPES

1 11 300000

69-110 PRELIM DESIGN MKI BUOY

8 12 300000

70- 90 CG SUPPORT MOORING TESTS

13 24 100000

70-100 PROC AND TEST MKI MOORINGS

13 24 675000

70-110 EVAL MKI PLATFORM MOCK-UP

16 20 240000

70-120 MODEL TESTS MKI DESIGNS

16 20 160000

70-130 CONTR DEF MKI PLATFORM

13 22 300000

70-140 CONTR DEF MKI DATA ACQ SYSTEM

13 24 300000

71-150 RESIDENT INSPECTOR

27 36 100000

71-100 DEV AND PROC 36MKI PLATFORMS

25 36 18000000

73- 57 ANALYSIS TEST RESULTS

49 60 400000

73-100 RES INSPECTOR

49 56 .0001

73-120 MAINTENANCE

49 60 300000

73-130 HARDWARE SUPPORT

52 60 3000000

SEABORNE SUPPORT

1

1 1

1 1

21

69-120 PRELIM DESIGN SERV SHIP

8 12 .001

70- 67 PROC MOD SHIP MK0 AND MK1

13 16 1500000

70-150 DESIGN SERVICE SHIP MK1 AND MK2

13	22	450000				
70-250	CONSTR FIRST SERVICE SHIP					
23	24	1700000				
70-260	DEV OCEAN HANDLING SYSTEM					
23	24	500000				
70-270	DEV SUPPORT PROPULSION SYSTEM					
23	24	500000				
71-8T	PROC FIRST SERVICE BARGE					
26	36	550000				
71-110	CONSTR FIRST SERVICE SHIP					
25	36	19500000				
71-120	DEV AND TEST HANDLING SYSTEMS					
25	36	720000				
71-130	DEV AND TEST PROPULSION SYSTEMS					
25	36	800000				
71-160	RES INSPECTOR SEABORNE SUPPORT					
29	36	800000				
72-9T	MOD SECOND SERVICE SHIP					
42	47	1500000				
72-10T	PROC SECOND SERVICE BARGE					
37	48	500000				
72-140	CONSTR SECOND SERVICE SHIP					
37	42	18500000				
72-260	CONSTR THIRD SERVICE SHIP					
43	48	17200000				
72-150	HANDLING TESTS					
37	45	400000				
72-160	PROPULSION TESTS					
37	45	200000				
72-170	RES INSPECTOR SEABORNE SUPPORT					
37	48	120000				
73-7T	SERVICE SHIP OPERATION					
49	60	1900000				
73-140	DEV SEABORNE SUPPORT					
49	60	200000				
73-150	RES INSPECTOR SEABORNE SUPPORT					
49	58	120000				
SHORE SUPPORT						
1			1	1	1	1
13						
69-130	PRELIM DESIGN SHORE SUPPORT					
8	12	.0001				
70-160	COMM SITE SELECTION					
13	21	200000				
70-200	ACQUISITION SHORE SUPPORT SITES					
18	29	1500000				
70-210	SHORE SUPPORT SYSTEM DESIGN					
18	29	1000000				
70-170	SITE SELECTION					
13	17	.0001				
71-140	CONSTRUCT INT SHORE SUPPORT					
30	36	9500000				
71-170	RESIDENT INSPECTOR SHORE SUPPORT					
33	36	30000				
72-120	DEV AND PROC SITE HARDWARE					
37	45	800000				
72-130	CONSTRUCT SECOND COMM SITE					
37	44	800000				
72-180	CONSTRUCT SECOND SHORE SUPPORT					
37	48	8500000				

72-190 RESIDENT INSPECTOR SHORE SUPPORT
 37 48 140000
 73-160 DEV SHORE SUPPORT SYSTEM
 49 60 200000
 73-170 RESIDENT INSPECTOR SHORE SUPPORT
 49 60 110000
 MK2

2
 SENSORS

1 1 1
 5
 71-180 DEV MK2 SENSORS
 31 36 365000
 72-200 END DEV MK2 SENSORS
 37 48 500000
 73- 60 LAB TESTING MK2 SENSORS
 49 55 300000
 73-111 PROCUREMENT MK2 SENSORS
 55 60 6500000
 73-180 ENG DEV MK2 SENSORS
 49 53 140000

HULL AND MOORINGS

1 1 1
 4
 71-190 DEV MK2 HARDWARE
 31 36 .0001
 72-210 DEV MK2 HARDWARE
 37 48 700000
 73- 91 PROCUREMENT MK2 PLATFORMS
 55 60 37000000
 73-190 DEV MK2 HARDWARE
 49 53 100000
 /8

APPENDIX F

COMPILATION LISTING FOR

THE INTEGRATED BUOY DEPLOYMENT COST MODEL

```

C PROGRAM DEPLOYMENT USING GRT CRL DISTANCES AND NAVG POINTS
C 7 OCT 1968 MON=0 NEW PRT DAY COMP. SELECTED TEST SUMMARY PRINT
C
  DIMENSION CAL(12),XA(5),CTEST(4),HDL1(20),HDL2(20),PNAME(3)
  DIMENSION DNAME(3),SNAMP(3),LOAD(5),NAVG(5),NMSTM(50),NMOPY(50)
  DIMENSION ATSEA(50),ATPRT(50),RQDYS(50),XSDYS(50),CTYPF(300)
  DIMENSION NUMR(300),BLAT(300),RLNG(300),IDPTH(300),BCNST(300)
  DIMENSION BLATR(300),PORT2R(300),BUOY2R(300),LAPSOL(20),NSUM(300)
  DIMENSION TCNST(300),KORNER(300),XTYPE(201),NBRM(201),TLAT(201)
  DIMENSION TLNG(201),IDPH(201),CSTB(201),TLATR(200),SPD(8),SPG(9)
  DIMENSION SCPH(8),INCR(4),STP(72),DAY(72),KBC(72),ACPH(72)
  DIMENSION SCST(16,8),ANDC(8),NRYS(9),DIST(9),KPSPD(8)

C
C READ INITIAL PROG DATA
C
  READ(1,502)IDAY,CMON,IYEAR,IMOUR,INCR
  502 FORMAT(16X,I2,A4,I3,4X,I2,23X,4I3)
  READ(1,500)CAL,XA,CTEST
  500 FORMAT(12A4,2X,5A1,2X,4A4)
  DO 3 J=1,8
    READ(1,509)(SCST(I,J),I=1,16)
  509 FORMAT(5X,F5.1,5(F3.0,F5.0,F6.2))
    SPD(J)=SCST(1,J)
  3 CONTINUE
  KCYCLE=0
  701 READ(1,501)KRUN,KRDY,RMON,KRYR,KHR1,KHR2,SPG,KPSPD
  501 FORMAT(2I3,A4,I3,7X,2I3,9F5.1,1X,8I1)
  IF(KHR1)702,702,703
  703 I=1
  706 IF(SPG(I))704,704,705
  705 I=I+1
  GO TO 706
  704 NSS=I-1
  702 READ(1,498)HDL1
  READ(1,498)HDL2
  498 FORMAT(20A4)
  499 FORMAT(1X,20A4)

C
C BASIC DEPLOYMENT INITIALIZATION
C
  KP=1
  NBC=0
  700 KRTNPT=0
  ICNT=0
  LCNT=0
  NBASE=0
  NRDEPZ=0
  NCBUDY=0
  NCRUSF=0
  NRIMCR=0
  MONTH=0
  MAXDTH=0
  LNGCRS=0
  MINDTH=90000

```

10/08/68

PORTMAIN

0002

GNORTH=-99.9
 GSNOUTH=99.9
 GEAST=-180.
 GWEST=180.
 GRTDAY=0.
 DRYDAY=0.
 SEADAY=0.
 TSEAD=0.
 TPRTD=0.
 CDIST=0.
 TDIST=0.
 TDPCT=0.
 TRYCT=0.
 DN 4 I=1,20
 TAPSOL(1)=0
 4 CONTINUE

C

C SET CLOCK TO START MONTH

C

DN 5 I=1,12
 IF(CMON-CAL(1))15,6,5
 6 GO TO 7
 5 CONTINUE
 7 MONTH=1
 1BDAY=IDAY
 1SDAY=IDAY
 1BMON=CMON
 1SMON=CMON
 1BYER=IYEAR
 1SYER=IYEAR
 1BHR=IHOUR*100
 1MR10C=1BHR
 IF(KCYCLE-1)604,123,604

C

C READ PORT CARD TEST LAT LNG FOR N,S,E,W MINPRT,MAXPRT,OVRHAL DAYS

C IF PDMIN,PDMAX,OVRHAL =0 VALUES ASSIGNED ARE 4,10,30 DAYS

C

674 READ(1,503)INPORT,PNAME,PLAT,PY,PLNG,PX,PDMIN,PDMAX,OVRHAL
 573 FORMAT(6X,13,5X,3A4,F6.1,A1,F6.1,A1,3F3.0)
 IF(PY-XA(1))15,16,15
 15 PLAT=PLAT*(-1.)
 PLATA=ABS(PLAT)
 GO TO 17
 16 PLATA=PLAT
 17 IF(PX-XA(2))18,19,18
 18 PLNG=PLNG*(-1.)
 PLNGA=ABS(PLNG)
 GO TO 20
 19 PLNGA=PLNG
 20 PLATR=PLAT/57.295779
 IF(OVRHAL)905,905,906
 905 OVRHAL=30.
 906 NAVSHD=365. - OVRHAL
 NAVSHD=AVSHDY
 IF(PDMAX)907,907,908

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907 PDMAX=10.
908 IF(PDMIN)909,909,910
909 PDMIN=4.
910 PDIFF=PDMAX-PDMIN

```

```

C
C READ DEPOT CARD TEST LAT LNG FOR N.S.F.W
C

```

```

      READ(1,510)NDEPOT,DNAME,DLAT,DY,DLNG,DX
510  FORMAT(1X,13,5X,3A4,F6.1,A1,F6.1,A1)
      IF(DY-XA(1))117,118,117
117  DLAT=DLAT*(-1.)
      DLATA=ABS(DLAT)
      GO TO 119
118  DLATA=DLAT
119  IF(DX-XA(2))120,121,120
120  DLNG=DLNG*(-1.)
      DLNGA=ABS(DLNG)
      GO TO 122
121  DLNGA=DLNG
122  DLATR=DLAT/57.295779

```

```

C
C SET BASIC SHIP CONSTANTS
C

```

```

123  SACS=SPD(1)
      SDCN=30.
      SDCM=SDCN*24.
      SMCN=99.
      SMCN=SMCN*24.
      HIPR=12.
      OVRSF=1.33
      SAFFAC=1.00
      PCFCTR=0.94
      RCPDM=2000.
      RCPDA=5000.
      RCPDX=8000.

```

```

C
C READ SHIP CARD
C

```

```

      READ(1,504)SNAME,KPRINT,SMBC,ASDCD,ASMCD,AHIPR,ADVRSF,ASFFAC,
      IAPCFTR,ABCPDM,ARCPDA,ABCPDX
504  FORMAT(8X,3A4,13,4X,4F3.0,3F5.2,3F6.0)
      NSRC=SMBC
      IF(ASDCD)126,126,125
125  SDCD=ASDCD
      SDCM=SDCD*24.
126  IF(ASMCD)128,128,127
127  SMCN=ASMCD
      SMCN=SMCN*24.
128  IF(AHIPR)130,130,129
129  HIPR=AHIPR
130  IF(ADVRSF)132,132,131
131  OVRSF=ADVRSF
132  IF(ASFFAC)134,134,133
133  SAFFAC=ASFFAC
134  IF(APCFTR)136,136,135

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135 PCFCTR=APCFTR
136 IF(ABCPDM)138,138,137
137 RCPDM=ABCPDM
138 IF(ABCPDA)140,140,139
139 RCPDA=ABCPDA
140 IF(ARCPDX)142,142,141
141 RCPDX=ARCPDX
142 DO 144 I=2,14,3
    IF(SMBC-SCST(I,1))144,143,144
143 NADD=I&1
    NCPM=I&2
    CSTCDY=RCPDA & SCST(NADD,1)
    CSTPDY=PCFCTR&CSTCDY
    CSTPM=SCST(NCPM,1)
    GO TO 145
144 CONTINUE
C
C WRITE ERROR MESSAGE  SMRC NOT IN COST TABLE
C
    WRITE(3,592)MSMC
592 FORMAT(1H1,/, ' COST VALUES NOT IN COST TABLE FOR SHIP BUOY CAPACIT
    IV =13, ' CHECK INPUT CARDS AND TRY AGAIN')
    GO TO 900
145 DO 146 J=1,8
    ADDC(J)=SCST(NADD,J)
    SCPM(J)=SCST(NCPM,J)
146 CONTINUE
C
C READ CRUISE LOAD LARD(5), TWO CARDS IF NBR CRUISES = OR GT 25, COUNT BUOYS
C
    DO 915 I=1,51
    LOAD(I)=0
    NAVG(I)=0
915 CONTINUE
    NTPMDZ=0
    NAVGPT=0
    READ(1,507)((LOAD(I),I=1,25)
507 FORMAT(4X,25I3)
511 FORMAT(26I3)
    IF(LOAD(25))912,912,911
911 READ(1,511)((LOAD(I),I=26,51)
912 I=1
165 IF(LOAD(I))166,166,167
167 I=I&1
    GO TO 165
166 KCR=I-1
C
C READ CRUISE NAVG POINTS, TWO CARDS IF NBR CRUISES GT 25, COUNT NAVG POINTS
C
    READ(1,507)((NAVG(I),I=1,KCR)
    DO 172 I=1,KCR,2
    NTPMDZ=NTPMDZ & LOAD(I) & LOAD(I&1)
    NAVGPT=NAVGPT & NAVG(I) & NAVG(I&1)
172 CONTINUE
    NTPNTS=NTPMDZ & NAVGPT

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C

C READ DEPLYMT ORDER CARD(S)

READ(1,500)(KORDER(I),J=1,NTPTS)

500 FORMAT(5X,25I3)

IF(KCYCLE-1)606,608,606

C

C READ COST CARD TEST FOR INPUT UNIT COSTS

C

606 READ(1,505)BFXCST,CSTSPK,CMRGFT,SCOPE

505 FORMAT(AX,F6.0,2X,F5.0,2X,F5.0,2X,F5.7)

IF(BFXCST)105,105,106

105 BFXCST=158000.

106 IF(CSTSPK)107,107,108

107 CSTSPK=7000.

108 IF(CMRGFT)109,109,110

109 CMRGFT=1750.

110 IF(SCOPE)112,112,113

112 SCOPE=1.00

113 CONTINUE

C

C WRITE DEPLOYMENT CONSTANTS PAGE

C

608 WRITE(3,520)KRUN,KRDY,RMON,KRYR

520 FORMAT(1H1,/, ' RUN NRR ',I3,3X,' DATE ',I2,A4,I3,/))

WRITE(3,499)MDL1

WRITE(3,499)MDL2

WRITE(3,521)IROAY,BMON,IBYFR

521 FORMAT (/, ' STARTING DEPLOYMENT DATE =',I3,A4,I3,/,/, ' CONSTANTS USED FOR THIS DEPLOYMENT',/)

WRITE(3,522)PNAME,PLATA,PY,PLNGA,PX

522 FORMAT(' PORT',/, ' NAME = ',A4,/, ' LAT =',F5.1,A1,/, ')

1 LONG =',F5.1,A1,/))

WRITE(3,523)DNAME,DLATA,DY,DLNGA,DX

523 FORMAT(' DEPOT',/, ' NAME = ',A4,/, ' LAT =',F5.1,A1,/, ')

1 LONG =',F5.1,A1,/))

WRITE(3,524)SNAME,SACS,MSRC,OVRSAF,HIPB

524 FORMAT(' SHIP',/, ' NAME = ',A4,/, ' AVERAGE CRUISING SPFE

10, KTS =',F5.1,/, ' MAXIMUM BUOY CAPACITY =',I3,/, ' OVE

2RALL SAFETY FACTOR =',F6.2,/, ' HOURS TO IMPLANT 1 BUOY

3 =',F5.1,/))

WRITE(3,525)SDCO,SMCO,PDNAX,PDNIN

525 FORMAT(' DESIRED SEA DAYS PER CRUISE =',F5.1,/, ' MAXIMUM SE

14 DAYS PER CRUISE =',F5.1,/, ' MAXIMUM PRT DAYS PER CRUISE =',F5.

21,/, ' MINIMUM PRT DAYS PER CRUISE =',F5.1,/))

WRITE(3,590)(LOAD(I),I=1,KCR)

590 FORMAT(' LOAD/CRUISE',/, (5X,25I3))

WRITE(3,591)(NAV(I),I=1,KCR)

591 FORMAT(/, ' NAV POINTS/CRUISE',/, (5X,25I3))

WRITE(3,497)

GO TO 950

497 FORMAT(/)

WRITE(3,526)CSTPDY

526 FORMAT(' CNSTS',/, ' SHIP',/, ' PORT DAY = ',F6.0, '00

1',/)

WRITE(3,553)CSTCDY

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553 FORMAT(' SEA DAY = 8*F6.0,'00',/)
WRITE(3,553)(SPD(I),I=1,8)
555 FORMAT(' COST PER NM TRAVELED',/, ' SPEED (KNT)'F5.1
1,F6.1)
WRITE(3,557)(SCPH(I),I=1,8)
557 FORMAT(' COST (8)'F7.1,F6.1,/)
950 WRITE(3,527)(FXCST,CST,SPK,CHRGF,SCOPE
527 FORMAT(' BUOY COSTS',/, ' BUOY W/O S/S SENSORS OR MOORING = 8
1*F8.0,/, ' SUBSURFACE SENSOR PACKAGE, EACH = 8*F8.0,/, ' MOD
2RING LINE PER 1000 FT = 8*F8.0,/, ' MOORING SCOPE = 'F5.
32)
IF(CYCLE-1)GOTO,30,610

```

C READ BUOY CARDS, ASSIGN COSTS, COUNT CARDS, TEST LAT LNG N, S, E, W

```

C
610 DO 38 I=1,201
READ(1,506)(XTYPE(I),NBRM(I),TLAT(I),BY,TLNG(I),BX,TDPH(I),BD,
ICST(I))
506 FORMAT(A4,I4,A4,I4,F6.1,A1,F6.1,A1,I6,A1,F7.0)
IF(XTYPE(I)-CTEST(1))GOTO,30,21
21 IF(XTYPE(I)-CTEST(4))GOTO,24,22
22 IF(ICST(I))GOTO,23,23,24
23 CSTA(I)=FXCST
24 IF(BY-XA(1))GOTO,25,26,25
25 TLAT(I)=TLAT(I)*(-1.)
26 IF(BX-XA(2))GOTO,27,28,27
27 TLNG(I)=TLNG(I)*(-1.)
28 IF(BD-XA(5))GOTO,29,102,29
102 DPTH=TDPH(I)*3.281
DPTH=DPTH*.5
IDPH(I)=DPTH
29 TLATR(I)=TLAT(I)/57.295779
38 CONTINUE

```

C READ A STOP CARD FOR BUOYS WRITE BUOY COST PAGE

```

C
10 DO 174 I=1,NTPNTS
J=KORDER(I)
CTYPE(I)=XTYPE(J)
NBRM(I)=NBRM(J)
TLAT(I)=TLAT(J)
BLNG(I)=TLNG(J)
IDPTH(I)=IDPH(J)
ICST(I)=CSTA(J)
BLATR(I)=TLATR(J)
174 CONTINUE
DO 913 I=1,NTPNTS
NSUB(I)=0
TCOST(I)=0.
913 CONTINUE
WRITE(3,520)KRUN,KRDY,RMON,KRYR
WRITE(3,499)HOL1
WRITE(3,499)HOL2
WRITE(3,528)
528 FORMAT(/,19X,'BUOYS - IN ORDER DEPLOYED',/, ' DEGS DEGS

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```

1  DEPTH  BASIC  S/S  TOTAL',/, '  NBR  LAT  LONG  (FT)
2  COST  PKGS  COST'
NTSUB=0
NTDPH=0
CALL SUBNRCTYPE, IDEPTH, RCOST, IAPSQL, NSUB, CSTSPK, CMRGFT, SCOPE,
INTPNTS, TCOST, NTSUB, NTDPH, CTEST)
DO 310 I=1, NTPNTS
IF (CTYPE(I)-CTEST(4)) 306, 310, 306
306 IF (BLAT(I)) 300, 300, 301
300 BY=XAL(4)
XLAT=ABS(BLAT(I))
GO TO 302
301 BY=XAL(1)
XLAT=BLAT(I)
302 IF (RLNG(I)) 303, 303, 304
303 BX=XAL(3)
XLNG=ABS(RLNG(I))
GO TO 305
304 BX=XAL(2)
XLNG=BLNG(I)
305 WRITE(3,529) NUMR(I), XLAT, BY, XLNG, BX, IDEPTH(I), BCOST(I), NSUB(I),
ITCOST(I)
529 FORMAT(4X, A4, F6.1, A1, F7.1, A1, I7, '  $', F7.0, I4, '  $', F7.0, '00')
TRYCST=TRYCST & TCOST(I)
LCNT=LCNT & 1
IF (LCNT-44) 310, 310, 307
307 WRITE(3,531)
531 FORMAT(1H1)
WRITE(3,528)
LCNT=0
310 CONTINUE
ARMCST=TRYCST/NTPMOZ
NDPAVG=NTDPH/NTPMOZ
NSRAVG=NTSUB/NTPMOZ
WRITE(3,530) TRYCST, NTMOZ
530 FORMAT(7, '  TOTAL BUOY HARDWARE COST (W/O SPARES)  $' F12.2, //, '
1  TOTAL NBR OF BUOYS TO BE DEPLOYED = ', I3)
IF (NDEPOT-NPORT) 151, 155, 151
151 DIFF=ABS(PLNG-DLNG)
IF (DIFF-180.) 154, 154, 153
153 DIFF=360.-DIFF
154 RLNG=DIFF/57.295779
GCA=SIN(PLATRI)*SIN(DLATRI)*COS(PLATRI)*COS(DLATRI)*COS(RLNG)
ARCRAD=ATAN2(SQRT(1.-GCA**2)/GCA)
IF (ARCRAD) 210, 212, 212
210 ARCRAD=3.14159 & ARCRAD
212 ARCOFG=ARCRAD*57.295779
PORT20=ARCOFG*60.11031
C
C COMPUTE PORT TO BUOY DISTANCES
C
155 DO 40 I=1, NTPNTS
DIFF=ABS(PLNG-BLNG(I))
IF (DIFF-180.) 36, 36, 34
34 DIFF=360.-DIFF

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30 RLNG=DIFF/57.295779
   GCA=SIN(PLATR)*SIN(BLATR(1))&COS(PLATR)*COS(BLATR(1))*COS(RLNG)
   ARCRAD=ATAN(SQRT(1.-GCA**2)/GCA)
   IF(ARCRAD)214,216,216
214 ARCRAD=3.14159 & ARCRAD
216 ARCDeg=ARCRAD*57.295779
   PORT2B(1)=ARCDeg*60.11031
40 CONTINUE
C
C COMPUTE BUOY TO BUOY DISTANCES
C
   K=NTPTS-1
   DO 50 I=1,K
     DIFF=ABS(RLNG(1)-RLNG(I&1))
     IF(DIFF-180.146,46,44)
44   DIFF=360.-DIFF
46   RLNG=DIFF/57.295779
     GCA=SIN(BLATR(1))*SIN(BLATR(I&1))&COS(BLATR(1))*COS(BLATR(I&1))
     &COS(RLNG)
     ARCRAD=ATAN(SQRT(1.-GCA**2)/GCA)
     IF(ARCRAD)218,220,220
218 ARCRAD=3.14159 & ARCRAD
220 ARCDeg=ARCRAD*57.295779
     BUOY2B(1)=ARCDeg*60.11031
50 CONTINUE
C
C COMPUTE DEPLOYMENT TO FIRST BUOY FROM PORT/DEPOT IF NC=NZ
C
   NCRUSE=NCRUSE & 1
   NBLAD=LOAD(NCRUSE)
   NCRPTS=NBLAD & NAVG(NCRUSE)
   NZBUOY=0
   NBDATF=0
10  NCBUOY=NZBUOY
12  NCBUOY=NCBUOY&1
   I=NCBUOY
   IF(NZBUOY-(NCBUOY-1))154,53,54
53  IF(NDEPOT-NPORT)154,52,156
156 HR=SAFFAC*(PORT2D/SACS)
     CDIST=CDIST&PORT2D
     SEADAY=SEADAY&(HR/24.)
     DPYDAY=DPYDAY&(HR/24.)
     KCLK=1
     TIME=HR
     CALL CLOCK(KCLK,TIME,IDAY,MONTH,IYEAR,IMOUR,CMON,CAL,ICNT)
     MHR100=IMOUR*100
     DIFF=ABS(OLNG-BLNG(1))
     IF(DIFF-180.1159,159,158)
158 DIFF=360.-DIFF
159 RLNG=DIFF/57.295779
     GCA=SIN(OLATR)*SIN(BLATR(1))&COS(OLATR)*COS(BLATR(1))*COS(RLNG)
     ARCRAD=ATAN(SQRT(1.-GCA**2)/GCA)
     IF(ARCRAD)222,224,224
222 ARCRAD=3.14159 & ARCRAD
224 ARCDeg=ARCRAD*57.295779

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DEPDZ=ARCEDEG*60.11031
DXR=DEPDZ
DPR=PORT2B(1)
HRS=SAFFAC*((DXR+DPR)/SACS) & HIPB
IF(CTYPE(1)-CTEST(4))55,176,55
176 HRS=HRS-HIPB
GO TO 55
52 DXR=PORT2B(1)
DPR=PORT2B(1)
HRS=SAFFAC*((12.0+DXR)/SACS) & HIPB
IF(CTYPE(1)-CTEST(4))55,177,55
177 HRS=HRS-HIPB
GO TO 55
C COMPUTE DEPLOYMENT TO NEXT BUOY IF NO GT NZ
54 J=1-1
DXR=BUOY2B(1)
DPR=PORT2B(1)
HRS=SAFFAC*((DXR+DPR)/SACS) & HIPB
IF(CTYPE(1)-CTEST(4))55,178,55
178 HRS=HRS-HIPB
C CHECK TIME AGAINST DES AND MAX SEA DAYS
55 TCHK=SEADAY*24.0HRS
IF(TCHK-SMCH)56,57,57
56 GO TO 60
57 IF(TCHK-SMCH)58,59,59
58 KRTNPT=KRTNPT-1
C PAST DES SEA DAYS PLANT BUOY, PRINT MESSAGE, CONTINUE DEPLOYMENT
GO TO 60
59 KRTNPT=2
C PAST MAX SEA DAYS, PRINT MESSAGE, RETURN TO PORT
60 IF(KPRINT)62,62,615
615 IF(NRIMCR)61,61,62
61 WRITE(3,520)KRUN,KRDY,RMON,KRYR
WRITE(3,499)HOL1
WRITE(3,499)HOL2
WRITE(3,531)
611 FORMAT(1X,16X,'CRUISE DEPLOYMENT SUMMARY',/)
WRITE(3,532)SNAME,NCRUSE
612 FORMAT(1X,34X,' CRUISE #12,/)
IF(NDPOT-NPORT)168,169,168
168 WRITE(3,543)PNAME,ISDAY,SMON,ISYR
543 FORMAT(' DEPARTED '134X,' ON'13,44,13,/)
169 WRITE(3,533)NLOAD,PNAME,TDAY,CNOM,IYEAR,MHR100,SEADAY
533 FORMAT(' UN-LOADED',13,' BUOYS AT '134X,/, ' SHIP UNDERWAY',13,44,1
13,' AT '14X,' HRS, SEADAYS '*64.1,/)
WRITE(3,534)
534 FORMAT(' BUOYS IMPLANTED IN FOLLOWING ORDER',/,/, ' BUOY DEGS OF
10S N MI N MI TO DATE SEA OPLYNT',/,/, ' NBR LAT LO
2NG ATWN PORT DAY DAY')
C
C PLANT BUOY, CALL CLOC, SET CNTRS
62 IF(KRTNPT-2)63,68,68
62 WRITE(3,545)NUMR(1)
545 FORMAT(1H,/, ' EXCEEDED MAX NBR OF SEA DAYS TO IMPLANT BUOY '14X,/,
1' REORDER BUOYS AND DO ANOTHER DEPLOYMENT')

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GO TO 900
63 CDIST=CDIST&DXR
NR=SAFFAC*(DXR/SACS) C HTPR
IF(CTYPE(I)-CTEST(4))179,180,179
180 NR=NR-HTPR
179 SFADAY=SEADAY*(NR/24.)
DPYDAY=DPYDAY*(NR/24.)
NRINCR=NRINCR&1
NRDEPZ=NRDEPZ&1
NRLETC=NRLETC-NRINCR
KCLK=1
TIME=NR
CALL CLOCK(KCLK,TIME,IDAY,MONTH,IYEAR,IMOUR,CMON,CAL,ICNT)
PMON=CMON
IF(PLAT(I))200,203,201
200 XLAT=ABS(PLAT(I))
RY=XA(4)
GO TO 202
201 XLAT=PLAT(I)
RY=XA(1)
202 IF(PLNG(I))203,203,204
203 XLNG=ABS(PLNG(I))
BX=XA(3)
GO TO 205
204 XLNG=BLNG(I)
BX=XA(2)
205 IF(INZBUOY-(NCBUOY-1))64,160,64
160 IF(NDEPOT-NPORT)161,65,161
161 IDXR=DEPOT2R
IDFR=PORT2R(I)
GO TO 162
44 IDXR=DXR
IDFR=DFR
GO TO 162
45 IDXB=DXR
IDFB=DFR
162 IF(KPRINT)617,617,616
616 WRITE(1,536)NUMB(I),XLAT,RY,XLNG,BX,IDXR,IDFR,IDAY,PMON,SFADAY,
DPYDAY
536 FORMAT(1X,A4,F6.1,A1,F7.1,A1,1X,14,4X,15,3X,12,A4,2X,F5.1,2X,F6.1)
617 IF(CTYPE(I)-CTEST(4))A3,A6,A3
43 IF(IDPTH(I)-MAXDTH)A4,A4,A5
44 GO TO A6
45 MAXDTH=IDPTH(I)
7MAXLT=BLAT(I)
DMAXLG=PLNG(I)
46 IF(IDPTH(I)-MINDTH)A7,A7,A8
47 MINDTH=IDPTH(I)
DMINLT=BLAT(I)
DMINLG=PLNG(I)
88 IF(GNORTH-BLAT(I))90,91,91
90 GNORTH=BLAT(I)
GNLONG=PLNG(I)
91 IF(BLAT(I)-GSOUTH)92,93,93
92 GSOUTH=BLAT(I)

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      GSLONG=BLNG(I)
93  IF(GEAST-BLNG(I))94,95,96
94  GEAST=BLNG(I)
      GELAT=BLAT(I)
95  IF(BLNG(I)-GWEST)96,100,100
96  GWEST=BLNG(I)
      GELAT=BLAT(I)
100 IF(KPRINT)66,66,618
618 IF(KRTMPT)66,67,66
66  IF(NBLFTC)70,70,17
C
C IF NBLFTC=0 CRUISE COMPLETED COMPUTE VAR FOR PRINT OUT
67  WRITE(3,537)
537  FORMAT(/,' EXCEEDED DESIRED SEA DAYS TO IMPLANT ABOVE BUOY',/)
      GO TO 66
70  CDIST=CDIST&DFF
      HR=SAFFAC*(DFF/SACS)
      SEADAY=SEADAY&(HR/24.)
      DPYDAY=DPYDAY&(HR/24.)
      NBLFTZ=NTPNTS-NBDEPZ
      NMICR=CDIST
      NBIMCR=NBIMCR+NAVG(NCRUSE)
      NRDATE=NRDATE&NBIMCR
      NRTOOD=NTPMDZ-NRDATE
      KCLK=1
      TIME=HR
      CALL CLOCK(KCLK,TIME,IDAY,MONTH,IYEAR,IMOUR,CMON,CAL,ICNT)
      HMR100=IMOUR*100
      IF(KPRINT)620,620,619
619  WRITE(3,538)PNAME,IDAY,CMON,IYEAR,HMR100
538  FORMAT(/,' SHIP RETURNED TO '3A4,' ON'13,A4,13,' AT '14,' HRS',/)
      WRITE(3,539)NMICR,NBIMCR,NRDATE,NRTOOD
539  FORMAT(' N MILES STEAMED THIS CRUISE =*16,/,,' BUOYS IMPLANTED TH
      ITS CRUISE =*13,/,,' TOTAL BUOY IMPLANTED TO DATE =*13,/,,' BUOYS R
      2 REMAINING TO BE DPLYD =*13,/)
620  PRTOAY=(POIFF*(NBLOAD/SMRC)) & POMIN
      IF(PRTOAY-PDMAX)116,116,115
115  PRTOAY=PDMAX
116  DPYDAY=DPYDAY & PRTOAY
      XDAY=DPYDAY*OVRSF
      TORCST=((CSTCDY*SEADAY)&(CSTPDY*PRTOAY)&(CDIST*GSTPM))
      XCDST=TORCST*OVRSF
      TOPCST=TOPCST & TORCST
      XTCST=TOPCST*OVRSF
      N=NCRUSE
      NMSTMIN)=NMICR
      NBOPY(N)=NBIMCR
      ATSEAIN)=SEADAY
      ATPRTINI)=PRTOAY
      RQDYSINI)=SEADAY & PRTOAY
      XSDYSINI)=OVRSF*(SEADAY&PRTOAY)
C
C CAL CLOCK TO RECORD IN PORT TIME
      KCLK=2
      TIME=PRTOAY

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0012

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CALL CLOCK(KCLK,TIME,IDAY,MONTH,IYEAR,IMOUR,CMON,CAL,ICNT)
ISDAY=IDAY
SHOW=CMON
ISYER=IYEAR
MHR100=IMOUR*100
IF(KPRINT)622,622,621
621 WRITE(3,540)SEADAY,PRTOAY
940 FORMAT(' MINIMUM PSBL SEA DAYS FOR THIS CRUISE = 'F5.1,/, ' MINIMUM
      1 REQUIRED PORT DAYS = 'F5.1,/)
WRITE(3,541)DPYDAY,XDAY
941 FORMAT(' MINIMUM PSBL DEPLOYMENT DAYS TO DATE = 'F5.1,/, ' MIN DP
      1LYMT DAYS X SAFETY FACTOR = 'F5.1,/)
WRITE(3,594)CSTCDY
994 FORMAT(' ----- AT $'F6.0, '00 PER SEA DAY -----')
WRITE(3,542)TCRCST,XCOST,TOPCST,XTCST
942 FORMAT(' MINIMUM SHIP COST FOR THIS CRUISE $'F10.0, '00',/, ' MI
      1N SHIP COST X SAFETY FACTOR $'F10.0, '00',/,/, ' TOTAL MINIMU
      24 SHIP COST TO DATE $'F10.0, '00',/,/, ' TOTAL MIN COST X SAFET
      3Y FACTOR $'F10.0, '00')
627 IF(NBLFTZ)80,80,74
C
C MORE BUOYS LEFT TO DEPLOY DETERMINE NLOAD
C DO ANOTHER DEPLOYMENT CRUISE
C
74 NCRUSE=NCRUSE+1
NLOAD=LOAD(NCRUSE)
NCRPTS=NLOAD & NAVG(NCRUSE)
NZRDY=NBDPZ
TSEAD=TSEAD&SEADAY
TDIST=TDIST&CDIST
TPRTD=TPRTD&PRTOAY
TOPYD=TSEAD&TPRTD
NRINCR=0
CDIST=0.
SEADAY=0.
KRTNPT=0
GO TO 10
C
C ALL MDZ BUOYS DEPLYD WRITE CRUISE SUMMARY PAGE
C
80 WRITE(3,520)KRUN,KRDY,RMON,KRYR
WRITE(3,499)MDL1
WRITE(3,499)MDL2
TDIST=TDIST&CDIST
TSEAD=TSEAD&SEADAY
TPRTD=TPRTD&PRTOAY
TOPYD=TSEAD&TPRTD
IF(GWLAT)400,401,401
400 KMLT=KA(4)
GO TO 402
401 KMLT=KA(1)
402 GWLAT=ABS(GWLAT)
IF(GWEST)403,404,404
403 KMLG=KA(3)
GO TO 405

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10/08/68

FORTMAIN

0011

```
404 XNLG=XA(2)
405 GWEST=ABS(GWEST)
    IF(GNORTH)406,407,407
406 XNLT=XA(4)
    GO TO 408
407 XNLT=XA(1)
408 GNORTH=ABS(GNORTH)
    IF(GNLONG)409,410,410
409 XNLG=XA(3)
    GO TO 411
410 XNLG=XA(2)
411 GNLONG=ABS(GNLONG)
    IF(GELAT)412,413,413
412 XELT=XA(4)
    GO TO 414
413 XELT=XA(1)
414 GELAT=ABS(GELAT)
    IF(GEAST)415,416,416
415 XELG=XA(3)
    GO TO 417
416 XELG=XA(2)
417 GEAST=ABS(GEAST)
    IF(GSOUTH)418,419,419
418 XSLT=XA(4)
    GO TO 420
419 XSLT=XA(1)
420 GSOUTH=ABS(GSOUTH)
    IF(GSLONG)421,422,422
421 XSLG=XA(3)
    GO TO 423
422 XSLG=XA(2)
423 GSLONG=ABS(GSLONG)
    IF(DMINLT)424,425,425
424 XMILT=XA(4)
    GO TO 426
425 XMILT=XA(1)
426 DMINLT=ABS(DMINLT)
    IF(DMINLG)427,428,428
427 XMILG=XA(3)
    GO TO 429
428 XMILG=XA(2)
429 DMINLG=ABS(DMINLG)
    IF(DMAXLT)430,431,431
430 XMXLT=XA(4)
    GO TO 432
431 XMXLT=XA(1)
432 DMAXLT=ABS(DMAXLT)
    IF(DMAXLG)433,434,434
433 XMXLG=XA(3)
    GO TO 435
434 XMXLG=XA(2)
435 DMAXLG=ABS(DMAXLG)
    WRITE(3,550)
    WRITE(3,552)IBDAY,BMON,IRYER,IBMR
    WRITE(3,554)
```

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FORTHAIN

2014

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WRITE(3,556)(N,NBODY(N),NMSTN(N),ATSEAI(N),ATPRY(N),RODYS(N),
IXSDYS(N),N=1,KCR)
NAVGD=TDIST/NTPMOZ
MDIST=TDIST
WRITE(3,558)KCR,NTPMOZ,MDIST,TSEAD,TPRTO,TPYD,XDAY
WRITE(3,559)CSTCDY
WRITE(3,560)TDCST
WRITE(3,570)XTCST
WRITE(3,572)TBYCST
WRITE(3,571)INTOPH,NTSUM
WRITE(3,573)NDPAVG
WRITE(3,578)NSRAVG
WRITE(3,582)ARMCST
WRITE(3,584)NAVG0
WRITE(3,574)
WRITE(3,576)SACS
WRITE(3,577)MSAC
WRITE(3,580)HIPA
WRITE(3,585)
WRITE(3,586)
WRITE(3,587)GMLAT,XMLT,GWEST,XWLG,GNORTH,XNLT,GNLONG,XNLG,DELAT,
IXELT,GFAST,XELG,GSOUTH,XSLT,GSLONG,XSLG
WRITE(3,588)MINDYH,OMINLT,XMILT,OMINLG,XMILG
WRITE(3,589)MAXDTH,OMAXLT,XMXLT,OMAXLG,XMXLG
C
C 07 RECYCLE TESTS FOR VARIABLE SPEED SHIP  HIPA=HIPB&INC
C FIND LONGEST CRUISE IN MILES AND DAYS
C
DO 623 I=1,KCR
  IF(LNGCRS-NMSTN(I))624,624,625
624  LNGCRS=NMSTN(I)
A75  IF(GRTDAY-ATSEAI(I))626,626,623
A76  GRTDAY=ATSEAI(I)
  KK=I
623  CONTINUE
  TRIP=TSEAD-NTPMOZ*(HIPB/24.)
  CRSE=GRTDAY-NBODY(KK)*(HIPA/24.)
650  NBASE=NBASE+1
  GO TO (A51,A50,652),NBASE
A50  NASIC=ACRDA
  GO TO 670
651  NASIC=BCPDH
  GO TO 670
A52  NASIC=ACPDH
670  WRITE(3,543)KRUN,KNDY,RNDN,KRYR
  WRITE(3,544)MDL1
  WRITE(3,544)MDL2
  WRITE(3,545)NTPMOZ,PNAME,MSAC
  WRITE(3,546)MDIST,LNGCRS
  WRITE(3,547)NASIC,PERCTR
  WRITE(3,596)(SPD(I),I=1,4)
  WRITE(3,597)(SCPW(I),I=1,4)
  WRITE(3,598)(ADDC(I),I=1,4)
  WRITE(3,560)NAVSHO
  ENDDO

```

```

DN 630 J=1,4
INC=INC & INCR(J)
IMPR=HIMP & INC
DIPR=NTPMDZ*(IMPR/24.)
NPBC=NNDPV(KK)*(IMPR/24.)
WRITE(3,549)IMPR,DIPR
DN 629 I=1,4
TSEAD=TRIP*(SACS/SPD(I)) & DIPR
BIGCR=CRSE*(SACS/SPD(I)) & NPBC
TDPYD=TSEAD & TPRTD
XDAY=TDPYD*NVRSAP
CSTCDY=BASIC & ANOC(I)
CSTPDY=PCFCTR*CSTCDY
TDP CST=((CSTCDY*TSEAD)&(CSTPDY*TPRTD)&(TDIST*SCPM(I)))/1000.
XTCST=TDP CST*NVRSAP
ANDPC=TDP CST/NTPMDZ
ANDPB=TDPYD/NTPMDZ
NBPSY=(AVSHDY/ANDPB) + .5
IF(KPSPD(I))680,680,682
680 WRITE(3,551)SPD(I),BIGCR,TSEAD,TPRTD,TDPYD,XDAY,TDP CST,XTCST,
    IANDPC,ANDPB,NBPSY
551 FORMAT(16X,F4.1,3F6.1,2F7.1,3F9.1,7X,F5.1,8X,I4)
682 IF(KHR1)629,629,631
631 IF(IMPR-KHR1)633,632,633
633 IF(IMPR-KHR2)629,632,629
632 IF(NRASE-2)629,653,629
653 DN 634 L=1,NSS
    IF(SPD(I)-SPG(L))634,635,634
635 STP(KP)=SPD(I)
    DAY(KP)=TSEAD
    KAC(KP)=NSAC
    ACPH(KP)=ANDPC
    KP=KPE1
    GO TO 629
634 CONTINUE
629 CONTINUE
630 CONTINUE
    IF(NRASE-3)660,654,654
654 NBC=NRC & 1
    NRYS(NBC)=NTPMDZ
    DIST(NBC)=TDIST
    READ(1,600)OPTION
600 FORMAT(A4)
    IF(OPTION-CTEST(2))601,602,601
602 KCYCLF=1
    KRUN=KRUN & 1
    IDAY=IDAY
    CMCM=B4NN
    IYEAR=IBYER
    IHOUR=IBHR/100
    GO TO 700
601 IF(OPTION-CTEST(3))636,603,636
603 IF(KHR1)637,637,638
638 CALL GRAPH(STP,DAY,KAC,HDL1,NSS,NRC,KHR1,KHR2,ACPH,NRYS,DIST)
637 KCYCLE=2

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FORTMAIN

0914

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12AY=180AY
CMON=8MON
IYEAR=1YER
IMHUR=18HR/100
GO TO 701
636 IF (HMR) 1900,900,640
640 CALL GRAPH(STP,DAY,KBC,MOL1,NSS,NBC,KMR1,KMR2,ACPD,NBYS,DIST)
GO TO 900

```

C
C FORMATS FOR SYSTEM SUMMARY PAGE

```

550 FORMAT(//,'          SYSTEM DEPLOYMENT SUMMARY',/)
552 FORMAT(//,' STARTING DATE = ',I2,A4,I3,' AT ',I4,' HRS',/)
554 FORMAT(//,' CRUISE BUOYS N MILES MIN SHIP MIN SHIP TOTAL MIN M
1IN X',/,,' NBR DPLYD STEAMED SEA DAYS PRT DAYS DPLY DAYS S
SAFETY')
556 FORMAT(//,I3,5X,I3,5X,I5,4X,F5.1,5X,F5.1,5X,F4.1,4X,F6.1)
558 FORMAT(//,I3,I3,5X,I3,3X,I7,3X,F6.1,4X,F6.1,4X,F7.1,3X,F7.1)
559 FORMAT(//,' ----- AT $F6.0,00 PER SEA DAY -----',
1)
560 FORMAT(//,' MINIMUM SHIP COST FOR THIS DEPLOYMENT $F10.0,00')
570 FORMAT(//,' MINIMUM SHIP COST X SAFETY FACTOR $F10.0,00')
572 FORMAT(//,' TOTAL COST FOR BUOY HARDWARE DEPLOYED $F10.0,00',/
1)
571 FORMAT(//,' TOTAL FEET OF MOORING REQUIRED =I6,/, ' TOTAL S/S SENSOR
1 PACKAGES DPLYD =I8)
573 FORMAT(//,' AVERAGE DEPTH PER BUOY IN MDZ =I6)
578 FORMAT(//,' AVERAGE NBR OF S/S PKGS PER BUOY IN MDZ =I6)
582 FORMAT(//,' AVERAGE HARDWARE COST PER BUOY IN MDZ $F10.0,00')
594 FORMAT(//,' AVERAGE DISTANCE TRAVELED PER BUOY DEPLOYED =I6,' N MI
1)
574 FORMAT(//,' SUMMARY OF CONSTANTS USED FOR THIS DEPLOYMENT')
576 FORMAT(//,' SHIP AVERAGE SPEED =F4.1)
577 FORMAT(//,' SHIP MAX BUOY CAPACITY =I3)
580 FORMAT(//,' HRS TO IMPLANT 1 BUOY =F4.1,/)
585 FORMAT(//,I1X,'MAXIMUM GEOGRAPHICAL LOCATIONS')
586 FORMAT(//,5X,'WEST',I0X,'NORTH',I1X,'EAST',I0X,'SOUTH')
587 FORMAT(//,I1X,F4.1,A1,I1X,F5.1,A1,3X,F4.1,A1,I1X,F5.1,A1,3X,F4.1,A1,
1X,F5.1,A1,3X,F4.1,A1,I1X,F5.1,A1,/)
588 FORMAT(//,' THE SHORTEST MOORING WAS ',I3,' FEET AT ',F4.1,A1,I1X,F5.1
1,A1)
589 FORMAT(//,' THE DEEPEST MOORING WAS ',I3,' FEET AT ',F4.1,A1,I1X,F5.1
1,A1)

```

C
C FORMATS FOR DEPLOYMENT TEST SUMMARY

```

543 FORMAT(//,I1,I3X,'RUN NBR ',I3,42X,'DATE ',I2,A4,I3,/,34X'DEPL YMENT
1 TEST SUMMARY',/)
544 FORMAT(//,I4X,20A4)
545 FORMAT(//,I3X,I3,' BUOYS DEPLOYED FROM '344,' SHIP BUOY CAPACITY
1=I3)
546 FORMAT(//,I4X,'TOTAL DISTANCE, N MI =I7,7X,'MAXIMUM CRUISE, N MI =I
16)
547 FORMAT(//,I4X,'BASE COST PER SEA DAY = $F6.0,00',3X,'COST/PORT DAY
1=F4.2,' X SEA DAY',/)

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FORT44IN

0017

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96: FORMAT(14X,'SPEED KN'SF7.2,3F8.2)
97: FORMAT(14X,'CST/MI 2'SF7.2,3F8.2)
98: FORMAT(14X,'SEC/DY 8'SF7.2,3F8.2,/)
99: FORMAT(16X,'AVG MAX MIN MIN MIN MIN',7X,'DEPLOYMENT CD
1ST. 8X,8X,'AVG MIN AVG MAX BUOYS',/,16X,'SHIP CRSE SFA POR
2T DPLY X SAF IN DPLY X SAF AVG/BUOY',4X,'DPLY DAYS DPLY
3PER SHIP',/,16X,'SPD (DAYS) DAYS DAYS DAYS FCTR DAYS F
4ACTOR (MIN)',6X,' PER BUOY IN ',13,' DAYS ')
549 FORMAT(/,14X,12,' HRS TO IMPLANT A BUOY, TOTAL TIME TO IMPLANT =',F
16.1,' DAYS -----')
990 CALL EXIT
END

```

10/08/68

FORTMAIN

0019

SCALARS

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
INAY	074C	LYEAR	0754	INOUR	0759	INOUR	0759
I	0760	KRUN	0768	KROY	076C	KROY	076C
KRYR	0774	KHR1	0778	KSS	0770	KSS	0770
NBC	0789	KTRNPT	078C	LCMT	0790	LCMT	0790
NBDEPZ	079C	KCRUSE	07A0	LCMT	0794	LCMT	0794
NBNDTH	07B0	KNGCRS	07A4	LCMT	0798	LCMT	0798
GEAST	07C4	KNGCRS	07B0	LCMT	079C	LCMT	079C
TSEAD	07D8	KNGCRS	07C8	LCMT	0794	LCMT	0794
TBYCST	07EC	KNGCRS	07D0	LCMT	0798	LCMT	0798
IBYER	0800	KNGCRS	07E0	LCMT	079C	LCMT	079C
PLAT	0814	KNGCRS	07F0	LCMT	0794	LCMT	0794
PDMAK	0828	KNGCRS	0804	LCMT	0798	LCMT	0798
AVSHDY	083C	KNGCRS	0818	LCMT	079C	LCMT	079C
NY	0850	KNGCRS	082C	LCMT	0794	LCMT	0794
DLATR	0864	KNGCRS	083C	LCMT	0798	LCMT	0798
SMCH	0878	KNGCRS	0844	LCMT	079C	LCMT	079C
BCPDM	088C	KNGCRS	0854	LCMT	0794	LCMT	0794
ASXCD	08A0	KNGCRS	0868	LCMT	0798	LCMT	0798
APCFTR	08A4	KNGCRS	087C	LCMT	079C	LCMT	079C
NADD	08C4	KNGCRS	0880	LCMT	0794	LCMT	0794
NTPMOZ	08DC	KNGCRS	0884	LCMT	0798	LCMT	0798
CSTSPK	08F0	KNGCRS	088C	LCMT	079C	LCMT	079C
BD	0904	KNGCRS	0890	LCMT	0794	LCMT	0794
XLNG	0918	KNGCRS	0894	LCMT	0798	LCMT	0798
RLNG	092C	KNGCRS	0898	LCMT	079C	LCMT	079C
K	0940	KNGCRS	08A4	LCMT	0794	LCMT	0794
HR	0954	KNGCRS	08B8	LCMT	0798	LCMT	0798
DFP	0968	KNGCRS	08CC	LCMT	079C	LCMT	079C
IOX9	097C	KNGCRS	08D0	LCMT	0794	LCMT	0794
DMINLG	0990	KNGCRS	08E0	LCMT	0798	LCMT	0798
NBLFTZ	09A4	KNGCRS	08F4	LCMT	079C	LCMT	079C
TCRCST	09B8	KNGCRS	08F8	LCMT	0794	LCMT	0794
XWLT	09CC	KNGCRS	0908	LCMT	0798	LCMT	0798
XELG	09E0	KNGCRS	091C	LCMT	079C	LCMT	079C
XMXLT	09F4	KNGCRS	0920	LCMT	0794	LCMT	0794
TRIP	0A08	KNGCRS	0924	LCMT	0798	LCMT	0798
NIPIR	0A1C	KNGCRS	0928	LCMT	079C	LCMT	079C
NRPST	0A30	KNGCRS	0934	LCMT	0794	LCMT	0794

ARRAYS

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
PNAME	0A3C	SYMBOL <td>0A54</td> <td>CTEST <td>0A60</td> <td>SYMBOL <td>0A70</td> </td></td>	0A54	CTEST <td>0A60</td> <td>SYMBOL <td>0A70</td> </td>	0A60	SYMBOL <td>0A70</td>	0A70
XA	0A80	SYMBOL <td>0A54</td> <td>CTEST <td>0A60</td> <td>SYMBOL <td>0A70</td> </td></td>	0A54	CTEST <td>0A60</td> <td>SYMBOL <td>0A70</td> </td>	0A60	SYMBOL <td>0A70</td>	0A70
SPG	0B14	SYMBOL <td>0A54</td> <td>CTEST <td>0A60</td> <td>SYMBOL <td>0A70</td> </td></td>	0A54	CTEST <td>0A60</td> <td>SYMBOL <td>0A70</td> </td>	0A60	SYMBOL <td>0A70</td>	0A70
HDL2	0C00	SYMBOL <td>0A54</td> <td>CTEST <td>0A60</td> <td>SYMBOL <td>0A70</td> </td></td>	0A54	CTEST <td>0A60</td> <td>SYMBOL <td>0A70</td> </td>	0A60	SYMBOL <td>0A70</td>	0A70
ATPRT	0E08	SYMBOL <td>0A54</td> <td>CTEST <td>0A60</td> <td>SYMBOL <td>0A70</td> </td></td>	0A54	CTEST <td>0A60</td> <td>SYMBOL <td>0A70</td> </td>	0A60	SYMBOL <td>0A70</td>	0A70
STP	12E8	SYMBOL <td>0A54</td> <td>CTEST <td>0A60</td> <td>SYMBOL <td>0A70</td> </td></td>	0A54	CTEST <td>0A60</td> <td>SYMBOL <td>0A70</td> </td>	0A60	SYMBOL <td>0A70</td>	0A70
TLAT	1968	SYMBOL <td>0A54</td> <td>CTEST <td>0A60</td> <td>SYMBOL <td>0A70</td> </td></td>	0A54	CTEST <td>0A60</td> <td>SYMBOL <td>0A70</td> </td>	0A60	SYMBOL <td>0A70</td>	0A70
INPH	2918	SYMBOL <td>0A54</td> <td>CTEST <td>0A60</td> <td>SYMBOL <td>0A70</td> </td></td>	0A54	CTEST <td>0A60</td> <td>SYMBOL <td>0A70</td> </td>	0A60	SYMBOL <td>0A70</td>	0A70

10/08/68		FORTNAIN		000020		ADDRESS BASE TABLE	
00414	34EA	00415	3500	00416	350E	00417	3516
00419	353A	00420	3542	00421	3558	00422	3566
00424	3584	00425	3592	00426	359A	00427	3580
00429	35C6	00430	35DC	00431	35EA	00432	35F2
00434	3616	00435	361E	00436	3624	00437	36A0
00439	3680	00440	3630	00441	3660	00442	36D8
00444	368C	00445	367C	00446	36FC	00447	36F6
00449	403E	00450	404E	00451	4062	00452	407E
00454	40F8	00455	40FC	00456	4124	00457	4174
00459	41C8	00460	41D8	00461	41E4	00462	41F2
00464	4238	00465	424C	00466	4280	00467	429C
00469	4364	00470	438E	00471	43FE	00472	433C
00474	4484	00475	44DA	00476	4512	00477	4466
00479	45C8	00480	4602	00481	462C	00482	4584
00484	46AA	00485	4606	00486	4718	00487	457F
00489	47DA	00490	47E8	00491	482C	00492	4794
00494	48DA	00495	48F8	00496	4918	00497	489C
00499		00500		00501		00502	48AC
00504		00505		00506		00507	
00509		00510		00511		00512	
00514		00515		00516		00517	
00519		00520		00521		00522	
00524		00525		00526		00527	
00529		00530		00531		00532	
00534		00535		00536		00537	
00539		00540		00541		00542	
00544		00545		00546		00547	
00549		00550		00551		00552	
00554		00555		00556		00557	
00559		00560		00561		00562	
00564		00565		00566		00567	
00569		00570		00571		00572	
00574		00575		00576		00577	
00579		00580		00581		00582	
00584		00585		00586		00587	
00589		00590		00591		00592	
00594		00595		00596		00597	
00599		00600		00601		00602	
00604		00605		00606		00607	
00609		00610		00611		00612	
00614		00615		00616		00617	
00619		00620		00621		00622	
00624		00625		00626		00627	
00629		00630		00631		00632	
00634		00635		00636		00637	
00639		00640		00641		00642	
00644		00645		00646		00647	
00649		00650		00651		00652	
00654		00655		00656		00657	
00659		00660		00661		00662	
00664		00665		00666		00667	
00669		00670		00671		00672	
00674		00675		00676		00677	
00679		00680		00681		00682	
00684		00685		00686		00687	
00689		00690		00691		00692	
00694		00695		00696		00697	
00699		00700		00701		00702	
00704		00705		00706		00707	
00709		00710		00711		00712	
00714		00715		00716		00717	
00719		00720		00721		00722	
00724		00725		00726		00727	
00729		00730		00731		00732	
00734		00735		00736		00737	
00739		00740		00741		00742	
00744		00745		00746		00747	
00749		00750		00751		00752	
00754		00755		00756		00757	
00759		00760		00761		00762	
00764		00765		00766		00767	
00769		00770		00771		00772	
00774		00775		00776		00777	
00779		00780		00781		00782	
00784		00785		00786		00787	
00789		00790		00791		00792	
00794		00795		00796		00797	
00799		00800		00801		00802	
00804		00805		00806		00807	
00809		00810		00811		00812	
00814		00815		00816		00817	
00819		00820		00821		00822	
00824		00825		00826		00827	
00829		00830		00831		00832	
00834		00835		00836		00837	
00839		00840		00841		00842	
00844		00845		00846		00847	
00849		00850		00851		00852	
00854		00855		00856		00857	
00859		00860		00861		00862	
00864		00865		00866		00867	
00869		00870		00871		00872	
00874		00875		00876		00877	
00879		00880		00881		00882	
00884		00885		00886		00887	
00889		00890		00891		00892	
00894		00895		00896		00897	
00899		00900		00901		00902	
00904		00905		00906		00907	
00909		00910		00911		00912	
00914		00915		00916		00917	
00919		00920		00921		00922	
00924		00925		00926		00927	
00929		00930		00931		00932	
00934		00935		00936		00937	
00939		00940		00941		00942	
00944		00945		00946		00947	
00949		00950		00951		00952	
00954		00955		00956		00957	
00959		00960		00961		00962	
00964		00965		00966		00967	
00969		00970		00971		00972	
00974		00975		00976		00977	
00979		00980		00981		00982	
00984		00985		00986		00987	
00989		00990		00991		00992	
00994		00995		00996		00997	
00999		01000		01001		01002	

```

SUBROUTINE SUBSNR(CTYPE,IDEPTH,BCOST,IAPSDL,NSUB,CSTSPK,CMRGFT,
1 SCOPE,NTPNTS,TCOST,NTSUB,NTOPH,CTEST)
DIMENSION CTYPE(200),IDEPTH(200),BCOST(200),IAPSDL(20),NSUB(200)
DIMENSION TCOST(200),CTEST(4)
IAPSDL(1)=0
IAPSDL(2)=33
IAPSDL(3)=66
IAPSDL(4)=98
IAPSDL(5)=164
IAPSDL(6)=246
IAPSDL(7)=328
IAPSDL(8)=492
IAPSDL(9)=656
IAPSDL(10)=984
IAPSDL(11)=1312
IAPSDL(12)=1641
IAPSDL(13)=1969
IAPSDL(14)=2625
IAPSDL(15)=3281
IAPSDL(16)=4922
IAPSDL(17)=6562
IAPSDL(18)=9843
IAPSDL(19)=13124
IAPSDL(20)=16405
DO 30 J=1,NTPNTS
IF(CTYPE(J)-CTEST(4))8,30,8
8 DO 15 I=1,20
IF(IDEPTH(J)-IAPSDL(I))10,12,15
10 BFLAST=(IDEPTH(J)-IAPSDL(I-1))
TEST=.30(IAPSDL(I)-IAPSDL(I-1))
IF(BFLAST-TEST)11,12,12
11 I=I-1
12 NSUR(J)=I
GO TO 25
15 CONTINUE
NSUB(J)=20
25 CSTSUB=CSTSPK*NSUR(J)
CSTMRG=CMRGFT/1000.+(IDEPTH(J)*SCOPE)
TCOST(J)=BCOST(J) & CSTSUB & CSTMRG
NTSUB=NTSUB & NSUR(J)
NTOPH=NTOPH & IDEPTH(J)
30 CONTINUE
RETURN
END

```

10/08/68

SUMMR

0002

SCALARS

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
J	009C	NTPTS	006B	BEFAST	00A4	TEST	00A9
CSTSUB	00AC	CSTSPK	007C	CMRGFT	00R0	SCOPE	0094
MTSUB	0090	NTDPH	0094				

CALLED SUBROUTINES

IJTACM

LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION
0000B	0142	00010	01E0	00012	02A8	00015	0294
00025	0282	00030	0350				
COMPIATION COMPLETE		AMOUNT OF COMMON 000000		AMOUNT OF CORE 001160		ADDRESS BASE TABLE 038A	

```

SUBROUTINE CLOCK(KCLK,TIME,IDAY,MONTH,IYEAR,IMHOUR,CMON,CAL,ICNT)
DIMENSION CAL(12)
IF(ICNT)5,5,6
5 TDAYS=0.
C IF KCLK=1,2,3 TIME IS IN HR, DAY, MON
6 GO TO(10,12,14),KCLK
C TIME INPUT IS IN HOURS
10 DAYS=TIME/24.
SAVE=DAYS
INTR=DAYS
XDAY=INTR
FP=SAVE-XDAY
TEST=24.*FP
TEST=TEST&.5
IADD=TEST
IDAY=IDAY&INTR
IMHOUR=IMHOUR&IADD
IF(IMHOUR-24)15,16,17
15 TDAYS=TDAYS&DAYS
GO TO 40
16 IDAY=IDAY&1
IMHOUR=0
TDAYS=TDAYS&DAYS
GO TO 40
17 IADD=IMHOUR-24
IMHOUR=IADD
IDAY=IDAY&1
TDAYS=TDAYS&DAYS
GO TO 40
C 14 TIME INPUT IN DAYS
12 TDAYS=TDAYS&TIME
ITIME=TIME
IDAY=IDAY&ITIME
XTIME=ITIME
FP=TIME-XTIME
TEST=24.*FP
TEST=TEST&.5
IADD=TEST
IMHOUR=IMHOUR&IADD
IF(IMHOUR-24)16,16,62
60 GO TO 40
61 IDAY=IDAY&1
IMHOUR=0
GO TO 40
62 IADD=IMHOUR-24
IMHOUR=IADD
IDAY=IDAY&1
60 IF(IDAY-31)18,19,20
18 GO TO 50
19 IDAY=1
MONTH=MONTH&1
30 IF(MONTH-12)21,22,23
21 GO TO 50
22 MONTH=1

```

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CLOCK

0000

```

    IYFAR=IYEAR&1
    GO TO 50
23 IADD=MONTH-13
    MONTH=IADD&1
    IYEAR=IYEAR&1
    GO TO 50
20 DAYS=IDAY
    XMON=DAYS/30.
    SAVF=XMON
    INTR=XMON
    XMON=INTR
    FP=SAVE-XMON
    TEST=30.*FP
    TEST=TEST&.5
    IADD=TEST
    MONTH=MONTH&INTR
    IDAY=IADD
    GO TO 30
C READ TIME INPUT IN MONTHS
14 ITIME=TIME
    TIME=TIME*30.
    TDAYS=TDAYS&TIME
    MONTH=MONTH&ITIME
    GO TO 30
50 ICNT=ICNT&1
    DN 65 I=1,12
    IF MONTH-I)66.66.65
46 GO TO 67
65 CONTINUE
67 CMON=CAL(I)
    RETURN
END
```

0003

CLOCK

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SCALARS

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
ICNT	00C4	KCLK	00A4	DAYS	00CC	TIME	00A9	TEST	00E0
SAVE	00D0	XDAY	00D8	FP	00DC	XTIME	00E8	CMON	00AC
IADD	00E4	IMDUR	00B8	ITIME	00E8				
MONTH	00B0	XMON	00F0	I	00F4				

CALLED SUBROUTINES

IJTACOM

LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION
00005	00CE	00010	00D6	00015	01C0	00C16	01D7	00016	01D7
00017	01F8	00012	022A	00061	02EA	00C47	03D4	00021	03A4
00040	0324	00019	033A	00030	0354	00C21	0354	00C50	045A
00022	0370	00020	038A	00014	0482				
00066	04EE	00067	04F4						
COMPILATION COMPLETE		AMOUNT OF COMMON 00C000		AMOUNT OF CORE 001688		ADDRESS BASE TABLE		0559	

DISK OPERATING SYSTEM/360 FORTRAN 360N-FD-451 31

```
SUBROUTINE GRAPH (SPD,DDAYS,KBC,HOLI,NSS,NHC,KHR1,KHR2,ACPB,NBYS,  
1TDIS)  
  DIMENSION KPC(41), TITLE(17), HOLI(20), KT(24),ACPB(72)  
  DIMENSION KRC(72),DDAYS(72),SPD(72),KTALC(533),KTALP(533)  
  DIMENSION VT(8), ST(8), NBYS(5), TDIS(5)  
  CONTINUE  
  RETURN  
  END
```

0002

GRAPH

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ARRAYS

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
VT	0070	ST	G090	KT	0080	KPC	C154
KTBL	01F8	KTBLP	0A4C				

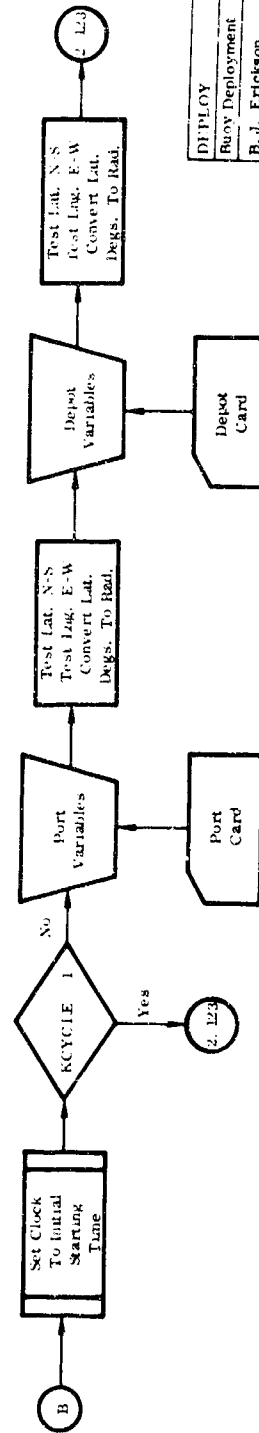
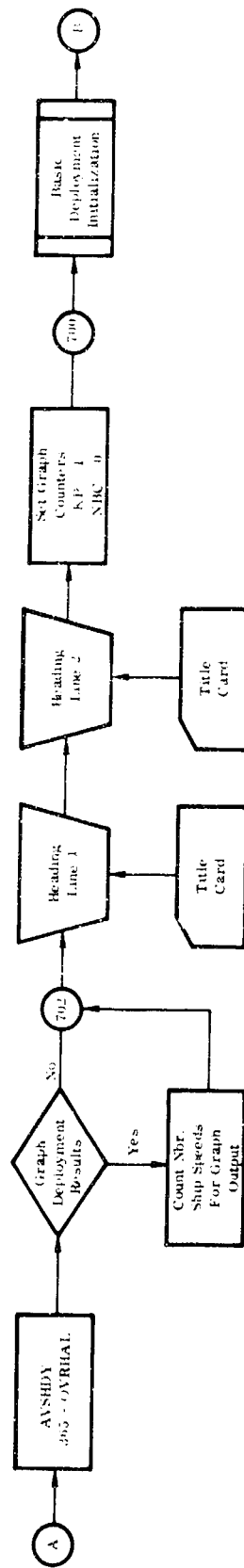
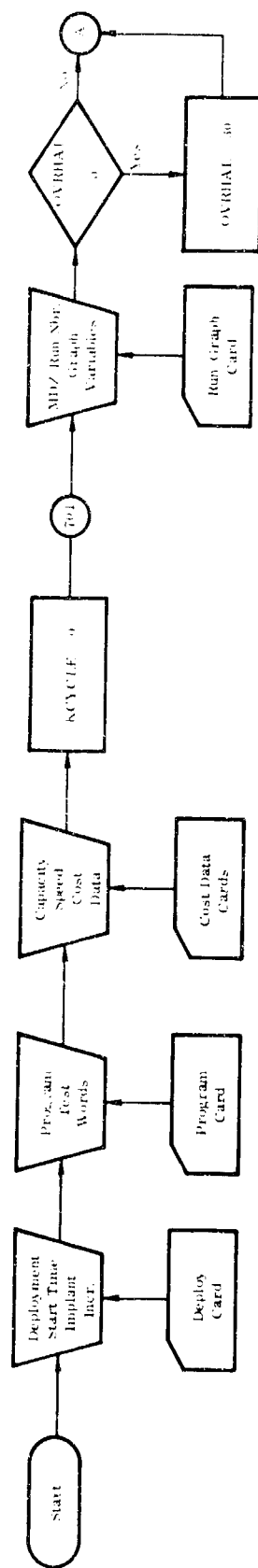
CALLED SUBROUTINES

1JYACOM

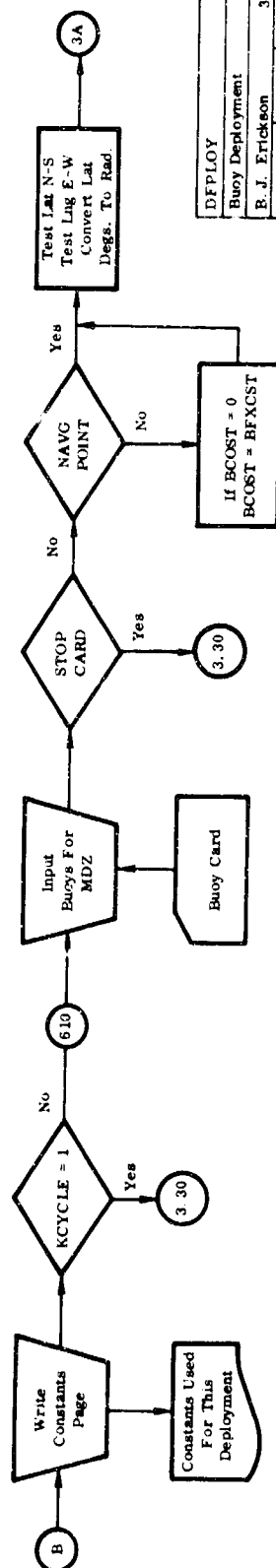
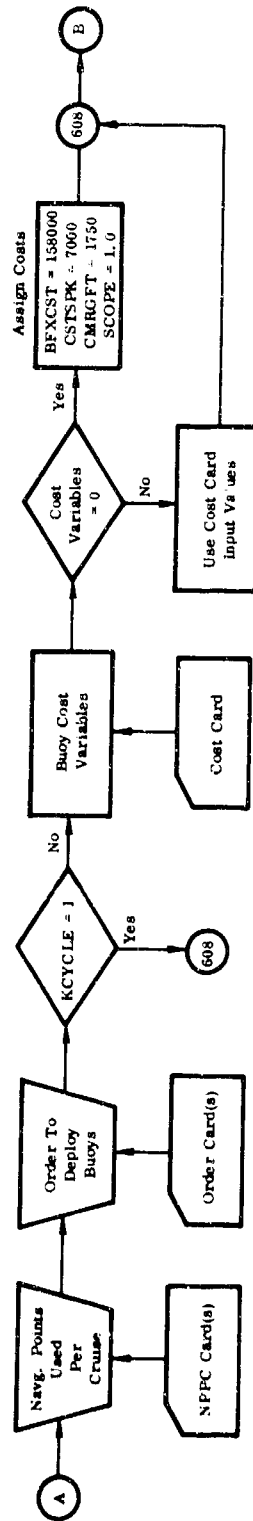
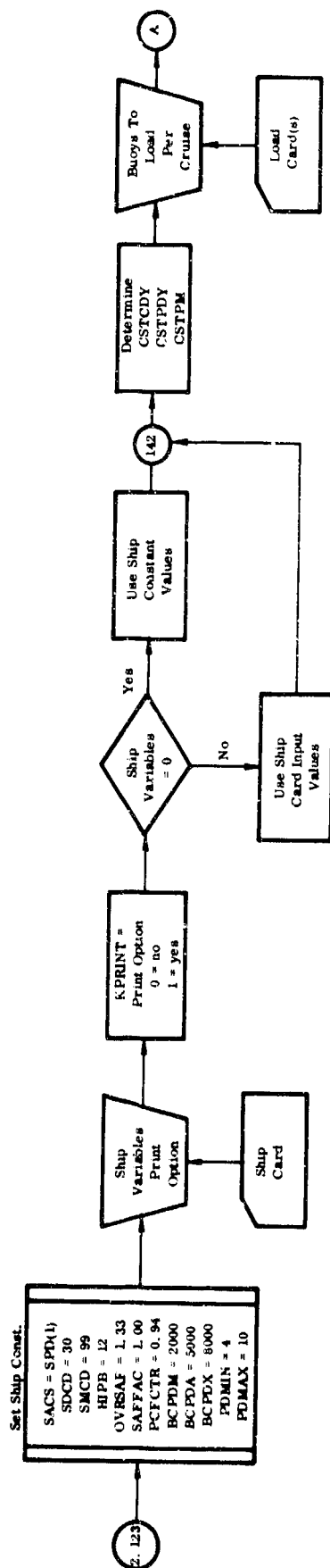
LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION
COMPILE	00000	AMOUNT OF COMMON	00000	AMOUNT OF CORE	004992	ADDRESS RAS	TABLE

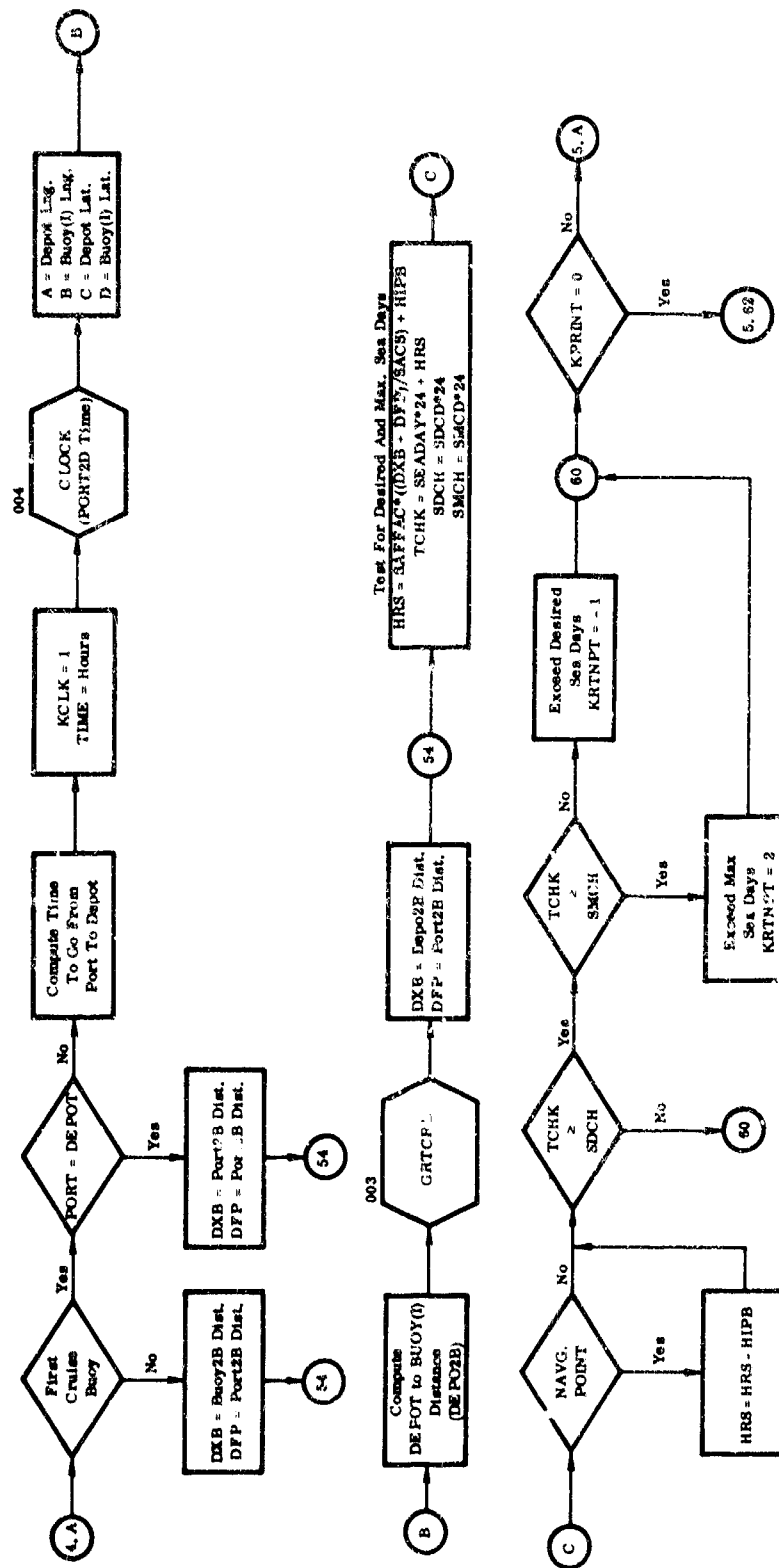
APPENDIX G

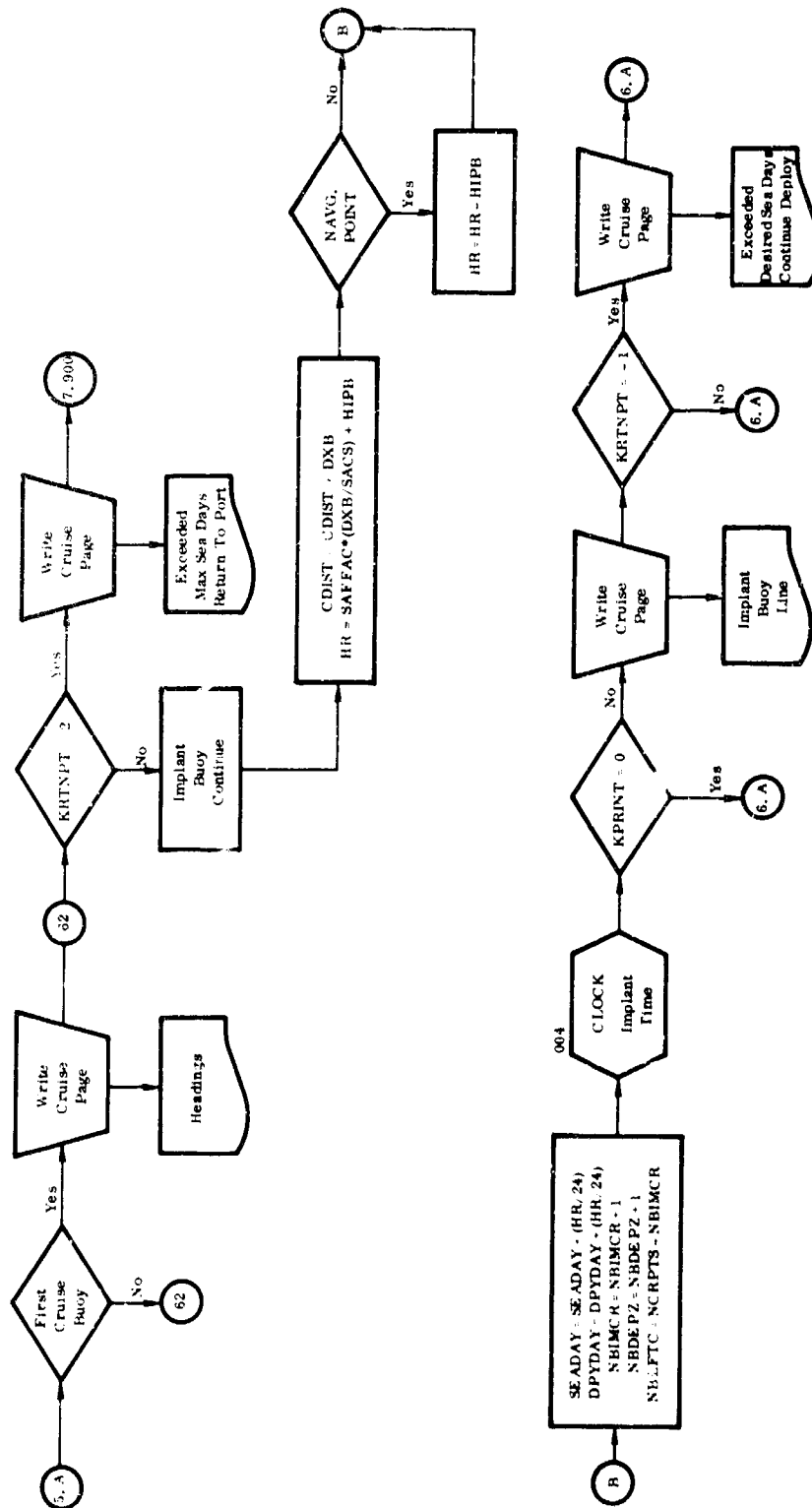
MICRO FLOW DIAGRAMS FOR
THE INTEGRATED BUOY DEPLOYMENT COST MODEL



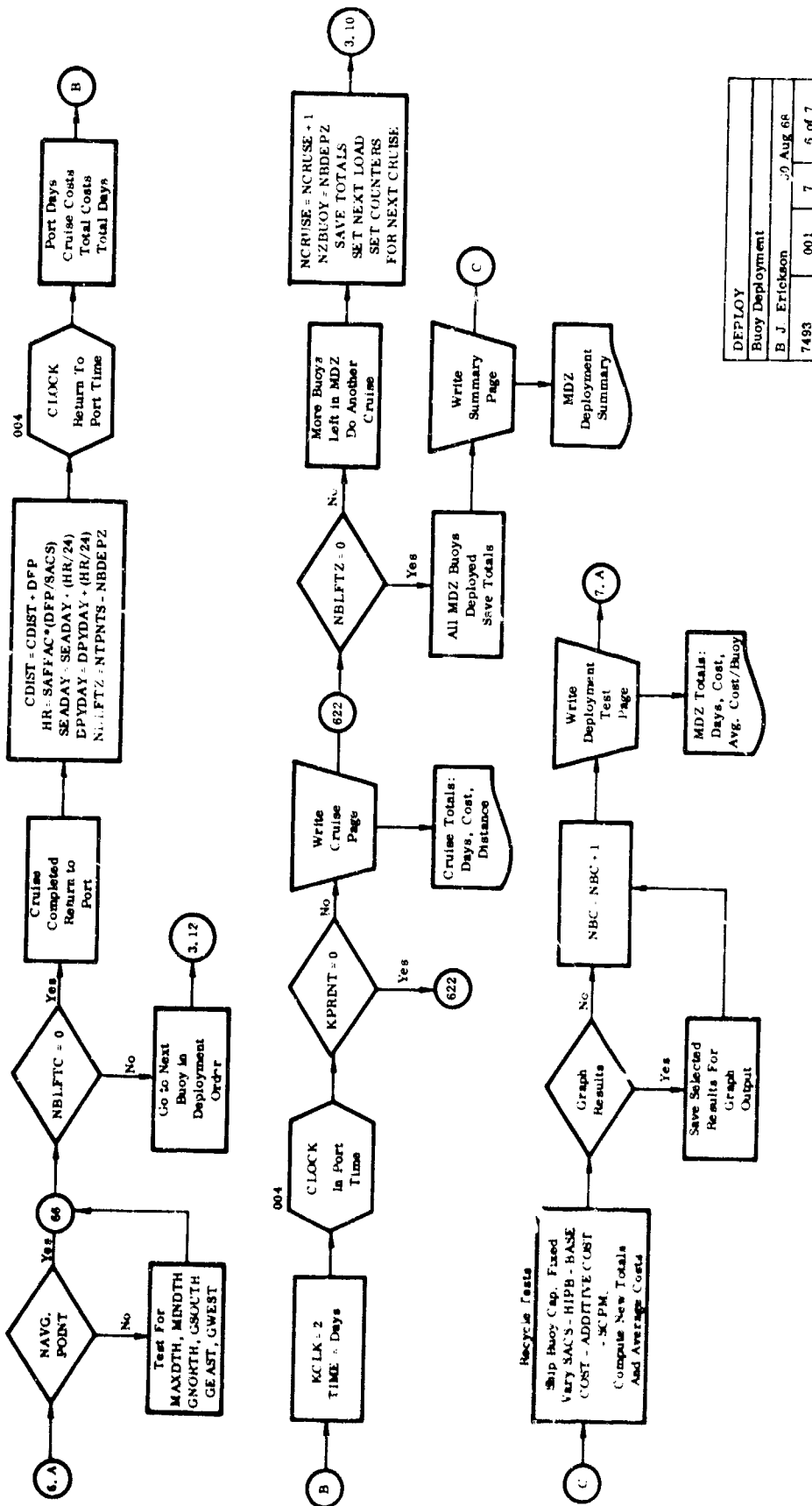
DEPLOY				
Ruby Deployment				
B. J. Erickson			30 Aug 08	
7493	001	7	1 of 7	



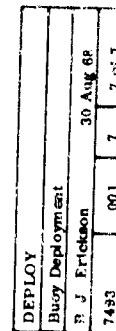


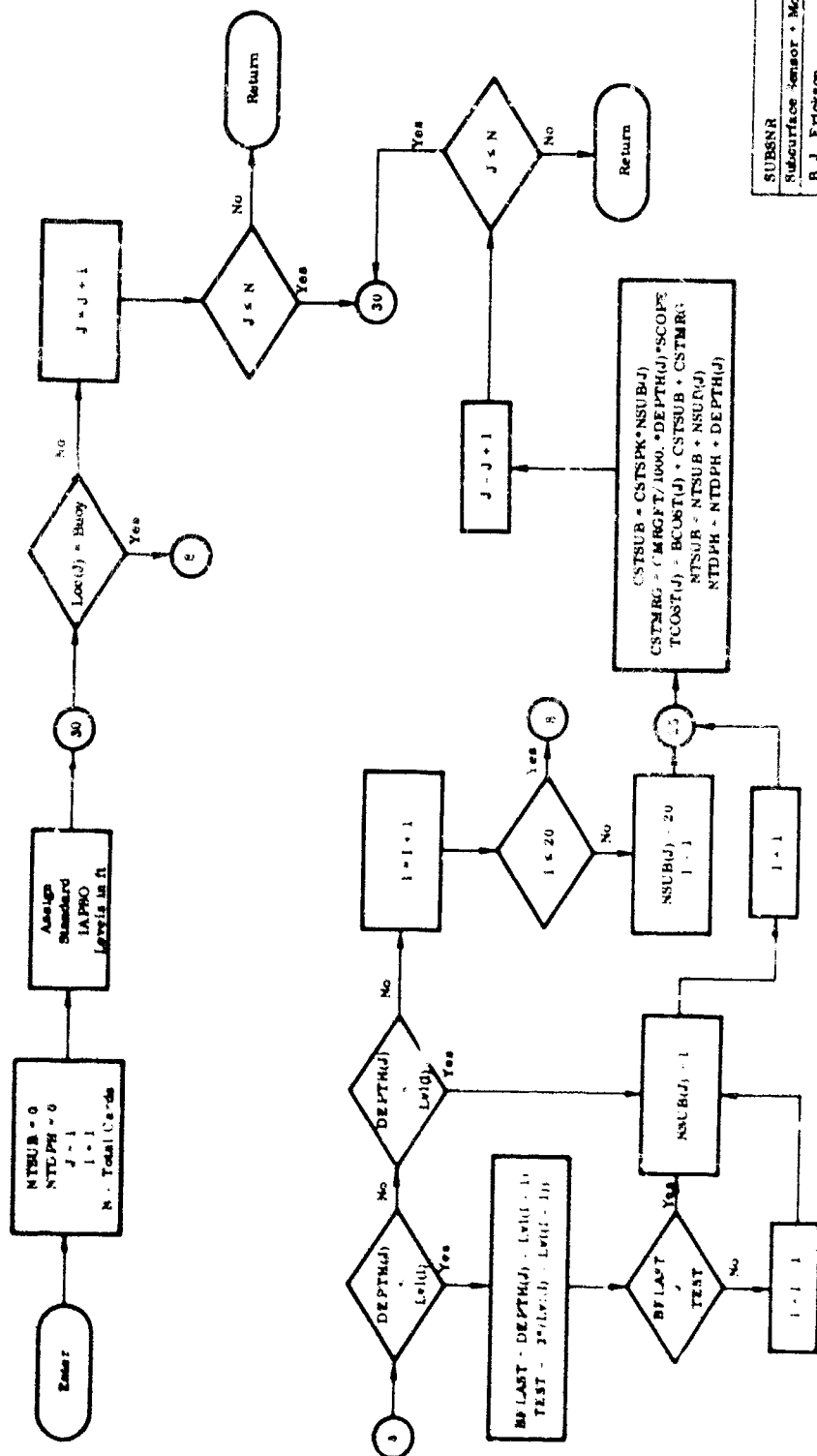


DEPLOY				
Buoy Deployment				
B. J. Erickson				
7493	001	7	5	of 7

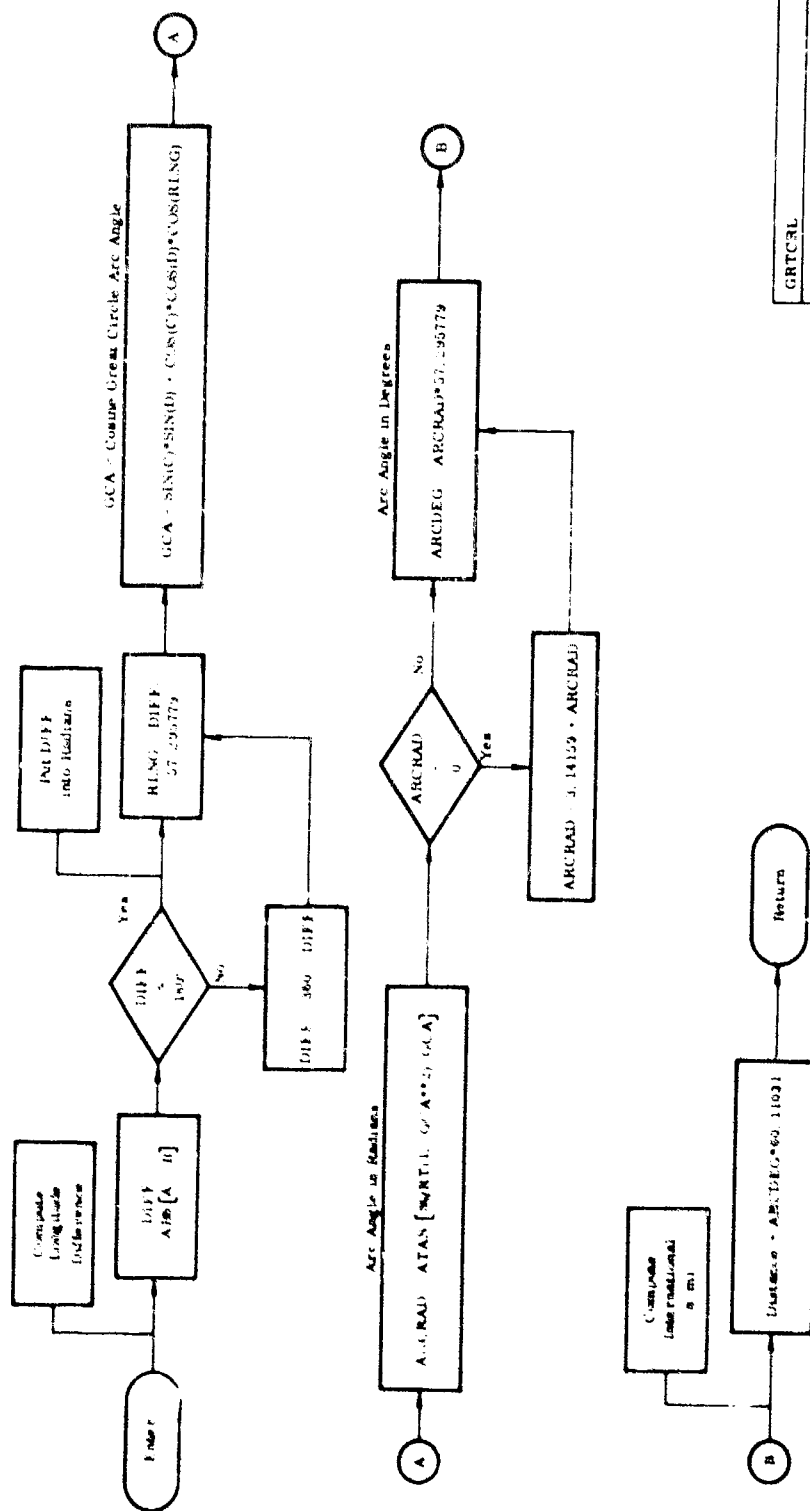


DEPLOY			
Buoy Deployment			
B. J. Erickson	001	7	5 of 7
7493			

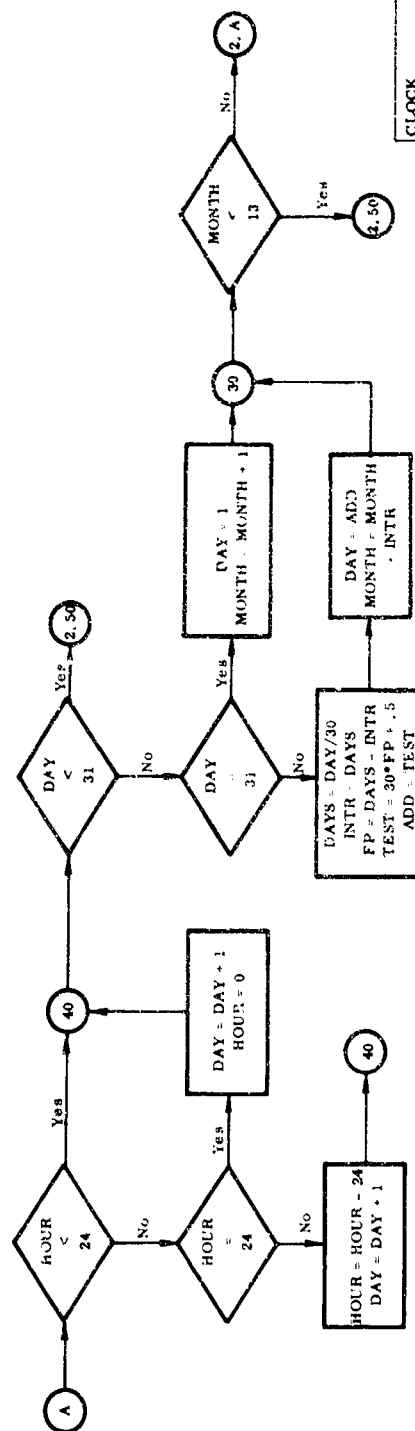
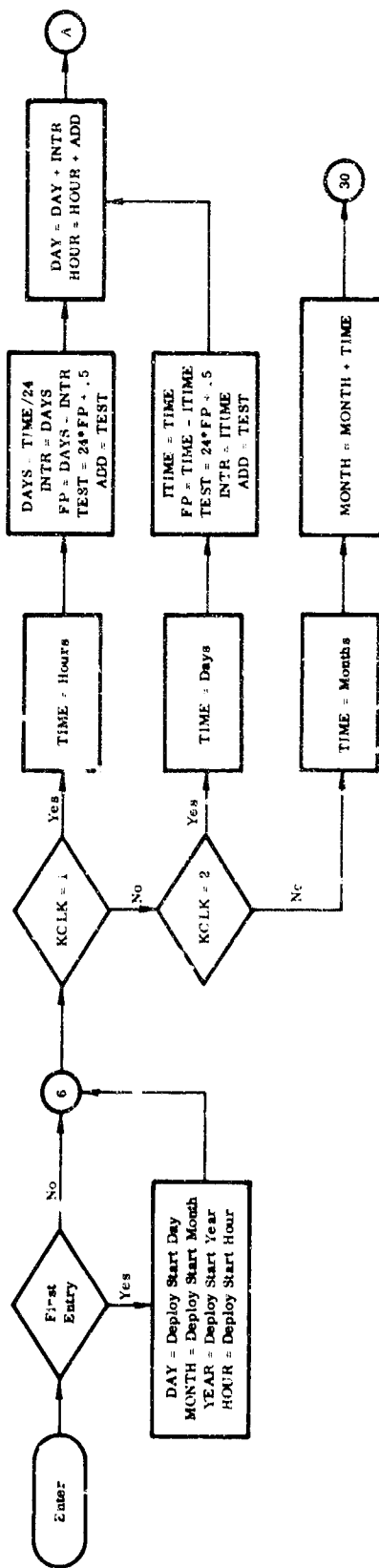




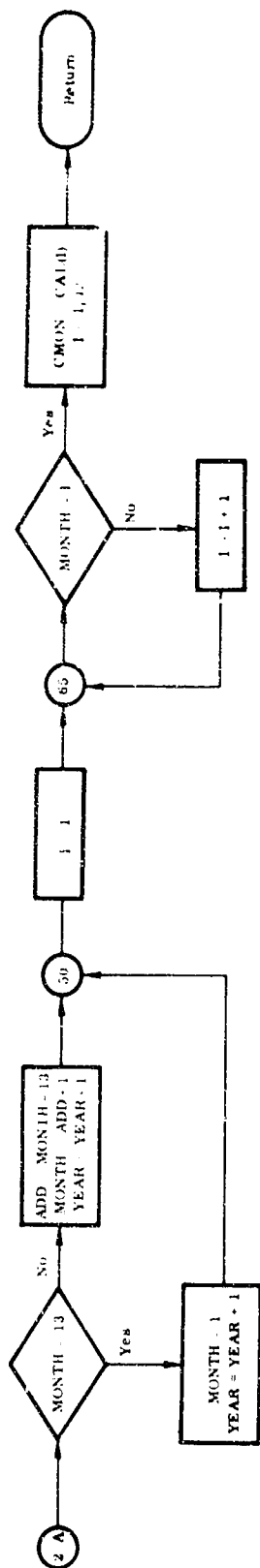
SUBSNR				
Subsurface Sensor + Mooring Cost				
B. J. Erickson				30 Apr 88
7493	072	1	1	1 of 1



GTRCL				
Great Circle Distance				
B. J. Erickson	20 July 68			
7493	003	3	1 of 1	



CLOCK				
Compute Flared Deployment Time				
R. J. Erickson				
10 Apr 68				
7493	004	1	1	1 of 2



CLOCK				
Compute Elapsed Deployment Time				
B. J. Erickson				10 Apr 68
7483	004	1		2 of 2

APPENDIX H

PROGRAM SOURCE CARD DECK FOR
THE INTEGRATED BUOY DEPLOYMENT COST MODEL

(Limited distribution of this Appendix is under separate cover)

APPENDIX I

COMPILATION LISTING FOR

THE PROCUREMENT, REPLACEMENT AND MAINTENANCE-COST MODEL

C BUOY SYSTEM COSTS FOR PROCUREMENT, REPLACEMENT, MAINTENANCE FOR 40 COMPONENTS
C 29 JUN6 68

C
 DIMENSION CTEST(3), DATE(5), TITLE(16), COMP(4,51), FNBR(51), FLIFE(51)
 DIMENSION COSTN(51), SALV(51), NBR(50), RCOST(50), RPLC(50), NEW(50)
 DIMENSION CLIFE(50)
 T.COST=0.
 P.COST=0.
 KCYCLF=0
 KOMP=0
 READ(1,100)CTEST
 100 FORMAT(3A4)

C
 C READ AND WRITE HEADING CARDS

C
 300 READ(1,101)NBRB,FCTR
 101 FORMAT(13X,13,26X,F3.1)
 IF(FCTR)12,10,12
 10 FCTR=1.
 12 READ(1,102)DATE
 102 FORMAT(5A4)
 WRITE(3,200)DATE
 200 FORMAT(1H1,15X,5A4,/)
 DO 14 I=1,2
 READ(1,103)TITLE
 103 FORMAT(16A4)
 WRITE(3,201)TITLE
 201 FORMAT(16X,16A4)
 14 CONTINUE

C
 C WRITE PAGE HEADINGS

C
 WRITE(3,202)NBRB
 202 FORMAT(/,16X,'AVERAGE ANNUAL REPLACEMENTS FOR',13,' BUOYS',//)
 WRITE(3,203)
 203 FORMAT(18X,'ITEM',12X,'NBR LIFE',7X,'COST SALVAGE REPLACEMENTS
 ITS/YR')
 WRITE(3,204)
 204 FORMAT(33X,'DPLY (YR)',7X,'EACH VALUE NBR COST')
 IF(KCYCLF)16,16,30

C
 C READ COMPONENT CARD LIST MAX OF 40 ITEMS

C
 16 DO 24 J=1,51
 READ(1,104)(COMP(I,J),I=1,4),FNBR(J),FLIFE(J),COSTN(J),SALV(J)
 104 FORMAT(4A4,4X,F4.0,F5.0,2X,F8.0,2X,F6.0)
 IF(COMP(1,J) - CTEST(1))18,30,19
 19 IF(FNBR(J))22,20,22
 20 FNBR(J)=NBRB
 22 NBR(J)=FNBR(J)
 KOMP=KOMP&1
 24 CONTINUE

C
 C CARD LIST COMPLETE COMPUTE NBRS AND COST

C

```

30 DO 36 I=1,KOMP
  CLIFE(I)=FLIFE(I)*FCYR
  RCOST(I)=FNBR(I)*(COSTN(I)-SALV(I))/CLIFE(I)
  TCOST=TCOST+RCOST(I)
  PCOST=PCOST+(FNBR(I)*COSTN(I))
  RPLC(I)=FNBR(I)/CLIFE(I)
36 CONTINUE
  AMAINT=.5*TCOST
  ANOPER=AMAINT & TCOST

```

C

C WRITE OUTPUT PAGE LINE ITEMS AND GRAND TOTALS

C

```

DO 40 J=1,KOMP
  WRITE(3,205)(COMP(I,J),I=1,4),NBR(J),CLIFE(J),COSTN(J),SALV(J),
  RPLC(J),RCOST(J)
205 FORMAT(16X,4A4,15,F6.1,' $',F9.0,' $',F7.0,F7.1,' $',F9.0)
40 CONTINUE
  WRITE(3,206)PCOST
206 FORMAT(1,16X,'TOTAL INITIAL PROCUREMENT COST      $',F9.0,'00')
  WRITE(3,207)TCOST
207 FORMAT(1,16X,'AVERAGE ANNUAL REPLACEMENT COST      $',F9.0,'00')
  WRITE(3,208)AMAINT
208 FORMAT(1,16X,'AVERAGE ANNUAL MAINTENANCE COST      $',F9.0,'00')
  WRITE(3,209)ANOPER
209 FORMAT(1,16X,'ANNUAL REPLACEMENT & MAINTENANCE      $',F9.0,'00')

```

C

C READ OPTION CARD FOR RECY,COMP. CHG IN NAME,NBR,LIFE,COST OR END

C

```

  READ(1,105)CTYPE
105 FORMAT(A4)
  IF(CTYPE-CTEST(2))50,52,50
  52 KCYCLF=1
  TCOST=0.
  PCOST=0.
  GO TO 300
  50 IF(CTYPE-CTEST(3))900,54,900
  54 KCYCLF=1
  TCOST=0.
  PCOST=0.
  READ(1,106)NTCHG,(NEW(I),I=1,NTCHG)
106 FORMAT(12,26I3/24I3)
  DO 56 K=1,NTCHG
    J=NEW(K)
    READ(1,104)(COMP(I,J),I=1,4),FNBR(J),FLIFE(J),COSTN(J),SALV(J)
    NBR(J)=FNBR(J)
  56 CONTINUE
  GO TO 300
900 CALL EXIT
  END

```


APPENDIX J

PROGRAM SOURCE CARD DECK FOR
THE PROCUREMENT, REPLACEMENT, AND MAINTENANCE-COST MODEL

(Limited distribution of this Appendix is under separate cover)

APPENDIX K
COMPILATION LISTING FOR
THE 10-YEAR TDP FINANCIAL PLAN COMPUTER PROGRAM

E. R. SWEETON TRAVELERS RESEARCH CENTER

THIS ROUTINE COMPUTES THE SUMMARY OF ALL FINANCIAL EXPENDITURES
FOR THE TEN YEAR PLAN, NATIONAL DATA RUNY SYSTEM.
INPUT REQUIRED IS AS FOLLOWS-

1. MAXBIN (15)
NUMBER OF DIFFERENT CATEGORIES COSTS ARE ALLOCATED TO.
 - 1A. BNH(I,J) (20A4)
TITLES IDENTIFYING EACH OF THE ABOVE CATEGORIES.
 2. NMJ (15)
NUMBER OF MAJOR ACTIVITIES TO BE INCLUDED IN THIS RUN.
 3. MJCTV (20A4)
ONE OF THE ABOVE NUMBER OF MAJOR ACTIVITIES.
 4. NSR (15)
NUMBER OF SUB ACTIVITIES INCLUDED IN ABOVE MAJOR ACTIVITY.
 5. MNCTV (20A4)
ONE OF THE ABOVE NUMBER OF SUB ACTIVITIES.
 6. NSWCH (40I2)
THE VECTOR INDICATING WHICH CATEGORIES THE FOLLOWING COSTS
ARE TO BE ALLOCATED TO. 1 INDICATES ALLOCATION, BLANK OR
ZERO CAUSES CATEGORY TO BE BYPASSED.
 7. KPOS (15)
NUMBER OF COST PERIODS INCLUDED IN ABOVE SUB ACTIVITY.
 - 7A. CPH(I) (10A4)
TITLE IDENTIFYING ONE OF THE ABOVE COST PERIODS.
 8. MSTART, MSTOP, TOOL (2I5,F12.0)
THE BEGINNING AND ENDING MONTH DEFINING ONE OF THE ABOVE
COST PERIODS AND THE TOTAL DOLLARS SPENT IN THIS PERIOD.
IF PERIOD FUNDING IS TO BE LEFT OPEN FOR FUTURE CONSIDER-
ATION, DO NOT ENTER ZERO FOR TOTAL DOLLARS. NONSENSICAL
AMOUNT MUST BE USED (IE., .0001).
 9. SCOST(I) (6F12.0)
THE MONTHLY COST FOR EACH OF THE MONTHS DEFINED IN THE
ABOVE TIME PERIODS. USED ONLY IF TOOL IN (8.) IS ZERO.
- CHECK SETUP NOTES-
- (3.) THRU (9.) ARE REPEATED THE NUMBER OF TIMES STATED IN
(2.), (5.) THRU (9.) THE NUMBER STATED IN (4.) AND (8.)
AND (9.) THE NUMBER STATED IN (7.).

DIMENSION BIN(27,120),TCOST(120),QTR(27,40),NSWCH(27),MJCTV(20),
1MNCTV(20),BNH(20,27),SCOST(120),CPH(10),ISCOST(120),IQTR(4),
2BAR(15,4),TYR(10),NTYR(4)

READ(1,10)MAXBIN,IBR
10 FORMAT(16I5)
READ(1,17)((BNH(I,J),I=1,20),J=1,MAXBIN)
WRITE(3,15)(J,(BNH(I,J),I=1,20),J=1,MAXBIN)
15 FORMAT(1H)17X2RHCOST VECTOR DEFINITION TABLE//8X8HCATEGORY32X
110HDEFINITION//((112,1X20A4))
C CLEAR BINS
25 DO 30 I=1,27
DO 30 J=1,120
BIN(I,J)=0.
30 CONTINUE

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PORTHAIN

0002

```

      READ(1,10)NMJ
C      READ MAJOR ACTIVITIES
      DO 490 I=1,NMJ
      READ(1,17)MJCTV
17  FORMAT(20A4)
      READ(1,10)NSB
C      READ SUB ACTIVITIES
      DO 215 I=1,NSB
35  READ(1,17)MNCTV
C      CLEAR COST MONTHS, READ COST VECTOR
40  DO 45 I=1,120
      TCOST(I)=0.
45  CONTINUE
      READ(1,50)(NSWCH(I),I=1,MAXBIN)
50  FORMAT(40I2)
      WRITE(3,55)MJCTV,MNCTV
55  FORMAT(1H17X16HMAJOR ACTIVITY- 20A4,39X5HINPUT//9X16H SUB-ACTIVIT
      1Y- 20A,///11X2HYR10X7HPROGRAM)
C      READ COST PERIODS
      READ(1,10)KPDS
      ILNS=6
      DO 175 K=1,KPDS
      READ(1,60)CPH,MSTART,MSTOP,TDOL
60  FORMAT(10A4/2I5,F12.0)
      ILNS=ILNS+5
      IF(ILNS-60)63,63,61
61  WRITE(3,62)
62  FORMAT(1H1)
      ILNS=5
63  WRITE(3,65)CPH,MSTART,MSTOP
45  FORMAT(1H010X10A4,2X13HSTART MONTH =16/54X12HSTOP MONTH =16)
      IF(TDOL)70,90,70
70  CPM=TDOL/FLOAT(MSTOP-MSTART+1)
      DO 80 I=MSTART,MSTOP
      TCOST(I)=CPH+TCOST(I)
90  CONTINUE
      ITDOL=(FIX(TDOL)+500)/1000
      ICPM=(FIX(CPM)+500)/1000
120 WRITE(3,130)ITDOL,ICPM
130 FORMAT(57X10HFUNDING =815,1HK/47X20HAYG FUNDING/MONTH =815,1HK)
      GO TO 175
90  READ(1,95)(SCOST(I),I=MSTART,MSTOP)
95  FORMAT(6F12.0)
      DO 140 I=MSTART,MSTOP
      TDOL=TDOL+SCOST(I)
140 CONTINUE
      ITDOL=(FIX(TDOL)+500)/1000
      DO 142 I=MSTART,MSTOP
      IS COST(I)=(FIX(SCOST(I))+500)/1000
142 CONTINUE
      WRITE(3,150)ITDOL,(ISCOST(I),I=MSTART,MSTOP)
150 FORMAT(57X10HFUNDING =815,1HK/(51X16HFUNDING/MONTH =815,1HK))
      DO 173 I=MSTART,MSTOP
      TCOST(I)=SCOST(I)+TCOST(I)
173 CONTINUE

```

```

174 CONTINUE
   ILNS=ILNS+(MAXBIN/15)*4+4
   IF (ILNS-60) 1792,1792,1790
1790 WRITE(3,1791)
1791 FORMAT(1H1)
1792 WRITE(3,176)
176 FORMAT(1H010X24HCOST ALLOCATION VECTOR -//)
   ILNS=MAXBIN/15
   IP=MOD(MAXBIN,15)
   IF (ILNS) 1790,1790,177
177 DO 179 L=1,ILNS
   IU=L+15
   IL=IU-14
   WRITE(3,1791)(I,I=IL,IU),(NSWCH(I),I=IL,IU)
179 FORMAT(15X10HCATEGORIES15(3/25X1513//))
179 CONTINUE
1790 IF (IP) 180,180,1791
1791 IL=ILNS+15+1
   IU=IL+IP-1
   WRITE(3,1792)(I,I=IL,IU)
1792 FORMAT(15X10HCATEGORIES1513)
   WRITE(3,1793)(NSWCH(I),I=IL,IU)
1793 FORMAT(25X1513)
C   ALLLOCATE COST
190 DO 210 I=1,MAXBIN
   IF (NSWCH(I)) 190,210,190
190 DO 200 K=1,120
   MIN(I,K)=MIN(I,K)+TCOST(K)
200 CONTINUE
210 CONTINUE
215 CONTINUE
490 CONTINUE
C   COMPUTE QUARTERS
220 DO 250 I=1,MAXBIN
   KTR=0
   DO 240 J=1,120,3
   KTR=KTR+1
   QTR(I,KTR)=0.
   LN=J+2
   DO 230 K=J,LN
   QTR(I,KTR)=QTR(I,KTR)+MIN(I,K)
230 CONTINUE
240 CONTINUE
250 CONTINUE
C   WRITE OUTPUT
DO 300 NR=1,MAXBIN
   WRITE(3,260)(NM(LT,NB),LT=1,20)
260 FORMAT(1H120A4)
   NY=0
   DO 2610 I=1,40,4
   NY=NY+1
   LN=I+3
   TYR(NY)=0.
   DO 2600 K=1,LN
   TYR(NY)=TYR(NY)+QTR(NB,K)

```

10/00/AR

FORTHAIN

0004

```

2600 CONTINUE
2610 CONTINUE
      IF (IBR) 2615, 255, 2615
2615 QMX=TYR(1)
      DO 2630 K=2, 10
      IF (TYR(K)-QMX) 2630, 2630, 2620
2630 QMX=TYR(K)
2630 CONTINUE
      SCL=1200.
      DO 2650 I=1, 5
      SCL=10.*SCL
      IF (QMX-SCL) 2640, 2640, 2650
2640 ISCL=I
      GO TO 2660
2650 CONTINUE
      ISCL=5
2660 NSCL=20*(10**ISCL)
      GO TO 267
267 QMX=QTR(NR, 1)
      DO 262 K=2, 40
      IF (QTR(NB, K)-QMX) 262, 262, 261
261 QMX=QTR(NR, K)
262 CONTINUE
      SCL=1200.
      DO 264 I=1, 5
      SCL=10.*SCL
      IF (QMX-SCL) 263, 263, 264
263 ISCL=I
      GO TO 265
264 CONTINUE
      ISCL=5
265 NSCL=20*(10**ISCL)
267 GO TO (2710, 2720, 2730, 2740, 2750), ISCL
2710 WRITE(3, 2715)
2715 FORMAT(97X12H8 THOUSANDS)
      GO TO 2760
2720 WRITE(3, 2725)
2725 FORMAT(96X15H8 10 THOUSANDS)
      GO TO 2760
2730 WRITE(3, 2735)
2735 FORMAT(95X16H8 100 THOUSANDS)
      GO TO 2760
2740 WRITE(3, 2745)
2745 FORMAT(94X11H8 MILLIONS)
      GO TO 2760
2750 WRITE(3, 2755)
2755 FORMAT(96X14H8 10 MILLIONS)
2750 WRITE(3, 2765)
2755 FORMAT(31X5HTOTAL12X9HQARTERLY15X61HC 1 2 3 4 5
1 6 7 8 9 10 11 12/23X4MYEAR4X4H(SK)3X7HQARTER6X4H(
26K)17X61H. . . . .
3 .)
NR=1949
NY=0
DO 290 I=1, 40, 4

```

0005

K-7

0006

FORTMAIN

10/08/68

SCALARS

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
MAXBIN	0214	IRR	0218	I	021C	J	0270
TMJ	0228	NSR	022C	ISB	0230	KPDS	0234
K	023C	MSTART	0240	MSTOP	0244	TDOOL	0248
ITDOL	0250	ICPM	0254	IP	0258	L	025C
IL	0264	KTR	0268	LN	026C	MB	0270
NY	0278	QMX	027C	SCL	0280	ISCL	0284
NR	028C	ITVR	0290	M	0294	GT	0298

ARRAYS

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
IQTN	02A0	NTVR	02B0	CPH	02C0	TVR	02E8
MNCTV	0360	NSMCH	0380	BAR	041C	TCOST	050C
ISCOST	08CC	BNH	0AAC	QTR	131C	BIN	23FC

CALLED SURROUTINES

IJTAPST	IJTAAFR	IJTACOM	IJTAIXI	IJTMOOI	MOD	CMPRAR
---------	---------	---------	---------	---------	-----	--------

LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION
00010	009C	00015	019C	00025	01E4	00030	0214
00035	02R4	00040	0208	00045	02F4	00050	0350
00060	0444	00061	0474	00062	048C	00063	04A0
00070	0518	00080	0566	00120	05D6	00130	05FC
00095	0688	00140	0682	00142	0736	00150	079C
00175	0804	01750	0858	01751	0860	01752	086C
00177	08D8	00178	0970	00179	0994	01790	09A8
01792	0A18	01793	0A78	001AC	0A86	00190	0AA2
00210	0AE9	00215	0AFC	0049C	0B10	00220	0824
00240	08CA	00250	08DE	0026C	0C54	02607	0CD2
02615	0D06	02620	0D2E	0263C	0D3E	02640	0D86
02660	0E84	00255	0DCE	00261	0E10	00267	0E2E
02720	0F14	00265	0EAC	00267	0E88	02710	0EE4
02745	0FAC	02725	0F34	02730	0F56	02735	0F70
00270	1174	02750	0FCA	02755	0FE4	02760	0FFE
00271	126E	02770	1194	02780	1106	02790	11FE
00292	145C	00272	12EC	00275	13A4	00290	138C
		002A1	14C0	00300	1518		
COMPILATION COMPLETE				AMOUNT OF COMMON 000000			
				AMOUNT OF CORE 027688			
				ADDRESS BASE 1519			

// EXEC ASSEMBLY

EXTERNAL SYMBOL DICTIONARY

PAGE 1

SYMBOL	TYPE	ID	ADDR	LENGTH	LD	ID
CMPBAR	SD	01	000000	0000A4		

PAR CHART CONSTRUCTION

LCC	OBJECT CODE	ADDR1	ADDR2	SYMT	SOURCE STATEMENT
000000				2 *	BASE REGISTER R2
				3	PRINT ON GEN DATA
				4 CMPRAR	START 0
				5	SAVE (14,12)
				6	360N-CL-453 SAVE CHANGE LEVEL 3-0
000000	000000	000000	000000	7	STM 14,12,12,4*(14+2-(14+2)/15+15)(13)
000000	000000	000000	000000	8	9ALR R2,C
000000	000000	000000	000000	9	USING R2
000000	000000	000000	000000	10	L R7,0(R1) R7 HAS ADD OF QUARTER ARRAY
000000	000000	000000	000000	11	L R6,4(R1) R6 HAS ADD OF 84X ARRAY
000000	000000	000000	000000	12	L R5,8(R1) R5 HAS ADD OF SCALE FACTOR
000000	000000	000000	000000	13	L R10,0(R5) R10 HAS SCALE FACTOR
000000	000000	000000	000000	14	SRDA R10,32(10)
000000	000000	000000	000000	15	D R10,=F'2'
000000	000000	000000	000000	16	L R10,0(R5)
000000	000000	000000	000000	17	L R8,=F'4'
000000	000000	000000	000000	18	LR R9,R7
000000	000000	000000	000000	19	A R9,=F'12'
000000	000000	000000	000000	20	LR R3,R6
000000	000000	000000	000000	21	MVI 0(R3),X'40'
000000	000000	000000	000000	22	MVC 1(59,R3),0(R3)
000000	000000	000000	000000	23	L R4,0(R7) R4 HAS QUARTER
000000	000000	000000	000000	24	AR R4,R11 ROUND UP TO NEAREST HALF SCALE
000000	000000	000000	000000	25	SRDA R4,32(10)
000000	000000	000000	000000	26	DR R4,R10
000000	000000	000000	000000	27	LTR R5,R5
000000	000000	000000	000000	28	9Z NXBR
000000	000000	000000	000000	29	LR R4,R5
000000	000000	000000	000000	30	S R4,=F'60'
000000	000000	000000	000000	31	AP OFFSCL QUARTER GREATER THAN 12'
000000	000000	000000	000000	32	L R4,=F'1'
000000	000000	000000	000000	33	AR R5,R3
000000	000000	000000	000000	34	S R5,=F'1'
000000	000000	000000	000000	35	MVI 0(R3),X'5C'
000000	000000	000000	000000	36	AXLE R3,R4,RLDBAR
000000	000000	000000	000000	37	A R6,=F'60'
000000	000000	000000	000000	38	AXLE R7,R8,QLRLP
000000	000000	000000	000000	39	RETURN (14,12)
000000	000000	000000	000000	40	360N-CL-453 RETURN CHANGE LEVEL 3-0
000000	000000	000000	000000	41	LM 14,12,12,4*(14+2-(14+2)/16+16)(13)
000000	000000	000000	000000	42	9R 14
000000	000000	000000	000000	43	MVC 0(11,R3),SCLMSG
000000	000000	000000	000000	44	A NXBR

BAR CHART CONSTRUCTION

PAGE 2

FDNS 113-1 12/28/45

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE	STATEMENT
000001				46 R1	EQU	1
000002				47 R2	EQU	2
000003				48 R3	EQU	3
000004				49 R4	EQU	4
000005				50 R5	FQU	5
000006				51 R6	EQU	6
000007				52 R7	EQU	7
000008				53 R8	EQU	8
000009				54 R9	EQU	9
000010				55 R10	EQU	10
000011				56 R11	EQU	11
000012				57 SCLMSG	DC	CL11' (OFF SCALE)'
000013	400AC6C640E2C3C1					
000014	03C550					
000015				58	LTORG	
000016				59		=F'2'
000017				60		=F'4'
000018				61		=F'12'
000019				62		=F'60'
000020				63		=F'1'
000021				64		END

CROSS-REFERENCE

SYMBOL	LEN	VALUE	DEFN	REFERENCES
BLNAR	0004	00005F	00035	0034
CMRBR	0001	00007C	00004	
MXAR	0004	000066	00037	0029 0044
OFFSCL	00006	000074	00043	0031
OTRIP	00002	00002C	00020	0038
RETURN	0004	00006E	00041	
R1	0001	000001	00046	0012 0011
R10	0001	00000A	00055	0013 0014
R11	0001	000008	00056	0024 0016 0026
R2	0001	000022	00047	0009
R3	0001	000003	00048	0022 0021 0022 0033 0035 0036 0043
R4	0001	000004	00049	0020 0021 0025 0026 0029 0030 0032 0036
R5	0001	000005	00050	0023 0024 0027 0027 0029 0033 0034
R6	0001	000006	00051	0012 0013 0016 0037
R7	0001	000007	00052	0011 0020 0023 0038
R8	0001	000008	00053	0010 0018 0019
R9	0001	000009	00054	0017 0018 0019
SCLMSG	0001	00007E	00057	0018 0019 0043

NO STATEMENTS FLAGGED IN THIS ASSEMBLY

APPENDIX L
PROGRAM SOURCE CARD DECK FOR
THE 10-YEAR TDP FINANCIAL PLAN COMPUTER PROGRAM

(Limited distribution of this Appendix is under separate cover)

APPENDIX M
BUOY COMPONENT CHARACTERISTICS DATA CARDS

(Limited distribution of this Appendix is under separate cover)

APPENDIX N
COMPILATION LISTING FOR
THE BUOY COMPONENT DATA CARD-TO-TAPE PROGRAM

C PROGRAM ALPINE TO READ BUOY COMPONENT DATA CARDS ONTO TAPE
 C EACH COMPONENT ENTRY HAS FROM 1 TO 6 CARDS TO SPECIFY ITS CHARACTERISTICS
 C EACH COMPONENT ENTRY WILL GENERATE 1 OR 2 RECORDS ON TAPE
 C H.J. ERICKSON, TRC, 15 OCT 1968
 C

C FILL IAK,IRK(4) BLANK ARRAYS FROM 6 BLANK CARDS
 C

```

      DIMENSION IAK(71),IRK(75),ICD(71),IRD(75),IT1(71),IT2(75)
      READ(1,1)(IAK(I),I=1,74)
      1 FORMAT(12,I3,A4,I4,I1,A2,2(A4),3A4,2A4,A4,2A4,2(A2),A3,2(2A4),A1)
      READ(1,2)(IAK(I),I=25,47)
      2 FORMAT(2A4,A2,A3,2A4,A3,A4,2(A2,A4),2(A4),A2,2A4,3(A4),A2,2A4)
      READ(1,3)(IAK(I),I=48,71)
      3 FORMAT(2A4,2(A2),2(A4),2(A4,A2),2(2A4,A2),A2,3(A4),A3,2(A4),A3)
      READ(1,4)(IRK(I),I=1,76)
      4 FORMAT(43,3(A4),A2,A1,A4,A3,A4,2(A3),2A4,A1,2(A4),2(A3),A1,A4,A3,
      1A4,2(A1,A4))
      READ(1,5)(IRK(I),I=27,50)
      5 FORMAT(A4,A3,2(A4),A3,A4,A1,A4,2(A3),A2,A4,A1,2(A4),A3,A4,2A4,
      12(A4),A2,A4,A3)
      READ(1,6)(IRK(I),I=51,75)
      6 FORMAT(3(A3),A4,2A4,A1,A4,2(2A4),4(A3),2(A1,A4),A2,2A4,A2,A4)

```

C
 C OUTPUT TAPE ON 11

```

      REWIND 11
      KREC=0
      KCARD=0
      KCOMP=0

```

C
 C READ FIRST CARD OF SET INTO ICD(CARD) ARRAY
 C

```

      200 READ(1,1)(ICD(I),I=1,24)
      IF(ICD(5)-6)10,10,205
      10 NCRD=ICD(5)
      IF(KCARD)14,12,14
      12 KCD=ICD(1)
      KCOMP=KCOMP & 1
      14 IF(ICD(4)-9999)16,900,16
      16 GO TO(20,30,40,40,40,40),NCRD

```

C
 C ONE CARD FOR THIS COMPONENT ENTRY
 C

```

      20 DO 22 J=1,24
      22 IT1(J)=ICD(J)
      24 J=25,71
      24 IT1(J)=IAK(J)
      KCARD=KCARD & ICD(5)
      GO TO 100

```

C
 C TWO CARDS FOR THIS COMPONENT ENTRY
 C

```

      30 READ(1,2)(ICD(I),I=25,47)
      32 J=1,47
      32 IT1(J)=ICD(J)

```

10/27/48

FORTMAIN

0002

```

      DO 14 J=48,71
14  IT1(J)=IAK(J)
      KCARD=KCARD & ICD(5)
      GO TO 100
C
C THREE OR MORE CARDS FOR THIS COMPONENT ENTRY
C
      DO READ(1,2)(ICD(1),I=25,47)
      READ(1,3)(ICD(1),I=48,71)
      DO 42 J=1,71
42  IT1(J)=ICD(J)
      KCARD=KCARD & ICD(5)
      IF(ICD(5)-4)100,50,44
44  IF(ICD(5)-6)60,70,70
C
C FOUR CARDS FOR THIS COMPONENT ENTRY
C
      DO READ(1,4)(IRD(1),I=1,26)
      DO 52 J=1,26
52  IT2(J)=IRD(J)
      DO 54 J=27,75
54  IT2(J)=IRK(J)
      GO TO 100
C
C FIVE CARDS FOR THIS COMPONENT ENTRY
C
      DO READ(1,4)(IRD(1),I=1,26)
      READ(1,5)(IRD(1),I=27,50)
      DO 62 J=1,50
62  IT2(J)=IRD(J)
      DO 64 J=51,75
64  IT2(J)=IRK(J)
      GO TO 100
C
C SIX CARDS FOR THIS COMPONENT ENTRY
C
      DO READ(1,4)(IRD(1),I=1,26)
      READ(1,5)(IRD(1),I=27,50)
      READ(1,6)(IRD(1),I=51,75)
      DO 72 J=1,75
72  IT2(J)=IRD(J)
C
C WRITE ONE RECORD ON TAPE 11,ICD(5)=1,2,3
C
100  WRITE(11,7)IT1
      7  FORMAT(I2,I3,A4,I4,I1,A2,2(A4),3A4,2A4,A4,2A4,2(A2),A3,2(2A4),A1,
        12A4,A2,A3,2A4,A3,A4,2(A2,A4),2(A4),A2,2A4,3(A4),A2,2A4,2A4,2(A2),
        22(A4),2(A4,A2),2(2A4,A2),A2,3(A4),A3,2(A4),A3)
      KREC=KREC & 1
      IF(KCD-IT1(1))102,104,102
102  KCD=KCD & 1
      KCD=IT1(1)
104  IF(ICD(5)-3)106,106,108
106  GO TO 200
C

```

10/23/68

FORTHAIN

0003

C WRITE TWO RECORDS ON TAPE 11, ICD(5)=4,5,6

C

178 WRITE(11,1)IT2

179 FORMAT(A3,3(A4),A2,A1,A4,A3,A4,2(A3),2A4,A1,2(A4),2(A3),A1,A4,A3,
1A4,2(A1,A4),A4,A3,2(A4),A3,A4,A1,A4,2(A3),A2,A4,A1,2(A4),A3,A4,
22A4,2(A4),A2,A4,A3,3(A3),A4,2A4,A1,A4,2(2A4),4(A3),2(A1,A4),A2,
32A4,A2,A4)

KREC=KREC & 1

GO TO 200

C

C END OF DATA CARDS

C

970 DO 901 J=1,24

901 IT1(J)=ICD(J)

DO 902 J=75,71

902 IT1(J)=IAK(J)

WRITE(11,7)IT1

KPFC=KREC & 1

END FILE 11

REWIND 11

WRITE(3,500)KCARD,KCOMP,KREC

570 FORMAT(1H1,/, ' TOTAL CARDS PROCESSED =',15,5X, 'TOTAL COMPONENTS PRO

CESSSED =',13,5X, 'TOTAL RECORDS ON TAPE =',15,/, ' LAST RECORD ON TAPE

? CONTAINS ONLY 99990 ENTRY')

GO TO 999

C

C NBR OF CARDS TO PROCESS EXCEEDS 6

C

905 WRITE(3,571)

571 FORMAT(1H1,/, ' THE FOLLOWING CARD TYPE 1 IS IN ERROR',//)

WRITE(3,502)(ICD(I),I=1,5)

572 FORMAT(1X,13,2X,13,2X,A4,2X,14,2X,11)

REWIND 11

999 CALL EXIT

END

10/23/68

FORTMAIN

0004

SCALARS

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
IT	0130	KREC	0134	KCARD	0138	KCOMP	013C
KCN	0144	J	0148				

ARRAYS

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
IAK	014C	ICN	0268	ITI	0384	IBK	0440
IT2	04F8						

CALLED SUBROUTINES

EXIT

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
LABL	0088	LABL	0130	LABL	01A8	LABL	0220
00001	0088	00002	0130	00003	01A8	00004	0220
00006	011C	00200	0370	0001C	03C4	00012	03DA
00016	03FC	00020	042A	00022	0432	00024	045F
00032	04E0	00034	050C	0004C	0542	00042	05D0
00050	042C	00052	0678	00054	06A4	00060	06CE
00064	0788	00070	07A2	00072	0880	00100	08A4
00102	0972	00104	0986	00106	0996	00108	099C
00900	0A6C	00901	0A74	00902	0AA0	00905	0B28
00501	0BDC	00502	0C54	00498	0C78		

COMPIATION COMPLETE

AMOUNT OF COMMON 007000

AMOUNT OF CORE 005288

ADDRESS BASE TABLE

0050

APPENDIX O
SOURCE CARD DECK FOR
THE BUOY COMPONENT DATA CARD-TO-TAPE PROGRAM

(Limited distribution of this Appendix is under separate cover)

APPENDIX P
COMPILATION LISTING FOR
THE BUOY COMPONENT DATA FILE RETRIEVAL PROGRAM

```

C PROGRAM ALPINE PRINT PRINT OUT BUINY COMPONENT DATA
C EACH COMPONENT WILL HAVE 1 OR 2 PAGES WITH 42 OR 84 CHARACTERISTICS
C R.J. FRICKSON,TRC, 1R OCT 1968
C
      DIMENSION COMP(8,32),IWRD(71,71),LWRD(75,71),TITLE1(20),TITLE2(27)
C
C READ COMPONENT NAME LIST
C
      DO 10 I=1,32
      10 READ(1,1)(COMP(I,J),I=1,8)
      1 FORMAT(7X,A4)
C
C READ 2 TITLE CARDS
C
      READ(1,2)TITLE1
      READ(1,2)TITLE2
      2 FORMAT(20A4)
C
C SET TAPE 11, SET COUNTERS,READ RECORD,MAKE TESTS
C
      REWIND 11
      MAXC=7
      KEND=0
      NPAGE=0
      202 KPAGE=0
      NCP=-0
      201 J=0
      200 J=J&1
      IF (J-MAXC)12,12,300
      12 READ(11,3)(IWRD(I,J),I=1,71)
      3 FORMAT(12,13,A4,14,11,A2,2(A4),3A4,2A4,A4,2A4,2(A2),A3,2(2A4),A1,
      12A4,A2,A3,2A4,A3,14,2(A2,A4),2(A4),A2,2A4,3(A4),A2,2A4,2A4,2(A2),
      22(A4),2(A4,A2),2(2A4,A2),A2,3(A4),A3,2(A4),A3)
C
      IF(IWRD(4,J)-9999)14,400,14
      14 IF(NCP)16,16,18
      16 NCP=IWRD(1,J)
      18 IF(IWRD(1,J)-NCP)30,20,30
      20 IF(IWRD(5,J)-3)200,200,22
      22 IF(KPAGE)24,24,24
      24 KPAGE=1
C
C COMPONENT HAS TWO PGS FOR EACH ENTRY
C
      24 READ(11,4)(LWRD(I,J),I=1,75)
      4 FORMAT(A3,3(A4),A2,A1,A4,A3,A4,2(A3),2A4,A1,2(A4),2(A3),A1,A4,A3,
      1A4,2(A1,A4),A4,A3,2(A4),A3,A4,A1,A4,2(A3),A2,A4,A1,2(A4),A3,A4,
      22A4,2(A4),A2,A4,A3,3(A3),A4,2A4,A1,A4,2(2A4),4(A3),2(A1,A4),A2,
      32A4,A2,2A4)
      GO TO 200
C
      400 IF(J-1)401,401,402
      401 GO TO 300
      402 KEND=2799

```

10/22/AA

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0002

GO TO 300

C
C COMPONENT CHANGED, WRITE OUTPUT PAGE(S)

C
30 BACKSPACE 11
IF(J-1) 31, 31, 300
31 GO TO 202

C
C OUTPUT ARRAY FILLED, WRITE OUTPUT PAGE(S)

C
320 J=J-1
NPAGE=NPAGE & 1
WRITE(3,5) TITLE1, NPAGE
5 FORMAT(1H1,/,1X,20A4,26X,'PAGE '(I4)
WRITE(3,6) TITLE2
5 FORMAT(1X,20A4,/)
WRITE(3,7) (COMP(I,NCP), I=1,N)
7 FORMAT(36X,'COMPONENT = 'A4,//)

C
C WRITE 35 CHARACTERISTICS FOR TOP HALF PAGE THIS COMP.

C
WRITE(3,32) (IWRD(3,K), K=1,J)
32 FORMAT(' QUNY ID NUMBER *',7(PX,A4,' *'))
WRITE(3,33) (IWRD(4,K), K=1,J)
33 FORMAT(' YEAR/MONTH AVAILABLE *',7(PX,I4,' *'))
WRITE(3,34) (IWRD(9,K), K=1,J)
34 FORMAT(' MANUFACTURER *',7(PX,A4,' *'))
WRITE(3,35) (IWRD(1,K), I=9,11), K=1,J)
35 FORMAT(' MODEL NUMBER *',7(3A4,' *'))
WRITE(3,36) (IWRD(1,K), I=12,13), K=1,J)
36 FORMAT(' COST, DOLLARS *',7(4X,2A4,' *'))
WRITE(3,37) (IWRD(14,K), K=1,J)
37 FORMAT(' RELIABILITY *',7(8X,A4,' *'))
WRITE(3,38) (IWRD(1,K), I=15,17), K=1,J)
38 FORMAT(' TYPE *',7(2X,2A4,A2,' *'))
WRITE(3,39) (IWRD(1,K), I=18,19), K=1,J)
39 FORMAT(' RANGE, LOW *',7(7X,A2,A3,' *'))
WRITE(3,40) (IWRD(1,K), I=20,21), K=1,J)
40 FORMAT(' RANGE, HIGH *',7(4X,2A4,' *'))
WRITE(3,41) (IWRD(1,K), I=22,24), K=1,J)
41 FORMAT(' ACCURACY *',7(3X,2A4,A1,' *'))
WRITE(3,42) (IWRD(1,K), I=25,27), K=1,J)
42 FORMAT(' OUTPUT CHARACTERISTICS *',7(7X,2A4,A2,' *'))
WRITE(3,43) (IWRD(1,K), I=28,30), K=1,J)
43 FORMAT(' SIZE *',7(1X,A3,2A4,' *'))
WRITE(3,44) (IWRD(1,K), I=31,32), K=1,J)
44 FORMAT(' WEIGHT *',7(5X,A3,A4,' *'))
WRITE(3,45) (IWRD(1,K), I=33,34), K=1,J)
45 FORMAT(' DIAMETER *',7(6X,A2,A4,' *'))
WRITE(3,46) (IWRD(1,K), I=35,36), K=1,J)
46 FORMAT(' LENGTH *',7(6X,A2,A4,' *'))
WRITE(3,47) (IWRD(37,K), K=1,J)
47 FORMAT(' HEIGHT *',7(PX,A4,' *'))
WRITE(3,48) (IWRD(39,K), K=1,J)
48 FORMAT(' WIDTH *',7(PX,A4,' *'))

```

WRITE(3,49)((IWRD(I,K),I=39,41),K=1,J)
49 FORMAT('O      DEPTH LIMITS *',7(2X,A2,2A4,' *'))
WRITE(3,50)((IWRD(42,K),K=1,J)
50 FORMAT('      SURVIVABILITY *',7(2X,A4,' *'))
WRITE(3,51)((IWRD(43,K),K=1,J)
51 FORMAT('O      CONSTRUCTION *',7(2X,A4,' *'))
WRITE(3,52)((IWRD(44,K),K=1,J)
52 FORMAT('      MATERIAL *',7(2X,A4,' *'))
WRITE(3,53)((IWRD(I,K),I=45,47),K=1,J)
53 FORMAT('      CAPACITY *',7(2X,A2,2A4,' *'))
WRITE(3,54)((IWRD(I,K),I=48,50),K=1,J)
54 FORMAT('O      CNDF TYPE *',7(2X,2A4,A2,' *'))
WRITE(3,55)((IWRD(I,K),I=51,52),K=1,J)
55 FORMAT('      ACCURACY, SPEED *',7(6X,A2,A4,' *'))
WRITE(3,56)((IWRD(53,K),K=1,J)
56 FORMAT('      ACCURACY, DIRECTION *',7(2X,A4,' *'))
WRITE(3,57)((IWRD(I,K),I=54,55),K=1,J)
57 FORMAT('      TYPE, SPEED *',7(6X,A4,A2,' *'))
WRITE(3,58)((IWRD(I,K),I=56,57),K=1,J)
58 FORMAT('      TYPE, DIRECTION *',7(6X,A4,A2,' *'))
WRITE(3,59)((IWRD(I,K),I=58,60),K=1,J)
59 FORMAT('      OUTPUT, SPEED *',7(2X,2A4,A2,' *'))
WRITE(3,60)((IWRD(I,K),I=61,63),K=1,J)
60 FORMAT('      OUTPUT, DIRECTION *',7(2X,2A4,A2,' *'))
WRITE(3,61)((IWRD(I,K),I=64,65),K=1,J)
61 FORMAT('O      POWER REQUIREMENTS *',7(6X,A2,A4,' *'))
WRITE(3,62)((IWRD(66,K),K=1,J)
62 FORMAT('      BIOLOGICAL IMMUNITY *',7(8X,A4,' *'))
WRITE(3,63)((IWRD(I,K),I=67,68),K=1,J)
63 FORMAT('      BREAKING STRENGTH *',7(5X,A4,A3,' *'))
WRITE(3,64)((IWRD(69,K),K=1,J)
64 FORMAT('      BUOYANCY MATERIAL *',7(2X,A4,' *'))
WRITE(3,65)((IWRD(70,K),K=1,J)
65 FORMAT('O      CARRIER FREQUENCY *',7(8X,A4,' *'))
WRITE(3,66)((IWRD(71,K),K=1,J)
66 FORMAT('      DIRECTION REFERENCE *',7(8X,A4,' *'))
C
C END OF FIRST COMPONENT REC. TEST FOR SECOND REC. END OF TAPE
C
      IF(KPAGE)204,204,212
204 IF(KEND-9999)204,200,206
206 IF(J-7)208,210,212
208 GO TO 202
210 GO TO 201
C
C WRITE SECOND REC. 7 CHAR. ON TOP HALF & 42 ON BOTTOM HALF
C
212 WRITE(3,67)((LWRD(I,K),I=1,7),K=1,J)
67 FORMAT('      DISPLACEMENT *',7(5X,A3,A4,' *'))
WRITE(3,68)((LWRD(3,K),K=1,J)
68 FORMAT('      ELECTRICAL INTEGRITY *',7(2X,A4,' *'))
WRITE(3,69)((LWRD(I,K),I=4,5),K=1,J)
69 FORMAT('      FREQUENCY *',7(6X,A4,A2,' *'))
WRITE(3,70)((LWRD(I,K),I=6,7),K=1,J)
70 FORMAT('      LATERAL DISPLACEMENT *',7(7X,A1,A4,' *'))

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WRITE(3,71)(LWRD(8,K),K=1,J)
71 FORMAT('          MEDIUM *',7(9X,A3,' *'))
WRITE(3,72)(LWRD(9,K),K=1,J)
72 FORMAT('    RESISTANCE CORROSION *',7(8X,A4,' *'))
WRITE(3,73)(LWRD(10,K),K=1,J)
73 FORMAT('    CORROSION PROT. BELOW *',7(9X,A3,' *'))
WRITE(3,120)
120 FORMAT(/,50X,'CONTINUED NEXT PAGE')

```

C END OF TOP HALF, WRITE 42 CHAR ON BOTTOM HALF FOR THIS COMP.
C

```

WRITE(3,74)(COMP(I,NCP),I=1,8),NPAGE
74 FORMAT(1H1,/,30X,'COMPONENT (CONT) = ',8A4,26X,'PAGE '14,' (CONT)',
1//)
WRITE(3,75)(LWRD(3,K),K=1,J)
WRITE(3,75)(LWRD(11,K),K=1,J)
75 FORMAT('          STRETCH TO BREAK *',7(9X,A3,' *'))
WRITE(3,75)((LWRD(I,K),I=12,13),K=1,J)
76 FORMAT('          TIME CONSTANT *',7(4X,2A4,' *'))
WRITE(3,77)((LWRD(I,K),I=14,15),K=1,J)
77 FORMAT('          SCOPE *',7(7X,A1,A4,' *'))
WRITE(3,78)((LWRD(I,K),I=16,17),K=1,J)
78 FORMAT('          BUOYANCY *',7(5X,A4,A3,' *'))
WRITE(3,79)(LWRD(19,K),K=1,J)
79 FORMAT('    CORROSION PROT. ABOVE *',7(9X,A3,' *'))
WRITE(3,80)((LWRD(I,K),I=19,20),K=1,J)
80 FORMAT('          POWER OUTPUT *',7(7X,A1,A4,' *'))
WRITE(3,81)(LWRD(21,K),K=1,J)
81 FORMAT('          ANCHOR RELEASE *',7(9X,A3,' *'))
WRITE(3,82)(LWRD(22,K),K=1,J)
82 FORMAT('          ANCHOR TYPE *',7(8X,A4,' *'))
WRITE(3,83)((LWRD(I,K),I=23,24),K=1,J)
83 FORMAT('          ANCHOR WEIGHT, POUNDS *',7(7X,A1,A4,' *'))
WRITE(3,84)((LWRD(I,K),I=25,26),K=1,J)
84 FORMAT('          ANCHOR COST, DOLLARS *',7(7X,A1,A4,' *'))
WRITE(3,85)(LWRD(27,K),K=1,J)
85 FORMAT('          ANCHOR CHAIN *',7(8X,A4,' *'))
WRITE(3,86)(LWRD(28,K),K=1,J)
86 FORMAT('          ANTENNA *',7(9X,A3,' *'))
WRITE(3,87)(LWRD(29,K),K=1,J)
87 FORMAT('          AVERAGE TIME, SPEED *',7(8X,A4,' *'))
WRITE(3,88)(LWRD(30,K),K=1,J)
88 FORMAT('          AVG. TIME, DIRECTION *',7(8X,A4,' *'))
WRITE(3,89)(LWRD(31,K),K=1,J)
89 FORMAT('          AUXILIARY FLOATS *',7(9X,A3,' *'))
WRITE(3,90)((LWRD(I,K),I=32,33),K=1,J)
90 FORMAT('          BALLAST MATERIAL *',7(7X,A4,A1,' *'))
WRITE(3,91)((LWRD(I,K),I=34,35),K=1,J)
91 FORMAT('          BALLAST WEIGHT *',7(5X,A4,A3,' *'))
WRITE(3,92)(LWRD(36,K),K=1,J)
92 FORMAT('          MODULATION TYPE *',7(9X,A3,' *'))
WRITE(3,93)((LWRD(I,K),I=37,38),K=1,J)
93 FORMAT('          BAND WIDTH *',7(6X,A2,A4,' *'))
WRITE(3,94)((LWRD(I,K),I=39,40),K=1,J)
94 FORMAT('          CAPACITY A/H *',7(7X,A1,A4,' *'))

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      WRITE(3,95)((LWRD(I,K),I=41,42),K=1,J)
05  FORMAT('          CHARGING SYSTEM *',7(5X,A4,A3,' *'))
      WRITE(3,96)((LWRD(I,K),K=1,J)
06  FORMAT('          EFFICIENCY *',7(5X,A4,' *'))
      WRITE(3,97)((LWRD(I,K),I=44,45),K=1,J)
07  FORMAT('          DATA RATE *',7(4X,2A4,' *'))
      WRITE(3,98)((LWRD(I,K),K=1,J)
08  FORMAT('          DRAFT *',7(5X,A4,' *'))
      WRITE(3,99)((LWRD(I,K),I=47,48),K=1,J)
09  FORMAT('          FUFL *',7(5X,A4,A2,' *'))
      WRITE(3,100)((LWRD(I,K),K=1,J)
100  FORMAT('INTERROGATION SECURITY *',7(5X,A4,' *'))
      WRITE(3,101)((LWRD(I,K),K=1,J)
101  FORMAT('          MAST HEIGHT *',7(5X,A3,' *'))
      WRITE(3,102)((LWRD(I,K),K=1,J)
102  FORMAT('          MAST DIAMETER *',7(5X,A3,' *'))
      WRITE(3,103)((LWRD(I,K),K=1,J)
103  FORMAT('MONITORING DEPTH CONTROL *',7(5X,A3,' *'))
      WRITE(3,104)((LWRD(I,K),K=1,J)
104  FORMAT('          REDUNDANCY *',7(5X,A3,' *'))
      WRITE(3,105)((LWRD(I,K),K=1,J)
105  FORMAT('          STORAGE CODE *',7(5X,A4,' *'))
      WRITE(3,106)((LWRD(I,K),I=55,56),K=1,J)
106  FORMAT('          STORAGE TYPE *',7(4X,2A4,' *'))
      WRITE(3,107)((LWRD(I,K),I=57,58),K=1,J)
107  FORMAT('          REEL CAPACITY *',7(7X,A1,A4,' *'))
      WRITE(3,108)((LWRD(I,K),I=59,60),K=1,J)
108  FORMAT('          SAMPLING RATE *',7(4X,2A4,' *'))
      WRITE(3,109)((LWRD(I,K),I=61,62),K=1,J)
109  FORMAT('          SCAN RATE *',7(4X,2A4,' *'))
      WRITE(3,110)((LWRD(I,K),K=1,J)
110  FORMAT('          STATIC STABILITY ANGLE *',7(5X,A3,' *'))
      WRITE(3,111)((LWRD(I,K),K=1,J)
111  FORMAT('          SWIVELS *',7(5X,A3,' *'))
      WRITE(3,112)((LWRD(I,K),I=65,66),K=1,J)
112  FORMAT('TOTAL MONITORING COST, $ *',7(5X,A3,A3,' *'))
      WRITE(3,113)((LWRD(I,K),I=67,68),K=1,J)
113  FORMAT('          TRANSMIT INTERVAL *',7(7X,A1,A4,' *'))
      WRITE(3,114)((LWRD(I,K),I=69,70),K=1,J)
114  FORMAT('          TRANSMIT DURATION *',7(7X,A1,A4,' *'))
      WRITE(3,115)((LWRD(I,K),I=71,73),K=1,J)
115  FORMAT('          POWER *',7(2X,A2,2A4,' *'))
      WRITE(3,116)((LWRD(I,K),I=74,75),K=1,J)
116  FORMAT('          FUNCTION *',7(5X,A2,A4,' *'))
      GO TO 204
070  REWIND 11
      CALL EXIT
      END

```

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SCALARS

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
J	0434	I	0438	MAXC	043C	KFND	0440	SYMBOL	LOCATION
KPAGE	0438	NCP	044C	K	0450			SYMBOL	LOCATION

ARRAYS

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
TITLE1	0454	TITLE2	04A4	COMP	04F4	IMRD	04F4	IMRD	04F4

CALLED SUBROUTINES

IJTARF	IJTAAFR	IJTACOM	IJTEXIT	EXIT
--------	---------	---------	---------	------

LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION
00010	0084	00001	00F0	00002	0139	00202	0164	00201	0176
00020	017E	00012	019E	00003	01F8	00014	02A2	00016	023E
00018	028E	00020	0206	00022	02F2	00024	02FE	00026	0334
00004	036C	00400	0404	00401	0418	00402	041E	00030	043C
00031	0450	00300	0456	00005	049C	00306	04D8	00007	0518
00032	049C	00033	061C	00034	0684	00035	072C	00036	074C
00037	0830	00038	08CC	00039	096C	00040	0A08	00041	0A84
00042	0844	00043	08E4	00044	0C84	00045	0D20	00046	0E4C
00047	0E30	00048	0FA4	00049	0F40	00050	0F88	00051	102C
00052	10A0	00053	113C	00054	11DC	00055	127C	00056	132C
00057	138C	00058	1428	00059	14C4	00060	1564	00061	1634
00062	1678	00063	1714	00064	1788	00065	17FC	00066	1878
00064	18AA	00206	188E	00208	18D2	00210	18D8	00212	193E
00067	1954	00068	19CA	00069	1A64	00070	180C	00071	1874
00072	14E8	00073	1C5C	00120	1C9C	00074	1D14	00075	1D3C
00076	1F78	00077	1F14	00078	1F80	00079	2074	00080	20C0
00081	2134	00082	21A8	00083	2244	00084	22F0	00085	2354
00086	2308	00087	243C	00088	2480	00089	2524	00090	25C0
00091	245C	00092	260C	00093	276C	00094	2808	00095	2914
00096	2918	00097	2984	00098	2A28	00099	2AC4	00100	2A38
00101	29AC	00102	2C2C	00103	2C94	00104	2D08	00105	2D7C
00106	2F18	00107	2E84	00108	2F50	00109	2FEC	00110	306C
00111	30D4	00112	317C	00113	32CC	00114	32A8	00115	3344
00116	33F4	00000	342A						

COMPIATION COMPLETE

AMOUNT OF COMPIATION 000000

AMOUNT OF CORE 019744

ADDRESS BASE TABLE

34C

APPENDIX Q
SOURCE CARD DECK FOR
THE BUOY COMPONENT DATA FILE RETRIEVAL PROGRAM

(Limited distrioution of this Appendix is under separate cover)

DOCUMENT CONTROL DATA - R & D		
UNITED STATES COAST GUARD		UNCLASSIFIED
REPORT TITLE		
COMPUTER PROGRAMS FOR NATIONAL DATA BUOY SYSTEMS SIMULATION & COST MODELS		
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11. SUPPLEMENTARY NOTES		12. SPONSORING MILITARY ACTIVITY
		UNITED STATES COAST GUARD
13. ABSTRACT		
This document is divided into three sections to logically present a different level for three sets of readers. Section 1, General Descriptions of Buoy Computer programs and Data, provides a comprehensive summary of the computer programs and data developed. This section is primarily for a management overview and is intended to present computer program capabilities and data descriptions with a minimum of the related details. Included in Section 1 is a description of the: (1) Integrated Buoy Deployment Cost Model Program (2) Procurement, Maintenance, and Replacements-Cost Model Program (3) 10-year TDP Financial Plan Program (4) Buoy Component Characteristics Data File (5) Fleet Numerical Weather Central Depth Data. Section 2, Computer Programs Operating Instructions, is for those persons desiring another level of detail about the programs. This section presents the information necessary to prepare data card decks and operate the computer programs. It is assumed that the reader of this section is familiar with basic automatic data processing. Section 3, is the Maintenance Programmer's Manual for the programs and data described. This section is for an experienced FORTRAN programmer and is supplemented with appropriate flow diagrams, compilation listings and tape dumps.		