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NRL Report 7875

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Oceanology's Charting and Navigation Facility

ANTHONY ZUCCARO AND JOHN H. OSTRANDER

Ship Facility Group
Oceanology Area

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NAVAL RESEARCH LABORATORY
Washington, D.C.

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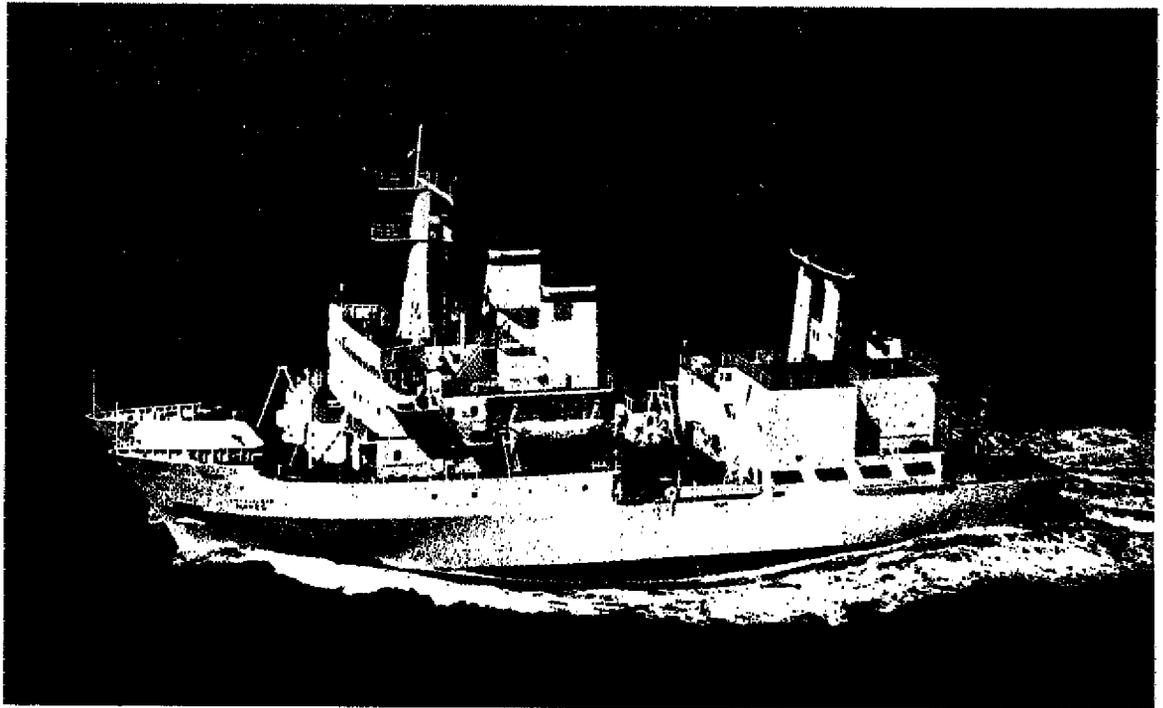
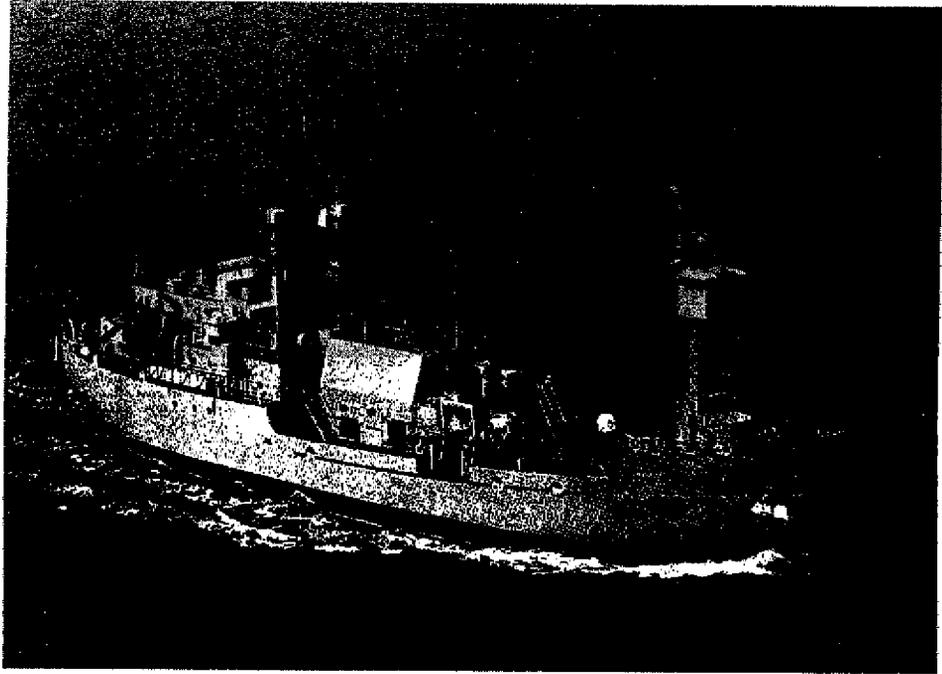
20. Abstract (cont)

these navigators is one of accurate and consistent 24-hr navigation control for the research scientist at sea. This navigation is documented by special navigation and weather data logs that are designed in a computer-compatible format.

A complete Navy chart system library is maintained by the Section. These include Omega, Loran C, Loran A, and specially constructed Mylar charts. A navigation publications library is also maintained which includes Tables of Computed Altitude and Azimuths (H.O. 214), Sight Reduction Tables for Marine Navigation (H.O. 229), Sailing Directions, Coast Pilots, Tide and Current Tables, Omega, Loran-A, Loran-C Tables, the Air Almanac, and the Nautical Almanac.

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NRL-High Sponsored Research Ships
USNS *Mizar* (T-AGOR 11) and USNS *Hayes* (T-AGOR 16)

OCEANOLOGY'S CHARTING AND NAVIGATION FACILITY

INTRODUCTION

This report deals with the capabilities and services of the Ship Facility Group. This Group (Code 8004), under the Association for Oceanology, was established on September 18, 1968 to provide personnel and technicians for operating the shipboard facilities and to perform services necessary to the divisions of the Research Department to support field experiments at sea. The services and functions as provided include but are not limited to the areas listed below.

1. The preparation and coordination requirements of scientific groups for experiments at sea, including the preparation of ships' schedules and arrangement for ship services.
2. The coordination of requests from the scientific group for modification and alterations to the ship and the reviewing of plans for the installation of scientific equipment to ensure compliance with requirements of regulatory bodies.
3. The design, procurement, installation, operation, and maintenance of the shipboard scientific equipment which is common to most field experiments.
4. The establishment, maintenance, and operation of a consolidated scientific radio communications systems and network, which includes the necessary shore and shipboard equipment.
5. The ability of providing the necessary technical competence and navigation equipment to assist scientific groups performing experiments at sea requiring precise navigation.
6. Providing experts who have the necessary technical competence and equipment to assist scientific groups requiring the use of explosives as part of their experiments at sea.
7. Providing the necessary seagoing technicians to maintain scientific systems of a nature common to most sea experiments, to repair these systems, and to assist the scientists by launching and retrieving devices to be placed over the side of the ship.

The Navigation Section of the Ship Facility Group has the capability of constructing special charts which may be used to plot positions as received from the various Navy navigation systems during sea experiments. At the request of scientists, the section also makes prognostic weather summaries to estimate weather and sea conditions likely to be encountered in proposed scientific experiments. Complete navigation control for a scientific project at sea is available through these navigators who have extensive seagoing

Note: Manuscript submitted February 14, 1975.

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navigation expertise plus wide experience in the use of electronic navigation systems. The primary function of these navigators is one of accurate and consistent 24-hr navigation control for the research scientist at sea. This navigation is documented by special navigation and weather data logs that are designed in a computer-compatible format. In a project where navigation positioning is essential, a scientist would be more than justified in having his navigational requirements evaluated by the Section navigators at an early stage in his planning.

A complete Navy chart system library is maintained by the Section and these include Omega, Loran C, Loran A, and specially constructed mylar charts. A navigation publications library is also maintained which includes *Tables of Computed Altitude and Azimuths* (H.O. 214), *Sight Reduction Tables for Marine Navigation* (H. O. 229), Sailing Directions, Coast Pilots, Tide and Current Tables, Omega, Loran A, Loran C tables and the *Air Almanac* and *Nautical Almanac*.

SECTION I — SERVICES AVAILABLE

PREEXPERIMENT NAVIGATIONAL PLANNING

Scientists of the Naval Research Laboratory (NRL) may avail themselves of many services from the Navigation Section of the Ship Facility Group, these services are discussed below.

The proposed area of investigation may be researched in the following manner

- Determine the period of time required to satisfactorily conduct the experiment, which would include transit time to and from the area of research. Anticipate the expected sea and weather conditions by having the Navigation Section prepare a prognostic weather summary comprised of state of the sea, swell, wind conditions, and also indicating the prevailing currents, if known. The evaluation of these data forms the basis for estimating the time at sea for the project.
- Navigation requirements must then be established. USNS *Mizar* (T-AGOR-11) and USNS *Hayes* (T-AGOR-16) generally have the following systems available:

Magnavox 702CA Satellite Navigation System (*Hayes* and *Mizar*)
Magnavox 706CA Satellite Navigation System (*Hayes* and *Mizar*)
Collins AN/SPN-30 Loran C Receiver (*Mizar*)
Collins AN/SPN-38 Loran C Receiver (*Mizar*)
Decca AN/SPN-45 Loran C Receiver (*Hayes*)
Tracor Model 560 Omega Receiver (*Mizar*)
Tracor Model 599 Omega Receiver (*Hayes*).

These systems are not maintained or operated by the ship, but by the Navigation Section, which normally has navigational control during a scientific operation.

One of the factors in determining the navigation system to be used would be the type of coverage available in the area where the experiment will take place; i.e., in areas where Omega and/or Loran C are available they would be used in conjunction with the Navy Navigation Satellite System.

When the navigation system and accuracy requirements have been established, it must then be determined what degree of plotting accuracy is required. The Navigation Section has a special chart construction program (SEACHART) whereby Mylar charts (0.003 in. thick) are constructed to the exact specifications of the project. These special charts are generated with Loran A, Loran C or Omega rates, with adequate spacing of rates to enable the user to plot accurately and expeditiously. These charts are reasonable in initial cost. Charts are constructed from the latest known data, which are received periodically by the Navigation Section from the DMA (Defense Mapping Agency) and Coast Guard.

It is no longer possible to obtain charts from DMA Hydrographic Center in Suitland, Md. Charts that were formerly acquired on short notice from that activity must now be ordered from the appropriate DMA Hydrographic Center in Philadelphia, Pa. or Clearfield, Utah. The Navigation Section will place orders for desired charts. Routine requests are normally filled within 3 to 5 weeks. Charts are listed in the DMA Catalog of Nautical Charts, 1st ed., April 1974.

After all preexperiment planning has been completed, the navigation requirements can then be determined. These include adequate documentation and the equipment and procedures needed to navigate with the accuracy that is considered essential for the success of the particular experiment.

NAVIGATIONAL CONTROL AT SEA

Once a scientist has determined what his navigation requirements are, he may decide that due to the nature of the operation, 24-hr navigation control, with the plotting of fixes as often as every 5, 10, or 15 min. is required. This cannot be properly accomplished by the ships' officers due to the nature of their watch. The scientist has two alternatives: one is to do the navigation himself, an unlikely choice because of the many aspects of an operation that require his attention or supervision; the other is to have a qualified person with the necessary expertise in general plus electronic navigation techniques to perform this task. Such navigators are fully qualified in all methods and phases of navigation.

The Navigation Section has developed an at-sea navigation routine and format that will give the scientist a ship's track and navigation log that is consistent for every 24-hr period that is under their navigational control. All course, speed, and evolution changes are directed through the NRL navigator to the bridge. No ship control commands are given by anyone other than the SSOB (senior scientist on board), who in turn gives this command to the NRL navigator. In this manner, ship control during an operation remains in the hands of the SSOB through his navigator.

All navigation data are recorded in the specially designed Ship Facility Group Navigation Data Log, which is in a computer format (see Figs. 1 and 2). This log has been used by many different groups at NRL and has proven to be satisfactory. The form is currently being revised.

The degree of navigational control varies depending upon the experiment. Some typical NRL requirements have been classified into the following categories:

- Survey Control, requiring constant and varying degrees of course and speed changes to maintain a survey line.
- Great Circle Track, requiring constant attention so as to maintain as accurate a track and speed deemed necessary for acoustic tow experiments.
- General Track, requiring a correction of course and/or speed as necessary to maintain the desired track.

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SHIP FACILITY GROUP
CODE 8004

Key for Filling out NRL Navigation Data Log

Col. 1 and 2 Ship's hull number, ie, T-AGOR 16, etc.

Col. 4 and 5 Ship day, number consecutively starting from the first day at sea to the last. Use right justification.

Col. 10-12 Julian day

Col. 14-17 Time (24-hour clock in Zulu)

Col. 18-22 Fix number. Number consecutively each fix. Use right justification.

Col. 23-31 Column No. 23 24 25 26 27 28 29 30 31
Latitude 7 0 5 0 7 1

For South latitudes a minus sign is placed in column 23; no sign is needed for North latitudes. Column 26 is always blank. Columns 30-31 read 1/10 and 1/100 of a minute.

Col. 32-41 Column No. 32 33 34 35 36 37 38 39 40 41
Longitude - 2 1 1 9 0

For West longitudes a minus sign is placed in column 32; no sign is needed for East longitudes. Column 36 is always blank. Columns 40-41 read 1/10 and 1/100 of a minute.

Col. 43-44 Fix type; enter the number code for the type of fix used as follows:

50 Satellite Fix
49 Satellite DR
40 Loran C Fix
39 Loran C-DR
30 Omega Fix
29 Omega DR
20 Loran A Fix
19 Loran A DR
10 Celestial Fix
09 Celestial DR
05 Radar Fix
04 Radar DR
03 Visual Fix

Col. 45-47 Course (T) made good to nearest degree.

Col. 48-51 Speed (K) made good to nearest 1/10 of a knot.

Col. 52-58 Depth in fathoms or meters (uncorrected)

Remarks Enter all navigation data, ie, course and speed changes, wind velocity, wind direction, Loran-C or Omega, etc.

Fig. 1 — Key for Filling out NRL Navigation Data Log

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SENIOR SCIENTIST _____
 NAVIGATOR _____

CRUISE NO. _____
 SHIP _____
 Date _____ Page _____ of _____

NAVAL RESEARCH LABORATORY
 NAVIGATION DATA LOG
 CODE 9004

SHIP DAY	YR.	SULIAN DAY	TIME (L)	FIX. NO.	LATITUDE	LONGITUDE	TYPE FIX	CN (U)	SPD (K)	DEPTH (M)	REMARKS
1	2	10	11	12	24	29	28	42	46	58	
2	3	11	13	14	25	30	43	47	60	60	
3	4	12	15	16	26	31	44	50	70	70	
4	5	13	17	18	27	32	45	55	80	80	
5	6	14	19	20	28	33	46	60	90	90	
6	7	15	21	22	29	34	47	65	100	100	
7	8	16	23	24	30	35	48	70	110	110	
8	9	17	25	26	31	36	49	75	120	120	
9	10	18	27	28	32	37	50	80	130	130	
10	11	19	29	30	33	38	51	85	140	140	
11	12	20	31	32	34	39	52	90	150	150	
12	13	21	33	34	35	40	53	95	160	160	
13	14	22	35	36	36	41	54	100	170	170	
14	15	23	37	38	37	42	55	105	180	180	
15	16	24	39	40	38	43	56	110	190	190	
16	17	25	41	42	39	44	57	115	200	200	
17	18	26	43	44	40	45	58	120	210	210	
18	19	27	45	46	41	46	59	125	220	220	
19	20	28	47	48	42	47	60	130	230	230	
20	21	29	49	50	43	48	61	135	240	240	
21	22	30	51	52	44	49	62	140	250	250	
22	23	31	53	54	45	50	63	145	260	260	
23	24	32	55	56	46	51	64	150	270	270	
24	25	33	57	58	47	52	65	155	280	280	
25	26	34	59	60	48	53	66	160	290	290	
26	27	35	61	62	49	54	67	165	300	300	
27	28	36	63	64	50	55	68	170	310	310	
28	29	37	65	66	51	56	69	175	320	320	
29	30	38	67	68	52	57	70	180	330	330	
30	31	39	69	70	53	58	71	185	340	340	
31	32	40	71	72	54	59	72	190	350	350	
32	33	41	73	74	55	60	73	195	360	360	
33	34	42	75	76	56	61	74	200	370	370	
34	35	43	77	78	57	62	75	205	380	380	
35	36	44	79	80	58	63	76	210	390	390	
36	37	45	81	82	59	64	77	215	400	400	
37	38	46	83	84	60	65	78	220	410	410	
38	39	47	85	86	61	66	79	225	420	420	
39	40	48	87	88	62	67	80	230	430	430	
40	41	49	89	90	63	68	81	235	440	440	
41	42	50	91	92	64	69	82	240	450	450	
42	43	51	93	94	65	70	83	245	460	460	
43	44	52	95	96	66	71	84	250	470	470	
44	45	53	97	98	67	72	85	255	480	480	
45	46	54	99	100	68	73	86	260	490	490	
46	47	55	101	102	69	74	87	265	500	500	
47	48	56	103	104	70	75	88	270	510	510	
48	49	57	105	106	71	76	89	275	520	520	
49	50	58	107	108	72	77	90	280	530	530	
50	51	59	109	110	73	78	91	285	540	540	
51	52	60	111	112	74	79	92	290	550	550	
52	53	61	113	114	75	80	93	295	560	560	
53	54	62	115	116	76	81	94	300	570	570	
54	55	63	117	118	77	82	95	305	580	580	
55	56	64	119	120	78	83	96	310	590	590	
56	57	65	121	122	79	84	97	315	600	600	
57	58	66	123	124	80	85	98	320	610	610	
58	59	67	125	126	81	86	99	325	620	620	
59	60	68	127	128	82	87	100	330	630	630	
60	61	69	129	130	83	88	101	335	640	640	
61	62	70	131	132	84	89	102	340	650	650	
62	63	71	133	134	85	90	103	345	660	660	
63	64	72	135	136	86	91	104	350	670	670	
64	65	73	137	138	87	92	105	355	680	680	
65	66	74	139	140	88	93	106	360	690	690	
66	67	75	141	142	89	94	107	365	700	700	
67	68	76	143	144	90	95	108	370	710	710	
68	69	77	145	146	91	96	109	375	720	720	
69	70	78	147	148	92	97	110	380	730	730	
70	71	79	149	150	93	98	111	385	740	740	
71	72	80	151	152	94	99	112	390	750	750	
72	73	81	153	154	95	100	113	395	760	760	
73	74	82	155	156	96	101	114	400	770	770	
74	75	83	157	158	97	102	115	405	780	780	
75	76	84	159	160	98	103	116	410	790	790	
76	77	85	161	162	99	104	117	415	800	800	
77	78	86	163	164	100	105	118	420	810	810	
78	79	87	165	166	101	106	119	425	820	820	
79	80	88	167	168	102	107	120	430	830	830	
80	81	89	169	170	103	108	121	435	840	840	
81	82	90	171	172	104	109	122	440	850	850	
82	83	91	173	174	105	110	123	445	860	860	
83	84	92	175	176	106	111	124	450	870	870	
84	85	93	177	178	107	112	125	455	880	880	
85	86	94	179	180	108	113	126	460	890	890	
86	87	95	181	182	109	114	127	465	900	900	
87	88	96	183	184	110	115	128	470	910	910	
88	89	97	185	186	111	116	129	475	920	920	
89	90	98	187	188	112	117	130	480	930	930	
90	91	99	189	190	113	118	131	485	940	940	
91	92	100	191	192	114	119	132	490	950	950	
92	93	101	193	194	115	120	133	495	960	960	
93	94	102	195	196	116	121	134	500	970	970	
94	95	103	197	198	117	122	135	505	980	980	
95	96	104	199	200	118	123	136	510	990	990	
96	97	105	201	202	119	124	137	515	1000	1000	
97	98	106	203	204	120	125	138	520	1010	1010	
98	99	107	205	206	121	126	139	525	1020	1020	
99	100	108	207	208	122	127	140	530	1030	1030	
100	101	109	209	210	123	128	141	535	1040	1040	

DATA PROCESSING CONTROL
 N00-411-42-26/2718 (1-74)

Fig. 2 - Navigation Data Log Sheet

- Drift Track, requiring sufficient fixes to determine the set and drift of a ship when in a drift mode.
- Deployment and/or Recovery Track; a track required when implanting or recovering submerged systems.

All these categories may require fixes as frequent as once a minute to once every 30 min or more. The frequency of fixes is determined by the specifications of the experiment together with local navigation, sea state, and weather conditions.

A scientist requiring precise navigation and ship control must specifically write this requirement into his operations order, stating that navigation control during operations will be under the direct supervision of the NRL navigator.

The SSOB may request through the Master that, during the at-sea phase of the operation, his officers keep and maintain the Weather Data Log (Fig. 3). This log may be kept on either Greenwich Mean Time (GMT) or local zone time, as the SSOB may direct. During these operations in the past, the navigation and scientific data have been keyed to GMT.

It should be stated that the navigation control by NRL is maintained only during project operations and in no way usurps the authority of the watch officer on the bridge when the safety or safe navigation of the ship is involved.

Close coordination between ships' officers and scientists is accomplished through a presailing conference, during which they outline the specifications of the experiment and ensure an understanding of what results are desired and the best way to attain these results. A complete understanding prior to sailing is essential to a successful operation.

CONSTRUCTION OF PLOTTING CHARTS

A computer program is utilized for the construction of navigation charts required for operations at sea. This program, named SEACHART, performs all the necessary calculations needed to plot a blank grid or a Loran A, Loran C, Omega, or any other hyperbolic set of coordinates on a Mercator projection. The program comprises 45 Fortran subroutines. SEACHART is executed on the CDC 3800 computer with a card reader, a magnetic tape drive, and a paper tape punch. The charts are plotted off-line on a Gerber Model 875 flatbed plotter using 0.003-in. Mylar. Originals of all charts are retained on file in the Ship Facility Group's charting system. Mylar or ozalid copies are used for project purposes. The originals are thus available for future reproduction and use by other scientists having interests in the same areas. The cost of these charts is absorbed by the scientist requiring the original.

The project navigator furnishes the input information which includes the size and area of the chart, the hyperbolic rates involved, transmitting station locations, coding rates, and other pertinent information.

The Sea Chart Loran C and Omega Station Coordinates manual (maintained by the Navigation Section) lists all the station coordinates and datum references for the Loran C and Omega stations in current use. This information is entered on the SEACHART Program Data Coding Form (Fig. 4 and 5) from which input cards are generated. Numerical designations for types of charts prepared by means of the SEACHART Construction Program are as follows:

- 1000 Series — Plain grid plotting sheets
- 2000 Series — Loran A charts
- 3000 Series — Loran C charts
- 4000 Series — Omega charts.

A complete and current listing of all Program SEACHART charts constructed to date is listed in Secs. II, I, J, and K.

FINAL NAVIGATION EVALUATION

When a Ship Facility Group navigator is part of the NRL scientific team on project at sea, at the request of the SSOB, he will provide at the end of the project a smooth track and a written summary on the performance of the navigation aids used. Many times a special plot is made for the implementation or recovery of deep-sea buoys. This special plot includes all pertinent data which would enable other navigators to return to the designated position to implant or recover the buoys.

At the end of the voyage all navigation data and track charts are given to the SSOB, and any unused charts are returned to the Navigation Section chart system.



SEACHART PROGRAM DATA CODING FORM

NAVAL RESEARCH LABORATORY WASHINGTON D.C.

CHART No. _____

FOR INFORMATION AND PREPARATION OF THIS FORM CONTACT SHIP FACILITY GROUP EXTENSIONS 273/2734/9900

SHEET 1 OF

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Fig. 4 - SEACHART Program Data Coding Form, Part I

SECTION II — CHARTS AND PUBLICATIONS

A. MANUALS AND CATALOGS

NOS PUB	Nautical Chart Catalog No. 1—United States, Atlantic and Gulf Coasts including Puerto Rico and the Virgin Islands
NOS PUB	Nautical Chart Catalog No. 2—United States, Pacific Coast including Hawaii, Guam, and Samoa Islands
NOS PUB	Nautical Chart Catalog No. 3—Alaska including the Aleutian Islands
NOS PUB	Lake Survey Center—Chart catalog of the Great Lakes and adjacent waterways

Catalogs

Current issues of the following HCP 1-N region catalogs provide information on the nautical charts and publications available.

HCP 1-N

Region 1	United States and Canada
Region 2	Central and South America and Antarctica
Region 3	Western Europe, Iceland, Greenland/Arctic
Region 4	Scandinavia, Baltic and USSR
Region 5	West Africa and the Mediterranean
Region 6	Indian Ocean
Region 7	Australia, Indonesia, and New Zealand
Region 8	Oceania
Region 9	East Asia

HCP 1-N-A

Special Purpose Navigational Charts and Publications (no charge, furnished on request) presents general information graphically portraying regions and areas covered by various lists of lights and sailing directions. Listings of navigational publications, small scale and other special purpose charts, and authorized sales agents are also included.

HC 1-N-B

Miscellaneous Charts and Sheets (no charge, furnished on request). This publication includes graphics of subregions and ocean basins, lists of plotting and display charts, and other miscellaneous items.

HCP 1-N-L Numerical listing of charts (no charge, furnished on request).
This numerical listing of charts is issued by DMA.

HCP 9 *American Practical Navigator*

HCP 9 Tables from *American Practical Navigator*

SP 94 Special Publication (Environmental Atlas) — *The Tongue of the Ocean (Bahamas)*

HOP 106 Atlas of Pilot Charts, Central American Waters and South Atlantic Ocean

HOP 107 Atlas of Pilot Charts, South Pacific and Indian Ocean

HOP 108 Atlas of Pilot Charts, Northern North Atlantic Ocean

HCP 150 World Port Index

HCP 151 Distances Between Ports

HCP 216 Air Navigation Manual

HCP 217 Maneuvering Board Manual

HCP 220 Navigation Dictionary

HOP 236 Currents, South China, Java, Celebes, and Sulu Seas

HOP 237 Ocean Currents (in the Vicinity of Japanese and China Coasts)

HOP 568 Atlas of Surface Currents, Southwestern Pacific Ocean

HOP 569 Atlas of Surface Currents, Northwestern Pacific Ocean

HOP 570 Atlas of Surface Currents, Northeastern Pacific Ocean

HOP 700 Oceanographic Atlas of the North Atlantic Ocean

HOP 705 Oceanographic Atlas of the Polar Seas

HOP 799B Atlas of Sea and Swell Charts, South Atlantic Ocean

HOP 799D Atlas of Sea and Swell Charts, Northeastern Pacific Ocean

HOP 799-CE Sea and Swell Charts, Northwestern Pacific Ocean and Southwestern Pacific Ocean

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HOP 1301-2-3 Bathymetric Atlas of the North Pacific Ocean
HOP 1302 Bathymetric Atlas of the Northcentral Pacific Ocean
HCP 1-PCL Portfolio Chart List, Atlantic,
HCP 1-PCL Portfolio Chart List, Pacific,
HCP 1-PCL Allowance to Portfolio Chart List, FOUO

The Portfolio Chart List presents a comprehensive listing of portfolios covering selected geographic areas of the world and provides guidelines and procedures for the correction of nautical charts and publications.

NP 131 Catalog of Admiralty Charts

B. U.S. Coast Pilots

NOS PUB Great Lakes Pilot
NOS PUB Coast Pilot No. 1, Atlantic Coast, Eastport to Cape Cod
NOS PUB Coast Pilot No. 2, Atlantic Coast, Cape Cod to Sandy Hook
NOS PUB Coast Pilot No. 3, Atlantic Coast, Sandy Hook to Cape Henry
NOS PUB Coast Pilot No. 4, Atlantic Coast, Cape Henry to Key West
NOS PUB Coast Pilot No. 5, Atlantic Coast, Gulf of Mexico, Puerto Rico, and Virgin Islands
NOS PUB Coast Pilot No. 7, Pacific Coast; California, Oregon, Washington, and Hawaii
NOS PUB Coast Pilot No. 8, Pacific Coast; Alaska—Dixon Entrance to Cape Spencer
NOS PUB Coast Pilot No. 9, Pacific and Arctic Coasts; Alaska, Cape Spencer to Beaufort Sea

C. Tidal Current Charts and Tide and Current Tables

Tidal Current Charts, Boston Harbor

Tidal Current Charts, Charleston Harbor South Carolina

Tidal Current Charts, Delaware Bay and River

Tidal Current Charts, Long Island Sound and Block Island Sound

Tidal Current Charts, Block Island Sound and Eastern Long Island Sound

Tidal Current Charts, Narragansett Bay to Nantucket Sound

Tidal Current Charts, Narragansett Bay

Tidal Current Charts, New York Harbor

Tidal Current Charts, Puget Sound Northern Part

Tidal Current Charts, Puget Sound Southern Part

Tidal Current Charts, San Francisco Bay

Tidal Current Charts, Upper Chesapeake Bay

Tidal Current Tables, Atlantic Coast of North America

Tidal Current Tables, Pacific Coast of North America and Asia

Tide Tables, Europe and West Coast of Africa

Tide Tables, East Coast of North and South America

Tide Tables, Central and Western Pacific and Indian Oceans

Tide Tables, West Coast of North and South America including the Hawaiian Islands

INST 3160.9B
OCEANAV

Observations—Instructions for Collection and Reporting of
Bathythermograph

OCEANAV 3167/1

Bathythermograph Log

the Air Almanac,

the Nautical Almanac,

D. Sailing Directions

Sailing Directions present a verbal description of navigable areas and the adjacent coasts. When used in conjunction with a chart, the description serves to verify and augment the chart information. If charts of sufficient scale or adequate quality are not available for an area, its specific, directive language and accurate description will enable a vessel to negotiate that area successfully.

HCP 12	Nova Scotia,—Bay of Fundy to Cape Breton Island
HCP 13	The Gulf and River St. Lawrence—western shores of the gulf and the river and seaway to Cornwall Island
HCP 14	Newfoundland—includes Strait of Belle Isle and St. Pierre and Miquelon Islands
HCP 15	Labrador and Hudson Bay—Labrador northward of St. Lewis Sound, Hudson Strait, and Hudson Bay
HCP 16	West Coast of Greenland—Kap Farvel to Kap Monis Jesup
HCP 17	East Greenland and Iceland—includes the Island of Jan Mayen
HCP 20	East Coasts of Central America and Mexico—includes north coast of Colombia
HCP 21	The West Indies, vol. 1—Bermuda, Bahamas, and Greater Antilles
HCP 22	The West Indies, vol. II—Lesser Antilles and Venezuela
HCP 23	South America, vol. I—East Coast from Venezuelan Border to and including Río de la Plata
HCP 24	South America, vol. II—East and West Coasts between Río de la Plata and Cabo Tres Montes, including Falkland, South Georgia, and South Sandwich Islands
HCP 25	South America, vol. III—West Coast between Gulf of Panama and Cabo Tres Montes
HCP 27	Antarctica—includes islands south of latitude 60 degrees
HCP 30	Ireland

- HCP 32 West Coasts of England and Wales—Land's End to Mull of Galloway, including Isle of Man
- HCP 33 West Coast of Scotland—Mull of Galloway to Cape Wrath, including the Hebrides
- HCP 34 North and East Coasts of Scotland - Cape Wrath to Fife Ness, including Orkney, Shetland, and Faeroe Islands
- HCP 38 Bay of Biscay—West Coast of France, North Coast of Spain
- HCP 45 Southwest Coast of Norway—Lindesnes to Fedje
- HCP 46 Northwest and North Coasts of Norway—Fedjeosen to Nyemyetski Point, USSR, including Svalbard Archipelago
- HCP 47 Northern USSR, vol. I—Mys Nemetskiy to Mys Kanin Nos
- HCP 48 Northern USSR, vol. II—Mys Kanin Nos to Ostrov Dikson
- HCP 49 Northern USSR, vol III—Ostrov Dikson to Mys Schmidt
- HCP 50 Southwest Coast of Africa—Cape Palmas to Cape of Good Hope
- HCP 51 West Coasts of Spain, Portugal, and Northwest Africa and Off-lying Islands—includes Azores, Madeira, Canary, and Cape Verde Islands and Africa southward to Cape Palmas
- HCP 60 Southeast Coast of Africa—Cape of Good Hope to Ras Hafun
- HCP 61 The Red Sea and Gulf of Aden—includes Suez Canal, Gulf of Suez, Africa north of Ras Hafun, Sugutra, and Arabian Coast Eastward to Ras al Hadd
- HCP 62 The Persian Gulf—includes Gulf of Oman and Northern Shore of Arabian Sea eastward to Ras Muari
- HCP 63 West Coast of India—includes Ceylon, Maldive, and Laccadive Islands
- HCP 64 Bay of Bengal—Point Calimere to Laem Pak Phra and the Andaman and Nicobar Islands
- HCP 65 South Indian Ocean—Madagascar and Islands westward of longitude 90 degrees

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- HCP 70 Malacca Strait and Sumatra—Central and Western Sumatra and Southwestern Malay Peninsula
- HCP 71 Soenda Strait and Western and Northeast Coasts of Borneo and Off-Lying Islands
- HCP 72 Java, Lesser Sundas, South, Southeast and East Coasts of Borneo, and Celebes—excludes Western End of Java between Tandjung Tjankuang and Ujung Krawang
- HCP 73 New Guinea—including Halmahera and Islands Southward
- HCP 74 North and West Coasts of Australia—Cape York to Cape Leeuwin
- HCP 75 East Coast of Australia—Sydney to Cape York, including Islands in the Coral Sea
- HCP 76 Southeast Coast of Australia—Cape Northumberland to Port Jackson, including Tasmania
- HCP 77 South Coast of Australia—Cape Leeuwin to Cape Northumberland
- HCP 78 New Zealand—includes Kermadec Islands and Islands Eastward and Southward of New Zealand
- HCP 80 The Pacific Islands, vol. III—The South-Central Groups
- HCP 81 The Pacific Islands, vol. II—Santa Cruz and New Hebrides Groups, New Caledonia, and adjacent Islands
- HCP 82 The Pacific Islands, vol. I—Western Groups, including the Solomon Islands
- HCP 90 Philippine Islands, vol. I—Northern Islands, including Western Negros and Northern Samar
- HCP 91 Philippine Islands, vol. II—Central Islands, including Eastern Negros, Southern Samar and Northern Mindanao
- HCP 92 Philippine Islands, vol. III—Southern Mindanao, Sulu Archipelago, and Palawan
- HCP 93 Western Shores of South China Sea—Singapore Strait to Hong Kong
- HCP 130 The Mediterranean (Planning Guide)

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HCP 131	Western Mediterranean (Enroute)
HPC 132	Eastern Mediterranean (Enroute)
HPC 150	World Port Index
HCP 152	North Pacific Ocean (Planning Guide)
HCP 153	West Coasts of Mexico and Central America (Enroute)
HCP 154	British Columbia (Enroute)
HCP 155	East Coast of the USSR (Enroute)
HCP 156	Japan (Enroute)
HCP 157	Coasts of Korea and China (Enroute)
HCP 191	English Channel
HCP 192	North Sea
HCP 193	Skagerrak and Kattegat
HCP 194	Baltic Sea, Southern Part
HCP 195	Gulf of Finland and Gulf of Bothnia
British Admiralty Publication	Black Sea Pilot - Comprising The Dardanelles, Marmara Denizi, The Bosphorus, Black Sea, and Sea of Azov, 1969

E. FLEET GUIDES

Fleet Guides are designed to acquaint personnel of incoming naval ships with pertinent command, navigational, operational, repair, and logistical information prior to arrival. These guides are intended for guidance only and excessive detail has been avoided by the use of references to local regulations and instructions. These publications are not for sale. They are for official use only (FOUO).

HCP 900	Hampton Roads
HCP 901	San Francisco Bay
HCP 902	Puget Sound and Adak

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HCP 903	New York
HCP 904	Philadelphia
HCP 905	Key West, 1970 (Canceled Oct. 1974)
HCP 906	San Diego
HCP 907	Los Angeles-Long Beach
HCP 908	Boston
HCP 909	Panama Canal Zone
HCP 910	Morehead City, North Carolina
HCP 912	Port Hueneme, California
HCP 915	Guam
HCP 916	Tokyo Wan
HCP 917	Sangley Point
HCP 918	Subic Bay
HCP 920	Charleston
HCP 921	Mayport, Florida
HCP 922	New London
HCP 923	Narragansett Bay
HCP 924	Roosevelt Roads
HCP 926	Bermuda
HCP 927	Argentia (Canceled Oct. 1974)
HCP 929	Pearl Harbor
HCP 931	Portsmouth, New Hampshire

F. SIGHT REDUCTION TABLES

The following tables consist of tabulated solutions of the navigational triangle, so arranged as to yield the computed altitude and azimuth angle by inspection. The tables are applicable equally to the observations of the sun, moon, planets, and navigational stars, whether observed in the north or south latitude. They are primarily for marine navigation. (To be canceled by HOP 229 on Dec. 31, 1975.)

HCP 214, vol. 1	Tables of Computed Altitude and Azimuth (0—9 degrees inclusive)
HCP 214, vol. 2	Tables of Computed Altitude and Azimuth (10—19 degrees inclusive)
HCP 214, vol. 3	Tables of Computed Altitude and Azimuth (20—29 degrees inclusive)
HCP 214, vol. 4	Tables of Computed Altitude and Azimuth (30—39 degrees inclusive)
HCP 214, vol. 5	Tables of Computed Altitude and Azimuth (40—49 degrees inclusive)
HCP 214, vol. 6	Tables of Computed Altitude and Azimuth (50—59 degrees inclusive), 1940
HCP 214, vol. 7	Tables of Computed Altitude and Azimuth (60—69 degrees inclusive), 1941
HCP 214, vol. 8	Tables of Computed Altitude and Azimuth (70—79 degrees inclusive), 1941
HCP 214, vol. 9	Tables of Computed Altitude and Azimuth (80—89 degrees inclusive), 1946

The following tables are designed for use with the *Nautical Almanac* and to facilitate the practice of astronomical navigation at sea by providing a table for all solutions of a spherical triangle when two sides and included angle are given.

HCP 229, vol. 1	Sight Reduction Tables for Marine Navigation (latitudes 0—15 degrees inclusive)
HCP 229, vol. 2	Sight Reduction Tables for Marine Navigation (latitudes 15—30 degrees inclusive)
HCP 229, vol. 3	Sight Reduction Tables for Marine Navigation (latitudes 30—45 degrees inclusive)

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- HCP 229, vol. 4 Sight Reduction Tables for Marine Navigation (latitudes 45–60 degrees inclusive)
- HCP 229, vol. 5 Sight Reduction Tables for Marine Navigation (latitudes 60–75 degrees inclusive)
- HCP 229, vol. 6 Sight Reduction Tables for Marine Navigation (latitudes 75–90 degrees north and south)

Sight Reduction Tables for Air Navigation

- HCP 249, vol. 1 Sight Reduction Tables for Air Navigation (Selected Stars) (Epoch 1975.0), 1972, 324 pp. This publication contains precomputed altitudes and azimuths of 41 selected navigational stars, representing solutions of the navigational triangle as required in usual navigation practices employing modern line-of-position method.
- HCP 249, vol. 2 Sight Reduction Tables for Air Navigation (latitudes 0–39 degrees, declinations 0-29 degrees)
- HCP 249, vol. 3 Sight Reduction Tables for Air Navigation (latitudes 40-89 degrees, declinations 0-29 degrees), 338

The tables listed above contain the precomputed altitude and azimuths of the sun, moon, planets, and stars within the declinations and latitude ranges indicated.

G. GENERAL CHART SYSTEM

Within the Ship Facility Group's Navigation Section a complete Navy chart system is maintained and kept up-to-date to facilitate the proper navigational planning required for projects at sea. This system is worldwide in scope and encompasses both the A and B portfolios of each geographical area. This chart system is comprised of the following portfolios, and a brief outline of their contents is described.

Atlantic Portfolio Index

- Portfolio WA General Charts of the Atlantic
- Portfolio WB General Charts of the World
- Portfolio 11 Gulf Coast of the United States, East and West Coasts of Florida, Key West to Cape Hatteras

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- Portfolio 12 East Coast of the United States, Cape Hatteras to Long Island Sound Including Chesapeake and Delaware Bays
- Portfolio 13 Northeast Coast of the United States (Block Island Sound to West Quoddy Head, Maine)
- Portfolio 14 Southeast Coast of Canada, Newfoundland, the Gulf of St. Lawrence, Cape Breton Island (St. Lawrence River, Quebec)
- Portfolio 15 Canada, East Coast of Labrador, Davis Strait, Hudson and Baffin Bays
- Portfolio 23 Argentina, Magellan Strait to Montevideo Including the Falkland Islands
- Portfolio 24 North and East Coasts of South America, Brazil and North Coasts of Colombia and Venezuela
- Portfolio 25 Eastern Part of Hispaniola, Puerto Rico, Lesser Antilles, and Windward Islands
- Portfolio 26 Islands of the West Indies, Bermuda, East and Southeast Coasts of Cuba, Approaches to Panama Canal
- Portfolio 27 North, South, and West Coasts of Cuba
- Portfolio 28 Mexico (East Coast) Central America, and the Republic of Panama
- Portfolio 29 Antarctica
- Portfolio 35 Scotland and Ireland; East and West Coasts of Scotland; North, South, and West Coasts of Ireland; Hebrides, Orkney, Shetland, and Faeroe Islands
- Portfolio 36 East Coasts of Ireland and West Coast of England; Firth of Clyde, English and Bristol Channels
- Portfolio 37 West Coast of France and East Coast of England, North Sea, Germany and Netherlands
- Portfolio 38 Greenland and Iceland
- Portfolio 42 Arctic Coast of USSR, The Islands of Svalbard, Zemlya Frantsa Iosifa, Novaya Zemlya, and The White Sea

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- Portfolio 43 South and West Coasts of Norway, Barents Sea Coast
- Portfolio 44 Denmark and Sweden, Baltic Sea-Gulf of Danzig, Southern and Western Shores of the Baltic, The Gulf of Finland and the Gulf of Bothnia
- Portfolio 51 West Coast of Portugal and South Coast of Spain; Azores, Madeira, and Canary Islands; West Coast of Africa
- Portfolio 52 Mediterranean Sea (Western Part), North Coast of Africa, South and East Coasts of Spain, Islands off East Coast of Spain
- Portfolio 53 The South Coast of France and the West Coast of Italy; Sicily, Corsica, Sardinia, and Maltese Islands
- Portfolio 54 Mediterranean Sea (Eastern Part) and the Adriatic Sea; The East and West Coasts of Greece, Cyprus, Turkey, and Crete
- Portfolio 55 The Dardanelles, Sea of Marmara, Bosphorus, and the Black Sea
- Portfolio 56 Africa (North Coast), Israel, Lebanon, and Cyprus
- Portfolio 57 Africa (West and South Coasts), Monrovia to Cape of Good Hope Including Ascension Island
- Portfolio 61 Africa (East Coast), Madagascar and the Islands of the South Indian Ocean
- Portfolio 62 The Red Sea and the Suez Canal, Gulf of Aden, Persian Gulf, Gulf of Oman, and Arabian Sea
- Portfolio 63 India; The South Coasts of Iran and West Coast of Burma; Ceylon, Maldive, and Laccadive Islands
- Pacific Portfolio Index**
- Portfolio WP General Charts of the Pacific
- Portfolio WB General Charts of the World
- Portfolio 16 Arctic Coast of Alaska, Mackenzie Bay to Bering Strait, Pribilof and Aleutian Islands, Kodiak Island to Yakutat Bay
- Portfolio 17 West Coast of Alaska and Canada, Lynn Canal to Vancouver Island

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- Portfolio 18 West Coast of the United States, Straits of Georgia and Juan de Fuca to San Diego including Puget Sound
- Portfolio 19 Hawaii; Hawaiian and Midway Islands
- Portfolio 21 West Coast of Central America, From Golfo de California to Golfo de Panama
- Portfolio 22 South and West Coasts of South America; Coasts of Peru, Ecuador, and Chile; Straits of Magellan and Galapagos Island
- Portfolio 29 Antarctica
- Portfolio 41 Arctic Coast of USSR, North Coast of Siberia from Bering Strait to Severnaya
- Portfolio 61 Africa (East Coast), Madagascar, and the Islands of the South Indian Ocean
- Portfolio 62 The Red Sea and the Suez Canal; Gulf of Aden, Persian Gulf, Gulf of Oman, and Arabian Sea
- Portfolio 63 India; The South Coast of Iran and West Coast of Burma; Ceylon, Maldive, and Laccadive Islands
- Portfolio 71 Sumatra and Borneo, Singapore and Adjacent Straits, The South and West Coasts of Borneo
- Portfolio 72 Java (Eastern Portion and Adjacent Islands) South and East Coasts of Borneo, Makassar Strait
- Portfolio 73 New Guinea, Admiralty and Hermit Islands, the North and East Coasts of Celebes, and Islands Between the Celebes and New Guinea
- Portfolio 74 Australia, Northern Portion
- Portfolio 75 Australia Southern Portion; the East, West, and South Coasts of Australia; Bass Strait, Tasmania
- Portfolio 76 New Zealand and Adjacent Islands
- Portfolio 81 Caroline Islands and Eniwetok Island; Guam, Palau, and Marianas Islands

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Portfolio 82	The Islands of the Pacific; Islands of New Caledonia, Loyalty, New Hebrides, Santa Cruz, New Hanover, New Ireland, New Britain, and Solomons
Portfolio 83	The Islands of the Pacific; Islands of Phoenix, Union, Samoa, Tonga, Fiji, Ellice, Gilbert, Austral, Society, Cook, and Marquesas
Portfolio 91	Philippine Islands (Northern Part); Islands of Mindoro, Luzon, Masbate, and Samar
Portfolio 92	Philippine Islands (Southern Part); Mindanao and Palawan Including Sulu Sea, Mindoro Strait, Moro Gulf, and the Celebes Sea
Portfolio 93	Coast of French Indo-China and China; The Tonkin Gulf, Hainan Strait, and the Gulf of Siam
Portfolio 94	Coast of China, South China Sea, Formosa Strait, and Taiwan
Portfolio 95	Korea and Japan; Coast of Korea From Yalu River to Mys Granitkyy, and West Coast of Honshu
Portfolio 96	Bering Strait; Siberia; Kamchatka (East Coast); Skhaaln Island; Okhotsk Sea; Hokkaido, Chishima Retto, and the Kuril Islands
Portfolio 97	Japan; East and South Coast of Honshu, (West Coast of Kyushu, Shikoku and Okinawa Shima
BC EAST PAC	Bottom Contour Charts of the Eastern Pacific
BC WEST PAC	Bottom Contour Charts of the Western Pacific

It should be noted that the charts listed above are for sea projects and project planning. Charts *are not corrected to date*. Corrections may be made if required.

H. WORLDWIDE ELECTRONIC NAVIGATION DATA

Data and information on the following electronic navigation systems are available from the Navigation Section.

Navy Navigation Satellite Systems

1. Geoidal Height Chart
2. *Navy Astronautics Group Newsletter*. This newsletter, which is received periodically, contains information concerning the satellite navigation receivers and the

performance of the Navy Navigation Satellite System. This newsletter is used in conjunction with project planning. It gives the latest information on the amount and quality of satellite passes that may be expected at any given latitude.

3. Specially designed Navigation Data Log (Figs. 1 and 2).
4. Specially constructed SEACHART grids (Section I).

Loran A

1. Loran A coverage chart
2. Loran A rates are generated on many general and coastal charts of the United States, and they are maintained in the general chart portfolio system.
3. Loran A rate tables, 221 Series (Section M)
4. Loran A charts, 7300 series (formerly VL 30 series) (Section M).

Loran C

1. Loran C coverage chart
2. Loran C rate tables, 221 series (Section N)
3. Loran C charts, 7400 series (formerly VLC-30 series) (Section N)
4. Specially constructed Loran C SEACHART grids (Section J)
5. Adoption of Loran C by the United States. The following excerpt is from the *Notice to Mariners* No. 1, 1975:

“(40) ADOPTION OF LORAN-C BY U.S.A.

The Commandant of the U.S. Coast Guard has advised that the Federal Government has adopted Loran-C as the civil radio navigation system for its Coastal Confluence Region. It will complement the Omega navigation system which has been selected for long-range world-wide use.

Subject to continued budgetary support, Loran-C coverage is planned to be extended by phases to all areas of the Coastal Confluence Region by Fiscal Year 1978. The present Loran-A systems will continue in operation for at least 2 years subsequent to the commissioning of each phase of Loran-C coverage. The first phase of implementation will be the

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West Coast, U.S.A., British Columbia and the Gulf of Alaska, due for completion by 1 January 1977. A new master station will be constructed for the East Coast, U.S.A. by 1 July 1978. At the same time three stations will be constructed in the Southern U.S.A., to provide coverage for the Gulf of Mexico and the Western Carribean Sea. Additionally, new stations will be constructed for the East Coast, U.S.A. chain, to provide coverage for the Great Lakes by 1 February 1980. Expansion of the Hawaiian Islands chain is under consideration.

Loran-A is consequently planned to be withdrawn in the Coastal Confluence Region as follows:

- 1 January 1979: Aleutian Islands
Gulf of Alaska
U.S. West Coast
- 1 July 1980: Gulf of Mexico
U.S. East Coast
Caribbean"

I. SEACHART PROGRAM GRIDS

Chart indexes, Figs. 6, 7, and 8, show the numbers of overlapping charts, which are listed in Secs. I, J, K.

<u>NRL Number</u>	<u>Date</u>	<u>Limits</u>	<u>Scale</u>
1001-1009	Charts Discontinued		
1010		24°19.5'N-24°24.5'N 76°21.5'W-76°16.5'W	8 in. = 1° Long.
1011		24°44'N-24°39'N 76°36'W-76°31'W	8 in. = 1° Long.
1012		24°53.5'N-24°48.5'N 76°39.5'W-76°34.5'W	8 in. = 1° Long.
1013	2-25-71	10°00'N-17°00'N 60°00'W-70°00'W	4 in. = 1° Long.
1014	2-25-71	10°00'N-17°00'N 70°00'W-80°00'W	4 in. = 1° Long.
1015	2-25-71	17°00'N-23°00'N 60°00'W-70°00'W	4 in. = 1° Long.

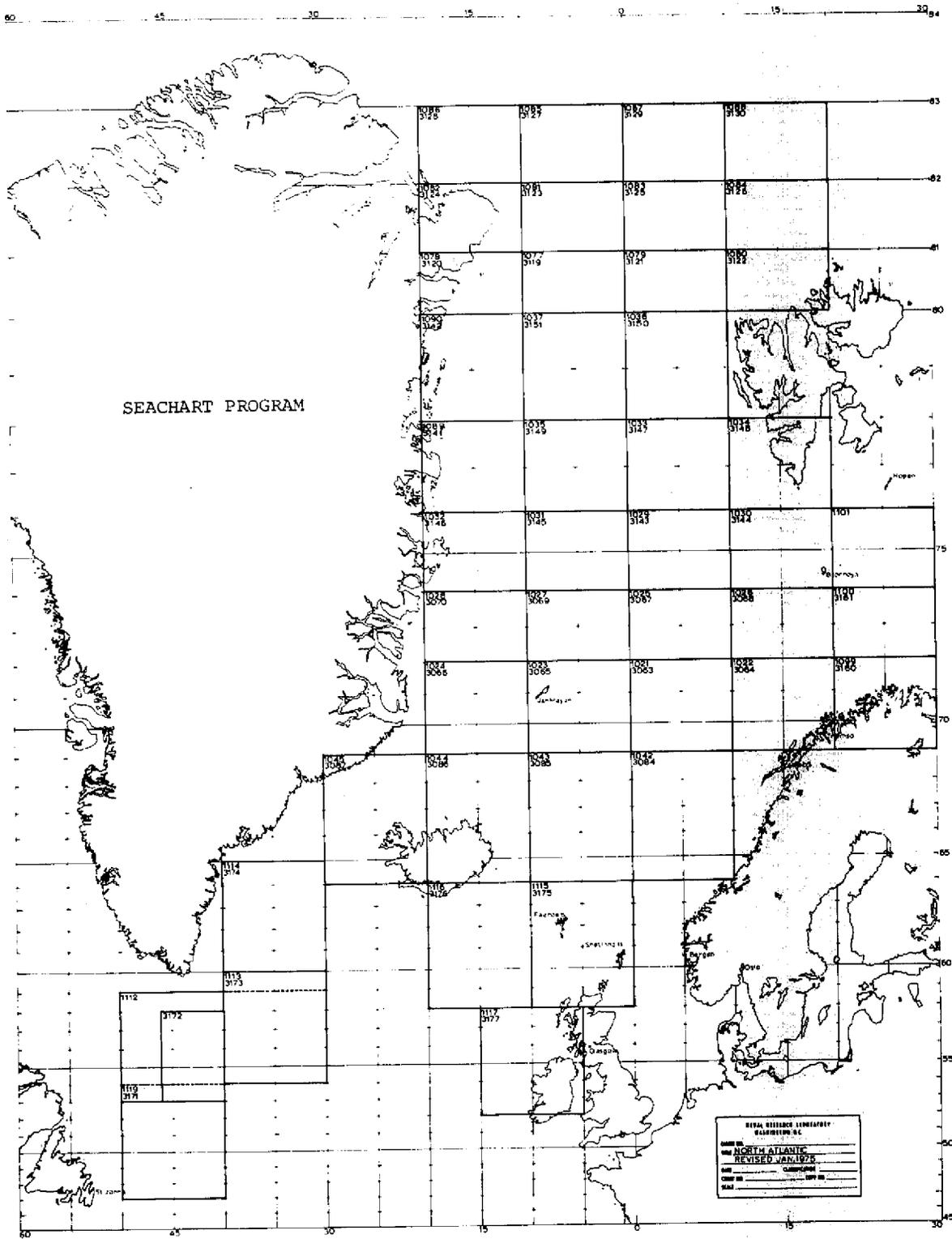


Fig. 6 - SEACHART Program Chartlet, Northern North Atlantic Ocean (4 in. = 1° Long.)

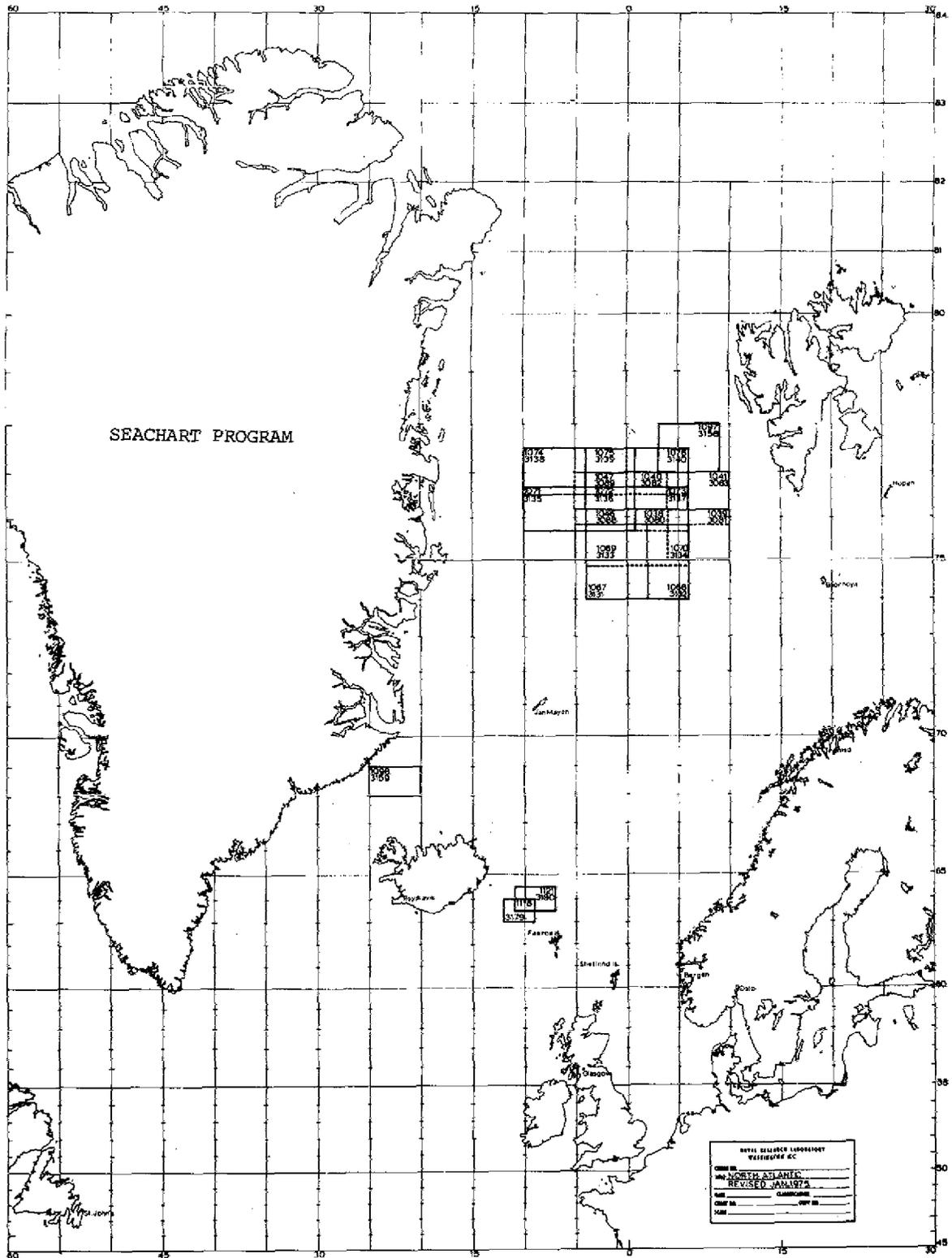


Fig. 7 - SEACHART Program Chartlet, Northern North Atlantic Ocean (8 in. = 1° Long.)

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SEACHART PROGRAM GRIDS

<u>NRL Number</u>	<u>Date</u>	<u>Limits</u>	<u>Scale</u>
1016	2-25-71	17° 00' N-23° 00' N 70° 00' W-80° 00' W	4 in. = 1° Long.
1017	2-25-71	14° 00' N-16° 30' N 70° 00' W-72° 30' W	16 in. = 1° Long.
1018	2-25-71	14° 00' N-16° 30' N 71° 30' W-74° 00' W	16 in. = 1° Long.
1019	2-25-71	15° 30' N-18° 00' N 70° 00' W-72° 30' W	16 in. = 1° Long.
1020	2-25-71	15° 30' N-18° 00' N 71° 30' W-74° 00' W	16 in. = 1° Long.
1021	7-19-71	69° 00' N-72° 00' N 0° 00' -10° 00' E	4 in. = 1° Long.
1022	7-19-71	69° 00' N-72° 00' N 10° 00' E-20° 00' E	4 in. = 1° Long.
1023	7-19-71	69° 00' N-72° 00' N 0° 00' -10° 00' W	4 in. = 1° Long.
1024	7-19-71	69° 00' N-72° 00' N 10° 00' W-20° 00' W	4 in. = 1° Long.
1025	7-19-71	72° 00' N-74° 00' N 0° 00' - 10° 00' E	4 in. = 1° Long.
1026	7-19-71	72° 00' N-74° 00' N 10° 00' E-20° 00' E	4 in. = 1° Long.
1027	7-19-71	72° 00' N-74° 00' N 0° 00' -10° 00' W	4 in. = 1° Long.
1028	7-19-71	72° 00' N-74° 00' N 10° 00' W-20° 00' W	4 in. = 1° Long.
1029	7-19-71	74° 00' N-76° 00' N 0° 00' -10° 00' E	4 in. = 1° Long.
1030	7-19-71	74° 00' N-76° 00' N 10° 00' E-20° 00' E	4 in. = 1° Long.

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SEACHART PROGRAM GRIDS

<u>NRL Number</u>	<u>Date</u>	<u>Limits</u>	<u>Scale</u>
1031	7-19-71	74° 00' N-76° 00' N 0° 00' -10° 00' W	4 in. = 1° Long.
1032	7-19-71	74° 00' N-76° 00' N 10° 00' W-20° 00' W	4 in. = 1° Long.
1033	7-19-71	76° 00' N-78° 00' N 0° 00' -10° 00' E	4 in. = 1° Long.
1034	7-19-71	76° 00' N-78° 00' N 10° 00' E-20° 00' E	4 in. = 1° Long.
1035	7-19-71	76° 00' N-78° 00' N 0° 00' -10° 00' W	4 in. = 1° Long.
1036	7-19-71	78° 00' N-80° 00' N 0° 00' -10° 00' E	4 in. = 1° Long.
1037	7-19-71	78° 00' N-80° 00' N 0° 00' -10° 00' W	4 in. = 1° Long.
1038	7-19-71	75° 00' N-76° 10' N 0° 00' -6° 00' E	4 in. = 1° Long.
1039	7-19-71	75° 00' N-76° 10' N 4° 00' E-10° 00' E	8 in. = 1° Long.
1040	7-19-71	75° 50' N-77° 00' N 0° 00' -6° 00' E	8 in. = 1° Long.
1041	7-19-71	75° 50' N-77° 00' N 0° 00' -10° 00' E	8 in. = 1° Long.
1043	7-19-71	64° 00' N-69° 00' N 0° 00' -10° 00' W	4 in. = 1° Long.
1044	7-19-71	64° 00' N-69° 00' N 10° 00' W-20° 00' W	4 in. = 1° Long.
1045	7-19-71	64° 00' N-69° 00' N 20° 00' W-30° 00' W	4 in. = 1° Long.

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SEACHART PROGRAM GRIDS

<u>NRL Number</u>	<u>Date</u>	<u>Limits</u>	<u>Scale</u>
1046	7-19-71	75°00'N-76°10'N 0°00'-5°00'W	8 in. = 1° Long.
1047	7-19-71	75°50'N-77°00'N 0°00'-5°00'W	8 in. = 1° Long.
1048	8-20-71	51°18'N-51°48'N 19°45'W-20°20'W	1 in. = 1' Long.
1049	8-20-71	41°40'N-42°15'N 19°00'W-19°35'W	1 in. = 1' Long.
1050	8-20-71	41°05'N-41°35'N 11°30'W-12°05'W	1 in. = 1' Long.
1051	8-20-71	37°20'N-37°50'N 13°50'W-14°25'W	1 in. = 1' Long.
1052	8-20-71	39°00'N-39°30'N 13°35'W-14°10'W	1 in. = 1' Long.
1053	8-20-71	36°45'N-37°20'N 10°45'W-11°15'W	1 in. = 1' Long.
1054	8-20-71	32°40'N-33°15'N 18°40'W-19°10'W	1 in. = 1' Long.
1055	8-20-71	36°00'N-36°35'N 23°45'W-24°20'W	1 in. = 1' Long.
1056	8-20-71	29°15'N-29°50'N 28°05'W-28°35'W	1 in. = 1' Long.
1057	3-9-72	27°25'N-27°35'N 70°25'W-70°35'W	2 in. = 1' Long.
1058	3-9-72	27°00'N-28°00'N 70°00'W-71°00'W	6 in. = 10' Long.
1059	3-9-72	28°00'N-29°00'N 70°00'W-71°00'W	6 in. = 10' Long.

SEACHART PROGRAM GRIDS

<u>NRL Number</u>	<u>Date</u>	<u>Limits</u>	<u>Scale</u>
1060	3-9-72	29° 00' N-30° 00' N 70° 00' W-71° 00' W	6 in. = 10' Long.
1061	3-9-72	30° 00' N-31° 00' N 70° 00' W-71° 00' W	6 in. = 10' Long.
1062	3-9-72	31° 00' N-32° 00' N 70° 00' W-71° 00' W	6 in. = 10' Long.
1063	3-9-72	32° 00' N-33° 00' N 70° 20' W-71° 20' W	6 in. = 10' Long.
1064	3-9-72	32° 00' N-33° 00' N 69° 40' W-70° 40' W	6 in. = 10' Long.
1065	3-9-72	40° 00' N-49° 00' N 125° 00' W-135° 00' W	4 in. = 1° Long.
1066	3-9-72	40° 00' N-49° 00' N 123° 30' W-135° 00' W	4 in. = 1° Lat. 2.828 in. = 1° Long.
1067	7-1-72	74° 00' N-75° 00' N 4° 00' W-2° 00' E	8 in. = 1° Long.
1068	7-1-72	74° 00' N-75° 00' N 0° 00' -6° 00' E	8 in. = 1° Long.
1069	7-1-72	74° 50' N-75° 50' N 4° 00' W-2° 00' E	8 in. = 1° Long.
1070	7-1-72	74° 50' N-75° 50' N 0° 00' -6° 00' E	8 in. = 1° Long.
1071	7-1-72	75° 40' N-76° 40' N 10° 00' W-04° 00' W	8 in. = 1° Long.
1072	7-1-72	75° 40' N-76° 40' N 5° 00' W-1° 00' E	8 in. = 1° Long.
1073	7-1-72	75° 40' N-76° 40' N 0° 00' W-6° 00' E	8 in. = 1° Long.

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SEACHART PROGRAM GRIDS

<u>NRL Number</u>	<u>Date</u>	<u>Limits</u>	<u>Scale</u>
1074	7-1-72	76° 30'N-77° 30'N 10° 00'W-4° 00'W	8 in. = 1° Long.
1075	7-1-72	76° 30'N-77° 30'N 5° 00'W-6° 00'E	8 in. = 1° Long.
1076	7-1-72	76° 30'N-77° 30'N 0° 00'-6° 00'E	8 in. = 1° Long.
1077	7-1-72	80° 00'N-81° 00'N 0° 00'-10° 00'W	4 in. = 1° Long.
1078	7-1-72	80° 00'N-81° 00'N 10° 00'W-20° 00'W	4 in. = 1° Long.
1079	7-1-72	80° 00'N-81° 00'N 0° 00'-10° 00'E	4 in. = 1° Long.
1080	7-1-72	80° 00'N-81° 00'N 10° 00'E-20° 00'E	4 in. = 1° Long.
1081	7-1-72	81° 00'N-82° 00'N 0° 00'-10° 00'W	4 in. = 1° Long.
1082	7-1-72	81° 00'N-82° 00'N 10° 00'W-20° 00'W	4 in. = 1° Long.
1083	7-1-72	81° 00'N-82° 00'N 0° 00'W-10° 00'E	4 in. = 1° Long.
1084	7-1-72	81° 00'N-82° 00'N 10° 00'E-20° 00'E	4 in. = 1° Long.
1085	7-1-72	82° 00'N-83° 00'N 0° 00'-10° 00'W	4 in. = 1° Long.
1086	7-1-72	82° 00'N-83° 00'N 10° 00'W-20° 00'W	4 in. = 1° Long.
1087	7-1-72	82° 00'N-83° 00'N 0° 00'-10° 00'E	4 in. = 1° Long.
1088	7-1-72	82° 00'N-83° 00'N 10° 00'E-20° 00'E	4 in. = 1° Long.

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SEACHART PROGRAM GRIDS

<u>NRL Number</u>	<u>Date</u>	<u>Limits</u>	<u>Scale</u>
1089	7-1-72	76° 00'N-78° 00'N 10° 00'W-20° 00'W	4 in. = 1° Long.
1090	7-1-72	78° 00'N-80° 00'N 10° 00'W-20° 00'W	4 in. = 1° Long.
1091		51° 45'N-52° 15'N 45° 35'W-44° 45'W	0.75 in = 1' Long.
1092		52° 45'N-53° 15'N 48° 15'W-47° 25'W	0.75 in. = 1' Long.
1093		53° 45'N-54° 15'N 45° 25'W-44° 45'W	0.75 in. = 1° Long.
1094		51° 20'N-54° 40'N 48° 45'W-43° 15'W	0.1212 in. = 1' Long.
1095		52° 30'N-53° 30'N 46° 50'W-45° 10'W	0.4 in. = 1' Long.
1097		77° 00'N-78° 00'N 3° 00'E-9° 00'E	8 in. = 1° Long.
1098	7-1-72	68° 00'N-69° 00'N 25° 00'W-20° 00'W	8 in. = 1° Long.
1099	7-1-72	69° 00'N-72° 00'N 20° 00'E-30° 00'E	4 in. = 1° Long.
1100	7-1-72	72° 00'N-74° 00'N 20° 00'E-30° 00'E	4 in. = 1° Long.
1101		74° 00'N-76° 00'N 20° 00'E-30° 00'E	4 in. = 1° Long.
1104	10-31-72	31° 40'N-33° 20'N 65° 00'W-66° 30'W	20 in. = 1° Long.
1105	10-31-72	31° 40'N-33° 20'N 66° 30'W-68° 00'W	20 in. = 1° Long.
1106	2-7-73	29° 50'N-30° 10'N 70° 20'W-70° 40'W	2 in. = 1' Long.

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SEACHART PROGRAM GRIDS

<u>NRL Number</u>	<u>Date</u>	<u>Limits</u>	<u>Scale</u>
1107	2-16-73	26° 00' N-27° 00' N 70° 00' W-71° 00' W	0.6 = 1' Long.
1108	2-16-73	25° 00' N-26° 00' N 70° 00' W-71° 00' W	0.6 in. = 1' Long.
1109	4-16-73	31° 00' N-38° 00' N 68° 00' W-75° 00' W	4 in. = 1° Long.
1110	4-16-73	25° 00' N-32° 00' N 70° 00' W-78° 00' W	4 in. = 1° Long.
1111	4-16-73	37° 00' N-41° 00' N 59° 00' W-65° 00' W	4 in. = 1° Long.
1112	6-19-73	53° 00' N-59° 00' N 40° 00' W-50° 00' W	4 in. = 1° Long.
1113	6-19-73	54° 00' N-60° 00' N 30° 00' W-40° 00' W	4 in. = 1° Long.
1114	6-19-73	59° 00' N-65° 00' N 30° 00' W-40° 00' W	4 in. = 1° Long.
1115	6-19-73	58° 00' N-64° 00' N 0° 00' -10° 00' W	4 in. = 1° Long.
1116	6-19-73	58° 00' N-64° 00' N 10° 00' W-20° 00' W	4 in. = 1° Long.
1117	6-19-73	52° 00' N-58° 00' N 5° 00' W-15° 00' W	4 in. = 1° Long.
1118	7-10-73	63° 00' N-64° 00' N 9° 00' W-12° 00' W	0.25 in. = 1' Long.
1119	6-19-73	47° 00' N-54° 00' N 40° 00' W-50° 00' W	4 in. = 1° Long.
1120	7-31-73	36° 20' N-37° 30' N 32° 00' W-33° 00' W	0.5 in. = 1' Long.
1121	9-4-73	63° 30' N-64° 30' N 7° 00' W-11° 00' W	0.25 in. = 1' Long.

SEACHART PROGRAM GRIDS

<u>NRL Number</u>	<u>Date</u>	<u>Limits</u>	<u>Scale</u>
1122	10-11-73	38° 00'N-39° 00'N 26° 30'W-27° 30'W	0.5 in. = 1' Long.
1123	10-11-73	36° 30'N-37° 30'N 33° 50'W-35° 20'W	0.5 in. = 1' Long.
1124	10-11-73	37° 00'N-38° 00'N 38° 50'W-40° 20'W	0.5 in. = 1' Long.
1125			
1126			
1127			
1128	11-26-73	26° 26'N-26° 33'N 84° 07'W-84° 14'W	5 in. = 1' Long.
1129		40° 45'N-43° 45'N 4° 00'E-9° 00'E	8 in. = 1° Long.
1130		37° -41°N 4° 00'E-9° 00'E	8 in. = 1° Long.
1131	7-74	56° 20'N-57° 40'N 43° 45'W-46° 15'W	16 in. = 1° Long.

J. SEACHART PROGRAM, LORAN C GRIDS

<u>NRL Number</u>	<u>Date</u>	<u>Limits</u>	<u>Scale</u>
3001-3052	Unassigned Chart Numbers		
3053	5-14-71	27° 53'N-28° 3'N 77° 53'W-78° 3'W	4 in. = 1' Long.
3054	5-14-71	36° 49.5'N-36° 59.5'N 75° 33'W-75° 43'W	4 in. = 1' Long.
3055	5-14-71	32° 43'N-32° 53'N 76° 35'W-76° 43'W	4 in. = 1' Long.

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SEACHART PROGRAM
Loran C Grids

<u>NRL Number</u>	<u>Date</u>	<u>Limits</u>	<u>Scale</u>
3056	5-14-71	34° 50' N-35° 00' N 69° 17' W-69° 27' W	4 in. = 1' Long.
3057	5-14-71	36° 15' N-36° 25' N 75° 31' W-75° 41' W	4 in. = 1' Long.
3058	5-14-71	30° 00' N-30° 10' N 80° 30' W-80° 40' W	4 in. = 1' Long.
3059		45° 00' N-47° 00' N 25° 00' W-30° 00' W	4 in. = 1° Long.
3060		45° 00' N-47° 00' N 20° 00' W-25° 00' W	4 in. = 1° Long.
3061		42° 30' -45° 00' N 25° 00' W-30° 00' W	4 in. = 1° Long.
3062		40° 00' N-42° 30' N 25° 00' W-30° 00' W	4 in. = 1° Long.
3063	7-19-71	69° 00' N-72° 00' N 0° 00' -10° 00' W	4 in. = 1° Long.
3064		69° 00' N-72° 00' N 10° 00' -20° 00' E	4 in. = 1° Long.
3065		69° 00' N-72° 00' N 0° 00' -10° 00' W	4 in. = 1° Long.
3066		69° 00' N-72° 00' N 10° 00' -20° 00' W	4 in. = 1° Long.
3067		72° 00' N-74° 00' N 0° 00' -10° 00' E	4 in. = 1° Long.
3068		72° 00' N-74° 00' N 20° 00' E-20° 00' E	4 in. = 1° Long.
3069		72° 00' N-74° 00' N 0° 00' -10° 00' W	4 in. = 1° Long.

SEACHART PROGRAM
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<u>NRL Number</u>	<u>Date</u>	<u>Limits</u>	<u>Scale</u>
3070		72° 00' N-74° 00' N 10° 00' W-20° 00' W	4 in. = 1° Long.
3071-3079	Unassigned Chart Numbers		
3080	7-19-71	75° 00' N-76° 10' N 0° 00' -6° 00' E	8 in. = 1° Long.
3081	7-19-71	75° 00' N-76° 10' N 4° 00' E-10° 00' E	8 in. = 1° Long.
3082	7-19-71	75° 50' N-77° 00' N 0° 00' -6° 00' E	8 in. = 1° Long.
3083	7-19-71	75° 50' N-77° 00' N 4° 00' E-10° 00' E	8 in. = 1° Long.
3084	7-19-71	64° 00' N-69° 00' N 0° 00' -10° 00' E	4 in. = 1° Long.
3085	7-19-71	64° 00' N-69° 00' N 0° 00' -10° 00' W	4 in. = 1° Long.
3086	7-19-71	64° 00' N-69° 00' N 10° 00' W-20° 00' W	4 in. = 1° Long.
3087	7-19-71	64° 00' N-69° 00' N 20° 00' W-3° 00' W	4 in. = 1° Long.
3088	7-19-71	75° 00' N-76° 10' N 0° 00' -5° 00' W	4 in. = 1° Long.
3089	7-19-71	75° 50' N-77° 00' N 0° 00' -5° 00' W	4 in. = 1° Long.
3090-3093	Unassigned Chart Numbers		
3094	8-20-71	51° 18' N-51° 48' N 19° 45' W-20° 20' W	1 in. = 1' Long.

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SEACHART PROGRAM
Loran C Grids

<u>NRL Number</u>	<u>Date</u>	<u>Limits</u>	<u>Scale</u>
3095-3099	Unassigned Chart Numbers		
3100	11-71	37° 00'N-41° 00'N 15° 00'W-20° 00'W	8 in. = 1° Long.
3101-3108	Unassigned Chart Numbers		
3109	3-9-72	27° 25'N-27° 35'N 70° 25'W-70° 35'W	2 in. = 1' Long.
3110	3-9-72	27° 00'N-28° 00'N 70° 00'W-71° 00'W	6 in. = 10' Long.
3111	3-9-72	28° 00'N-29° 00'N 70° 00'W-71° 00'W	6 in. = 10' Long.
3112	3-9-72	29° 00'N-30° 00'N 70° 00'W-71° 00'W	6 in. = 10' Long.
3113	3-9-72	30° 00'N-31° 00'N 70° 00'W-71° 00'W	6 in. = 10' Long.
3114	3-9-72	31° 00'N-32° 00'N 70° 00'W-71° 00'W	6 in. = 10' Long.
3115	3-9-72	32° 00'N-33° 00'N 70° 20'W-71° 20'W	6 in. = 10' Long.
3116	3-9-72	32° 00'N-33° 00'N 69° 40'W-70° 40'W	6 in. = 10' Long.
3117-3118	Unassigned Chart Numbers		
3119	7-1-72	80° 00'N-81° 00'N 0° 00'-10° 00'W	4 in. = 1° Long.
3120	7-1-72	80° 00'N-81° 00'N 10° 00'W-20° 00'W	4 in. = 1° Long.

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<u>NRL Number</u>	<u>Date</u>	<u>Limits</u>	<u>Scale</u>
3121	7-1-72	80° 00'N-81° 00'N 0° 00'-10° 00'E	4 in. = 1° Long.
3122	7-1-72	80° 00'N-81° 00'N 10° 00'E-20° 00'E	4 in. = 1° Long.
3123	7-1-72	81° 00'N-82° 00'N 0° 00'-10° 00'W	4 in. = 1° Long.
3124	7-1-72	81° 00'N-82° 00'N 10° 00'W-20° 00'W	4 in. = 1° Long.
3125	7-1-72	81° 00'N-82° 00'N 0° 00'-10° 00'E	4 in. = 1° Long.
3126	7-1-72	81° 00'N-82° 00'N 10° 00'E-20° 00'E	4 in. = 1° Long.
3127	7-1-72	82° 00'N-83° 00'N 0° 00'-10° 00'W	4 in. = 1° Long.
3128	7-1-72	82° 00'N-83° 00'N 10° 00'W-20° 00'W	4 in. = 1° Long.
3129	7-1-72	82° 00'N-83° 00'N 0° 00'-10° 00'E	4 in. = 1° Long.
3130	7-1-72	82° 00'N-83° 00'N 10° 00'E-20° 00'E	4 in. = 1° Long.
3131	7-1-72	74° 00'N-75° 00'N 2° 00'E-4° 00'W	8 in. = 1° Long.
3132	7-1-72	74° 00'N-75° 00'N 0° 00'-6° 00'E	8 in. = 1° Long.
3133	7-1-72	74° 50'N-75° 50'N 2° 00'E-4° 00'W	8 in. = 1° Long.
3134	7-1-72	74° 50'N-75° 50'N 0° 00'-6° 00'E	8 in. = 1° Long.

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SEACHART PROGRAM
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<u>NRL Number</u>	<u>Date</u>	<u>Limits</u>	<u>Scale</u>
3135	7-1-72	75° 40' N-76° 40' N 4° 00' W-10° 00' W	8 in. = 1° Long.
3136	7-1-72	75° 40' N-76° 40' N 1° 00' E-5° 00' W	8 in. = 1° Long.
3137	7-1-72	75° 40' N-76° 40' N 0° 00' -6° 00' E	8 in. = 1° Long.
3138	7-1-72	76° 30' N-77° 30' N 4° 00' W-10° 00' W	8 in. = 1° Long.
3139	7-1-72	76° 30' N-77° 30' N 1° 00' E-5° 00' W	8 in. = 1° Long.
3140	7-1-72	76° 30' N-77° 30' N 0° 00' -6° 00' E	8 in. = 1° Long.
3141	7-1-72	76° 00' N-78° 00' N 10° 00' W-20° 00' W	4 in. = 1° Long.
3142	7-1-72	78° 00' N-80° 00' N 10° 00' W-20° 00' W	4 in. = 1° Long.
3143	7-1-72	74° 00' N-76° 00' N 0° 00' -10° 00' E	4 in. = 1° Long.
3144	7-1-72	74° 00' N-76° 00' N 10° 00' E-20° 00' E	4 in. = 1° Long.
3145	7-1-72	74° 00' N-76° 00' N 0° 00' -10° 00' W	4 in. = 1° Long.
3146	7-1-72	74° 00' N-76° 00' N 10° 00' W-20° 00' W	4 in. = 1° Long.
3147	7-1-72	76° 00' N-78° 00' N 0° 00' -10° 00' E	4 in. = 1° Long.
3148	7-1-72	76° 00' N-78° 00' N 10° 00' E-20° 00' E	4 in. = 1° Long.
3149	7-1-72	76° 00' N-78° 00' N 0° 00' -10° 00' W	4 in. = 1° Long.

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<u>NRL Number</u>	<u>Date</u>	<u>Limits</u>	<u>Scale</u>
3150	7-1-72	78° 00'N-80° 00'N 0° 00'-10° 00'E	4 in. = 1° Long.
3151	7-1-72	78° 00'N-80° 00'N 0° 00'-10° 00'W	4 in. = 1° Long.
3152	7-1-72	29° 22'N-29° 24'N 75° 56'W-76° 00'W	16 in. = 1' Long.
3153	7-1-72	51° 45'N-52° 15'N 44° 45'W-45° 35'W	0.75 in. = 1' Long.
3154	7-1-72	52° 45'N-53° 15'N 47° 25'W-48° 15'W	0.75 in. = 1' Long.
3155	7-1-72	53° 45'N-54° 15'N 44° 45'W-45° 25'W	0.75 in. = 1' Long.
3156	7-1-72	51° 20'N-54° 40'N 43° 15'W-48° 45'W	0.1212 in. = 1' Long.
3157	7-1-72	52° 30'N-53° 30'N 45° 10'W-46° 50'W	0.4 in. = 1' Long.
3158	7-1-72	77° 00'-78° 00'N 3° 00'E-9° 00'E	8 in. = 1° Long.
3159	7-1-72	68° 00'N-69° 00'N 20° 00'W-25° 00'W	8 in. = 1° Long.
3160	7-1-72	69° 00'N-72° 00'N 20° 00'E-30° 00'E	4 in. = 1° Long.
3161	7-1-72	72° 00'N-74° 00'N 20° 00'E-30° 00'E	4 in. = 1° Long.
3162	Unassigned Chart Number		
3163	10-31-72	31° 40'N-33° 20'N 65° 00'W-66° 30'W	20 in. = 1° Long.

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Loran C Grids

<u>NRL Number</u>	<u>Date</u>	<u>Limits</u>	<u>Scale</u>
3164	10-31-72	31° 40'N-33° 20'N 66° 30'W-68° 00'W	20 in. = 1° Long.
3165	2-7-73	29° 50'N-30° 10'N 70° 20'W-70° 40'W	20 in. = 1° Long.
3166	2-16-73	26° 00'N-27° 00'N 70° 00'W-71° 00'W	0.6 in. = 1' Long.
3167	2-16-73	25° 00'N-26° 00'N 70° 00'W-71° 00'W	0.6 in. = 1' Long.
3168	4-16-73	31° 00'N-38° 00'N 68° 00'W-75° 00'W	4 in. = 1° Long.
3169	4-16-73	25° 00'N-32° 00'N 70° 00'W-78° 00'W	4 in. = 1° Long.
3170	5-9-73	37° 00'N-41° 00'N 59° 00'W-65° 00'W	4 in. = 1° Long.
3171	6-19-73	47° 00'N-54° 00'N 40° 00'W-50° 00'W	4 in. = 1° Long.
3172	6-19-73	53° 00'N-58° 00'N 40° 00'W-46° 00'W	4 in. = 1° Long.
3173	6-19-73	54° 00'N-60° 00'N 30° 00'W-40° 00'W	4 in. = 1° Long.
3174	6-19-73	59° 00'N-65° 00'N 30° 00'W-40° 00'W	4 in. = 1° Long.
3175	6-19-73	58° 00'N-64° 00'N 0° 00'-10° 00'W	4 in. = 1° Long.
3176	6-19-73	58° 00'N-64° 00'N 10° 00'W-20° 00'W	4 in. = 1° Long.
3177	6-19-73	52° 00'N-58° 00'N 5° 00'W-15° 00'W	4 in. = 1° Long.
3178	6-26-73	30° 30'N-31° 30'N 78° 40'W-79° 40'W	4 in. = 1° Long.

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SEACHART PROGRAM
Loran C Grids

<u>NRL Number</u>	<u>Date</u>	<u>Limits</u>	<u>Scale</u>
3179	7-10-73	63°00'N-64°00'N 9°00'W-12°00'W	0.25 in. = 1' Long.
3180	9-4-73	63°30'N-64°30'N 7°00'W-11°00'W	0.25 in. = 1' Long.
3181	11-26-73	26°26'N-26°33'N 84°07'W-84°14'W	5 in. = 1' Long.
3182	12-4-73	29°10'N-29°15'N 80°16'W-80°21'W	5 in. = 1' Long.
3183	3-27-74	16°00'N-24°00'N 56°00'W-66°00'W	4 in. = 1° Long.
3184	3-27-74	24°00'N-32°00'N 52°00'W-62°00'W	4 in. = 1° Long.
3185	3-27-74	32°00'N-40°00'N 52°00'W-62°00'W	4 in. = 1° Long.
3186	3-27-74	40°00'N-48°00'N 46°00'W-56°00'W	4 in. = 1° Long.
3187		40°45'N-43°45'N 5°00'E-8°00'E	8 in. = 1° Long.
3188		37°00'N-41°00'N 5°00'E-8°00'E	8 in. = 1° Long.
3189	7-16-74	53°00'N-59°00'N 40°00'W-50°00'W	4 in. = 1° Long.
3190	7-16-74	56°20'N-57°40'N 43°45'W-46°15'W	16 in. = 1° Long.

K. SEACHART PROGRAM GRIDS AND LORAN-C GRIDS

These charts listed below are of overlapping areas, as shown in Figs. 6-8.

<u>Loran-C</u>	<u>Grid</u>	<u>Loran-C</u>	<u>Grid</u>
3063	1021	3135	1071
3064	1022	3136	1072
3065	1023	3137	1073
3066	1024	3138	1074
3067	1025	3139	1075
3068	1026	3140	1076
3069	1027	3141	1089
3070	1028	3142	1090
3080	1038	3143	1029
3081	1039	3144	1030
3082	1040	3145	1031
3083	1041	3146	1032
3084	1042	3147	1033
3085	1043	3148	1034
3086	1044	3149	1035
3087	1045	3150	1036
3088	1046	3151	1037
3089	1047	3153	1091
3109	1057	3154	1092
3110	1058	3155	1093
3111	1059	3156	1094
3112	1060	3157	1095
3113	1061	3158	1097
3114	1062	3159	1098
3115	1063	3160	1099
3116	1064	3161	1100
3119	1077	3163	1104
3120	1078	3164	1105
3121	1079	3165	1106
3102	1080	3166	1107
3123	1081	3167	1108
3124	1082	3168	1109
3125	1083	3169	1110
3126	1084	3170	1111
3127	1085	3171	1119
3128	1086	3173	1113
3129	1087	3174	1114
3130	1088	3175	1115
3131	1067	3176	1116
3132	1068	3177	1117
3133	1069	3179	1118
3134	1070	3180	1121

<u>Loran-C</u>	<u>Grid</u>	<u>Loran-C</u>	<u>Grid</u>
3181	1128	3190	1131
3187	1129		
3188	1130		

L. BOTTOM CONTOUR CHARTS

A complete set of bottom contour charts for the North Atlantic and Indian Oceans, Mediterranean Sea, and North Pacific regions are available for information and project planning purposes. Figures 9 and 10 comprise the chart index. These charts have had limited use in the past and are kept in the Ship Facility Group system primarily for historical purposes. However, if sufficient use of these charts warrants it, they may be received by automatic distribution from DMA as newer and more up-to-date editions are produced. Below are listed the bottom contour charts currently available in the Ship Facility Group charting system.

Bottom Contour Charts for North Atlantic and Indian Oceans, Mediterranean Sea

<u>New N.O. Chart No.</u>	<u>Old H.O. Chart No.</u>	<u>Scale</u>
B0107	BC 107	4 in. = 1° Long.
B0108	BC 108	4 in. = 1° Long.
B0109	BC 109	4 in. = 1° Long.
B0111	BC 111	4 in. = 1° Long.
B0117	BC 117	2 in. = 1° Long.
B0205	BC 205	4 in. = 1° Long.
B0206	BC 206	4 in. = 1° Long.
B0207	BC 207	4 in. = 1° Long.
B0208	BC 208	4 in. = 1° Long.
*B0209	BC 209	4 in. = 1° Long.
B0210	BC 210	4 in. = 1° Long.
†B0211	BC 211	4 in. = 1° Long.
B0216	BC 216	2 in. = 1° Long.
B0217	BC 217	2 in. = 1° Long.
*B0304	BC 304	4 in. = 1° Long.
B0305	BC 305	4 in. = 1° Long.
B306	BC 306	4 in. = 1° Long.
*B0307	BC 307	4 in. = 1° Long.
†B0308	BC 308	4 in. = 1° Long.
†B0309	BC 309	4 in. = 1° Long.
B3010	BC 310	4 in. = 1° Long.
*B0313	BC 313	4 in. = 1° Long.
*B0315	BC 315	2 in. = 1° Long.
B0401	BC 401	4 in. = 1° Long.
B0402	BC 402	4 in. = 1° Long.
B0403	BC 403	4 in. = 1° Long.
B0404	BC 404	4 in. = 1° Long.
B0405	BC 405	4 in. = 1° Long.
B0406	BC 406	4 in. = 1° Long.
*B0407	BC 407	4 in. = 1° Long.
*B0408	BC 408	4 in. = 1° Long.

<u>New N.O. Chart No.</u>	<u>Old H.O. Chart No.</u>	<u>Scale</u>
†B0409	BC 409	4 in. = 1° Long.
B0410	BC 410	4 in. = 1° Long.
B0411	BC 411	4 in. = 1° Long.
B0412	BC 412	4 in. = 1° Long.
B0413	BC 413	4 in. = 1° Long.
B0414	BC 414	4 in. = 1° Long.
B0415	BC 415	2 in. = 1° Long.
B0501	BC 501	4 in. = 1° Long.
B0502	BC 502	4 in. = 1° Long.
B0504	BC 504	4 in. = 1° Long.
B0505	BC 505	4 in. = 1° Long.
†B0506	BC 506	4 in. = 1° Long.
*B0508	BC 508	4 in. = 1° Long.
*B0509	BC 509	4 in. = 1° Long.
*B0509	BC 509	4 in. = 1° Long.
B0510	BC 510	4 in. = 1° Long.
B0511	BC 511	4 in. = 1° Long.
B0512	BC 512	4 in. = 1° Long.
B0513	BC 513	4 in. = 1° Long.
B0514	BC 514	4 in. = 1° Long.
B0515	BC 515	2 in. = 1° Long.
B0602	BC 602	4 in. = 1° Long.
*B0604	BC 604	4 in. = 1° Long.
B0605	BC 605	4 in. = 1° Long.
*B0606	BC 606	4 in. = 1° Long.
B0607	BC 607	4 in. = 1° Long.
†B0612	BC 612	4 in. = 1° Long.
B0613	BC 613	4 in. = 1° Long.
B0614	BC 614	4 in. = 1° Long.
*B0704	BC 704	4 in. = 1° Long.
*B0705	BC 705	4 in. = 1° Long.
*B0706	BC 706	4 in. = 1° Long.
*B0707	BC 707	4 in. = 1° Long.
*B0708	BC 708	4 in. = 1° Long.
B0712	BC 712	4 in. = 1° Long.
B0713	BC 713	4 in. = 1° Long.
B0714	BC 714	4 in. = 1° Long.
*B0803	BC 803	4 in. = 1° Long.
*B0804	BC 804	4 in. = 1° Long.
*B0805	BC 805	4 in. = 1° Long.
*B0806	BC 806	4 in. = 1° Long.
*B0807	BC 807	4 in. = 1° Long.
*B0902	BC 902	4 in. = 1° Long.
*B0903	BC 903	4 in. = 1° Long.
*B0904	BC 904	4 in. = 1° Long.
B2116	BC 2116	2 in. = 1° Long.
B2117	BC 2117	2 in. = 1° Long.
B2215	BC 2215	2 in. = 1° Long.
B2216	BC 221-	2 in. = 1° Long.
B2217	BC 2217	2 in. = 1° Long.
†B2316	BC 2316	2 in. = 1° Long.

<u>New N.O. Chart No.</u>	<u>Old H.O. Chart No.</u>	<u>Scale</u>
B2317	BC 2317	2 in. = 1° Long.
*B2415	BC 2415	2 in. = 1° Long.
B2417	BC 2417	2 in. = 1° Long.
B2801	BC 2801	4 in. = 1° Long.
B3612	BC 3612	4 in. = 1° Long.
*B3613	BC 3613	4 in. = 1° Long.
C0507	BC 507	4 in. = 1° Long.
C0508	BC 508	4 in. = 1° Long.
C0509	BC 509	4 in. = 1° Long.
C0603	BC 603	4 in. = 1° Long.
C0606	BC 606	4 in. = 1° Long.
C0607	BC 607	4 in. = 1° Long.
C0704	BC 704	4 in. = 1° Long.
C0705	BC 705	4 in. = 1° Long.
C0706	BC 706	4 in. = 1° Long.
C0708	BC 708	4 in. = 1° Long.
C0803	BC 803	4 in. = 1° Long.
C0805	BC 805	4 in. = 1° Long.
C0806	BC 806	4 in. = 1° Long.
C0807	BC 807	4 in. = 1° Long.
C0903	BC 903	4 in. = 1° Long.
C3613	BC 3613	4 in. = 1° Long.

Bottom Contour Charts for the North Pacific Ocean

<u>New N.O. Chart No.</u>	<u>Old H.O. Chart No.</u>	<u>Scale</u>
B0901	BC 901	4 in. = 1° Long.
*B0902	BC 902	4 in. = 1° Long.
*B0903	BC 903	4 in. = 1° Long.
*B1002	BC 1002	4 in. = 1° Long.
*B1003	BC 1003	4 in. = 1° Long.
B1104	BC 1104	4 in. = 1° Long.
B1202		4 in. = 1° Long.
†B1203	BC 1203	4 in. = 1° Long.
†B1204	BC 1204	4 in. = 1° Long.
B1205	BC 1205	4 in. = 1° Long.
*B1206		4 in. = 1° Long.
B1305	BC 1305	4 in. = 1° Long.
*B1306	BC 1306	4 in. = 1° Long.
*B1307	BC 1307	4 in. = 1° Long.
*B1308	BC 1308	4 in. = 1° Long.
*B1309	BC 1309	4 in. = 1° Long.
*B1310	BC 1310	4 in. = 1° Long.
B1405	BC 1405	4 in. = 1° Long.
B1406	BC 1406	4 in. = 1° Long.
†B1407	BC 1407	4 in. = 1° Long.
B1408	BC 1408	4 in. = 1° Long.
B1409	BC 1409	4 in. = 1° Long.
B1410	BC 1410	4 in. = 1° Long.

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<u>New N.O. Chart No.</u>	<u>Old H.O. Chart No.</u>	<u>Scale</u>
†B1411	BC 1411	4 in. = 1° Long.
B1412	BC 1412	4 in. = 1° Long.
B1502		4 in. = 1° Long.
*B1503	BC 1503	4 in. = 1° Long.
*B2504	BC 1504	4 in. = 1° Long.
*B1505	BC 1505	4 in. = 1° Long.
B1506	BC 1506	4 in. = 1° Long.
B1507	BC 1507	4 in. = 1° Long.
B1508	BC 1508	4 in. = 1° Long.
B1510	BC 1510	4 in. = 1° Long.
B1511	BC 1511	4 in. = 1° Long.
B1512	BC 1512	4 in. = 1° Long.
B1513	BC 1513	4 in. = 1° Long.
B1602		4 in. = 1° Long.
*B1603	BC 1603	4 in. = 1° Long.
*B1605	BC 1605	4 in. = 1° Long.
B1606	BC 1606	4 in. = 1° Long.
B1607	BC 1607	4 in. = 1° Long.
B1608	BC 1608	4 in. = 1° Long.
B1610	BC 1610	4 in. = 1° Long.
B1611	BC 1611	4 in. = 1° Long.
B1612		4 in. = 1° Long.
*B1703	BC 1703	4 in. = 1° Long.
*B1704		4 in. = 1° Long.
*B1705	BC 1705	4 in. = 1° Long.
*B1706	BC 1706	4 in. = 1° Long.
*B1707	BC 1707	4 in. = 1° Long.
B1708	BC 1708	4 in. = 1° Long.
B1709	BC 1709	4 in. = 1° Long.
B1710	BC 1710	4 in. = 1° Long.
B1711	BC 1711	4 in. = 1° Long.
**B1804	BC 1804	4 in. = 1° Long.
**B1806	BC 1806	4 in. = 1° Long.
B1807	BC 1807	4 in. = 1° Long.
B1808	BC 1808	4 in. = 1° Long.
B1809	BC 1809	4 in. = 1° Long.
B1810	BC 1810	4 in. = 1° Long.
B1811	BC 1811	4 in. = 1° Long.
B1813	BC 1813	4 in. = 1° Long.
B1901		4 in. = 1° Long.
B1902		4 in. = 1° Long.
*B1904	BC 1904	4 in. = 1° Long.
*B1905	BC 1905	4 in. = 1° Long.
B1906	BC 1906	4 in. = 1° Long.
B1907	BC 1907	4 in. = 1° Long.
B1908	BC 1908	4 in. = 1° Long.

<u>New N.O. Chart No.</u>	<u>Old H.O. Chart No.</u>	<u>Scale</u>
B1909	BC 1909	4 in. = 1° Long.
*B1910	BC 1910	4 in. = 1° Long.
**B1911	BC 1911	4 in. = 1° Long.
**B1912	BC 1912	4 in. = 1° Long.
B1913	BC 1913	4 in. = 1° Long.
B2001	BC 2001	4 in. = 1° Long.
B2004	BC 2004	4 in. = 1° Long.
B2005	BC 2005	4 in. = 1° Long.
B2006	BC 2006	4 in. = 1° Long.
B2007	BC 2007	4 in. = 1° Long.
B2009	BC 2009	4 in. = 1° Long.
*B2010	BC 2010	4 in. = 1° Long.
*B2011	BC 2011	4 in. = 1° Long.
B2012	BC 2012	4 in. = 1° Long.
B2013	BC 2013	4 in. = 1° Long.
B2104	BC 2104	4 in. = 1° Long.
B2105	BC 2105	4 in. = 1° Long.
B2106	BC 2106	4 in. = 1° Long.
B2107	BC 2107	4 in. = 1° Long.
B2108	BC 2108	4 in. = 1° Long.
B2109	BC 2109	4 in. = 1° Long.
B2110	BC 2110	4 in. = 1° Long.
B2111	BC 2111	4 in. = 1° Long.
B2112	BC 2112	4 in. = 1° Long.
B2113	BC 2113	4 in. = 1° Long.
*B2203	BC 2203	4 in. = 1° Long.
*B2204	BC 2204	4 in. = 1° Long.
B2206	BC 2206	4 in. = 1° Long.
B2207	BC 2207	4 in. = 1° Long.
B2208	BC 2208	4 in. = 1° Long.
B2209	BC 2209	4 in. = 1° Long.
B2210	BC 2210	4 in. = 1° Long.
B2211	BC 2211	4 in. = 1° Long.
B2212	BC 2212	4 in. = 1° Long.
B2303	BC 2303	4 in. = 1° Long.
B2307	BC 2307	4 in. = 1° Long.
B2308	BC 2308	4 in. = 1° Long.
B2309	BC 2309	4 in. = 1° Long.
†C0903	BC 903	4 in. = 1° Long.
C1503		4 in. = 1° Long.
C1504		4 in. = 1° Long.
C1603		4 in. = 1° Long.
C1605		4 in. = 1° Long.
C1703		4 in. = 1° Long.
C1704		4 in. = 1° Long.
C1705	BC 1705	4 in. = 1° Long.
C1706		4 in. = 1° Long.

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<u>New N.O. Chart No.</u>	<u>Old H.O. Chart No.</u>	<u>Scale</u>
C1707		4 in. = 1° Long.
C1904		4 in. = 1° Long.
C1905	BC 1905	4 in. = 1° Long.
C1910		4 in. = 1° Long.
C2010		4 in. = 1° Long.
C2011		4 in. = 1° Long.

M. LORAN A CHARTS AND PUBLICATIONS

The Loran A system is being phased out of service, and ships now using Loran A will eventually be using the Omega system of navigation. However, a complete set of Air/Surface Loran A Position Plotting Charts and publications is available to interested scientists and navigators.

Loran A Tables

The Loran tables listed below contain necessary data for establishment of hyperbolic lines of position for the pertinent rate and area of coverage.

HCP 221-S	Loran Multiplication Table
	<u>Atlantic Ocean</u>
HCP 221 (101)	Baffin Bay Area (Rate 256)
HCP 221 (102)	Baffin Bay Area (Rate 2S7)
HCP 221 (103)	North Atlantic (Rate 1L6)
HCP 221 (104)	North Atlantic (Rate 1L7)
HCP 221 (105)	North Atlantic (Rate 1L2)
HCP 221 (106)	North Atlantic (Rate 1L3)
HCP 221 (107)	North Atlantic (Rate 1H1)
HCP 221 (108)	West Indies (Rate 3L2)
HCP 221 (109)	West Indies (Rate 3L3)
HCP 221 (110)	North Atlantic (Rate 1L0)

*Includes Loran A navigational information.

†Includes Loran A and Loran C navigational information.

+Prefix C indicates Loran C navigational information.

Loran-A Tables

HCP 221 (111)	North Atlantic (Rate 1L1)
HCP 221 (112)	Denmark Strait Area (Rate 1L5)
HCP 221 (113)	Denmark Strait Area (Rate 1L4)
HCP 221 (114)	East Coast USA (Rate 3H7)
HCP 221 (115)	English Channel (Rate 1S3)
HCP 221 (116)	Bay of Biscay (Rate 1S4)
HCP 221 (117)	North Atlantic (Rate 1H2)
HCP 221 (118)	North Atlantic (Rate 1H3)
HCP 221 (119)	North Atlantic (Rate 3H5)
HCP 221 (120)	North Atlantic (Rate 3H4)
HCP 221 (121)	North Atlantic (Rate 3H6)
HCP 221 (122)	North Sea (Rate 1S1)
HCP 221 (123)	North Sea (Rate 1S2)
HCP 221 (124)	West Portugal (Rate 1S5)
HCP 221 (125)	Azores (Rate 1S6)
HCP 221 (126)	Azores (Rate 1S7)
HCP 221 (127)	Gulf of Mexico (Rate 3H0)
HCP 221 (128)	Gulf of Mexico (Rate 3H1)
HCP 221 (129)	Gulf of Mexico (Rate 3H2)
HCP 221 (130)	Gulf of Mexico (Rate 3H3)
HCP 221 (131)	Southeast USA (Rate 3L5)
HCP 221 (132)	Gulf of Maine (Rate 1H7)
	Pacific Ocean
HCP 221 (201)	South Japan (Rate 2S7)

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Loran-A Tables

HCP 221 (202)	South Japan (Rate 2H6)
HCP 621 (203)	South Japan (Rate 2H7)
HCP 221 (204)	Central Pacific (Rate 2L7)
HCP 221 (205)	Asiatic Area (Rate 2H4)
HCP 221 (206)	Asiatic Area (Rate 2H3)
HCP 221 (207)	Asiatic Area (Rate 1L6)
HCP 221 (208)	Asiatic Area (Rate 1L7)
HCP 221 (209)	Central Pacific (Rate 2L6)
HCP 221 (210)	Central Pacific (Rate 1H2)
HCP 221 (211)	Central Pacific (Rate 1H1)
HCP 221 (213)	Central Pacific (Rate 2L5)
HCP 221 (214)	West Coast USA (Rate 1H5)
HCP 221 (215)	West Coast USA (Rate 1H6)
HCP 221 (216)	West Coast USA (Rate 1L0)
HCP 221 (217)	West Coast USA (Rate 1L1)
HCP 221 (218)	Japanese Area (Rate 2S3)
HCP 221 (219)	Japanese Area (Rate 2S4)
HCP 221 (220)	West Japan (Rate 2S5)
HCP 221 (221)	West Japan (Rate 2S6)
HCP 221 (222)	South Pacific (Rate 2L1)
HCP 221 (223)	South Pacific (Rate 2L2)
HCP 221 (224)	South Pacific (Rate 2L3)
HCP 221 (225)	East Japan (Rate 2S1)

Loran-A Tables

HCP 221 (226)	East Japan (Rate 2S2)
HCP 221 (227)	North Pacific (Rate 1L2)
HCP 221 (228)	North Pacific (Rate 1L3)
HCP 221 (229)	North Pacific (Rate 1L7)
HCP 221 (230)	North Pacific (Rate 1L6)
HCP 221 (231)	Philippine Sea (Rate 2H5)
HCP 221 (232)	West Coast USA (Rate 1H4)
HCP 221 (233)	South Japan (Rate 2S0)
HCP 221 (234)	West Coast Canada (Rate 1L4)
HCP 221 (235)	West Coast Canada (Rate 1L5)
HCP 223	Auxiliary Tables for Loran Computation

Loran Lattice Tables

HCP 245, vol. 1	Loran Lattice Tables 0-23 Degrees
HCP 245, vol. 2	Loran Lattice Tables 24-47 Degrees
HCP 245, vol. 3	Loran Lattice Tables 48-65 Degrees
HCP 245, vol. 4	Loran Lattice Tables 66-90 Degrees

The above Loran lattice tables give the Loran signal travel time directly in microseconds between two positions having coordinates of integral degrees of latitude and longitude. Also provided is the azimuth (bearing) angle of the terminal position from the initial position measured east or west from the elevated pole.

HCP 245	Loran Lattice Nomogram
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N. LORAN C CHARTS AND TABLES

Loran C has been used extensively by the navigators of NRL and consequently an extensive library of Loran C charts and Loran C rate tables is available. Below are listed the charts and tables for the Atlantic and Pacific areas and their current rates. This series of charts, formerly the VLC-30 series, has been redesignated to the 7400 series.

ZUCCARO AND OSTRANDER

Defense Mapping Agency Air/Surface Loran C Navigation Charts

<u>Chart No.</u>	<u>Rates</u>
7402	5930-X(SH7-X),5930-Y(SH7-Y),5930-Z(SH7-Z),
7403	5930-Y(SH7-Y),5930-Z(SH7-Z),7930-W(SL7-W),7930-Z(SL7-Z), 9930-X(SS7-X),9930-Z(SS7-Z)
7404	7970-W(SL3-W),49903-X(S13-X),49903-Y(S13-Y),7970-Z(SL3-Z), 7930-W(SL7-W),7930-X(SL7-X),7930-Z(SL7-Z)
7405	7970-W(SL3-W),7970-X(SL3-W),7970-Y(SL3-Y),7970-Z(SL3-Z)
7408	5930-X(SH7-X),5930-Y(SH7-Y),5930-Z(SH7-Z),9970-W(SS3-W)
7409	5930-X(SH7-X),5930-Y(SH7-Y),5930-Z(SH7-Z),9970-W(SS3-W)
7410	5930-Z(SH7-Z),5930-Y(SH7-Y),5930-Z(SH7-Z),4990-Y(S1-Y)
7411	7930-Z(SL7-Z),9930-X(SS7-X),9930-Y(SS7-Y),9930-Z(SS7-Z)
7412	7930-W(SL7-W),5930-X(SH7-X),7930-Z(SL7-Z),9930-X, 9930-Y(SS7-Y),9930-Z(SS7-Z)
7413	7970-W(SL3-W),7970-Y(SL3-Y),7930-W(SL7-W),7930-X(SL7-X), 7930-Z(SL7-Z)
7414	7990-Y(SL1-Y),7990-Z(SL1-Z),7970-W(SL3-W),5970-X(SL3-X)
7415	7990-Y(SL1-Y),7970-W(SL3-W),7970-X(SL3-X),7990-X(SL1-X)
7416	9970-W(SS3-W),9970-X(SS3-X),9970-X(SS3-Y),9970-Z(SS3-Z)
7417	9970-W(SS3-W),9970-X(SS3-X),9970-Y(SS3-Y)
7418	5930-X(SH7-X),5930-Z(SH7-Z),9970-W(SS3-W),9970-X(SS3-W)
7419	5930-X(SH7-X),5930-Z(SH7-Z),4990-X(S1-Y)
7420	5930-X(SH7-X),5930-Z(SH7-Z),4990-X(S1-X),4990-Y(S1-Y)
7421	9930-W(SS7-W),9930-X(SS7-X),9930-Y(SS7-Y),9930-Z(SS7-Z)
7422	9930-W(SS7-W),9930-X(SS7-X),9930-Y(SS7-Y),9930-Z(SS7-Z)
7423	7930-Z(SL7-Z),9930-W(SS7-W),9930-X(SS7-X),9930-Y(SS7-Y)
7424	7990-Z(SL1-Z),7970-W(SL3-W),7930-X(SL7-X),7990-X(SL1-X)
7425	7990-Y(SL1-Y),7990-Z(SL1-Z),7990-X(SL1-X)
7426	7990-Y(SL1-Y),7990-Z(SL1-Z),7990-X(SL1-X)
7428	5970-X(SH3-X),5970-Y(SH3-Y),5970-Z(SH3-Z),9970-Y(SS3-Y), 9970-Z(SS3-Z)
7429	9970-W(SS3-W),9970-X(SS3-X),9970-Y(SS3-Y),9970-Z(SS3-Z)
7430	4990-X(S1-X),4990-Y(S1-Y),9970-Y(SS3-Y),9970-Z(SS3-Z)
7431	5930-X(SH7-X),5930-Z(SH7-Z),4990-X(S1-X),4990-Y(S1-Y)
7432	5930-X(SH7-X),5930-Z(SH7-Z),4990-X(S1-X),4990-Y(S1-Y)
7433	9930-W(SS7-W),9930-Y(SS7-Y),9930-Z(SS7-Z)
7434	9930-W(SS7-W),9930-X(SS7-X),9930-Y(SS7-Y),9930-Z(SS7-Z)
7435	9930-W(SS7-W),9930-X(SS7-X),9930-Y(SS7-Y),9930-Z(SS7-Z)
7436	7930-Z(SL7-Z),9930-W(SS7-W),9930-X(SS7-X),9930-Y(SS7-Y)
7437	7990-Y(SL1-Y),7990-Z(SL1-Z)
7438	7990-Y(SL1-Y),7990-Z(SL1-Z)
7439	7990-Y(SL1-Y),7990-Z(SL1-Z)
7441	5970-X(SH3-X),5970-Y(SH3-Y),5970-Z(SH3-Z)
7442	5970-X(SH3-X),5970-Y(SH3-Y),5970-Z(SH3-Z),9970-Y(SS3-Y), 9970-Z(SS3-Z)
7443	9970-W(SS3-W),9970-Y(SS3-Y),9970-Z(SS3-Z)
7444	4990-X(S1-X),4990-Y(S1-Y),9970-W(SS3-W),9970-Z(SS3-Z)
7445	4990-X(S1-X),4990-Y(S1-Y)
7446	4990-X(S1-X),4990-Y(S1-Y)
7447	9930-W(SS7-W),9930-Y(SS7-Y),9930-Z(SS7-Z)

Defense Mapping Agency Air/Surface Loran C Navigation Charts

<u>Chart No.</u>	<u>Rates</u>
7448	9930-W(SS7-W),9930-X(SS7-X),9930-Y(SS7-Y),9930-Z(SS7-Z)
7449	9930-W(SSO-W),9930-X(SSO-X),9930-Y(SSO-Y),9930-Z(SSO-Z)
7450	9930-W(SS7-W),9930-X(SS7-X),9930-Y(SS7-Y)
7455	5970-X(SH3-X),5970-Y(SH3-Y),5970-Z(SH3-Z)
7456	9970-W(SS3-W),9970-Y(SS3-Y),9970-Z(SS3-Z)
7457	9970-W(SS3-W),9970-Y(SS3-Y),9970-Z(SS3-Z)
7458	4990-X(S1-X),4990-Y(S1-Y),9970-W(SS3-W)
7459	4990-X(S1-X),4990-Y(S1-Y)
7460	4990-X(S1-X),4990-Y(S1-Y)

Note: The above are a basic long-range air/surface plotting charts that contain essential topographic information, Loran curves, magnetic variation overprint, and tinted land areas.

Loran C Rate Tables

<u>Pub. No.</u>	<u>Region</u>
HCP 221 (1001)	East Coast U.S.A., Pair 9930-W(Pair SS7-W)
HCP 221 (1002)	East Coast U.S.A., Pair 9930-Y(Pair SS7-Y)
HCP 221 (1003)	Mediterranean Sea, Pair 7790-X(Pair SL1-X)
HCP 221 (1004)	Mediterranean Sea, Pair 7790-Y(Pair SL1-Y)
HCP 221 (1005)	Norwegian Sea, Pair 7970-X(Pair SL3-X)
HCP 221 (1006)	Norwegian Sea, Pair 7970-Y(Pair SL3-Y)
HCP 221 (1009)	North Sea, Pair 7970-W(Pair SL3-W)
HCP 221 (1010)	North Atlantic, Pair 9930-W(Pair SL7-W)
HCP 221 (1011)	North Atlantic, Pair 9930-X(Pair SL7-X)
HCP 221 (1012)	North Atlantic, Pair 9930-Z(Pair SL7-Z)
HCP 221 (1013)	East Coast U.S.A., Pair 9930-X(Pair SS7-X)
HCP 221 (1014)	Eastern U.S.A., Pair 9930-Z(Pair SS7-Z)
HCP 221 (2001)	North Pacific, Pair 5930-Z(Pair SH7-Z)
HCP 221 (2002)	North Pacific, Pair 5930-X(Pair SH7-X)
HCP 221 (2003)	Central Pacific, Pair 4990-X(Pair S1-X)
HCP 221 (2004)	Central Pacific, Pair 4990-Y(Pair S1-Y)
HCP 221 (2006)	Northwest Pacific, Pair 9970-W(Pair SS3-W)
HCP 221 (2007)	Northwest Pacific, Pair 9970-X(Pair SS3-X)
HCP 221 (2008)	Northwest Pacific, Pair 9970-Y(Pair SS3-Y)
HCP 221 (2009)	Northwest Pacific, Pair 9970-Z(Pair SS3-Z)
HCP 221 (2010)	Southeast Asia, Pair 5970-X(Pair SH3-X)
HCP 221 (2011)	Southeast Asia, Pair 5970-Y(Pair SH3-Y)
HCP 221 (2012)	Southeast Asia, Pair 5970-Z(Pair SH3-Z)

O. Omega System Status and Availability Prognosis

The following paragraphs provide specific status information regarding each Omega station in the worldwide, eight-station Omega network due for completion by 1977. Users are advised that during the latter part of calendar year 1974 and early 1975, areas covered by Omega will vary as research and development (R&D) stations are replaced by full-power operational antennas and equipment. System coverage will increase, from that previously provided by A, B, C, and D stations, starting early calendar 1975 as new stations are added to the network, with full worldwide coverage anticipated by 1977.

Station A, Omega Norway — Station A is presently operating at reduced power of approximately 7-1/2 kW.

Station B, Omega Trinidad/Omega Liberia — Omega Trinidad is presently operating utilizing R&D equipment and radiates approximately 1 kW of power. This station will continue in operation until the Liberian station, scheduled to commence operation by December 1975, replaces it. At that time, the Trinidad station will be removed from service permanently.

Station C, Omega Hawaii — Station C is presently operating at full power.

Station D, Omega North Dakota — Station D is presently operating at full power of 10 kW.

Station E, Omega Reunion (Indian Ocean) — Station E is a new station under construction and is scheduled to commence full-power operation by December 1975.

Station F, Omega Argentina — Station F is a new station under construction and is scheduled to commence full-power operation by July 1975.

Station G, Omega Australia — Station G is a planned new station, subject to the signing of a country-to-country agreement.

Station H, Omega Japan — Station H is a new station that commenced full-power operation in April 1975.

Summary of Omega Coverage Prognosis

December 1, 1974 - April 1, 1975

1. Four-station operation (A,B,C,D)
2. North Atlantic, Polar, Aleutians, Continental U.S., Gulf of Mexico coverage available.

April 1, 1975 - July 1, 1975

1. Five-station operation (A,B,C,D,H)
2. Northern Hemisphere coverage except the Indian Ocean, the southwestern portion of the North Pacific, and the southeastern portion of the North Atlantic Ocean.

July 1, 1975 - December 1, 1975

1. Six-station operation (A,B,C,D,F,H)
2. World covered except South Pacific and Indian Oceans.

December 1, 1975 - 1977

1. Seven-station operation (A,B,C,D,E,F,H)
2. All world covered except South Pacific and eastern Indian Oceans.

1977

1. Full eight-station operation
2. Global coverage.

Omega Navigational Charts 7500 Series (Formerly VO 30 Series). Several copies of each chart is available and all charts are the latest editions. (see Section P)

Omega Lattice Tables and Omega Propagation Correction Tables. Three complete sets of the above tables are available for scientists' use. (see Section P)

Many of the sailing and coastal charts have Omega and are available from the General Chart System.

The Omega system has been evaluated by the navigators of the Ship Facility Group; however, due to the construction of new stations Omega has not been used extensively during the past two years. Accuracy of the system has been estimated to be about 1 to 2 mi during the day and 2 to 5 mi at night. The above accuracy is estimated by the use of Omega Propagation Correction Tables only; these corrections may actually fluctuate daily and are not constant. The greatest periods of diurnal propagation inaccuracy are during sunrise and sunset at the transmitting stations. Local conditions may also affect accuracy. However, when used in conjunction with the Navy Navigation Satellite System or Loran C, accuracy may be greatly increased.

P. OMEGA CHARTS

With the implementation of a worldwide Omega chain in progress, the Navigation Section has in its charting system the most comprehensive and up-to-date library of Omega

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Lattice Tables, Omega Propagation Correction Tables, and Omega Navigational Charts. Below are listed the Omega Charts, Lattice Tables, and Omega Propagation Correction Tables currently available for scientific project planning for experiments at sea. NRL scientists and project planners may obtain these charts either on a returnable or non-returnable basis. It should be noted that the VO series of Omega charts has been redesignated by DMA to Omega 7500 chart series. The VO 30 series has been discontinued.

Defense Mapping Agency, Omega Position Plotting Charts

Chart No.

5179	Omega Linear Interpolator (not graphically indexed) (sheet size 8-1/2 × 11 in.)				
	Omega Pairs				
7501	A-C,	A-D,	B-C,	A-H,	D-H
7502	A-D,	A-H,	B-C,	B-H,	C-H
7503	A-D,	A-H,	B-C,	B-H,	C-H
7504	A-C,	A-D,	A-B,	B-C,	D-H
7505	A-C,	A-D,	A-B,	B-C,	D-H
7506	C-H,	A-D,	B-H,	A-H,	B-C
7507	A-D,	C-H,	B-C,	A-C,	B-H
7508	B-D,	C-H,	B-H,	B-C,	D-H
	A-C,	B-D,	A-B,	B-C,	D-H
7509	A-C,	A-B,	B-D,	B-C,	D-H
7510	A-D,	B-H,	C-D,	C-H,	D-H
7511	C-H,	B-C,	C-D,	A-C,	B-H
7512	A-C,	B-C,	C-D,	A-D,	D-H
	B-H,	C-H,	B-C,	D-H,	C-D
7513	B-C,	B-D,	B-H,	C-H,	D-H
	B-D,	B-H,	A-D,	B-C,	A-C
7514	B-D,	B-H,	B-C,	A-D,	A-C
7515	B-D,	A-H,	A-B,	B-H,	C-H
7516	A-H,	C-H,	D-H,	A-C,	A-D
7517	A-H,	C-H,	C-D,	D-H,	A-C
7518	A-C,	A-H,	C-H,	C-D,	A-D
7519	A-B,	A-C,	B-C,	D-H,	B-H
	A-C,	B-C,	C-D,	A-B,	B-D
7522	A-B,	A-C,	B-D,	B-C,	A-D
	B-D,	A-H,	A-B,	B-H,	D-H
7523	A-H,	B-H,	B-D,	D-H,	A-B
7524	A-E,	C-E,	E-H,	A-C,	A-H
7525	C-D,	A-C,	A-H,	C-H,	A-D

Chart No.

Omega Pairs

7526	A-H,	C-D,	C-H,	A-C,	D-H	
7527	A-H,	C-D,	D-H,	D-H,	A-C	West of 180°
	A-H,	C-H,	C-D,	D-H,	A-B	East of 180°
7528	A-B,	A-C,	B-D,	C-D,	B-H	
7529	A-B,	B-H,	B-D,	A-C,	C-D	West of 120°W
	A-C,	B-C,	C-D,	B-D,	A-B	East of 120°W
7530	B-C,	B-F,	C-D,	B-D,	A-C	
7531	A-B,	B-C,	B-D,	A-C,	A-D	
7532	A-B,	A-C,	A-D,	B-C,	B-D	
7533	A-B,	A-C,	B-D,	B-C,	A-D	West of 0°
7535	A-C,	A-E,	A-H,	C-E,	E-H	
7536	A-E,	C-E,	E-H,	A-C,	A-H	
7537	A-C,	A-E,	C-E,	C-H,	E-H	
7538	A-E,	D-E,	E-H,	C-H,	A-C	
7540	A-C,	A-H,	B-D,	B-H,	C-H	
7541	A-D,	A-H,	C-H,	C-H,	C-D	
7542	B-C,	B-F,	C-D,	C-F,	D-F	
7543	A-C,	C-F,	C-D,	A-F,	B-D	
7544	A-C,	A-F,	B-F,	C-F,	B-D	
7545	A-B,	A-D,	A-C,	B-C,	B-D	
7546	A-B,	A-C,	A-D,	B-C,	B-D	
7546	A-B,	A-C,	A-D,	B-C,	B-D	
5747	A-B,	A-C,	A-D,	B-C,	B-D	West of 0°
7548	A-E,	E-H,	A-B,	D-H,	D-E	
7549	A-E,	C-E,	E-H,	A-C,	A-H	
7550	A-E,	C-E,	E-H,	C-H,	A-C	
7551	A-E,	D-E,	C-H,	C-E,	E-H	
7552	A-E,	C-E,	D-E,	C-H,	D-H	

Omega Navigational Charts involving station F (Argentina) will not be usable until this station becomes operational. The transmitting data for this station will be announced in the *Notice to Mariners*.

Note: These are basic long-range air/surface plotting charts that contain essential topographic information and have Omega curves, magnetic variation overprint, and tinted land areas. This new series replaced the VO 30 series.

Omega Lattice Tables

The Omega Lattice Tables contain necessary data for the establishment of hyperbolic lines of position for the pertinent station pair and the area of coverage.

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<u>Publication Number</u>	<u>Station Pair</u>	<u>Region</u>	<u>Area</u>
HCP 224 (100)	A-D A-H B-C B-H C-H	North Polar	00
HCP 224 (101)	A-C A-C A-E A-H B-D B-H C-D C-E	Northern Europe	01
HCP 224 (102)	A-B A-C A-C A-E B-C D-E D-H	Central U.S.S.R.	02
HCP 224 (103)	A-B A-C A-D B-C C-D C-H	Eastern U.S.S.R.	03
HCP 224 (104)	A-B A-C A-C B-C B-H C-D C-H	Alaska	04
HCP 224 (105)	A-B A-C A-D B-C B-D B-H C-D C-H	Canada	05

<u>Publication Number</u>	<u>Station Pair</u>	<u>Region</u>	<u>Area</u>
HCP 224 (106)	A-B A-C A-D B-C B-C B-H	Greenland	06
HCP 224 (107)	A-B A-D A-E B-C B-D B-E	Mediterranean	07
HCP 224 (108)	A-C A-E A-H C-E E-H	Asia	08
HCP 224 (109)	A-C D-H	Northwest Pacific	09
HCP 224 (110)	A-B A-C C-D D-F D-H F-H	Central Pacific	10
HCP 224 (111)	A-B A-C A-F B-C B-D B-F C-D C-F	North America	11
HCP 224 (112)	A-B A-C A-D A-E B-C B-D	North Atlantic	12

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<u>Publication Number</u>	<u>Station Pair</u>	<u>Region</u>	<u>Area</u>
HCP 224 (112)	B-E B-F D-E D-F		
HCP 224 (113)	A-F E-F	Southern Africa	13
HCP 224 (114)	A-E E-H	Indian Ocean	14
HCP 224 (115)	C-E C-F C-H E-F	Australia	15
HCP 224 (116)	B-C D-F	South Pacific	16
HCP 224 (117)	A-B B-C C-F D-F	East Pacific	17
HCP 224 (118)	A-B A-C B-F D-E D-F E-F	South Atlantic	18
HCP 224 (119)	B-F E-F C-H	Queen Maud Land	19
HCP 224 (121)	C-H E-F E-H	Victoria Land	21
HCP 224 (122)	B-C	Ross Sea	22
HCP 224 (123)	C-F	Amundsen Sea	23
HCP 224 (124)	B-F E-F	Weddell Sea	24

Omega Propagation Correction Tables

The Omega Propagation Correction Tables are printed at each grid point, with each table containing a matrix of skywave correction values. These correction values are arranged horizontally by Greenwich Mean Time and vertically are arranged in semimonthly periods.

Omega Propagation Correction Tables for 10.2 kHz for specific areas are shown in the following publications.

<u>Publication Number</u>	<u>Region</u>	<u>Area</u>	<u>Station</u>
HCP 224 (100-C)A	North Polar	00	A, Norway
HCP 224 (100-C)B			B, Trinidad
HCP 224 (100-C)C			C, Hawaii
HCP 224 (100-C)D			D, N. Dakota
HCP 224 (100-C)H			H, Japan
HCP 224 (101-C)A	Northern Europe	01	A, Norway
HCP 224 (101-C)B			B, Trinidad
HCP 224 (101-C)C			C, Hawaii
HCP 224 (101-C)D			D, N. Dakota
HCP 224 (101-C)H			H, Japan
HCP 224 (102-C)A	Central U.S.S.R.	02	A, Norway
HCP 224 (102-C)B			B, Trinidad
HCP 224 (102-C)C			C, Hawaii
HCP 224 (102-C)D			D, N. Dakota
HCP 224 (102-C)E			H, Japan
HCP 224 (103-C)A	Eastern U.S.S.R.	03	A, Norway
HCP 224 (103-C)B			B, Trinidad
HCP 224 (103-C)C			C, Hawaii
HCP 224 (103-C)D			D, N. Dakota
HCP 224 (103-C)H			H, Japan
HCP 224 (104-C)A	Alaska	04	A, Norway
HCP 224 (104-C)B			B, Trinidad
HCP 224 (104-C)C			C, Hawaii
HCP 224 (104-C)D			D, N. Dakota
HCP 224 (104-C)H			H, Japan
HCP 224 (105-C)A	Canada	05	A, Norway
HCP 224 (105-C)B			B, Trinidad
HCP 224 (105-C)C			C, Hawaii
HCP 224 (105-C)D			D, N. Dakota
HCP 224 (105-C)H			H, Japan

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<u>Publication Number</u>	<u>Region</u>	<u>Area</u>	<u>Station</u>
HCP 224 (106-C)A HCP 224 (106-C)B HCP 224 (106-C)C HCP 224 (106-C)D HCP 224 (106-C)H	Greenland	06	A, Norway B, Trinidad C, Hawaii D, N. Dakota H, Japan
HCP 224 (107-C)A HCP 224 (107-C)B HCP 224 (107-C)D HCP 224 (107-C)H	Mediterranean	07	A, Norway B, Trinidad D, N. Dakota H, Japan
HCP 224 (108-C)A HCP 224 (108-C)C HCP 224 (108-C)H	Asia	08	A, Norway C, Hawaii H, Japan
HCP 224 (109-C)A HCP 224 (109-C)C HCP 224 (109-C)D HCP 224 (109-C)H	Northwest Pacific	09	A, Norway C, Hawaii D, N. Dakota H, Japan
HCP 224 (110-C)A HCP 224 (110-C)B HCP 224 (110-C)C HCP 224 (110-C)D HCP 224 (110-C)H	Central Pacific	10	A, Norway B, Trinidad C, Hawaii D, N. Dakota H, Japan
HCP 224 (111-C)A HCP 224 (111-C)B HCP 224 (111-C)C HCP 224 (111-C)D HCP 224 (111-C)H	North America	11	A, Norway B, Trinidad C, Hawaii D, N. Dakota H, Japan
HCP 224 (112-C)A HCP 224 (112-C)B HCP 224 (111-C)C HCP 224 (111-C)D	North Atlantic	12	A, Norway B, Trinidad C, Hawaii D, N. Dakota
HCP 224 (117-C)B HCP 224 (117-C)C HCP 224 (117-C)D	East Pacific	17	B, Trinidad C, Hawaii D, N. Dakota
HCP 224 (118-C)B HCP 224 (118-C)D	South Atlantic	18	B, Trinidad D, N. Dakota

Omega Propagation Correction Tables for 3.4 kHz for specific areas are shown in the following publications.

<u>Publication Number</u>	<u>Region</u>	<u>Area</u>	<u>Station</u>
HCP 224 (201-C)A HCP 224 (201-C)B HCP 224 (201-C)C HCP 224 (201-C)D HCP 224 (201-C)H	Northern Europe	01	A, Norway B, Trinidad C, Hawaii D, N. Dakota H, Japan
HCP 224 (204-C)A HCP 224 (204-C)B HCP 224 (204-C)C HCP 224 (204-C)D HCP 224 (201-C)H	Alaska	04	A, Norway B, Trinidad C, Hawaii D, N. Dakota H, Japan
HCP 224 (205-C)A HCP 224 (205-C)B HCP 224 (205-C)C HCP 224 (205-C)D HCP 224 (205-C)H	Canada	05	A, Norway B, Trinidad C, Hawaii D, N. Dakota H, Japan
HCP 224 (206-C)A HCP 224 (206-C)B HCP 224 (206-C)C HCP 224 (206-C)D HCP 224 (206-C)H	Greenland	06	A, Norway B, Trinidad C, Hawaii D, N. Dakota H, Japan
HCP 224 (210-C)A HCP 224 (210-C)B HCP 224 (210-C)C HCP 224 (210-C)D HCP 224 (210-C)H	Central Pacific	10	A, Norway B, Trinidad C, Hawaii D, N. Dakota H, Japan
HCP 224 (211-C)A HCP 224 (211-C)B HCP 224 (211-C)C HCP 224 (211-C)D HCP 224 (211-C)H	North America	11	A, Norway B, Trinidad C, Hawaii D, N. Dakota H, Japan
HCP 224 (212-C)A HCP 224 (212-C)B HCP 224 (212-C)C HCP 224 (212-C)D	North Atlantic	12	A, Norway B, Trinidad C, Hawaii D, N. Dakota
HCP 224 (214-C)H	Indian Ocean	14	H, Japan
HCP 224 (215-C)C HCP 224 (215-C)H	Australia	15	C, Hawaii H, Japan

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