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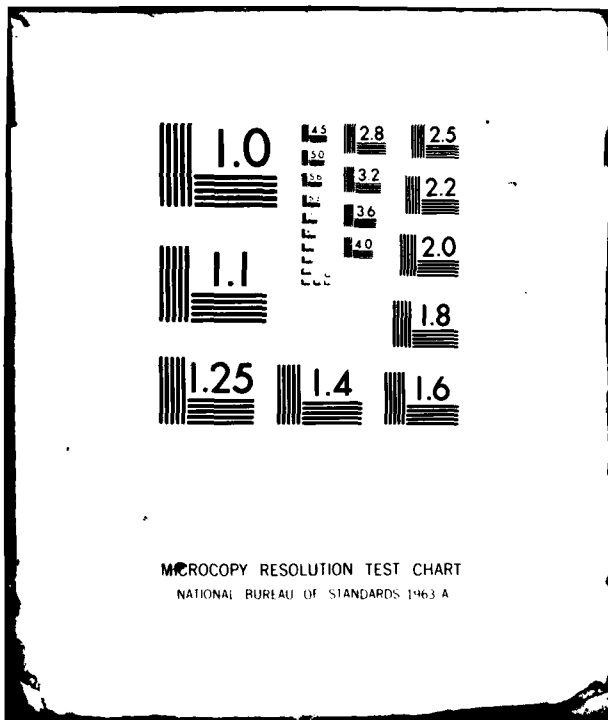
DEFENSE MAPPING AGENCY HYDROGRAPHIC/ TOPOGRAPHIC CENT--ETC F/G 8/2
DMA'S ROLE WITH THE MARINER, (U)
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DECEMBER 1978**DMA's Role With The Mariner****Dennis J. Granato****ABSTRACT**

This paper addresses the organization, mission, and service that the Defense Mapping Agency (DMA), specifically, the Hydrographic/Topographic Center (HTC), provides to the general mariner. Included in the discussion are the following: the interface between DMA and the merchant mariner, how the requirements process works to support merchant marine activities, and how the merchant marine can aid DMA's product availability and accuracy through a data collection effort.

The paper also addresses the various types of products that DMA provides to the mariner, highlighting new automated developments which are expected to be of significant value to all users of hydrographic data and products. Those developments discussed include the use of remotely sensed data for hydrographic purposes and the Automated Notice to Mariners System. These new processes stress the attempts being made by the Defense Mapping Agency to improve product availability, reliability, and accuracy, thereby improving safety of life at sea.

INTRODUCTION

On 1 July 1972, the mapping, charting, and geodetic (MC&G) activities within the three military Departments of the United States were consolidated into a new agency of the U.S. Department of Defense, known as the Defense Mapping Agency (DMA) with headquarters in Washington, D.C. All map and chart production and distribution facilities of the Departments of the Army, Navy, and Air Force became Production Centers under the direction of DMA.

The separate Centers functioned technically as they did before the establishment of DMA; however, the acquisition of new data at an ever increasing rate, and changing requirements called for new methods of processing and managing data, especially in digital form. Consequently, over a period of time, manual compilation and production functions tended to become more and more automated. With this automation came the establishment of data bases containing many areas of common ground independent of their use for hydrographic or topographic applications. Advancement of technology within DMA towards increasing uniformity of production techniques and processes, especially between the Hydrographic and Topographic Centers, predicated a decision by DMA to merge these two Centers in September 1978. Coincident with this consolidation, the distribution functions of all three DMA Production Centers were combined into a single new command; namely, the Office of Distribution Services (DMAODS), collocated with the Hydrographic/Topographic Center (HTC), in Brookmont, Maryland.

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The mission of the new Defense Mapping Agency Hydrographic/Topographic Center is to provide topographic, hydrographic, navigational, and geodetic data, maps, charts, digital data output, and related products and services to the Armed Forces, other federal agencies, the merchant marine, and mariners in general (Figure 1). As you are probably aware, DMA shares the nautical charting responsibility with the National Ocean Survey (NOS) of the Department of Commerce. NOS is responsible for charting the coasts of the United States and possessions. DMA provides charts and related products of all foreign areas. An effort has been made to ensure that the hydrographic programs supporting the mariner maintain a high profile in the organizations.

DMA/MERCHANT MARINE INTERFACE

For the purpose of this forum, I will take some liberties with the definition of what is the Defense Mapping Agency. Let's not think of DMA as the Defense Mapping Agency with the accent on DEFENSE -- for this symposium I offer a new formulation: DMA -- Duty to Maritime Activities.

This duty is spelled out very clearly in the mission statement of the organization, and more importantly in Title 10 of the United States Code.

The Agency's statutory responsibility as stated in Title 10 U.S.C. is to:

"... improve means of navigating vessels of the Navy and the Merchant Marine by providing . . . accurate and inexpensive nautical charts, sailing directions, books on navigation, and manuals of instruction for the use of all vessels of the United States and of navigators generally."

Also, an agreement resulting from the Inter-Governmental Maritime Consultative Organization (IMCO) 1974 International Conference on Safety of Life at Sea, Chapter 5, Safety of Navigation, Regulation 20: Nautical Publication states that:

"All ships shall carry adequate and up-to-date charts, sailing directions, list of lights, notice to mariners, tide tables, and all other nautical publications necessary for the intended voyage."

This last statement identifies both a DMA and a mariner responsibility. Needless to say, this Agency has no problem in defining its responsibility. The classic question is then, "How is this responsibility handled?"

Primarily, DMA handles its responsibility in three ways: the requirements process, data collection, and distribution of products. For the purpose of this paper, I will address the requirements process and data collection. The distribution of products, which is handled by ODS, would make for an interesting discussion in itself.

REQUIREMENTS PROCESS

The requirements process involves the determination of what products, data, or services are needed by the user. In order for DMA to process requests expeditiously, requirements are divided into three categories:

- Area Requirements
- System Requirements
- Special Requests

For this symposium I will direct the discussion to only the area requirements and the special requests topics.

Area Requirements

Area requirements are categorized (grouped) by specific geographic areas of the world for which a given MC&G product or service is required. The product or service is used for navigation and in support of planning, operations, training, and intelligence objectives by the fleet, merchant marine, and various staffs.

The philosophy for area requirements applies to all DOD components and other government agencies having an area requirement for MC&G products or services to support their assigned planning, training, operational, and intelligence missions and objectives of national security concern.

The submission of area requirements and priorities to DMA forms the basis for developing programs for:

- production
- maintenance/revision
- data collection where needed

Area requirements and priorities should express the total need for a product without consideration as to the availability or adequacy of existing product coverage or the feasibility of producing the required product or service because of source material or resource constraints. On the other hand, requirements objectives should be realistically achievable over a specified time frame. The major nautical products presently included under area requirements are shown in Figure 2.

Of course, our nautical charts are sold over the counter by DMA and by our sales agents everywhere, but how do we identify the areas to be charted by civil sector users?

The submission of merchant marine area requirements is handled by the Maritime Administration (MARAD), specifically the Office of Ship Operations. Heretofore, merchant marine requirements submitted by MARAD have been assigned a uniformly low priority. This can have an impact in the assignment of chart production priorities with competition for finite manpower and funding resources. Basically, this low priority level supports all U.S. statutory responsibilities, except for areas that coincide with those assigned higher priorities to meet military requirements. With the increasing importance placed on shipment of strategic materials to support both military and commercial applications, DMA is investigating the priority determination process. It is anticipated that after this investigation is completed certain key maritime port and harbor requirements will be elevated in the priority scheme. Those merchant marine area requirements that are not normally included in MARAD submissions should be made directly to HQ DMA PR.

Special Requests

Another avenue open to the user for requesting data, products, or services is the procedure for handling special requests. In order for a request to qualify under this category it must meet the following criteria:

- one time MC&G product/service not previously validated
- needed to satisfy an unanticipated requirement which needs a near real time response

Examples of the above are:

- production of a special chart or plotting sheet for a weapon system test or special operation
- one time foreign chart coverage for a rarely visited foreign port
- special overprints such as grids, electronic lattices, etc.
- special studies

If these requests require MC&G support, are within DMA's capability to respond, and there is insufficient lead time for normal program development, then DMA will approve such requests. In the specific case of the non-DOD user, requests for support should be directed to Headquarters, DMA, Program, Production and Operations (HQ DMA PP) rather than to the Production Centers.

DATA COLLECTION/REPORTING

DMA's principal source of hydrographic data (Figure 3) for production of nautical charts and related publications historically has resided with the other maritime nations of the world which have shared our concern for the safety of

navigation. Of these nations, 47 currently belong to the International Hydrographic Organization (IHO), headquartered in Monaco, which exists for the purpose of:

- coordination of activities of national hydrographic offices.
- obtaining greatest possible uniformity in nautical charts.
- adoption of reliable and efficient methods of hydrographic surveys.
- development of the sciences in hydrography and descriptive oceanography.

Additionally, DMA has bilateral exchange agreements with 28 other chart-producing nations. These agreements serve not only to encourage sharing hydrographic information but further, under stated conditions, permit reproduction (with minor modification) of charts published by the other party to the agreement. Although most major maritime nations conduct periodic hydrographic surveys of their coasts, not all coastal states have the resources or inclination to carry out necessary investigations of their navigational waters.

During the 19th Century, European nations which maintained extensive colonial empires surveyed trade routes in support of the slow, relatively shallow draft vessels then engaged in the world's commerce. But today's great bulk carriers having drafts to 90 feet and lengths of over 1000 feet are not uncommon. The surveys of the 1800's were generally not inaccurate but sounding by hand lead line and navigational fixes limited to the range of visibility in coastal waters imposed severe operational constraints. The limited data taken during that period when combined with subsequent man-made and natural coastal processes has resulted in a recognized need for a massive infusion of modern data. Probably less than one-third of the continental shelves of the world have been surveyed in accordance with standards considered appropriate for today's deep draft shipping.

The U.S. Naval Oceanographic Office (NAVOCEANO) in Bay St. Louis, Mississippi, represents the standard survey capability responsive to DMA's needs for data to support its nautical charting program. This capability currently consists of one coastal hydrographic survey ship (two in FY 81 and beyond), four deep ocean survey ships, an aircraft assigned to geophysical surveys, and the shore facilities and operating personnel assigned. This modest force is confronted by an estimated 200 ship years of effort required to satisfy only high priority needs in coastal waters. NAVOCEANO has in recent years augmented its collection effort through the Hydrographic Survey Assistance Program (HYSAP), a cooperative effort with 11 South American and Caribbean area countries in which NAVOCEANO provides technical assistance in developing a host nation capability. Additionally, NAVOCEANO is currently developing a contractor capability.

A constant demand for improvements in the quality, quantity, and display of all forms of navigational information is a natural outgrowth of the increase in the size and speed of seagoing vessels as well as improved and expanded port and harbor facilities.

Although the basic hydrographic data is deficient as discussed above, the quality of navigational information published by the DMA Hydrographic/Topographic Center has constantly improved over the years, as evidenced by the worldwide acceptance of our products. This improvement has resulted primarily through the reports and constructive criticisms of voluntary observers, both naval and merchant marine. Now, more than ever, there is a tremendous need for reporting and data collection. The best information still is that of the person who has "been there," has seen the changes, and can compare these changes to the charts and publications on issue.

The basic document that addresses the data collection/reporting subject is the "Guide to Marine Observing and Reporting," better known as Pub. 606 (Figure 4). This publication is published by HTC with input from the U.S. Naval Oceanographic Office, U.S. Coast Guard, and the National Oceanic and Atmospheric Administration. Publication 606 addresses the reporting procedures for various types of information including:

- dangers to navigation (ice, wrecks, mines)*
- magnetic disturbances
- earthquakes, volcanic activity, and false shoals
- sonic soundings*
- current reports
- port installations
- port regulations
- aids to navigation*
- electronic navigation
- coast and approaches
- photographs
- radarscope photography
- route reports

Information from all sources is evaluated and used in the production, and maintenance of DMA charts and publications. This information reported is generally reviewed by Marine Information Specialists in the Navigation

*Most important

Department, many of whom are former merchant marine officers. Other personnel within the Center who review this information are assigned to the Plans and Requirements Directorate, and the Scientific Data Department. One major point that I want to emphasize is that all reports are examined regardless of their importance, content, or method of presentation. A common erroneous belief is that an observer feels that his or her report is of no consequence, since this Center already receives the most up-to-date and accurate information available from other sources. Contrary to this belief, the most recent information, and generally the more reliable and valuable is a result of direct observations by the mariner. A very important point to remember is that the report should include the greatest detail possible and be as accurate and prompt as possible. For specific reporting formats I refer you to the appropriate chapter in Pub. 606 and to Chart 5503 fold in.

Still another interface between DMA and the merchant mariner, on more of a personal note, involves the HTC representatives located in New York and New Orleans. Most of you here are probably familiar with these gentlemen, Mr. R. Higgins and Mr. E. Pace. A great deal of information gathered by these gentlemen follows a prescribed path into DMA products. Through their efforts the service and support of DMA are being made known to an ever increasing clientele. Most notable are their recent efforts concerning the interface between DMA and the major oil companies.

Another idea that is currently being considered is that of a DMA/maritime users conference to be held periodically, possibly annually, at HTC in Washington, D.C. The format of the conference would include a general briefing on DMA, including a tour of the facility, and meetings to discuss agenda items offered by the users and DMA.

AUTOMATED DEVELOPMENTS

Now that the interface for input has been established, the next item of discussion addresses ways that DMA is attempting to provide the most up-to-date and useful product. In order that this Center provide the service and support to maritime users without degrading the product, automation has become a necessity. Mini-computers, such as those that have found their way onto many of your vessels, are being put to good use at DMA for special purpose applications. Some applications that directly concern the merchant mariner and will have a tremendous impact on product accuracy and usability are LANDSAT, HALS, Active Passive System, Prototype chart, and Notice to Mariners System.

LANDSAT

Current and proposed advances in navigation technology and the remote sensing of oceanic parameters will require nautical charts more accurate or at least more complete than many of the charts that are in use today. Foreseeing

this, the Defense Mapping Agency has been investigating a new charting tool that may provide a partial solution to the inaccessibility of certain coastal and island areas, and the lack of adequate hydrographic survey resources. This new tool is the LANDSAT System (Figure 5).

The goal of the DMA LANDSAT program is to use LANDSAT multispectral scanner (MSS) data for hazard detection, chart improvement, and also as a tool for hydrographic survey planning. The MSS green band data can be used to probe clear oceanic waters to those depths required for safe navigation by most ships (10-30 meters). This is of prime importance when one is navigating in areas where safe routes have not been firmly established. The use of very deep draft surface ships has necessitated a reassessment of routes previously considered safe. Conventional passages such as the Strait of Malacca are too shallow for the new deep draft vessels. Consequently, they must seek out longer, less well surveyed, but deeper routes to their destinations.

The preparation of navigation charts depicting shoal areas or other navigation hazards, derived from LANDSAT data, involves answering several important questions. These questions concern the accuracy of the position of the LANDSAT derived hazard, and the sureness that a feature identified on a LANDSAT scene is a real feature, not an illusion caused by Sun angle, cloud patch, surface water effect, etc. With procedures both developed by DMA and adopted from other organizations, the answers to these questions are being found.

The prime example of using LANDSAT data to locate navigation hazards and subsequently update a nautical chart occurred in the Chagos Archipelago in the Indian Ocean. Film imagery revealed an uncharted reef (9 meters least depth) 8 kilometers long as well as a number of features not accurately portrayed on the existing chart of the area (U.S. Chart No. 61610, Second Edition, February 21, 1976, 1:363230). Film images at 1:1,000,000 scale were obtained for the Chagos scenes and the chart of the area was reduced to the same scale in order to compare features.

When the imaged features were registered to the charted island features, significant variations were apparent (Figure 6). A major reef or bank was present where the chart showed safe, deep water and other banks appeared to be out of position by as much as 15 kilometers relative to the nearest land. Radio warnings were issued and the information was included in Notice to Mariners, prior to work being completed on the third edition of chart 61610 in August 1976 (Figure 7).

The very fact that a shoal or reef appears on the images indicated that it presents a navigation hazard. In addition to this depth capability, the LANDSAT imagery also provides a useful tool that can be used to improve horizontal positioning of remote islands and reefs on nautical charts. Although its limited resolution cannot identify small navigational hazards, in many areas it can provide data that are, in some cases, orders of magnitude better than the existing surveys. Even though 4 years of research and development have passed since the issue of the Chagos Chart, further development is still necessary before satisfactory algorithms

can be developed that will permit operational depth range analysis of the MSS digital data. Since 1978 DMA has been involved with the development of a test range in the Bahamas area for sensor testing and calibration. A detailed three-dimensional knowledge of the water column and sub-surface bottom features is being developed. Still the importance of LANDSAT development to DMA and the mariner can be emphasized by the ever increasing cost related to hydrographic surveying, and the lack of adequate hydrographic data worldwide.

HALS

This system, known as the Hydrographic Airborne Laser Sounder (HALS), is being developed by the Naval Ocean Research and Development Activity (NORDA). The system will be capable of surveying 100 times faster than presently used launch-borne sonar (Figure 8).

While incorporating a pulsed laser to scan and profile ocean water depths to 165 feet, the system will have the capability to cover 7-10 square nautical miles an hour from a helicopter, depending on the area charted. The airborne laser systems work by sending out a pulse of laser light that is reflected from both the ocean surface and then the bottom. Depth is determined from the elapsed time between return of the two signals, with corrections for wave height. Depth accuracy is expected to be within a foot in waters less than 65 feet deep and within 3 1/2 feet at greater depths. Onshore positioning stations, and later GPS, will be used to determine aircraft position.

Active/Passive System for Hydrographic Surveying

The Active/Passive system is a hybrid device incorporating the scanning laser depth determination capabilities of a system like HALS, and the multi-spectral recording techniques of a collection system like LANDSAT.

Operationally the system will be deployed in a fixed wing aircraft which will make two passes over the area to be surveyed. The first pass will be a relatively low level (2000 feet) employing the laser to collect the depths along certain flight paths. This information will then be used to calibrate the sensor response derived from the second pass at a higher level (10,000 feet). The sensor data will be passed through a computer algorithm to derive the depth associated with a given spectral signature at a specific location.

This system has the advantage of being able to collect large amounts of data very rapidly, and also provide an analog product which can be used to position and orient the hydrographic features such as offshore islands and reefs which are in the area. The system is currently in the Engineering Development stage with simulations being performed to determine on board processing characteristics of the data.

Prototype Chart

Because these laser techniques will have derived the depth at many positions, the traditional portrayal of the bottom through the use of soundings may or may not be continued in all areas. These systems will, in many cases, be more productive when a new method of portraying the hydrographic information is used. Studies, within DMA, are currently underway to evaluate computer-derived depth bands which will define, through color coding, or symbology, the depth in certain bands throughout the chart area. The main feature of the prototype chart would be depiction of bathymetry in 3-meter deep zones (0-3, 3-6, 6-9, etc.) to a depth of approximately 21 meters. Selected soundings representing "general truth" would also be shown at about the same density as is shown on deep ocean bathymetric charts. It is believed that this depth range presentation would only be used in areas where it would provide the best we can do, and if it will be more useful than what is currently available (i.e., individual depths).

Automated Notice to Mariners

The Automated Notice to Mariners System (ANMS) is a new automated system for the computerized typesetting of the weekly Notice and Summary of Corrections publications (Figure 9). In addition to supporting this computerized publication requirement, the data base has many other uses and benefits. One such benefit, via modern communications equipment, will allow a user to query the data base from anywhere in the world on a 24-hour basis.

The data base of corrections is also a major source of maintenance information for nautical charts. Provision has been made in the chart correction software to assign and total correction points which are based upon the relative difficulty that each individual chart correction represents. These data can be used to indicate the need for chart revisions and other management considerations.

Though the ANMS has a distinct benefit for nautical cartography, the major use of the system will be to support the mariner. As the size and speeds of ships have increased, conversely the size of the crews and time that can be devoted to the important task of correcting charts and publications aboard ship have decreased. Recognizing this turn of events, some charting agencies provide supplemental material with their Notice to Mariners to alleviate the chart correction task for the navigator. Such additional material is helpful, but it increases the production workload. Consequently, DMA's approach to the problem was to restructure the Notice in such a way to provide shipboard users with corrective information in a more usable format. This computer-compatible format was developed to take advantage of automated data processing procedures and modern printing techniques, and resulted in the automation of many of the repetitive, manual data handling procedures.

As a benefit to mariners in general, once the data base is established, the ANMS is equipped with query programs. These programs output navigation information in a variety of formats, which will provide the remote user with a rapid chart correction capability. In order to optimize use of long-distance communications, chart corrections may be ascertained from the last printed Notice

available on board the ship and query to the data base for later corrections. If several Notices are missing, the navigator can query corrections between specific Notice numbers or the data base may be queried for all the effective Notices pertaining to a chart(s). User instructions will be published by DMAHTC to enable maritime users to make the most effective use of expensive communications time.

New commercial global communication systems such as MARISAT can provide instant links to the DMAHTC data base from anywhere in the world. At present, this link would require the user to have a small inexpensive data terminal with acoustic coupler attached. There are four commercial data lines installed at DMAHTC. The user would dial in over one of these voice grade, 300 baud lines, and use one of seven public options to query the DMAHTC data base available. At sea users would at this time use one of the voice grade channels of the MARISAT system (Figure 10). The "land line" communications link is the less expensive alternative. This could be used from any port in the world and allow the ship's navigator to correct charts (Figure 11). Further, it would be of great use to cover unplanned changes to his schedule or to ascertain the very latest navigation information. It is too early at this point to predict the number of "at-sea" and remote "in-port" users of this system. It is a new and revolutionary capability and factors such as reduction of insurance rates and burden of proof in marine accidents could greatly affect its usage.

The ANMS data base and use of modern communication equipment makes chart correction information available to potential users on a near real-time basis. The mariner at sea is the largest potential beneficiary of this capability; but, the data base offers nautical cartographers everywhere a valuable data resource. It is expected that use of the remote query capability will improve the safety of navigation in all of its various phases.

CONCLUSION

National and international concern is being expressed over the growing need to provide navigation and hydrographic information as quickly and accurately as possible. DMA also has identified this concern, and through such programs as LANDSAT and ANMS is hoping to alleviate the problem. With the rapid technological changes in the fields of communications, data processing, and cartography, DMA will continue to search out and apply those processes that will enable the Agency to provide the best available information. But no matter how sophisticated the equipment, it is imperative for contributors to provide data that meets standards such as prescribed in Pub 606; otherwise, our technology results only in speed without improvement in accuracy or completeness. So keep all those cards and letters coming. They are received, read, and incorporated in the products and data bases that you use, and greatly appreciated. With your support we at DMA can truly meet the needs of the maritime community and maintain our "Duty to Maritime Activities."

HYDROGRAPHIC/TOPOGRAPHIC CENTER

MISSION

- **PROVIDE**
- **HYDROGRAPHIC, TOPOGRAPHIC
NAVIGATIONAL AND
GEODETIC DATA**
- **MAPS**
- **CHARTS**
- **RELATED PRODUCTS
AND SERVICES**
- **TO**
- **ARMED FORCES**
- **FEDERAL AGENCIES**
- **MERCHANT MARINE**
- **MARINERS IN GENERAL**

HYDROGRAPHIC AREA REQUIREMENTS

- ★ HARBOR AND APPROACH CHARTS
- ★ COASTAL CHARTS
- ★ COMBAT CHARTS/AMPHIBIOUS ASSAULT CHARTS
- ★ NAVAL WARFARE PLANNING CHARTS
- ★ MAD OPERATIONAL EFFECTIVENESS (MOE) CHARTS
- ★ BOTTOM CONTOUR CHARTS
- ★ LORAN C PLOTTING CHARTS
- ★ OMEGA PLOTTING CHARTS
- ★ MISCELLANEOUS NAUTICAL CHARTS & RELATED PRODUCTS

HYDROGRAPHIC DATA SOURCES

U. S. WATERS:

- NATIONAL OCEAN SURVEY

FOREIGN WATERS:

- FOREIGN HYDROGRAPHIC SURVEY ORGANIZATIONS
- U. S. NAVAL OCEANOGRAPHIC OFFICE
- FLEET HYDROGRAPHIC DATA COLLECTION
- LANDSAT

PUB. 606

GUIDE TO MARINE OBSERVING AND REPORTING

THIS PUBLICATION IS PREPARED BY:

The U.S. Naval Oceanographic Office

The United States Coast Guard

National Oceanic and Atmospheric Administration

The Defense Mapping Agency, Hydrographic Center



FEBRUARY 1977

Figure 4



LANDSAT:

HYDROGRAPHIC REMOTE SENSING

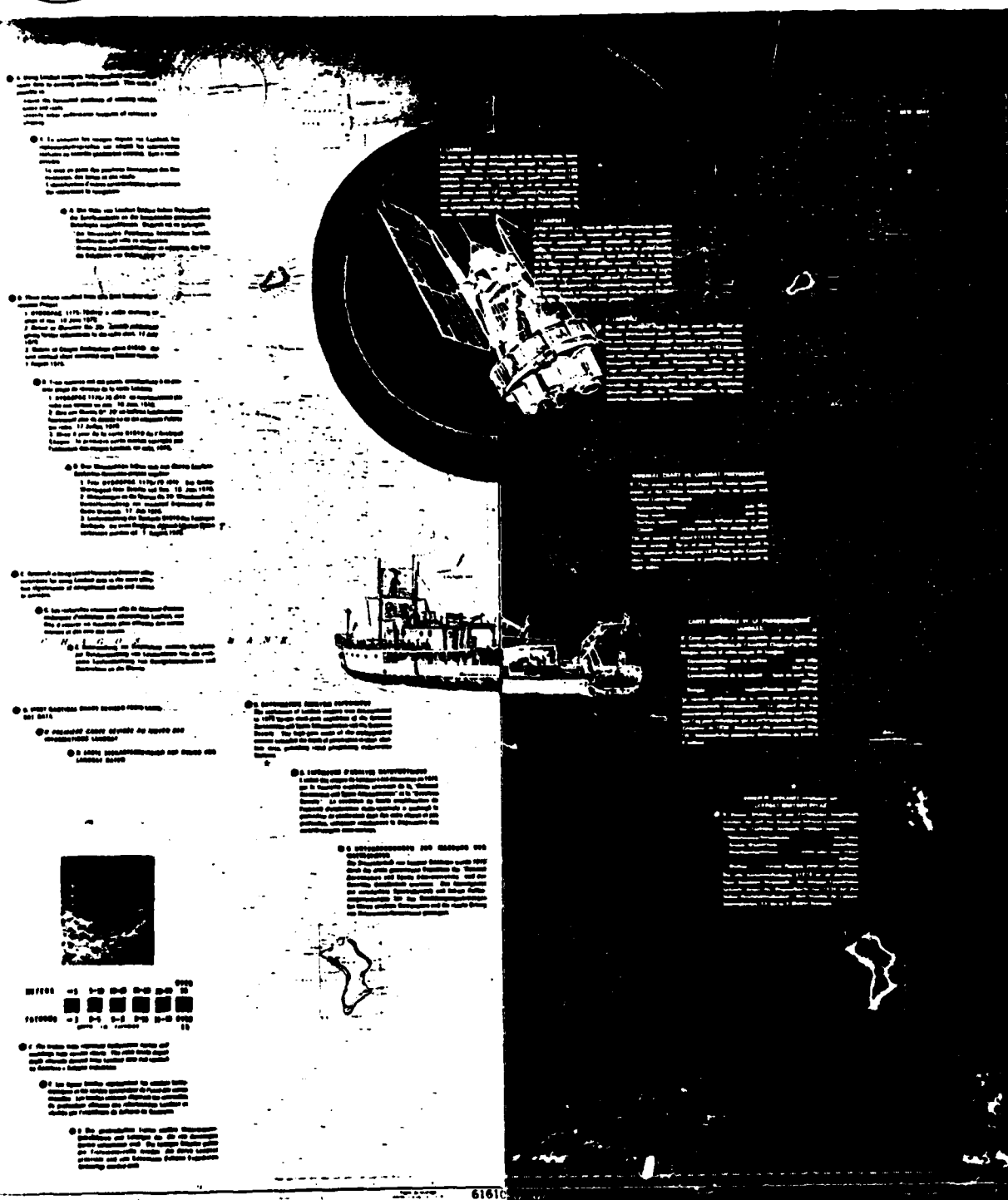


Figure 5



Figure 6

NAVAL MESSAGE		ORIGINATOR'S NAME		PAGE		PAGES	
RELEASED BY		FOR		PHONE EXT NR		OF	
3159		181809Z JUN 76		31166		42	
3160		DATE		CHECKED BY		ROUTINE	
		18 JUNE 1976		142			
		MESSAGE NR		ROUTED BY			
		DATE/TIME GROUP		R H LUTHEAD			
				IMMEDIATE			
				FLASH			
				PRECEDENCE			
				ACTION			
				INFO			

FM DMJHC WASHINGTON DC

TO AIG 9280

MIDEASTFOR-RHCFMCK

UNCLAS

HYDROPAC 1175 176(61). INDIAN OCEAN, CHAGOS ARCHIPELAGO.

CHART 61610.

1. DANGEROUS SHOAL EXTENDS BETWEEN 04-51S 04-56S AND 72-36E 72-38E.
2. GANGES BANK IS LOCATED 8 MILES WESTWARD OF CHARTED POSITION 07-22S 71-06E.
3. PITT BANK 07-00S 71-14E EXTENDS 4 MILES FURTHER NORTHWESTWARD AND 6 MILES FURTHER SOUTHEASTWARD THAN CHARTED.

Radio message to mariners warning of hazards revealed by Landsat.

Figure 7

HELICOPTER AIRBORNE LASER SOUNDER

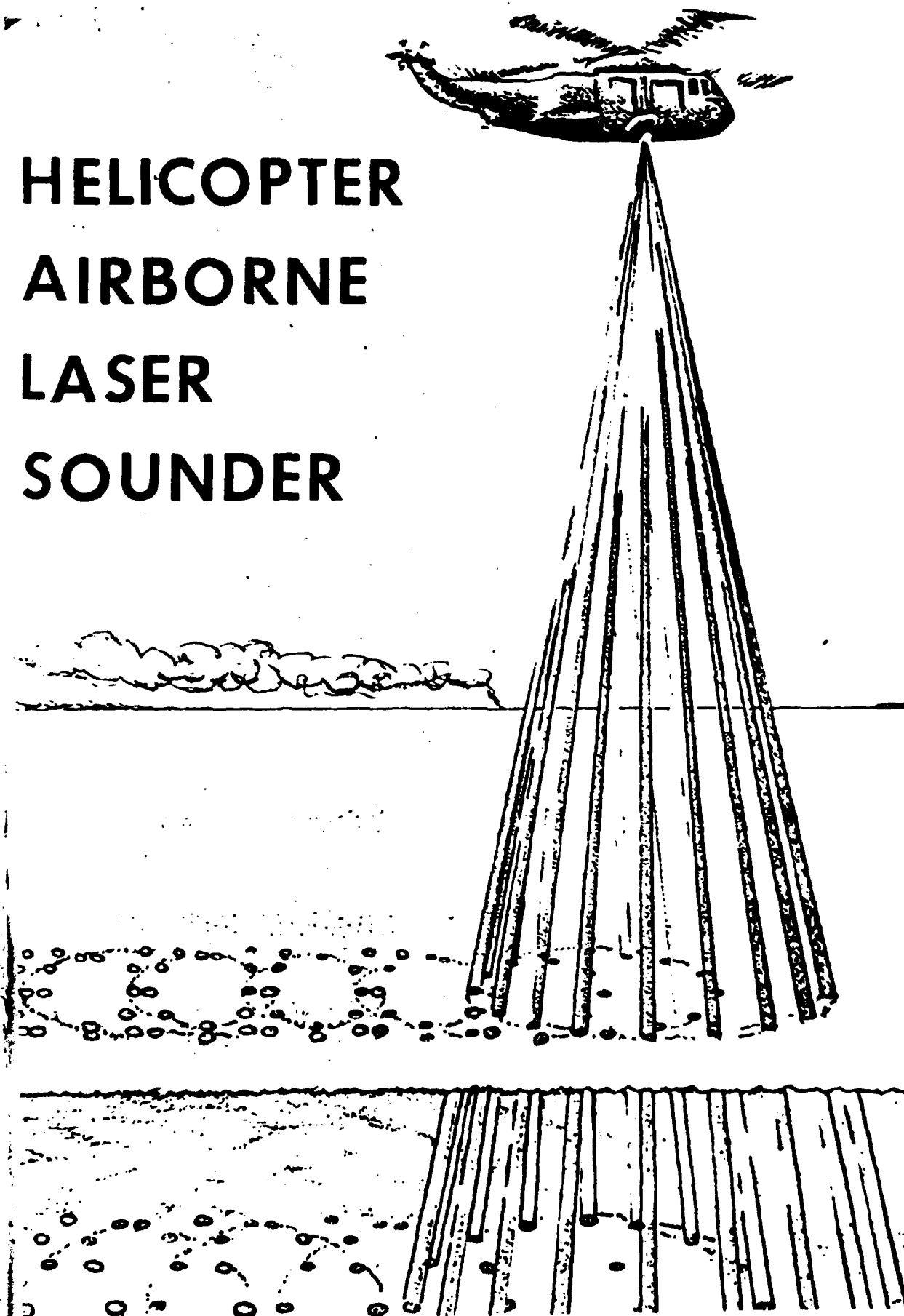


Figure 8

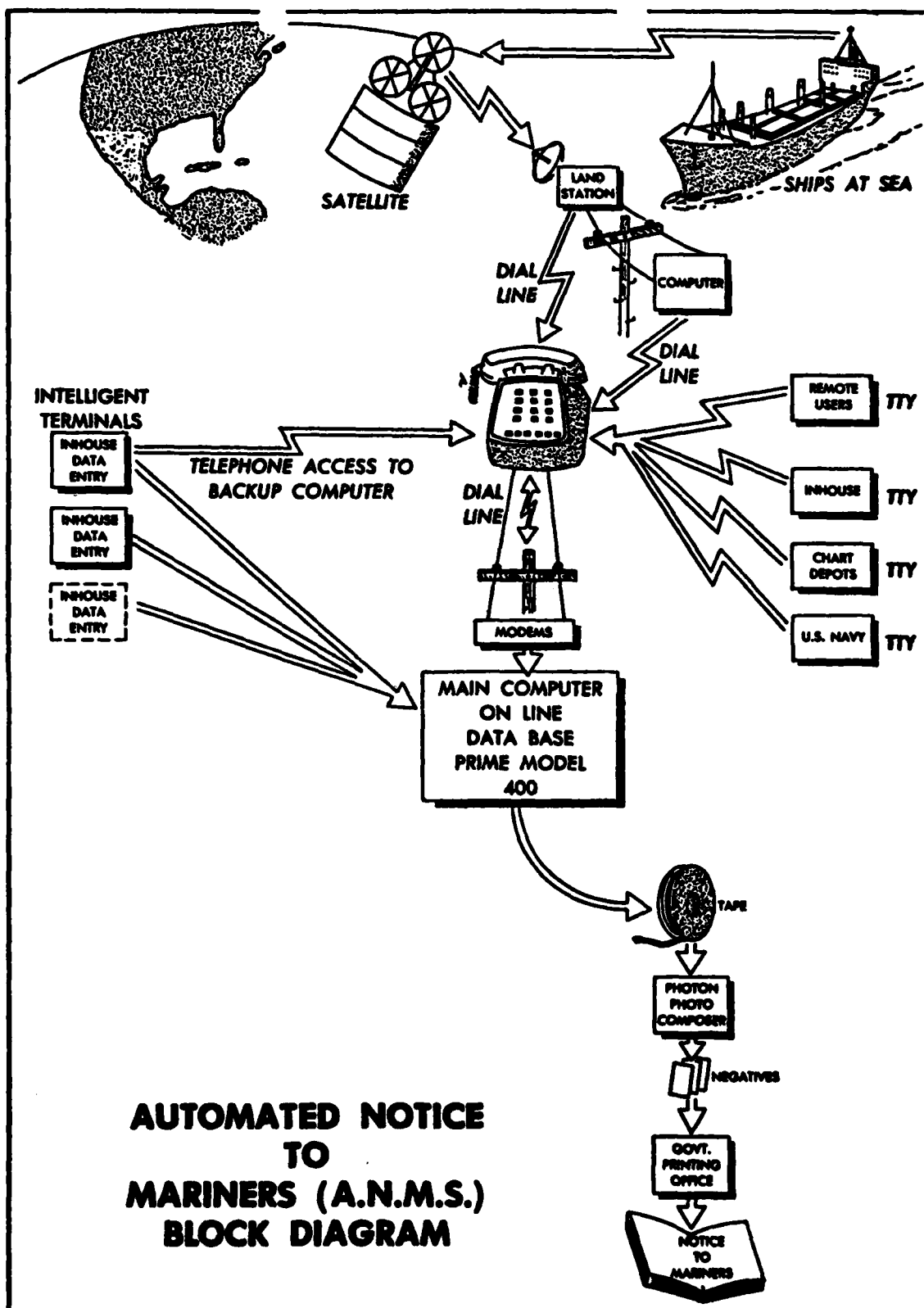


Figure 9

THE MARISAT SYSTEM

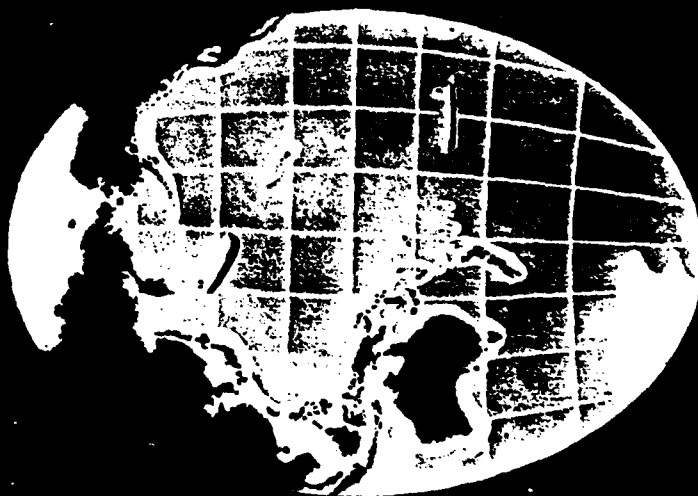
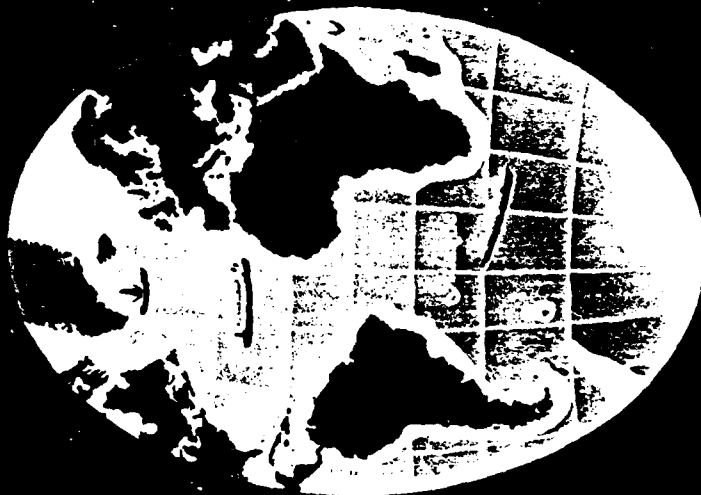
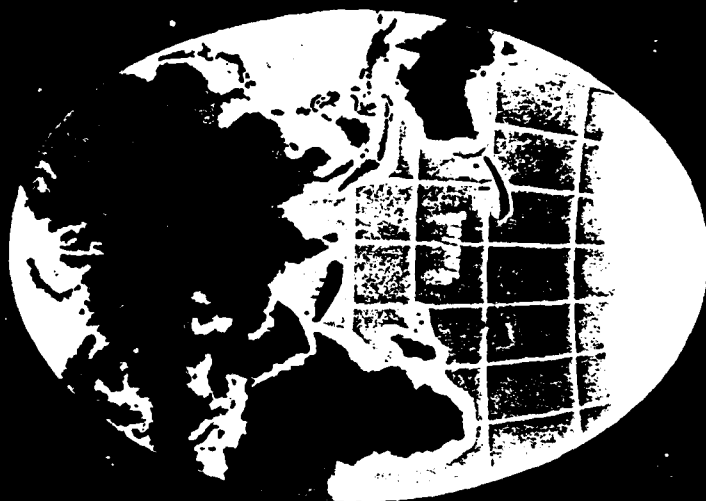


Figure 10

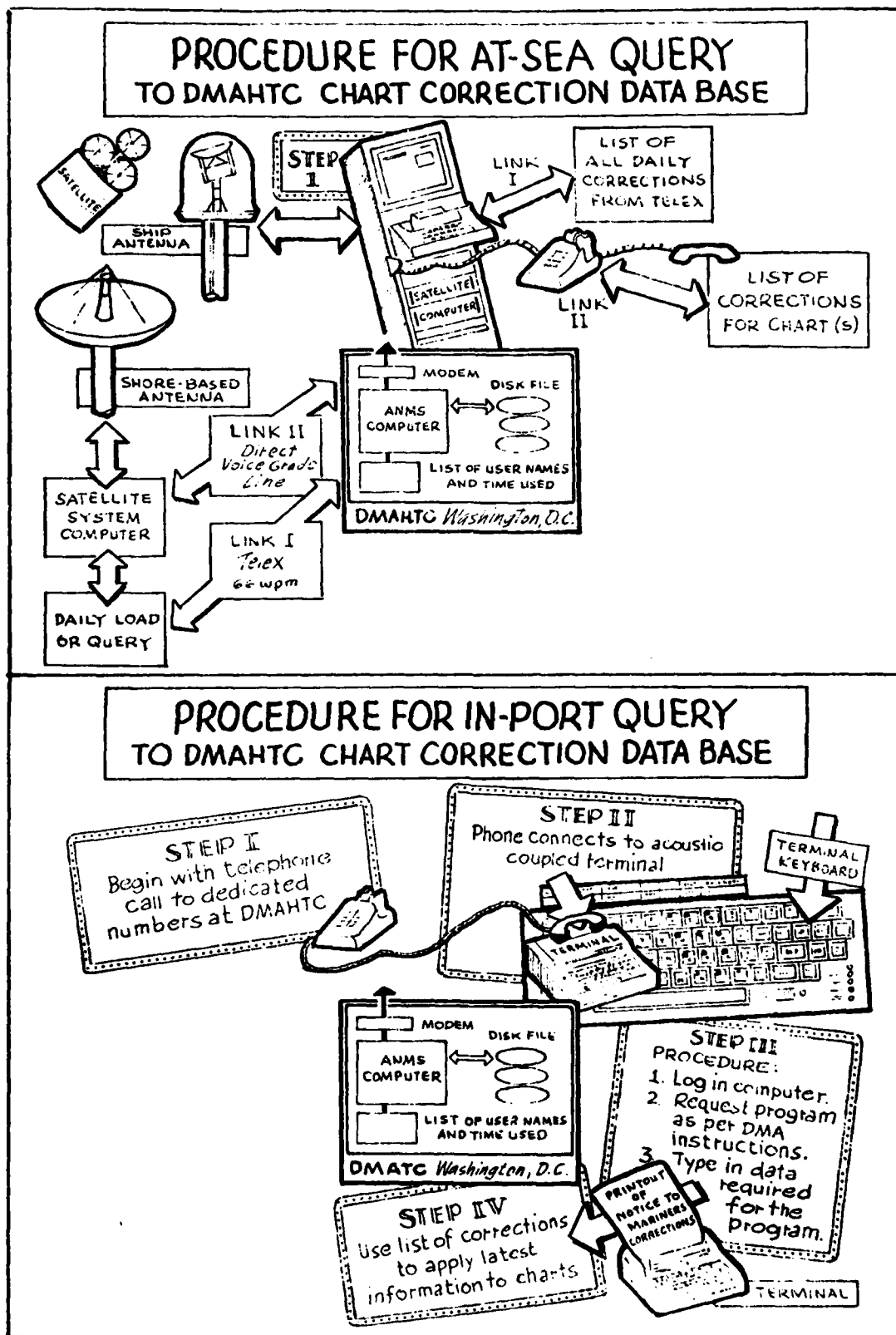


Figure 11