

MARINE SAFETY INFORMATION

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Before describing the development of Marine Safety Information Broadcasts and the specialised receivers which have been designed to maximise their effectiveness, the existing, so called 'traditional', means of passing essential information to ships, and the reasons which underlie the drive to find more effective and efficient systems will be briefly reviewed.

In essence, the existing requirements are defined in the Safety of Life at Sea Convention, chapters 4 and 5. These cover the responsibilities of nations to broadcast messages relating to marine hazards, the obligation placed upon Masters to report such hazards, and to receive messages broadcast about them.

Three separate kinds of information are dealt with in the SOLAS Convention. Firstly, meteorological services: these are the business of the World Meteorological Organization which seeks to co-ordinate the work of various national meteorological administrations. Unfortunately, a multitude of overlapping services and areas have grown up out of an expanding practical requirement and capability. This has resulted in overlap of services provided and consequent multiplication of effort.

Next, SOLAS deals with search and rescue information. A co-ordinated effort is clearly necessary to achieve an effective result — particularly in offshore waters. In this case each nation provides only those services which it deems appropriate and which it can afford. There is virtually no standardization of equipment, but methods have been partly standardized through the International Maritime Organization.

Finally, SOLAS addresses the problem of general hazards to navigation. These are handled by the World Wide Navigational Warning Service (WWNWS), which has been one of the major successes of IHO and IMO. The operating agreement and procedures for this service are contained in IMO Resolution A419(XI) which lays down how the efforts of maritime States are to be co-ordinated to produce a global standard product.

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These, then, are the three basic kinds of information which a mariner requires in order to conduct a safe passage at sea. They have all been made possible by the use of radio at sea, and all are, to a greater or lesser degree, dependent upon the availability of marine radio services. Together they form the total information package which has come to be known as 'Marine Safety Information', and which is regarded as an essential support for the safety of life at sea in the future.

THE WWNWS

The component of Marine Safety Information which is of particular concern to most of us is the provision of navigational hazard warnings through the World Wide Navigational Warning Service. This represents the IHO response to the growth of marine radio. It establishes a hierarchy of three types of warning, related to three types of source, and matched to suitable long, medium and short range communications facilities.

First of these are Navarea warnings, the long range warnings. They include information which generally concerns routing and passage through the main offshore shipping lanes. One lead Hydrographic Office edits the series of warnings in each area as a service to all mariners throughout the area.

The second level of warnings, and perhaps the most prolific, are coastal warnings. These are usually the most important warnings, and have traditionally been broadcast using voice communications, both MF and VHF. These warnings give short term notice of generally transient hazards, such as lights temporarily unlit, of interest only in the vicinity of the transmitter.

The final, lower level of radio warning is the local warning. It may be issued by Port Authorities and sometimes by local coastguards for broadcast usually on VHF voice only.

The navigational warning has been the first of three basic information categories to achieve a real degree of international co-ordination and standardization.

The universal structure of the WWNWS has therefore been used as the framework for the design and development of a new range of radio equipment dedicated to the efficient broadcast and reception of Marine Safety Information.

THE CONCEPT

In 1979 the International Maritime Organization resolved to establish a new, co-ordinated maritime distress and safety service. It was intended that this would make use of the latest developments in marine communications whilst at the same time reflecting a greater level of international co-operation and co-ordination between maritime nations of the world.

Clearly the central theme of this Future Global Maritime Distress and Safety Service was the setting up of the world-wide search and rescue plan, and establishing the communications networks to support that plan. However, whilst it is vital to be able to save lives in a distress situation, it is even more important to prevent mariners needing to use these search and rescue services.

It was for this reason that Member States co-operated within the IHO and the WMO, under the umbrella of IMO, to develop new communications systems which are designed to deliver safety-related information to the mariner in a clear, efficient and cost-effective way. The United Kingdom has played, and is continuing to play, a prominent role in that development process. To this end IMO have decided that, beginning in 1991, an increasing number, and eventually all ships over 300 tons, shall be required to 'be capable of automatically receiving scheduled and unscheduled broadcasts from the shore of navigational and meteorological warnings and urgent information by direct printing' — which sounds admirable and simple.

However, as always there is a catch. In this instance, it lies in the two words 'automatically' and 'unscheduled', and it was some time before the difficulties of meeting these requirements were fully understood.

First it will be described how Navtex has been developed to fulfil these requirements in coastal waters. That will provide the context for examining not only the demands which this system places on the traditional radio navigational warning services, but also the growing concept of marine safety information and the work which is currently in hand to develop a satellite broadcast system for all navigable waters of the world.

The concept of Navtex is of a total co-ordinated system which culminates on board ship in a simple, cheap, automated receiver, mounted on the bridge. The system provides shipping with the latest urgent information on navigation, weather warnings and distress alerts. In short, the classes of information which a Master is required to receive by the Safety of Life at Sea Convention 1974 (see Fig. 1).

Figure 1 illustrates the complete system. It shows the three principal types of information provided by the service and the way in which they are forwarded through a co-ordinating and editing network before broadcast. It also shows the functions which are performed at the receiving equipment, partly by operator selection and partly within the electronics of the receiver.

The purpose of all these receiver functions is to reject information which is not relevant to the ship in which that particular receiver is carried. The diagram shows that the operator is able to instruct the receiver to ignore information which does not pertain to the ship's area of operations, or, for example, messages relating to a type of Navaid which the ship does not carry. Within the constraints imposed by those instructions, the receiver will also reject messages which are garbled beyond the point of readability and any messages which it has already printed out within the previous 72 hours.

To see why these operations are necessary we must look back at the functional requirements established in IMO. The need to 'automatically' receive information, including 'unscheduled' broadcasts, means in effect that the equipment

NAVTEX IN ACTION

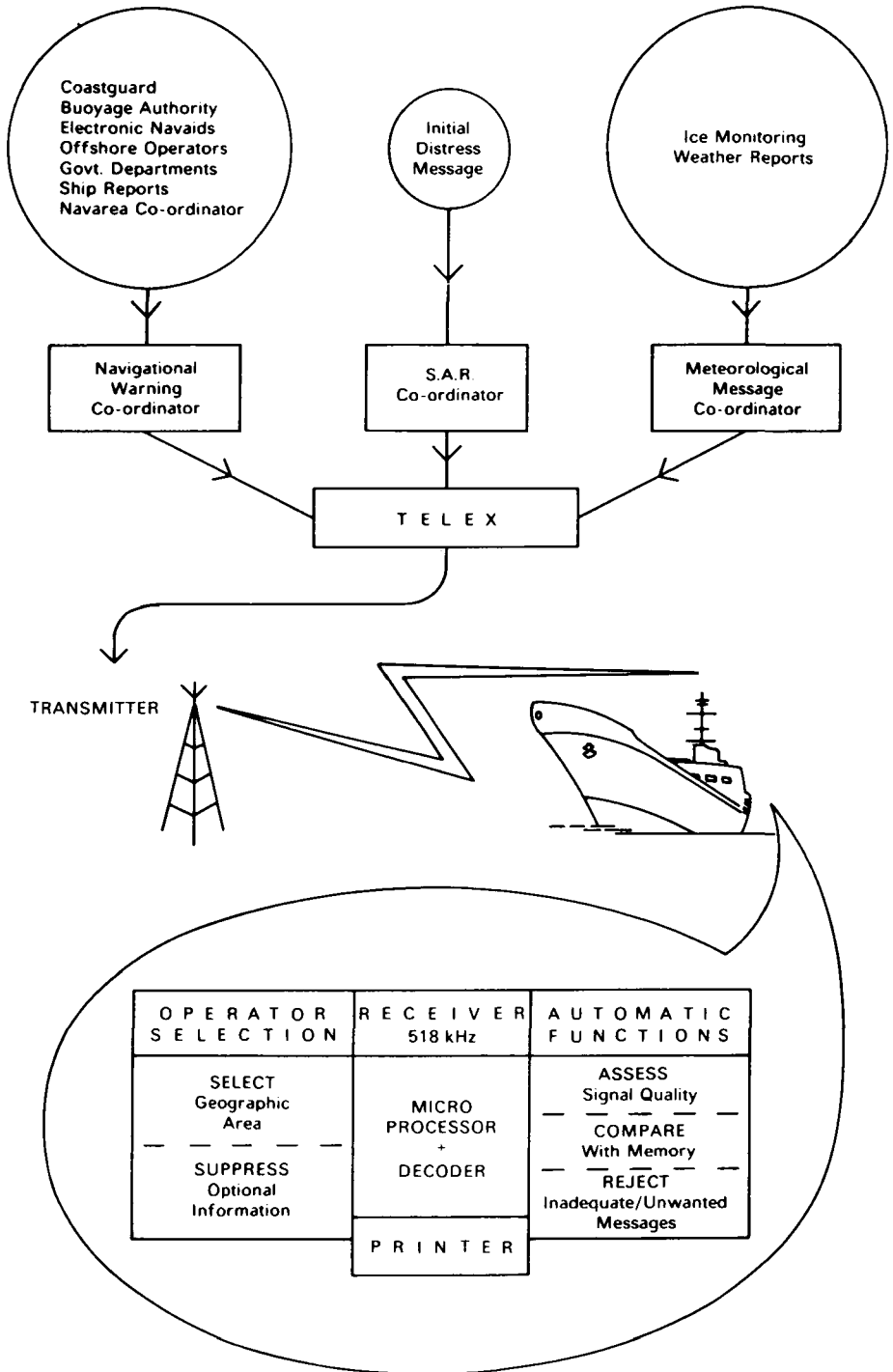


FIG. 1. — Navtex in action.

must be able to receive messages 24 hours a day.

That implies it must either scan a number of frequencies, or continuously watch a single frequency. In practice the first of these options is only possible with radio operator intervention, which is not an 'automatic' function, or by using a very complex and expensive scanning receiver. For these, and other reasons, the time-shared single frequency option has been preferred, and the 518 kilohertz frequency is used.

To meet IMO requirements, Navtex must also be a truly world-wide service, and therefore the content, timing and power of transmissions on this single frequency must be rigidly controlled in order to avoid interference and redundancy.

Clearly, no mariner would be interested in receiving printed messages on a range of subjects referring to areas hundreds, perhaps thousands of miles away from his trading route, and so the receiver must also provide the automatic message rejection facilities which we have seen.

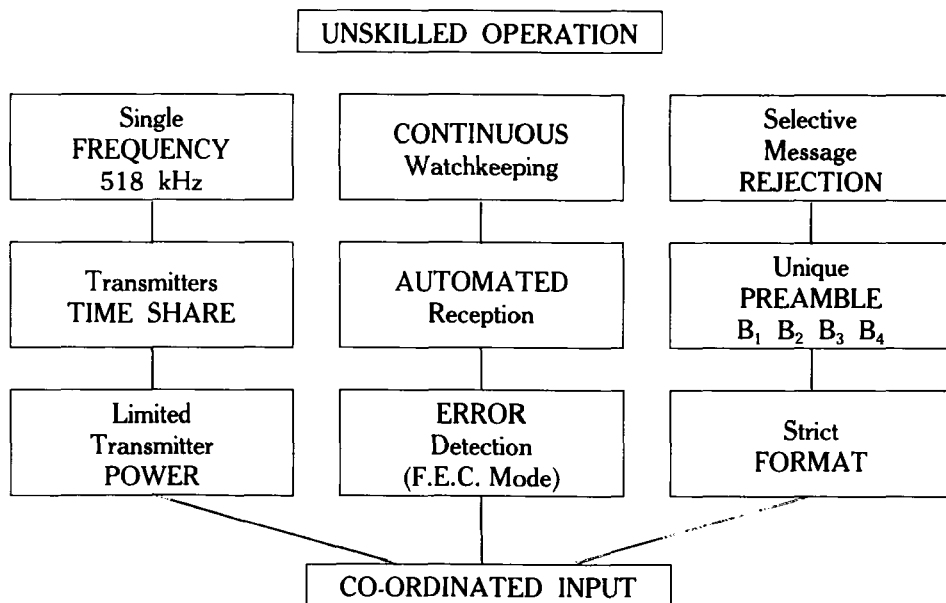


FIG. 2. — The essential features of Navtex.

Figure 2 shows the critical features which enable the Navtex service to operate in this automated way. By following the diagram through, the logic behind the system and some of the critical areas of organization can be seen. The need for continuous, unskilled watchkeeping establishes the requirement for single frequency operation; therefore, the transmitters must time-share and it follows the transmitter power must be limited, so that the same time slot can be re-used elsewhere in the world.

Similarly, the need for continuous watchkeeping means that reception must

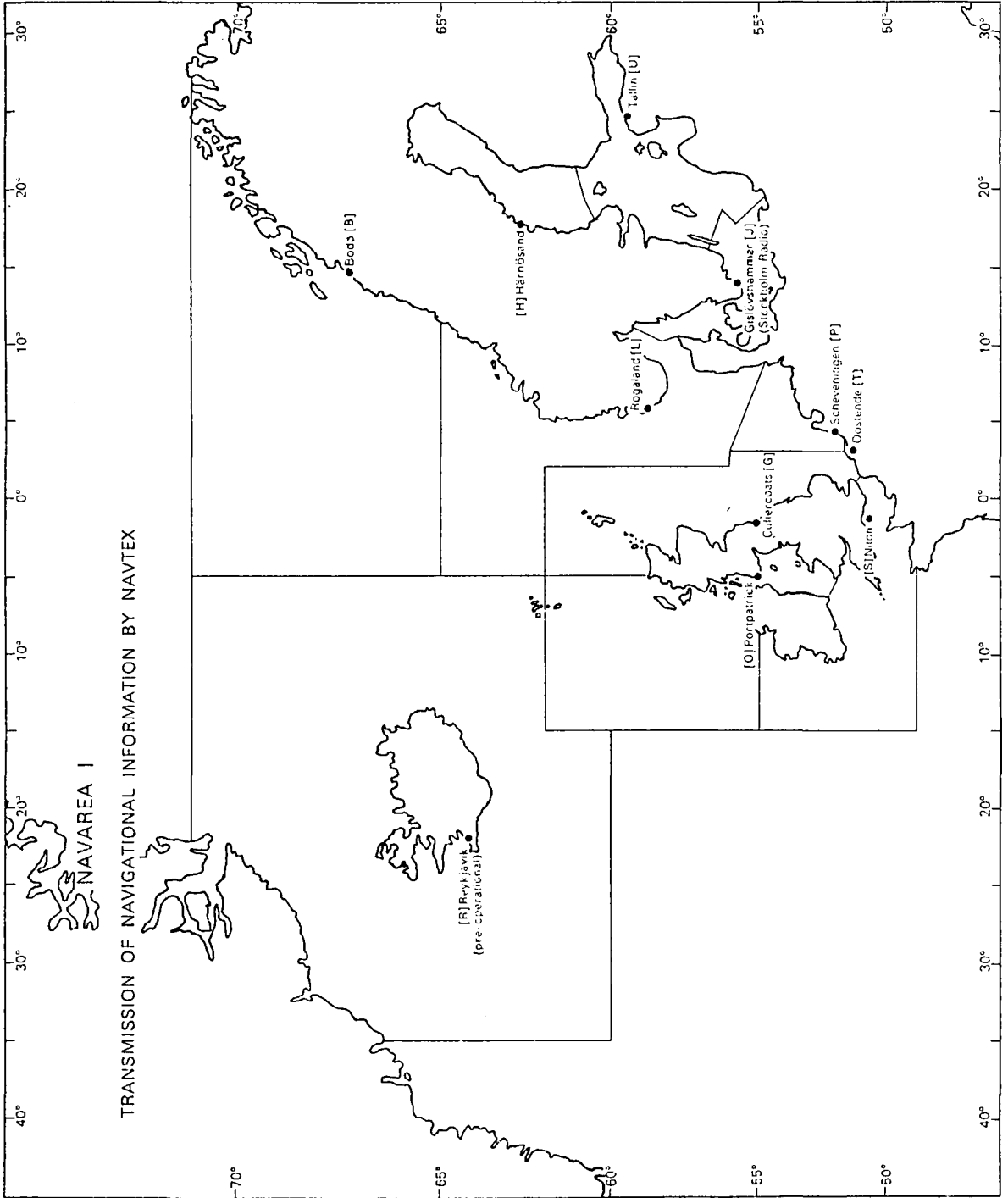


FIG. 3. NAVTEX in NAVAREA I

be automated, and therefore some form of signal quality control is essential to avoid printing out rubbish. The final column shows how the selective message rejection is achieved. Each message has a unique four-character preamble, consisting of two letters followed by two numbers.

The first letter, B_1 , is specific to the transmitter from which the message is being broadcast. By nominating a definite area of operations to each transmitter, this letter can be used to reject messages from areas remote from the ship's operational sphere. The second letter B_2 , identifies the subject of the message. For instance, 'A' is Navigational Warnings, 'B' is Meteorological Warnings and so on. The receiver can be programmed to reject all messages with a particular ' B_2 ' character. This could, for example, be used to reject all messages relating to the Omega system in a ship not fitted with that Navaid. The two numbers ' B_3, B_4 ' are consecutive numbers in each subject series from a given transmitter, and are used to reject repeat broadcasts of messages already printed out.

Figure 3 shows the practical application of the theory that has been discussed. It is the Navtex service provided in North West Europe, where the system was developed and where the service first became operational in July 1983. It shows the region divided into discrete Navtex Areas, with one transmitter serving each area, identified by its own ' B_1 ' character. The types of information broadcast, the ' B_2 ' characters, are standardized throughout the world, and time is shared between users of the frequency according to an internationally agreed schedule.

The strict requirements of the microprocessor controlled receiver, and the need to avoid unnecessary duplication of information have meant that hydrographers and others have had to adopt a new, disciplined approach to the exchange of information and the drafting of messages. Obtaining international agreement to these processes has been one of the most taxing aspects of setting up the new service. In this regard, it is interesting to record the principal events in the development of Navtex, leading to an established service in North West Europe and universal adoption within IMO.

Milestones in the Development of Navtex

- 1977 First trials at Gothenburg Radio.
- 1978 Draft technical specifications developed.
Trial service established in the Baltic and North Sea.
International Maritime Organization takes an interest.
- 1979 Baltic and North Sea nations meet to co-ordinate the trial service.
Reports from sea are favourable and more stations join the trials.
- 1980 Evaluation continues.
Gothenburg Radio withdrawn as co-ordinated service develops.
- 1981 North Sea Hydrographic Commission supports Navtex.
International Hydrographic Organization supports Navtex.
Baltic and North Sea services declared 'pre-operational'.

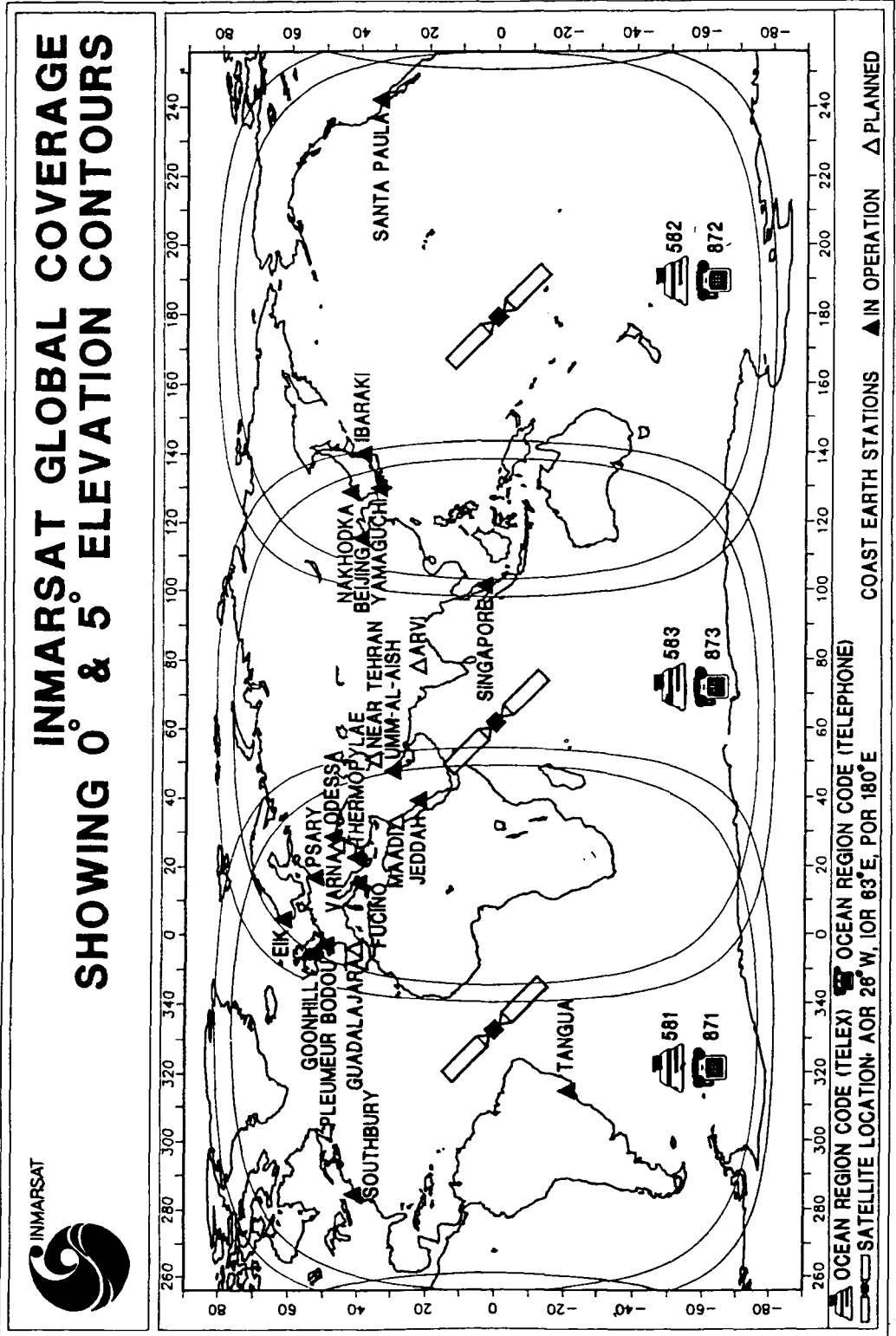


FIG. 4. — Inmarsat global coverage.

- 1982 International Maritime Organization establishes a Co-ordinating Panel for Navtex.
- 1983 World Administrative Radio Conference allocates 518 kHz for the International Navtex Service.
Baltic and North Sea Navtex Services declared operational.
Other nations take an interest.
- 1984 Navtex receivers shown at the London Boat Show.
Trial transmissions take place in many parts of the world.
Full services established in the English Channel and West coast of UK.
Draft 'Navtex Manual' circulated.
Mediterranean and Black Sea nations support Navtex.
- 1985 IMO adopts Navtex as a basic element of the Future Global Maritime Distress and Safety Service and the World Wide Navigational Warning Service.
Trial transmissions from Spain and in the Mediterranean.
- 1986 IMO establishes a mandatory carriage requirement for Navtex in all vessels over 300 GRT — to take effect 1 August 1991.

Navtex has an artificially imposed service range limitation of about 250 miles. This has been done to aid the organization of time-sharing. Even so, it would be recalled that only three transmitters are needed to cover the entire coast of UK compared with the large number of voice transmitters presently used.

It is anticipated that some adjustment of the demarcation between types of warning will be possible when Navtex becomes the prime coastal information system in the early 1990's.

The range limitation which we have had to impose on the Navtex transmitters has rendered the system unsuitable for providing information in the oceans, and indeed there will be many areas of the world's coastline where Navtex will not be provided. Stretches of the southwest coast of Africa come immediately to mind. Because of this, the United Kingdom has led the search within IMO for a further system capable of providing blanket broadcasts over all navigable waters of the globe. After examining several possibilities it became clear that satellite communications could be the most effective answer to this problem, and the global cover of the Inmarsat satellites seen on Figure 4 provides the best solution available in a single system.

The variety of maritime satellite communication facilities in the Inmarsat system (see Fig. 5) is formidable, but the size and weight of the directional antenna equipment make such facilities unsuitable for many vessels. However an alternative exists. This is the 'Enhanced Group Call' system which is currently under development by a combined team of international experts and Inmarsat staff.

It is simplest to regard the 'Enhanced Group Call' system as a world-wide satellite Navtex service. Indeed the receiver may well be indistinguishable from a Navtex receiver, and will only require an omni-directional aerial the size of a beer

SYSTEM CONFIGURATION

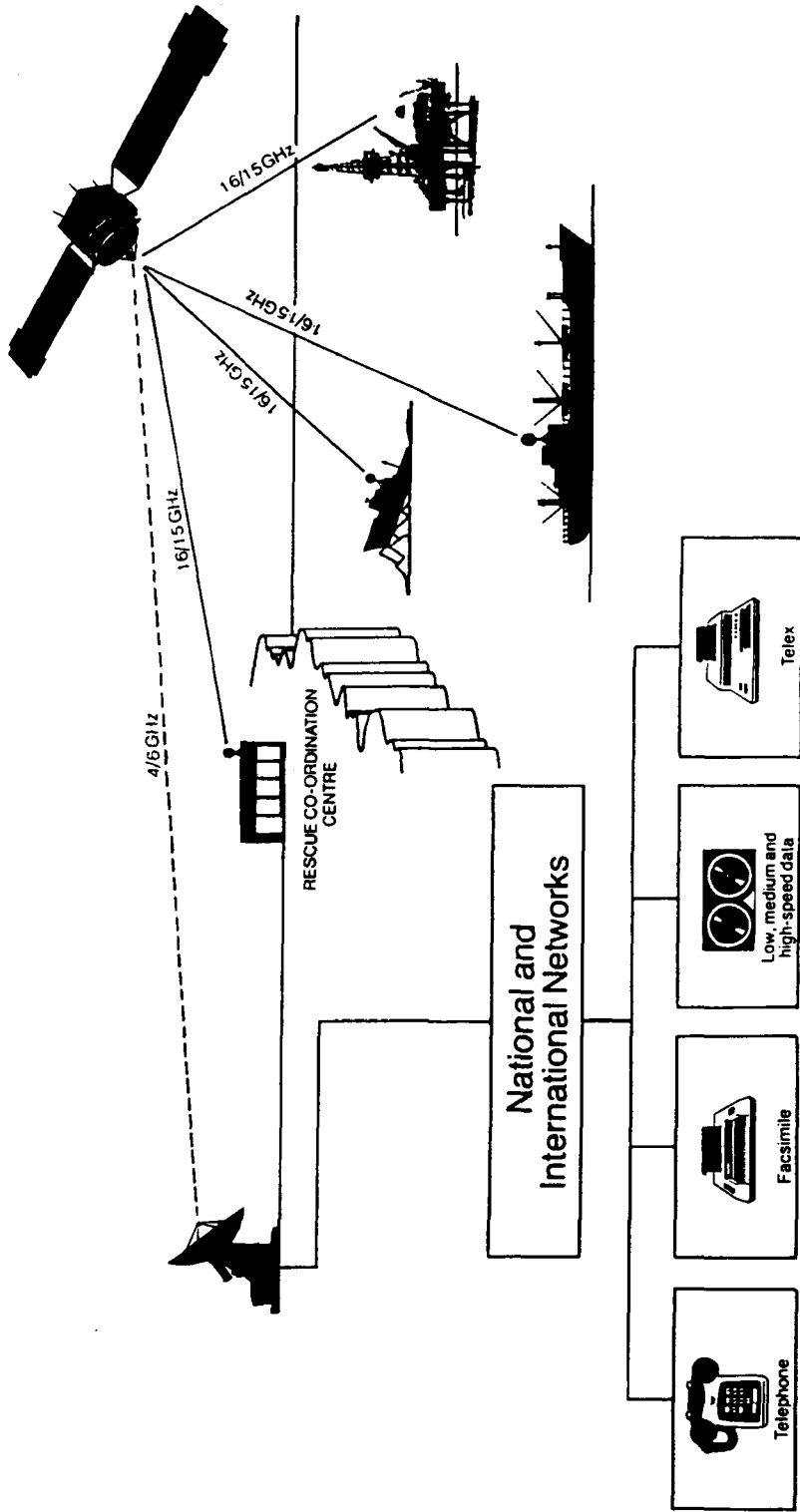
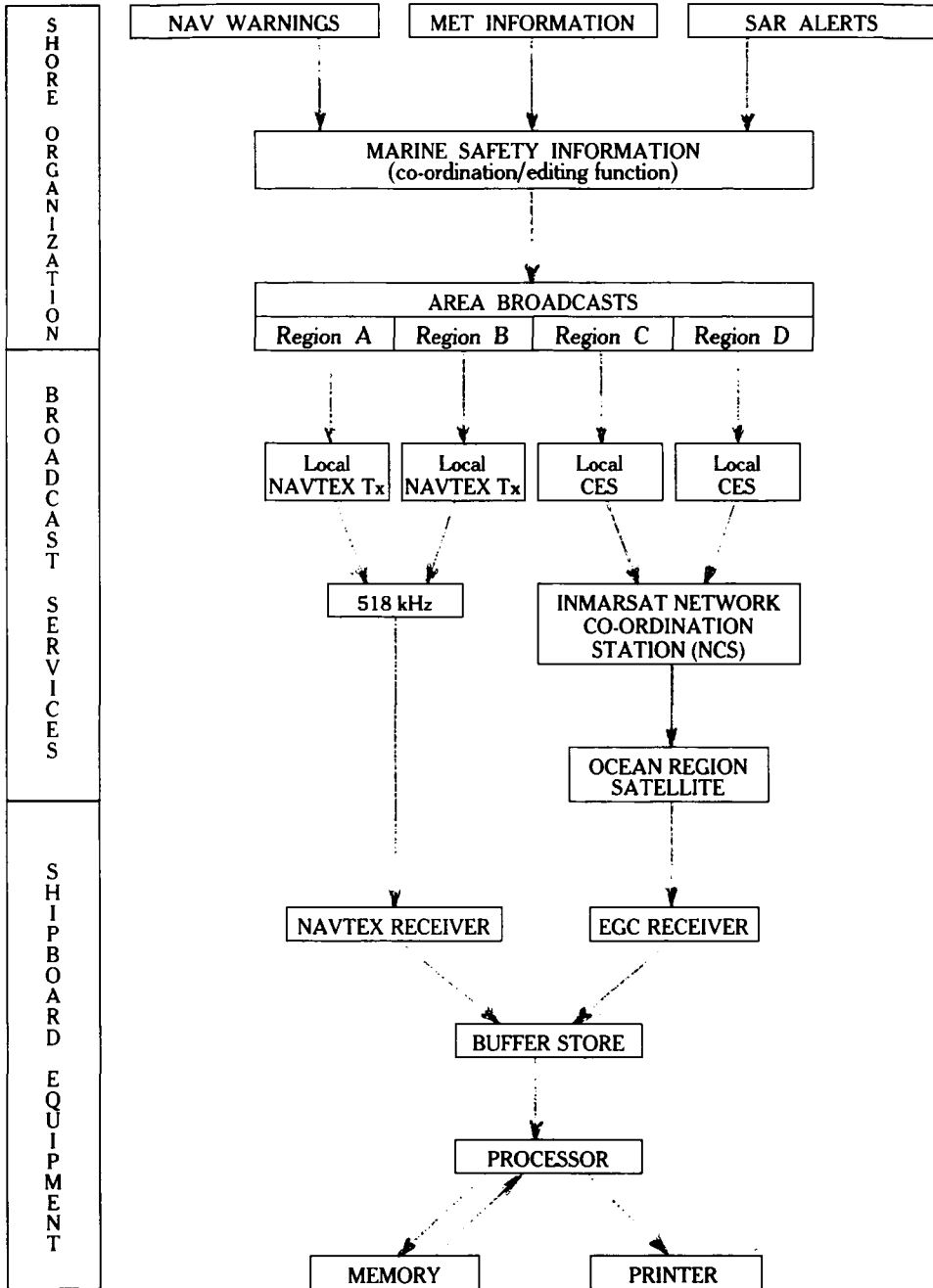


FIG. 5.

THE IDEAL INTERNATIONAL MSI CONCEPT (*)



(*) Additional broadcast flow channels serving other shipboard reception facilities will be necessary if the Organization does not adopt a single standard reception capability as a mandatory carriage requirement.

FIG. 6.

can. Prototype receivers are already at sea, taking part in a live sea trial in the North Atlantic. Every indication points to these trials being successful. Production costs for the receivers are expected to equate to Navtex, that is between £500 and £1000. If that proves to be the case, it is fully expected the IMO to adopt a mandatory carriage requirement for Inmarsat 'Enhanced Group Call' as they have for Navtex.

The Ideal MSI Concept shown in Figure 6 means that after 1991 the mariner will receive marine safety information, on the bridge, in printed form, to a common set of international standards. This is the conceptual context within which these systems are being developed. It shows a shore organization for collating and co-ordinating the full spectrum of Marine Safety Information, editing the whole into dedicated products for specific sea areas and broadcasting those products using Navtex or Inmarsat 'Enhanced Group Call' as appropriate, to provide a fully automated 'News Wire' service on the bridge of all kinds of vessel.

However, these developments have produced an organization backlash. In order to utilize the power of these automated facilities and make proper use of the information matrix, maritime States will need to make further progress with the World Wide SAR Plan in IMO, work towards a universal marine meteorological service within WMO and examine the need for restructuring the WWNWS within IHO. In this context, IHO must consider whether the existing limits of Navareas exploit the new systems in the most effective way, and whether the definitions of Navarea and coastal warnings require revision. Indeed Navtex and 'Enhanced Group Call' receivers might eventually be combined in one equipment. This would lead to a requirement for international co-ordination of broadcast times for long range services. Already the use of universal systems has shown up a lack of standardization in the language and phraseology of navigational warnings.

These developments will have to be co-ordinated by the International Maritime Organization's Working Group on Promulgation of Marine Safety Information. We can expect to see a great deal of change during the next few years, but I am certain that these new systems will make a significant contribution to the safety of marine operations world-wide.

Exemptions to the carriage of a radio officer are already being granted on condition that Navtex is carried, and ship owners may hope to see a parallel reduction in operating costs as the new systems become more widespread.