9 Safety at sea

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Since time immemorial the sea has been synonymous with adventure and danger; human tragedy and ecological disaster have induced states and the various parties concerned by such questions to take certain measures in order to improve safety at sea and coastal safety.

The criteria which characterize the system of measures adopted concerning safety on board ships may be classified according to two, or even three types of actions: (1) as regards preventive measures designed to prevent accidents from occurring, we shall be drawing a distinction between, on the one hand, the legislative side and, on the other, the various navigational aid systems; (2) finally we shall be examining the different assistance and rescue operations which are planned before an accident occurs and which are intended to alleviate the effects of any such accident.

REGULATIONS CONCERNING SAFETY AT SEA

The development of safety standards comes under co-operation between states

From ancient times onwards the maritime community has taken preventive and coercive measures to reduce the number of accidents at sea, such as banning navigation during the winter months. In the Middle Ages the captain held the power of life and death over the pilot if the latter caused the ship to run aground. At the end of the thirteenth century certain major Mediterranean ports (Marseilles, Venice, Barcelona, etc.) laid down load line regulations so as to avoid overloading and its resultant dangers in terms of ship manoeuvrability. In France, the Naval Ordinance of 1681 established a system of inspection for ships in French ports, regulating the role of visiting inspectors and introducing legal sanctions for wreckers. Article 225 of the Code of Mercantile Law (1808) amended and reinforced inspection procedure for ships.

From the nineteenth century onwards, regulations become more and more extensive and a certain harmonization of safety rules is to be noted, with the signing of bilateral treaties. In this way, in 1848, France and Britain signed an agreement on the lighting of ships, added to by the 1856 agreement on signals, the 1862 agreement on

rules relating to sea routes. At the beginning of the twentieth century the *Titanic* disaster in 1912 induced the major maritime powers to plan a greater level of co-operation between states. Post-1945 the role of major international organizations gained in importance, resulting in the signing of treaties or agreements ratified by a significant number of governments.

In fact the problem of safety at sea has to be tackled on two levels: first, the problem of establishing technical safety standards and, second, that of applying such standards, with due regard for the resources available in terms of manpower and equipment.

The main international organizations founded by the United Nations, such as ILO (the International Labour Organization), IMO (the Intergovernmental Maritime Organization), IASS (the International Association for Signalling at Sea), ITU (the International Telecommunications Union), WMO (the World Meteorological Organization), ICRCS (the International Committee for Radio Communication at Sea), take an active part in this process of co-operation, bringing together the representatives of the various member states. We should also add to this list the numerous non-governmental organizations which group together members from areas of activity such as classification companies, insurance companies and the representatives of seagoing personnel (officers and crew). Organizations such as these have the status of consultative members within the international organizations, two of which play a major role: ILT and IMO.

The adoption of agreements such as SOLAS (Safety of Life at Sea) and MARPOL (Maritime Pollution), i.e. the establishment of safety rules, leads to power broking within these international organizations, and the texts adopted are often a compromise between divergent interests. This is one of the weaknesses of the system, which produces incomplete regulations, since when no agreement is reached on a particular point (the compartmentation of car decks on roll-on/roll-off ships, for example) the problem is put to one side. As regards other criticisms which can be made of the system, the delays in putting procedures into effect should be emphasized; a minimum delay of between five and seven years is normal for most agreements.

The problems involved in verifying whether safety standards are being properly applied show where the limits lie in terms of co-operation between states

Under maritime law each state has jurisdiction over ships sailing under its national flag. International verification procedures come into conflict with legal principles concerning the right of passage and the rights associated with a national flag. Flag rights imply that the state concerned exercises administrative powers, that its public servants verify the validity of documentation and organize inspection

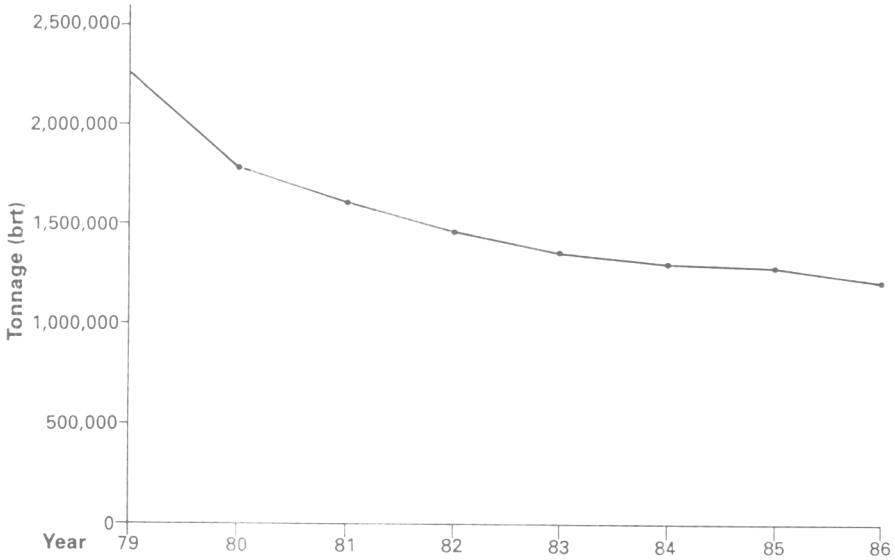
tours and on-board inspections. The state also possesses powers of sanction in respect of the ship concerned, which can be refused permission to cast off should it not be up to standard. On-board inspections are carried out from the first phases of construction of the ship onwards, in the shipyard, and the commissioning authorities issue a seaworthiness certificate if the ship conforms to the required standards.

Obviously some states enforce inspection procedures more than others, if only on account of the size of the fleet concerned. A state which has 300 ships does not have the same problems, particularly if it has a long-established maritime tradition, as a state which has several thousand ships. This link, which should in principle be a valid link, between the state which is responsible for inspections and the ship which is subject to those inspections, in practice leads to lax attitudes and to a total lack of sanctions; this is why there exist today ships which are sub-standard, ships which represent a danger to safety in terms of the various criteria concerning the hull, equipment and lifeboats, leaving aside the inadequate level of training for seagoing personnel. It is an accepted fact that there is a correlation between a lack of safety at sea and sub-standard ships. The same national flags always head the statistics relating to accidents at sea (see Figure 9.3).

In order to fill the gap left by the state of origin, which can only be called convenient, the state in which the port receiving the ship concerned is to be found takes on an increasingly prominent role in terms of jurisdiction. Allowance has already been made for this in the 1974 SOLAS agreement regarding technical standards, and in the 1976 agreement concerning the training given to seagoing personnel and as regards minimum welfare standards. It has to be acknowledged that inspection procedures for foreign ships are not generally enforced by the receiving state. In this respect France, affected by maritime disasters in recent years (The *Amoco Cadiz* disaster of 1978, etc.) which have caused the pollution of the Brittany coastline, has taken on a front-line role. But it is certainly true to say that it is not in the interests of the ports to place restrictions on their clients (this represents an example of the contradictions at work between the dictates of immediate commercial interests and safety imperatives); this type of lax attitude, without respect for established standards, can produce ports where convenience is the rule.

It would therefore seem to be rather difficult to harmonize safety standards on an international basis. The signing in January 1982 of the Paris Memorandum on Safety, with the agreement of fourteen European states, should for this reason be heralded as a major event. The signatory states have in this way shown their determination to see agreements enforced and have undertaken to set a specific quota for on-board ship inspection (25 per cent of ships using the ports concerned).

Figure 9.1 Total losses of vessels, 1979-86



A pan-European data file for ships has been created in Saint-Malo, at the Centre for the Administration of Maritime Affairs. All the countries which have signed the memorandum supply the centre with information. In four years (1982 to 1986) inspections undertaken by receiving states have obtained some good results, even if the 25 per cent mark has not been reached: 38,000 ships have been inspected, a figure which represents 21.5 per cent of ships entering the ports concerned, and 1,500 of these ships have been held in port because of serious faults until such time as they complied with international standards.

Why then, despite all the checks and regulations, do ships still catch fire, explode, run aground or sink? For the simple reason that each accident represents a special case; this was unfortunately true in the case of the sinking of the British car ferry *Herald of Free Enterprise* on 6 March 1987, less than a kilometre off the port of Zeebrugge, in calm sea conditions, resulting in nearly 200 deaths. In each disaster human failings and acts of negligence, or a decision to put profits before safety, result in tragedy. And yet systems and techniques in the accident prevention field are becoming more and more sophisticated.

ACCIDENT PREVENTION TECHNIQUES AND SYSTEMS DESIGNED TO PREVENT ACCIDENTS FROM OCCURRING

Whatever the type of ship, safety is ensured on several levels: at the time of the construction and the fitting out of the ship, throughout its service life, in port as well as out at sea. It is not possible here to take

Figure 9.2 Losses, by cause, 1986 (%)

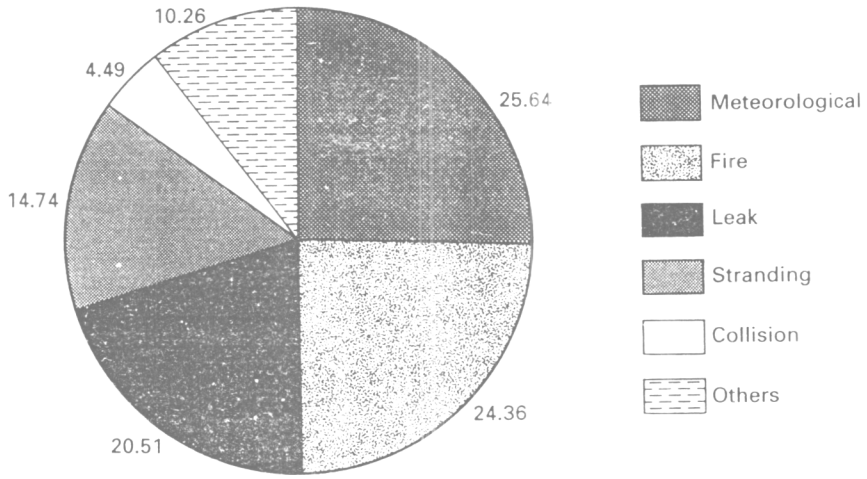
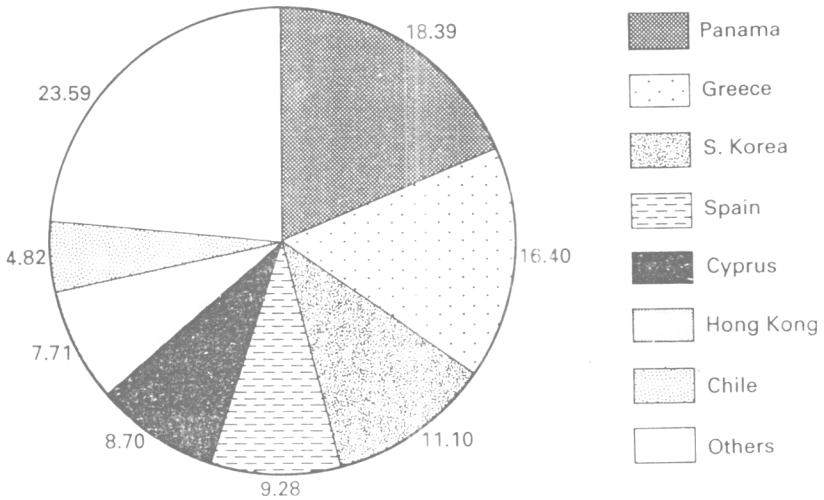


Figure 9.3 Losses, by flag, 1986 (%)



all these aspects into account, and in particular the great range of safety standards, depending on the type of navigation undertaken, on the type of ship concerned, whether specialized or non-specialized (tankers, roll-on/roll-off ships, container ships) and on the type of cargo transported. On the other hand, we shall be concentrating upon the various types of navigational aids (radio aids, meteorological aids, hydrographic aids, beaconing and other forms of signalling at sea). Some examples, referring mainly to France, will allow us to understand the usefulness of such aids.

Radio aids

The developments which have taken place in the field of radio aids in recent years seem to offer an additional guarantee against accidents at sea. There are several major systems of radio detection in existence; radio beacons are the least accurate, while land-based hyperbolic systems of the Decca, Loran, Toran or Omega type remain the most popular; the satellite system is, however, the most accurate but, for reasons of cost, is not yet to be found on board many ships.

INMARSAT (the International Maritime Satellite Organization) was created in July 1979 at the conclusion of a conference convened by IMO; this organization is recognized by around fifty countries, and approximately 8,000 ships around the world use the services it provides (8,000 out of 34,257 ships of more than 300 b.r.t., as recorded on 1 July 1986); this figure should climb to 10,000 by 1990.

The INMARSAT system is composed of a network of geostationary satellites which are located 36,000 km above the equator and above the Atlantic, Pacific and Indian Oceans. These communications satellites allow vessels at sea to remain in uninterrupted contact, either by radio or by telephone, with just about any point of the globe. As far as France is concerned, communications by telephone and telex, via the satellite network, go through the land-based coastal station at Pleumeur-Bodou.

Meteorological aids and the role of France-Télécom's coastal stations

Ships using the system receive information from the national or regional broadcasting stations, but also from France-Télécom's coastal stations, which transmit reports by radiotelephone in the case of coastal shipping and by radiotelegraphy for ocean-going craft. The world's shipping fleets contribute moreover to the information-gathering process. Satellites have changed operational procedures in this area as well: in January 1986, to replace its two weather station frigates, which were costing too much (again the conflict of interest between cost-effectiveness and safety), France decided to adopt SARE (Automated On-board Radiosonde System). SARE is installed on board ships, in particular the four multi-purpose refrigerated container ships owned by the Compagnie Générale Maritime operating the France-West Indies link. Information is transmitted by satellite (Météosat) to the French stations. This new system has permitted the Ministry responsible for such services to reduce the number of on-board meteorological personnel by half.

In the interests of cost-effectiveness, France-Télécom's management, putting forward as a reason, quite rightly, the increasingly important role played by satellite links, is intending in the years to come to cut down on the operations of its coastal stations, the role of which at present extends far beyond simply broadcasting

weather reports. There are, aside from Saint-Lys near Toulouse, six maritime coastal stations operated by France-Télécom: Boulogne, Brest-Le Conquêt, Saint-Nazaire, Arcachon, Marseilles and Grasse. These stations have two types of assignments:

1 They handle commercial traffic, i.e. the transmission of radio communications and radio telegrams from land to ship. They also process this radio traffic in metric wave.
2 They have a major role to play as regards safety: they broadcast, as was stated previously, regular weather reports at fixed times as well as wind speed warnings. Except in a few cases they operate a twenty-four-hour watch on communication frequencies (emergency and safety): 2,182 kHz (for radiotelephony) and 500 kHz (for radiotelegraphy).

VHF, which covers coastal sectors only, is not used by the emergency watch; as we shall see, in France the CROSS (see below) are responsible for such operations on channel 16. The watch operated by France-Télécom is therefore concentrated upon the high seas.

However, over the past few years the level of commercial traffic (which represents almost 80 per cent of all traffic) has been falling, as a result of satellite links. Communications concerning safety matters, distress calls, radio-medical links, weather reports, wind speed and storm warnings and emergency communications to report malfunctions making navigation dangerous (beacons, lights or lighthouses out of action, buoys which are out of position or have sunk) are transmitted free of charge. A cold reading of the statistics has led France-Télécom's management to consider closing down some centres, and, at the very least, abandoning the night watch. By 1988/89 only three coastal stations will remain operational: Boulogne, Brest-Le Conquêt and Marseilles.

Progress, or in other words the increasing importance of satellite links, means the loss of a service which is at present the most effective in safety terms.

Beaconing and signalling at sea

This represents another facet of navigational aids. Each and every maritime state is under a statutory obligation to provide a system of coastal signalling; to this end France has a Lighthouse and Beacon Service.

Early on in history, in contrast to the crafty tactics employed by wreckers, mankind sought to guide sailors with the aid of lights. In the third century BC Ptolemy, then ruler of Egypt, ordered the construction, on the island of Pharos, near Alexandria, of the world's first lighthouse, a tower made of white marble and standing 180 m high, with its light, to guide sailors, shining brightly at night and

giving out smoke by day.

The first lighthouse in Europe was built in France in the eleventh century at the mouth of the river Gironde. Sea traders insisted that this dangerous estuary had to be lit with beacons. The people of Bordeaux then thought that they would demand the payment of duty on each vessel entering the port, which would cover the wage bill for the four men responsible for keeping the light burning on the Cordouan rock, as well as the cost of the fuel. Edward, the Black Prince, at that time ruler of Gascony, decided that the Cordouan light was not in itself enough, and so ordered a tower standing 40 ft high to be built.

The nineteenth century saw the construction of lighthouses signalling the approach to dangerous stretches of coastline. In France marvellous examples of workmanship such as the Armen lighthouse, built upon one of the reefs extending out from the Ile de Sein and inaugurated in 1881 after fourteen years of heroic struggle, saw the light of day at this time. Today, over the 5,500 km of French coastline, 2,712 illuminated signals, which include 1,696 lighthouses, 1,013 buoys and beacons and three lightships are lit automatically or operated by technicians, so as to provide navigational guidance for sailors.

The maintenance of property safety levels depends on a few teams of operatives, such as those working for the Lighthouse and Beacon Service, who work in what are often difficult conditions, all the more so since an improved level of safety at sea implies increased efforts on their part. In this way, in Brest, operatives no longer work in depths of 60 m, as was the case a few years ago, but in depths of 120 m. Buoys used not so long ago to weigh eighteen to twenty tonnes, such as the Nordeste buoy in the Ouessant sea lane. But it has proved necessary to go beyond this, the Nordeste being too small, like a candle on the sea in fact.

In this way there is the Suroît buoy in the sea lane, a lighthouse buoy weighing ninety tonnes, with a 500 m-long chain (diameter, 44 mm) and a four-tonne anchor attached. This buoy cannot be placed on board the (equivalent of) Trinity House boats and is towed into position instead.

All this equipment has to be properly maintained. The chains become worn very quickly as the rocks abrade the links, and plans have to be made to replace this equipment once every two years approximately. Maintaining these buoys and other beacons is obviously a problem in all the approach channels to ports; in the interests of navigational safety it is advisable to correct constantly the positioning of buoys and beacons moved by the winds and currents.

Other navigational aids

It is indeed important to mention the assistance provided by the

hydrographic services which, in drawing up nautical charts, have for centuries played a vital role as far as sailors are concerned, as is the case with the assistance given by pilotage services; since time immemorial, pilots have been looked upon as guides for vessels. The need for pilots to be employed is justified principally in terms of the concern for public safety in ports.

Besides such navigational aids, and in addition to general navigational standards, in certain sectors which are subject to a disproportionate density of sea traffic, and so where the risk of collision is high, sea traffic control systems have been introduced. Following the *Amoco Cadiz* disaster in March 1978, France put forward a proposal through IMO for a system to be introduced off Ouessant whereby sea traffic could be kept apart; this system became operational in 1979. Two other systems of this kind exist, one off the Cotentin (Cherbourg Peninsula), and the other in the Straits of Dover.

As far as sea traffic off Ouessant is concerned, a new project, developed by IMO, was set out in 1981; the introduction of this project, subject to the construction of a 'super-beacon' out at sea, described as a 'major navigational aid', was to involve moving the sea lane a further twelve nautical miles out to sea. The Minister of Maritime Affairs discontinued the development of this project in May 1986. Certain technical problems had in fact emerged as the project was under development. In addition, maritime officials were becoming more and more doubtful as to the wisdom of undertaking such work in so far as the number of infringements of sea traffic control rules in this sea lane had fallen away considerably (0.4 per cent in 1985). Was this major aid for sea traffic still as useful in the satellite age? Certainly the use of a satellite-based tracking system implies the presence of properly equipped ships and properly trained crews, which is far from being generally the case. Perhaps one of the reasons why the project was abandoned lies, as is often the case with safety matters, in the projected cost of the construction work: the figure of 500 million francs has been mentioned, but it would appear according to the Ministry that this figure is an underestimate.

Whatever the position is regarding these many navigational aids, whether land-based, at sea or in the sky, and in spite of any improvements which can be made in the various methods used, it is a generally accepted fact that there is always some element which cannot be foreseen in accidents, especially at sea, where a very high price is sometimes paid as a result of human error, negligence or the priority given to cost-effectiveness over safety measures. For this reason coastal states have established a whole system for the assistance of ships in difficulty.

ASSISTANCE AND RESCUE OPERATIONS

In this field also the increasingly important role played by satellites is again to be noticed; but, to prevent tragedies from occurring at sea, a country like France relies upon a logistical set-up centred upon CROSS (Centre Opérationnel de Surveillance et de Sauvetage: Monitoring and Rescue Regional Operations Centre).

From distress signal beacons to satellites

Radio communications for search and rescue at sea are of vital importance. IMO has been working for many years on perfecting the future Global Marine Distress and Safety System (GMDSS), which should in principle be fully operational around 1990. At the present time several different systems operate alongside one another.

The International Satellite Organization INMARSAT hopes to take advantage of the fact that a new generation of satellites comes into service around 1988 and fit these satellites with radio functions for the purpose of sea rescue based on EPIRBS (Emergency Positioning Indicating Radio Beacons), which for the time being operate either on 121.5 MHz (civil aircraft), 243 MHz (military aircraft), 156.8 MHz (Channel 16, VHF marine band) or on 2,182 kHz (limited range).

Canada, Finland, France, Great Britain, Norway, Sweden and the USA, which have promoted the SARSAT system, and the USSR, which has developed the COSPAS system, have created an international project (SARSAT-COSPAS) covering the surface of the globe.

Tens of humans lives are saved every year at sea thanks to beacons transmitting radio signals to satellites orbiting above the transit zone, following a polar course at an altitude of 800 to 1000 km. With four satellites (two American and two Russian) and a dozen stations on earth (fifteen in 1988), the transmission time which elapses is two hours at worst (around the equator) and one hour in the North Atlantic hemisphere. Toulouse is the receiving station in France, and if a distress signal is sent to the Toulouse station the signal is retransmitted immediately to the CROSS concerned. The market in radio beacons, which operate on 406 MHz, is massive, since ships must now be fitted with these beacons. Prices, in the region of 25,000 to 35,000 francs in 1985, have fallen since then, as by the end of 1986 the going rate was around 10,000 francs.

Before the GMDSS does in fact cover the whole globe quite a lengthy transitional period will be required, in order to allow time for coastal states to set up the necessary infrastructure, and ships to be properly equipped. The problem lies in the fact that the majority of distress situations involve vessels not covered by international agreements. In addition, the difficulties encountered are serious when it comes to trying to reconcile existing systems, not so much on a

technical as at a political and financial level. When compared with European nations, with the former maritime powers, Third World countries do not have the same economic potential, are not in a position to manufacture the equipment required, nor on occasion to buy or maintain such equipment; neither do they possess adequately trained personnel.

Satellite systems are used more and more frequently as a means of assisting ships in difficulty, but the information supplied is transmitted to an organization which brings together land-based, sea and air rescue services, with the aim of ensuring a successful outcome for rescue operations. We shall be taking French rescue services as an example.

CROSS

In France the system designed to prevent tragedies from occurring at sea is centred upon the CROSS. The international agreement on Search and Rescue at Sea, concluded in Hamburg in April 1979 and signed by France in April 1980 (France was the first state to sign this agreement), came officially into force in June 1985. But before this date France had already organized its search and rescue services, operating off French coasts in accordance with the provisions laid down in the agreement. There are two separate administrative structures.

Admiralty authorities have been established at strategic points: Cherbourg for the Channel, Brest for the Atlantic and Toulon for the Mediterranean. These authorities deal principally all with service matters, but since 1979, following the *Amoco Cadiz* disaster, each authority runs a Civilian Affairs Department, which is given the task of supervising sea rescue and seeing that laws relating to the protection of coasts are properly enforced.

Departments of Maritime Affairs, civilian services above all else, are responsible for monitoring boats and crews which do not come under French navy jurisdiction (trading, fishing and yachting). They ensure that vessels conform to safety standards and sea traffic regulations. They are in charge of the Monitoring and Rescue Regional Operations Centres (CROSS), but the Admiralty authority co-ordinates search and rescue operations from these centres.

There are five main regional centres for the French coastline: the CROSS at Cap Gris Nez, near Boulogne, and the CROSS at Jobourg (Cherbourg peninsula), which come under the Cherbourg Admiralty Authority; the CROSS at Corsen, near Brest, and the CROSS at Etel, which come under the Brest Admiralty Authority; the CROSS at Lagarde comes under the Toulon Admiralty Authority. Three sub-regional centres or sub-CROSSes have been set up, one at Soulac, on the Atlantic coast, the other two on the Mediterranean, at Agde and on the Ile Rousse in Corsica.

The first CROSS was established at Cap Gris Nez in 1974 and modernized in 1984 to keep a closer watch on a narrow passage which is negotiated by 450 vessels a day. Other centres were set up afterwards, but it was above all after the *Amoco Cadiz* disaster that these centres saw their role significantly extended. The latest centre to be opened is the CROSS at Corsen, 30 km north-west of Brest, which became operational in October 1982; these installations are complemented by a radar tower which was built on Pointe du Stiff, on the Ile d'Ouessant, and has been operational since the beginning of 1981; this tower covers a monitoring sector spreading forty nautical miles (72 km) out to sea. In the CROSS at Corsen two radar screens, one main screen and one back-up screen, receive on a round-the-clock basis information transmitted by electromagnetic wave from the radar tower; the screen gives a truly photographic image of the sea lane. To this are added radiogoniometric data transmitted from the tower at Le Créac'h, also on Ouessant; these data allow the direction of ships' radio transmissions to be identified.

Furthermore air and other services operated by various agencies (navy, customs, gendarmerie, etc.) patrol French waters on a continuous basis. The CROSS have at their disposal an extensive radio data link system which allows them to maintain permanent contact with all their 'sources'. The latter are in fact an integral part of the prevention and rescue system.

The organization of rescue operations in France

It is not our purpose here to discuss lifeguard operations on beaches in summer, which usually cover a sector extending 300 m out to sea; it is beyond this point that the CROSS, and the air and sea services which they have at their disposal, intervene.

The French gendarmerie alone puts at the disposal of the localities the services of eighty-six lifeguards or sea rescue personnel, 380 pilots of rescue craft and 165 divers. On a national level, the gendarmerie has available fifty-four patrol launches, 145 small rescue craft, forty-two helicopters and six aircraft.

The French navy is also very much involved in the organization of sea rescue operations, and devotes considerable resources to this area. Three deep-sea tugboats are on permanent alert in Cherbourg, Brest and Toulon. Until 31 August 1986 these boats were hired out to the company Abeilles International but since then, in the interests of cost-cutting, Fish has won the contract for the Mediterranean, while Abeilles has retained the contract for the Atlantic and the Channel, though only by agreeing to cut the number of crew on board from fifteen to twelve. This cut in crew numbers provoked a lengthy industrial dispute during the summer of 1986. The seamen emphasize the point that, as far as sea rescue is concerned, it is out of the question to improvise or make do with inadequate resources.

The tugboat operators, according to the terms of the new contract, with twelve-man crews, will remain strictly within French coastal waters, and will no longer be able to go beyond the sixty-mile zone. In case of operational difficulties the tugboat captain will have to call in a back-up team. Besides the tugboats a Dauphin helicopter, chartered out for rescue operations, is based in Cherbourg. The big Super-Frelon helicopters based at Lanvéoc-Poulmic and Saint-Mandrier, the Bréguet-Atlantic and Nord 262 helicopters based at Lann-Bihoué and Nîmes are held on stand-by, ready to intervene when the craft already despatched to the site of the operation are inadequate for the task. (In 1985 these craft totalled 2,900 flight hours).

Finally the French navy makes its own vessels available for sea rescue operations. In total, in 1985, the navy came to the aid of eight merchant vessels, thirty-three trawlers and seventy-one yachts; this permitted 620 lives to be saved, for eight missing or dead.

The customs service acts as back-up to the above services, with around sixty patrol launches and a dozen aircraft (in fact eight 404 and 406 Cessna-type aircraft and four Ecureuil helicopters. The Department of Civil Defence and Public Safety also makes a contribution: fire brigades such as the Marseilles fire brigade (maritime unit) place at the disposal of the CROSS their various lifeguards and all their specialist rescue equipment.

All these rescue services are backed up by SNSM (Société Nationale de Sauvetage en Mer) volunteers; the SNSM is a state-approved institution, in accordance with the provisions of the 1901 Act of Parliament on the subject. The nature of its activities varies from going to the aid of vessels which have run on to rocks to rescuing wind-surfers who have drifted out to sea.

Founded in 1967 in succession to two voluntary rescue associations (the Société Centrale de Sauvetage des Naufragés and the Hospitaliers Sauveteurs Bretons), the SNSM represents the clearest expression of the sense of comradeship among seafarers, and its services are run free of charge by people who love the sea. The SNSM has a total of 255 stations along the coastline, which are either manned all year round or in summer only, and a fleet composed of forty-two all-weather, high-speed boats, twenty-four Class One launches, eighty-eight launches of various types and 418 inflatables.

The SNSM is dependent for the running of its operations on donations, bequests and on local, regional and central government grants. The state covers 50 per cent of its capital budgeting and 20 per cent of its operational budget. The SNSM finds itself at the present time in a very difficult financial situation, given that every year one all-weather lifeboat (or one launch) should be built to replace craft in the existing fleet; however, the SNSM's financial resources cannot cover such expenditure (an all-weather boat costs 3 million francs). The SNSM's budget, which is in the region of 25 million francs, cannot cover both the upkeep of existing equipment and its

replacement. In comparison, the budget of the SNSM's British counterpart, the RNLI (Royal National Lifeboat Institution), is around 160 million francs a year! If each of France's 600,000 yachtsmen paid a membership fee of approximately 100 francs, it would be enough to cover all the costs of implementing the SNSM's modernization scheme.

In spite of the organizational set-up on a national level in France, described above, with its obvious or not so obvious pros and cons, the sea still remains in control too much of the time, since human error will always exist. Yet at the same time we should beware of placing too much emphasis on this idea of the human factor without trying to get to the heart of the matter. Individual human failures or the failures of a group of individuals are in fact to a large extent the product of the surrounding environment. However, this environment, as far as shipping is concerned, has greatly evolved in the space of three decades; ships are growing in size all the time and becoming more and more sophisticated, and the advent of new economic parameters has an influence on safety; the constant striving for increased cost-effectiveness produces the concept of minimum — not maximum — safety measures.

CONCLUSION: THE INTRODUCTION OF UNMANNED VESSELS AS A WAY OF AVOIDING HUMAN TRAGEDY?

This could be the answer to the problem of sea rescue, an idea which amounts to keeping men from going out to sea so that they do not then have to be rescued. What a thought! Yet we have the technology to build ships with automatic pilots: the miniaturization of monitoring and positioning equipment and the increase in the number of sea surveillance satellites make it possible to contemplate the navigation of unmanned vessels from one continent to another. So we have now reached the opposite extreme of the central theme of this symposium on the role of human activity in maritime development, since we are now talking about excluding man from this domain.

Is it not the case that we are faced with the following dilemma? Namely, in safety terms, would it be better to see ships which are more or less properly maintained and fitted out by unscrupulous owners, who employ crews of ill-assorted origin, or rather the ships of the future, on board which the control room is completely silent and deserted, with nothing but the lights on the computers flickering, while outside the only object showing any signs of movement is the radar aerial, turning sluggishly, and there is no one to be seen on the gangways any more than in the equipment room?

It is in fact between these two extremes that the men and the organizations responsible for ensuring and promoting safety at sea and coastal safety actually operate. We are today in a position to assess just how much progress has been made since the beginning of the century.

All that can be said has already been said about the 1,000 people who lost their lives when the *Titanic* sank, who met their deaths by drowning because there was no space left in the lifeboats. Until the time of the 1914 SOLAS agreement (much strengthened since then), which forced shipowners to fit out their ships in such a way as to allow the evacuation of all the people on board, many sailors and passengers were left no option, if the ship was wrecked, but to try to save themselves by any means available. Those were the days of 'every man for himself'. Fortunately, that is now a thing of the increasingly distant past.