Focus on IMO

International Maritime Organization, 4 Albert Embankment, London SE1 7SR, United Kingdom
Tel: +44 (0)20 7735 7611 Fax: +44 (0)20 7587 3210
Contacts: Lee Adamson – Senior External Relations Officer; Natasha Brown – External Relations Officer
E-mail: media@imo.org Web site: www.imo.org

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SOLAS: the International Convention for the Safety of Life at Sea, 1974

Background

Of all international conventions dealing with maritime safety, the most important is the International Convention for the Safety of Life at Sea (SOLAS).

It is also one of the oldest, the first version having been adopted at a conference held in London in 1914.

Since then there have been four other SOLAS conventions: the second was adopted in 1929 and entered into force in 1933; the third was adopted in 1948 and entered into force in 1952; the fourth was adopted (under the auspices of IMO) in 1960 and entered into force in 1965; and the present version was adopted in 1974 and entered into force in 1980.

The SOLAS conventions have all covered many aspects of safety at sea. The 1914 version, for example, included chapters on safety of navigation, construction, radiotelegraphy, life-saving appliances and fire protection. These subjects are still dealt with in separate chapters in the 1974 version.

The 1914 Convention was, as the title implies, concerned primarily with the safety of human life. The late 19th and early 20th centuries represented the golden age of passenger travel by sea: there were no aircraft, and emigration, from Europe to the Americas and other parts of the world, was still taking place on a massive scale. Passenger ships were therefore much more common than they are today and accidents frequently led to heavy casualties. The annual loss of life from British ships alone averaged between 700 and 800 during this period.

The incident which led to the convening of the 1914 international SOLAS conference was the sinking of the White Star liner *Titanic* on her maiden voyage in April 1912. More than 1,500 passengers and crew died and the disaster raised so many questions about the safety standards in force that the United Kingdom Government proposed holding a conference to develop international regulations. The Conference was attended by representatives of 13 countries and the SOLAS Convention which resulted was adopted on 20 January 1914.

It introduced new international requirements dealing with safety of navigation for all merchant ships; the provision of watertight and fire-resistant bulkheads; life-saving appliances; and fire prevention and fire fighting appliances on passenger ships. Other requirements dealt with the carriage of radiotelegraph equipment for ships carrying more than 50 persons (had the *Titanic*'s distress messages not been picked up by other ships the loss of life would probably have been even greater); the Conference also agreed on the establishment of a North Atlantic ice patrol.

The Convention was to enter into force in July 1915, but by then war had broken out in Europe and it did not do so, although many of its provisions were adopted by individual nations.

In 1927, however, proposals were made for another conference which was held in London in 1929.

This time 18 countries attended. The conference adopted a new SOLAS convention which followed basically the same format as the 1914 version but included several new regulations. It entered into force in 1933.

One of the two annexes to the convention revised the international regulations for preventing collisions at sea (Collision Regulations).

By 1948 the 1929 convention had been overtaken by technical developments and the United Kingdom again hosted an international conference which adopted the third SOLAS Convention. It followed the already established pattern but covered a wider range of ships and went into considerably greater detail.

Important improvements were made in such matters as watertight subdivision in passenger ships; stability standards; the maintenance of essential services in emergencies; structural fire protection, including the introduction of three alternative methods of subdivision by means of fire resistant bulkheads, and the enclosure of main stairways. An international safety equipment certificate for cargo ships of 500 gross tons and above was introduced - an indication of the growing importance of cargo ships relative to passenger ships, which were already facing competition from aircraft.

The Collision Regulations were also revised and regulations concerning the safety of navigation, meteorology and ice patrols were brought up to date. A separate chapter was included dealing with the carriage of grain and dangerous goods, including explosives. There had been considerable developments in radio since 1929 and the 1948 Convention took these into account (the title of the relevant chapter made specific reference to radiotelephony as well as radiotelegraphy).

The year 1948 was particularly significant because a conference held in Geneva under the auspices of the United Nations adopted a convention establishing IMO - or the Inter-Governmental Maritime Consultative Organization (IMCO), as it was then known.

The 1948 SOLAS Convention recognized that the creation of this new Organization would, for the first time, mean that there was a permanent international body capable of adopting legislation on all matters related to maritime safety. It was originally intended that the Convention would be kept up to date by periodic amendments adopted under the auspices of IMO but in the event it took so long to secure the ratifications required to bring the IMO Convention into force that the new Organization did not meet until 1959. It was then decided that rather than amend the 1948 Convention it would be better to adopt a completely new instrument - the fourth SOLAS Convention.

The 1960 SOLAS Convention

The 1960 SOLAS Conference, which was attended by delegates from 55 countries, 21 more than in 1948, was the first conference to be held by IMO. Although only twelve years had passed since the last SOLAS Convention was adopted, the pace of technical change was quickening and the 1960 SOLAS Convention incorporated numerous technical improvements.

Like its predecessor, the new Convention incorporated control provisions including requirements for various surveys and certificates for cargo ships of 300 gross tons and above making international voyages and for a Government to investigate casualties when "it judges that such an investigation may assist in determining what changes in the present regulations might be desirable" and to supply IMO with pertinent information.

Many safety measures which had once applied only to passenger ships were extended to cargo ships, notably those dealing with emergency power and lighting and fire protection. The radio requirements were again revised and in the chapter dealing with life-saving appliances, provision was made for the carriage of liferafts, which had developed to such an extent that they could be regarded as a partial substitute for lifeboats in some cases.

Regulations dealing with construction and fire protection were revised as were the rules dealing with the carriage of grain and dangerous goods. The final chapter contained outline requirements for nuclear-powered ships which in 1960 seemed likely to become important in the years to come.

As in 1929 and 1948 revised Collision Regulations were annexed to the Convention.

Finally, the Conference adopted some 56 resolutions, many of which called upon IMO to undertake studies, collect and disseminate information or take other action. These included, for example, a request that IMO develop a unified international code dealing with the carriage of dangerous goods - a resolution which resulted in the adoption five years later of the International Maritime Dangerous Goods Code.

The 1960 SOLAS Conference was to determine much of IMO's technical work for the next few years.

It was originally intended that the 1960 SOLAS Convention would be kept up to date by means of amendments. The first set was adopted in 1966 and from then on amendments were introduced regularly. Their contents are summarized below:

1966: amendments to Chapter II, dealing with special fire safety measures for passenger ships.

1967: six amendments adopted, dealing with fire safety measures and arrangements for life-saving appliances on certain tankers and cargo ships; VHF radiotelephony in areas of high traffic density; novel types of craft; and the repair modification and outfitting of ships.

1968: new requirements introduced into Chapter V dealing with shipborne navigational equipment, the use of automatic pilot and the carriage of nautical publications.

1969: various amendments adopted, dealing with such matters as firefighters' outfits and personal equipment in cargo ships; specifications for lifebuoys and lifejackets; radio installations and shipborne navigational equipment.

1971: regulations amended concerning radiotelegraphy and radiotelephony and routeing of ships.

1973: regulations concerning life-saving appliances; radiotelegraph watches; pilot ladders and hoists. The major amendment was a complete revision of Chapter VI which deals with the carriage of grain.

Unfortunately, it became increasingly apparent as the years went by that these efforts to respond to the lessons learnt from major disasters and keep the SOLAS Convention in line with technical developments were doomed to failure - because of the nature of the amendment procedure adopted at the 1960 conference. This stipulated that amendments would enter into force twelve months after being accepted by two-thirds of Contracting Parties to the parent Convention.

This procedure had been perfectly satisfactory in the past when most international treaties were ratified by a relatively small number of countries. But during the 1960s the membership of the United Nations and international organizations such as IMO was growing rapidly. More and more countries had secured their independence and many of them soon began to build up their merchant fleets. The number of Parties to the SOLAS Convention grew steadily. This meant that the number of ratifications required to meet the two-thirds target needed to secure entry into force of SOLAS amendments also increased. It became clear that it would take so long for these amendments to become international law that they would be out of date before they did so.

As a result IMO decided to introduce a new SOLAS Convention which would not only incorporate all the amendments to the 1960 Convention so far adopted but would also include a new procedure which would enable future amendments to be brought into force within an acceptable period of time.

The 1974 SOLAS Convention

The 1974 SOLAS Conference was held in London from 21 October to 1 November and was attended by 71 countries. The Convention which was adopted is the version currently in force and it is unlikely to be replaced by a new instrument because of the new tacit amendment procedure which is included in Article VIII.

Tacit acceptance

As explained earlier, the amendment procedure incorporated in the 1960 Convention stipulated that an amendment would only enter into force when it had been accepted by two-thirds of Contracting Governments. It therefore required Contracting Governments to take positive action to accept the amendment. This usually meant that acceptance was delayed pending introduction of the necessary national legislation and this was not always given high priority by Governments, particularly as the pace of acceptance by other States was slow.

The 1974 Convention endeavours to solve this problem by in effect reversing the process: it assumes that Governments are in favour of the amendment unless they take positive action to make their objection known.

Article VIII states that amendments to the chapters (other than chapter I) of the Annex, which contain the Convention's technical provisions - shall be deemed to have been accepted within two years (or a different period fixed at the time of adoption) unless they are rejected within a specified period by one-third of

Contracting Governments or by Contracting Governments whose combined merchant fleets represent not less than 50 per cent of world gross tonnage.

The article contains other provisions for entry into force of amendments including the explicit acceptance procedure but in practice the tacit acceptance procedure described above proves the most rapid and effective way of securing the entry into force of amendments to the technical annex (other than Chapter I) and is now invariably used.

The Annex

Chapter I: General provisions

The most important of these concern the surveys required for various types of ships and the issuing of documents signifying that ships meet the requirements of the Convention.

The survey requirements for passenger ships include a survey before the ship is put into service; a periodical survey (in most cases once every 12 months) and additional surveys as the occasion arises. In the case of cargo ships, after the initial survey, the ship is subject to a subsequent survey every two years in respect of life-saving appliances and other equipment; once every year in respect of radio installation; and in respect of hull, machinery and equipment, at such intervals as the Administration may consider necessary to ensure that the ship's condition is in all respects satisfactory.

Regulation 12 of Chapter I lists the various certificates which have to be issued by the flag State as proof that a ship has been inspected and found to be in compliance with the requirements of the Convention. The certificates cover Passenger Ship Safety, Cargo Ship Safety Construction, Cargo Ship Safety Equipment and Cargo Ship Safety Radio certificates. There is also an Exemption Certificate which is issued when an exemption from requirements is granted by the flag State.

The control procedures laid down in Regulation 19 of this chapter are primarily designed to enable port State officers to ensure that foreign ships calling at their ports possess valid certificates. In most cases, possession of valid certificates is sufficient proof that the ship concerned complies with Convention requirements.

The port State officer is empowered to take further action if there are clear grounds for believing that the condition of the ship or of its equipment does not correspond substantially with the particulars of any of the certificates.

The officer can take steps to ensure that the ship does not sail until it can do so without endangering passengers, crew or the ship itself. If action of this type is taken, the flag State must be informed of the circumstances and the facts must also be reported to IMO.

Chapters II-1 and II-2

This chapter includes a number of important changes from the 1960 version mainly in the area of fire safety and the 1974 Conference found it necessary to divide the chapter into two sections. The main points of the chapters are as follows:

Chapter II-1: Construction - subdivision and stability, machinery and electrical installations

The subdivision of passenger ships into watertight compartments must be such that after assumed damage to the ship's hull the vessel will remain afloat in a stable position. Requirements for the watertight integrity and bilge pumping arrangements for passenger ships are also laid down.

The degree of subdivision - measured by the maximum permissible distance between two adjacent bulkheads - varies with the ship's length and the service in which it is engaged. The highest degree of subdivision applies to ships of the greatest length primarily engaged in the carriage of passengers.

The requirements for machinery and electrical installations are designed to ensure that services which are essential for the safety of the ship, passengers and crew are maintained under various emergency conditions.

Chapter II-2: Construction - Fire protection, fire detection and fire extinction

Casualties to passenger ships through fire in the early 1960s emphasized the need to improve the fire protection provisions of the 1960 Convention, and in 1966 and 1967 amendments were adopted by the IMO Assembly. These and other amendments, particularly detailed fire safety provisions for passenger ships,

tankers and combination carriers, have been incorporated in this chapter, including requirements for inert gas systems in tankers.

These provisions are based on the following principles:

1. Division of the ship into main and vertical zones by thermal and structural boundaries.
2. Separation of accommodation spaces from the remainder of the ship by thermal and structural boundaries.
3. Restricted use of combustible materials.
4. Detection of any fire in the zone of origin.
5. Containment and extinction of any fire in the space of origin.
6. Protection of the means of escape or of access for fire-fighting purposes.
7. Ready availability of fire-extinguishing appliances.
8. Minimization of the possibility of ignition of flammable cargo vapour.

Chapter III: Life-saving appliances

The original Chapter III was divided into three parts.

Part A contained general requirements, which applied to all ships, described appliances by type, their equipment, construction specifications, methods of determining their capacity and provisions for maintenance and availability. It also described procedures for emergency and routine drills. Parts B and C contained additional requirements for passenger and cargo ships respectively.

Chapter IV: Radiotelegraphy and radiotelephony

The chapter is divided into four parts.

Part A prescribes the type of radio installations to be carried and Part B the operational requirements for radio watchkeeping, while technical requirements are detailed in Part C. This latter part includes technical provisions for direction-finders and for motor lifeboat radiotelegraph installations, together with portable radio apparatus for survival craft.

The radio officer's obligations regarding mandatory log-book entries are listed in Part D.

The chapter is closely linked to the Radio Regulations of the International Telecommunication Union.

Chapter V: Safety of navigation

The provisions of this chapter are mainly of an operational nature and apply to all ships on all voyages. This is in contrast to the Convention as a whole, which only applies to ships of a certain size engaged on international voyages.

The subjects covered include the maintenance of meteorological services for ships; the ice patrol service; routeing of ships; and the provision of search and rescue services; etc.

The chapter also includes a general obligation for Contracting Governments to ensure that all ships are sufficiently and efficiently manned from a safety point of view.

Requirements for the fitting of radar and other navigational aids are also contained in this chapter.

Chapter VI: Carriage of grain

Shifting is an inherent characteristic of grain, and its effect on a ship's stability can be disastrous. Consequently, the SOLAS Convention contains provisions concerning stowing, trimming and securing the cargo.

In the 1974 Convention this chapter was radically amended, following extensive study and testing after the introduction of the 1960 version. This chapter was also adopted by the IMO Assembly as resolution A.264(VIII) in 1973 and Governments were urged to introduce its provisions as a replacement for the 1960 chapter.

The 1974 Convention recognizes ships constructed specially for the transport of grain, and specifies a method for calculating the adverse heeling moment caused by shift of cargo in ships carrying bulk grain.

Each ship must carry a document of authorization, grain loading stability data and associated plans of loading.

Chapter VII: Carriage of dangerous goods

This chapter prescribes the classification, packing, marking and stowage of dangerous substances in packaged form. The chapter does not apply to substances carried in bulk in purpose-built ships.

The provisions on classification follow the method used by the UN for all modes of transport, although IMO provisions are more stringent.

Contracting Governments are required to issue or cause to be issued detailed instructions concerning the carriage of dangerous goods, and for this purpose the International Maritime Dangerous Goods Code was adopted by IMO in 1965. For many years it has been up-dated periodically to accommodate new substances and to supplement or revise existing provisions to keep pace with developments.

Chapter VIII: Nuclear ships

Only basic requirements are given, which were supplemented by various recommendations contained in an attachment to the Final Act of the 1974 SOLAS Conference. These recommendations have now been overtaken by the safety code for nuclear merchant ships and recommendations on the use of ports by nuclear merchant ships.

The Collision Regulations

One subject which was not discussed at the 1974 SOLAS Conference was the revision of the Collision Regulations, which had been on the agenda of all previous SOLAS conferences. The reason was the decision taken some years before that the Collision Regulations should no longer be appended to the SOLAS Convention but should become a separate international instrument.

The Convention on the International Regulations for Preventing Collisions at Sea was adopted by an IMO conference in 1972 and entered into force in 1977. It is significant that this Convention, like SOLAS, also incorporates a "tacit acceptance" procedure.

The 1978 SOLAS Protocol

The requirements for entry into force of the SOLAS Convention - acceptance by 25 States with at least 50 per cent of world gross tonnage of merchant shipping - meant that it would take several years before the Convention entered into force. It finally did so on 25 May 1980.

In the meantime a series of accidents involving oil tankers in the winter of 1976-77, led to increasing pressure for further international action. As a result, early in 1978, IMO convened an international conference on tanker safety and pollution prevention which adopted a number of important modifications to SOLAS as well as to the International Convention for the Prevention of Pollution from Ships (MARPOL), 1973.

Since the 1974 SOLAS Convention had not entered into force it was impossible to amend the Convention. Instead the conference decided to adopt a Protocol which would enter into force six months after ratification by 15 States with 50 per cent of world tonnage of merchant ships (but not before the parent 1974 SOLAS Convention had entered into force). The Protocol entered into force on 1 May 1981.

The main points of the Protocol are as follows:

1. New crude carriers and product carriers of 20,000 dwt and above are required to be fitted with an inert gas system (Chapter II-2).
2. An inert gas system is mandatory for existing crude oil carriers of 70,000 dwt as of 1 May 1983, and as of 1 May 1985 for ships of 20,000-70,000 dwt (Chapter II-2).
3. In the case of crude carriers of 20,000-40,000 dwt there is provision for exemption by flag States where it is considered unreasonable or impracticable to fit an inert gas system and high-capacity fixed washing machines are not used. But an inert gas system is always required when crude oil washing is operated (Chapter II-2).
4. An inert gas system is required on existing product carriers as from 1 May 1983 and as from 1 May 1985 for ships of 40,000-70,000 dwt and down to 20,000 dwt where ships are fitted with high capacity washing machines (Chapter II-2).
5. All ships of 1,600-10,000 tons gross tonnage are required to be fitted with radar, and ships of 10,000

gross tonnage and above must have two radars, each capable of operating independently. Requirements for operation and testing of steering gear were also introduced (Chapter V).

6. All tankers of 10,000 gross tonnage and above must have two remote steering gear control systems, each operable separately from the navigating bridge (Chapter II-1).
7. The main steering gear of new tankers of 10,000 gross tonnage and above must comprise two or more identical power units, and be capable of operating the rudder with one or more units (Chapter II-1).
8. A number of important regulations designed to improve the survey and certification of ships were also adopted. These include modifications to the provisions relating to the intervals of surveys and inspections and the introduction of intermediate surveys of life-saving appliances and other equipment of cargo ships and, in the case of hull, machinery and equipment, periodical surveys for cargo ships and intermediate surveys for tankers of ten years of age and over. Unscheduled inspections and mandatory annual surveys were also introduced. Furthermore the port State control provisions were rewritten (Chapter I).

The 1981 Amendments

As previously noted, the 1974 Convention basically consists of the 1960 version incorporating the amendments adopted between 1966 and 1973, together with the new "tacit acceptance" procedure.

During the 1970s the Organization prepared a number of major changes to the Convention, some of which were incorporated in the 1978 Protocol. Others were included in amendments adopted in November 1981 and, under the tacit acceptance procedure, entered into force on 1 September 1984.

The most important of these concern Chapter II-1 (Construction - subdivision and stability, machinery and electrical installations) and Chapter II-2 (Construction - fire protection, fire detection and fire extinction). In both cases the chapters have virtually been rewritten and updated.

The changes to Chapter II-1 include the provisions of resolution A.325(IX), which was adopted in 1975, on machinery and electrical requirements. They also include further modification to regulations 29 and 30 of the 1978 SOLAS Protocol on steering gear. The requirements introduce the concept of duplication of steering gear control systems in tankers and were developed to prevent a repetition of the defects which led to the grounding of the tanker *Amoco Cadiz* in 1978.

Other amendments to Chapter II-1 include collision bulkheads in cargo ships, passenger ships designed for the carriage of goods vehicles and accompanying personnel, and bilge pumping arrangements for cargo ships.

The amendments to Chapter II-2 include the requirements of resolutions A327(IX) and A.372(X), adopted in 1975 and 1977 respectively, provisions for halogenated hydrocarbon extinguishing systems and a new regulation 62 on inert gas systems. The extensive amendments which had to be incorporated made a complete rearrangement of that chapter necessary.

Chapter III (Life-saving appliances) was slightly amended to provide a cross-reference to the amendments to Chapter II-1 and minor amendments were made to several regulations in Chapter IV (Radiotelegraphy and radiotelephony).

Important changes were made to Chapter V (Safety of navigation), including the addition of new requirements concerning the carriage of shipborne navigational equipment (Regulation 12). The revised requirements cover such matters as gyro and magnetic compasses; radar installations; automatic radar plotting aids; echo-sounders; devices to indicate speed and distance; rudder angle indicators; propeller revolution indicators; rate-of-turn indicators; radio direction-finding apparatus; and equipment for homing on the radiotelephone distress frequency.

The application of Chapter VI (Carriage of grain) was extended to ships of less than 500 gross tonnage engaged on international voyages.

The 1983 Amendments

The second set of amendments to the SOLAS Convention was adopted in November 1983 and entered into force on 1 July 1986.

They include a few editorial changes to Chapter II-1 and some further revisions of Chapter II-2, including several amendments to regulations which were changed in 1981. This was considered necessary by

IMO's Maritime Safety Committee (MSC) because of their importance to the safety of bulk carriers and passenger ships in particular.

One of the most important changes affects regulation 56 (Location and separation of spaces in tankers) which was completely rewritten. One section of the new regulation applies specifically to combination carriers.

The revised Chapter III was increased from 38 regulations to 53 and retitled "Life-saving appliances and arrangements". The main changes were to ensure operational readiness of ships and the safe abandonment survival, detection and retrieval of survivors.

The requirements of the revised chapter applied to new ships the keels of which were laid on or after 1 July 1986 (the date of entry into force of the 1983 amendments). A few requirements, mostly dealing with life-saving appliance operations and drills, also applied to existing ships as from 1 July 1986. Some requirements, including those for the carriage of additional liferafts, life-saving radio equipment, lifejacket lights and other aids to assist detection, immersion suits and thermal protective aids, applied to existing ships not later than 1 July 1991.

The amendments were designed not only to take into account new developments but also to provide for the evaluation and introduction of novel life-saving appliances or arrangements.

Like the original chapter, the new chapter contained three parts, but the arrangement is very different. Part A deals with general matters such as application, exemptions, definitions, evaluation and testing and production tests. Part B is concerned with ship requirements and contains three sections: Section I (regulations 6 to 19) deals with passenger ships and cargo ships; Section II (regulations 20 to 25) contains additional requirements for passenger ships and Section III (regulations 26 to 29) include additional requirements for cargo ships.

Part C deals with life-saving appliance requirements. It contains 24 regulations divided into eight sections.

Among the more important changes introduced by the revised Chapter III are those involving lifeboats and liferafts.

Generally speaking, the lifeboats required by the original Chapter III of SOLAS 1974 are of the traditional open design, most of them without power. The revised chapter required that all partially or totally enclosed lifeboats be equipped with an engine (regulation 41). All totally enclosed boats must be self-righting. Cargo ships must carry sufficient totally enclosed lifeboats on each side to accommodate all on board. Cargo ships must also carry liferafts for launching on each side which will accommodate all on board. Chemical and oil tankers must carry totally enclosed lifeboats equipped with a self-contained air support system (if the cargo emits toxic gases). In addition these lifeboats must afford protection against fire for at least eight minutes (where the cargo is flammable).

Rescue boats - that is, boats which are designed to rescue persons in distress and to marshal survival craft are also required.

On passenger ships partially or totally enclosed lifeboats are required on each side able to accommodate not less than 50 per cent of all persons on board. However, passenger ships on short international voyages (ferries) are permitted to substitute liferafts for some of the lifeboats.

The requirements for inflatable and rigid liferafts were also rewritten and expanded. The new chapter incorporated several regulations which were designed to ensure that all life-saving appliances were kept in good condition and could be used promptly in the event of an emergency.

Chapter III required (regulation 13) that survival craft be capable of being launched when the ship has a list of 20 degrees in either direction: the original Chapter III of SOLAS 1974 only required launching with a 15 degree list.

The revised Chapter III also included (regulation 28) a requirement that lifeboats on cargo ships of 20,000 gross tons and above be capable of being launched when the ship is making headway at speeds of up to 5 knots. This was a new requirement in response to the fact that ships had increased greatly in size since the original chapter had been drafted and tookmuch longer to stop.

The greatest danger in an accident at sea is not drowning but hypothermia, and the new chapter included a number of regulations designed to reduce this threat. These included requirements for improved personal life-saving appliances, including immersion suits (protective suits which reduce the body heat-loss of a person

in cold water) and thermal protective aids (a bag or suit made of waterproof material with low thermal conductivity).

The revised Chapter III also made it easier for survivors to be located. Lifejackets had to be fitted with lights and a whistle and provision was made for the use of retro-reflective materials.

The amendments to Chapter VII (Carriage of dangerous goods) of the Convention were of great importance since they extended its application to chemical tankers and liquefied gas carriers. The original chapter applied only to dangerous goods carried in packaged form.

The revised chapter achieved this by making reference to two new codes which have been developed by IMO. These are the **International Bulk Chemical (IBC) Code** and the **International Gas Carrier (IGC) Code**.

Regulation 10 of the new chapter states that "a chemical tanker shall comply with the requirements of the International Bulk Chemical Code and shall ... be surveyed and certified as provided for in that Code. For the purpose of this regulation the requirements of the Code should be treated as mandatory".

Regulation 13 makes a similar reference to gas carriers and the International Gas Carrier Code.

Both Codes relate to ships built on or after 1 July 1986 and were finalized and adopted by the MSC during the session in which the amendments were adopted.

The (April) 1988 Amendments

In March 1987 the roll-on/roll-off passenger ferry *Herald of Free Enterprise* capsized and sank shortly after leaving Zeebrugge in Belgium. The accident resulted in the deaths of 193 passengers and crew members and led to demands for action to improve the safety of a ship type which has proved outstandingly successful from a commercial point of view.

Shortly after the accident the United Kingdom came to IMO with a request that a series of emergency measures be considered for adoption. The proposals, many of which were based on the findings of the inquiry into the disaster, were presented to IMO in separate packages, the first of which was adopted by the MSC in April 1988.

The amendments involve the addition of new regulations 23-2 and 42-1 to Chapter II-1 of the SOLAS Convention. Regulation 23-2 deals with the integrity of the hull and superstructure, damage prevention and control and requires that indicators be provided on the navigating bridge for all doors which, if left open, could lead to major flooding of a special category space or a ro-ro cargo space.

The same regulation also requires that means be arranged, such as television surveillance or a water leakage detection system, to provide an indication to the navigating bridge of any leakage through doors which could lead to major flooding. Existing ships could be exempted from this requirement for a period of three years after the entry into force of the amendments (i.e. until 22 October 1992).

Special category and ro-ro spaces must also be patrolled or monitored by effective means, such as television surveillance, so that undue movement of vehicles in adverse weather and unauthorized access by passengers can be observed whilst the ship is underway.

A new regulation 42-1 deals with supplementary emergency lighting for ro-ro passenger ships. All public spaces and alleyways must be provided with supplementary lighting that can operate for at least three hours when all other sources of electric power have failed and under any condition of heel.

A portable rechargeable battery-operated lamp must be provided in every crew space alleyway, recreational space and every working space which is normally occupied unless supplementary emergency lighting is provided. Existing ships could be exempted until
22 October 1990.

The amendments entered into force on 22 October 1989 under tacit acceptance procedure. This normally results in amendments entering into force within two and a half years of the date of adoption by the MSC, but Article VIII does allow the Committee to select a different period of time but not less than a year and a half and this was the first time that the procedure had been used to reduce the period before entry into force to less than two and a half years. The amendments entered into force only 18 months after adoption - an indication of the great importance which IMO attaches to ro-ro safety.

The (October) 1988 Amendments

In October 1988 the MSC met again in a special session requested and paid for by the United Kingdom to consider a second package of amendments arising from the *Herald of Free Enterprise* tragedy. The amendments adopted entered into force on 29 April 1990.

One of the most important amendments concerns regulation 8 of Chapter II-1 and was designed to improve the stability of passenger ships in the damaged condition. Work on the amendment began before the *Herald of Free Enterprise* sinking but adoption was brought forward because of its relevance to ro-ro safety. The amendment applied to ships built on or after 29 April 1990.

The amendment considerably expands the existing regulation by introducing a value of 15 degrees for a minimum range of positive residual lever curve and a value of 0.015 m-rad for the area under the righting lever curve in the final condition after damage. For the purpose of calculating heeling moments it takes into account such factors as the crowding of passengers on to one side of the ship, the launching of survival craft on one side of the ship and wind pressure. The amendment also stipulates that the maximum angle of heel after flooding but before equalization shall not exceed 15 degrees.

A further amendment to regulation 8 was proposed by the United Kingdom. It is concerned with intact rather than damage stability. It requires masters to be supplied with data necessary to maintain sufficient intact stability and the amendment expands the regulation by requiring that the information must show the influence of various trims, taking into account operational limits.

Ships must also have scales of draughts marked clearly at the bow and stern. Where these are not easily readable the ship must also be fitted with a reliable draught indicating system. After loading and before departure the master must determine the ship's trim and stability.

The next amendment adds a new regulation 20-1 which requires that cargo loading doors shall be locked before the ship proceeds on any voyage and remain closed until the ship is at its next berth.

The third amendment affects regulation 22 and states that at periods not exceeding five years a lightweight survey must be carried out to passenger ships to verify any changes in lightweight displacement and the longitudinal centre of gravity. The lightweight of a ship consists of the hull, machinery crew and fittings without fuel and stores. Additions to the structure can add significantly to lightweight and affect the ship's stability.

The November 1988 Protocols
(Harmonization)

The April and October amendments were all adopted in response to an emergency. By contrast the other changes made to SOLAS during 1988 were all the result of many years of careful deliberation. They involved two subjects - the introduction of the Global Maritime Distress and Safety System (GMDSS) and the introduction of a harmonized survey and certification system.

The latter was recommended by the 1978 conference on tanker safety and pollution prevention. It recognized the difficulties caused by the survey and certification requirements of SOLAS, the International Convention on Load Lines, 1966 and the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto.

All three instruments require the issuing of certificates to show that requirements have been met and this has to be done by means of a survey which can involve the ship being out of service for several days. However, the survey dates and intervals between surveys do not always coincide. As a result, a ship may have to go into port or repair yard for a survey required by one convention shortly after doing the same thing in connection with another instrument. The
1978 conference called upon IMO to develop a harmonized system which would enable the surveys to be carried out at the same time.

Although MARPOL can be amended by means of a tacit acceptance procedure, this procedure cannot be applied to SOLAS and the Load Lines conventions as far as surveys and certification are concerned. It was decided therefore to introduce the harmonized system by means of Protocols to the two instruments which would enter into force 12 months after being accepted by not less than 15 States whose combined merchant fleets constitute not less than 50 per cent of world tonnage. Neither Protocol could enter into force before the other and entry into force requirements have not yet been met.

The harmonized system provides for a maximum period of validity of five years for all certificates of

cargo ships and 12 months for the Passenger Ship Safety Certificate. Annual inspections have been made mandatory for cargo ships and unscheduled inspections have been discontinued. Other changes have been made to survey intervals and requirements.

The 1988 (GMDSS) Amendments

Work on the Global Maritime Distress and Safety System (GMDSS) began in the 1970s and the amendments entered into force on 1 February 1992. The System is being phased in between 1 February 1992 and 1 February 1999.

The basic concept of the system is that search and rescue (SAR) authorities ashore as well as shipping in the immediate vicinity of the ship in distress will be rapidly alerted to a distress incident so they can assist in a co-ordinated SAR operation with the minimum of delay.

The system also provides for safety communications and the dissemination of maritime safety information, including navigational and meteorological warnings and other urgent information to ships.

Although satellites operated by the International Mobile Satellite Organization (Inmarsat) play an important part in the GMDSS, they will not completely replace coast radio stations and equipment requirements vary according to the sea area in which the ship operates. Ships operating within range of DSC (Digital Selective Calling) VHF coast stations, for example, only have to carry DSC VHF radio installations.

The new system requires the carriage of other equipment designed to improve the chances of rescue following an accident, such as satellite emergency position-indicating radio beacons (EPIRBs) and search and rescue radar transponders (SARTs) for the location of the ship or survival craft.

The implementation of GMDSS is helping to greatly speed up SAR operations and ensure that distress messages are received quickly and reliably. The use of the Morse Code, which has been used for distress communications at sea since the beginning of the century, is also being phased out.

The April 1989 Amendments

Further amendments to SOLAS were adopted by the MSC in April 1989. They also entered into force on 1 February 1992.

Several regulations of Chapter II-1 were amended, the most important being regulation 15 which deals with openings in watertight bulkheads in passenger ships. From 1 February 1992 new ships, except in specific cases, have had to be equipped with power-operated sliding doors, which must be capable of being closed from a console on the bridge in not more than 60 seconds. The amendments make it clear that all watertight doors must be kept closed except in exceptional circumstances. Other amendments affect Chapters II-2, III, IV, V and VI.

The May 1990 Amendments

Important changes were made to the way in which the subdivision and damage stability of cargo ships is determined. They apply to ships of 100 metres or more in length built on or after 1 February 1992.

The amendments introduce a new part B-1 of Chapter II-1, containing subdivision and damage stability requirements for cargo ships based upon the so-called "probabilistic" concept of survival, which was originally developed through study of data relating to collisions collected by IMO. This showed a pattern in accidents which could be used in improving the design of ships: most damage, for example, is sustained in the forward part of ships and it seemed logical, therefore, to improve the standard of subdivision there rather than towards the stern. Because it is based on statistical evidence as to what actually happens when ships collide, the probabilistic concept provides a far more realistic scenario than the earlier "deterministic" method, whose principles regarding the subdivision of passenger ships are theoretical rather than practical in concept.

At the same meeting, amendments were adopted to the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code) and the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code).

The May 1991 Amendments

Perhaps the main change made in these amendments, which entered into force on 1 January 1994, was the

complete rewriting of Chapter VI, which previously only covered the carriage of grain. The amendments extended the chapter to cover other cargoes, including bulk cargoes.

Other amendments affect Chapter II-2, which deals with fire safety, Chapter III (life-saving appliances), Chapter V (safety of navigation) and Chapter VII (carriage of dangerous goods).

The new Chapter VI was retitled Carriage of Cargoes. It applies to all cargoes except liquids in bulk and gases in bulk, both of which were covered by other IMO instruments. The chapter contains three sections. Part A contains general provisions. Regulation 2 requires shippers to provide masters with appropriate information concerning the cargo. Regulation 3 covers oxygen analysis and detection equipment and regulation 4 deals with the use of pesticides: reference is made to the IMO *Recommendation on the safe use of pesticides in ships.* Regulation 5 deals with stowage and securing and is particularly concerned with cargo units and containers.

Part B of Chapter VI deals with bulk cargoes other than grain. It contains only two regulations, the first of which (Regulation 6) deals with the acceptability of cargoes for shipment. Two IMO recommendations, on intact stability and on severe wind and rolling criterion, are referred to. Regulation 7 deals with the stowage of bulk cargoes.

Part C also only contains two regulations and its chief purpose is to define the coverage of the International Grain Code.

The provisions of Chapter VI are backed by a number of Codes.

Only the International Grain Code was mandatory in its entirety. The other Codes were all recommended. They are the Code of Safe Practice for Cargo Stowage and Securing (parts of which have been mandatory since 1 July 1996), the Code of Safe Practice for Solid Bulk Cargoes (BC Code) and the Code of Safe Practice for Ships Carrying Timber Deck Cargoes. Regulation 1 of the revised Chapter says that Contracting Governments to SOLAS must ensure that "appropriate information on cargo and its stowage and securing is provided". By means of an asterisk, reference is then made to the Codes.

Code of Safe Practice for Cargo Stowage and Securing

The aim of the Code is to provide an international standard for the safe stowage and securing of cargoes. It gives advice on ways of securing and stowing cargoes and gives specific guidance on cargoes which are known to create difficulties or hazards. It also gives advice on actions to be taken in heavy seas and to remedy cargo shift.

The Code is divided into seven chapters and a number of annexes dealing with such "problem" cargoes as portable tanks and receptacles; wheel-based cargoes; heavy cargo items such as locomotives and transformers; coiled sheet steel; heavy metal products; anchor chains; metal scrap in bulk; flexible intermediate bulk containers (FIBCs); the under-deck stowage of logs; and unit loads.

Code of Safe Practice for Ships Carrying Timber Deck Cargoes, 1991

The Code replaces a version first circulated in 1972. It was necessary to revise this because of the continuing occurrence of casualties involving shift and the loss of timber deck cargoes, the employment of larger and more sophisticated ships, new techniques and the desirability of having more comprehensive recommendations.

It covers such matters as stability, stowage, personnel protection and safety devices and action to be taken during the voyage. One appendix gives advice on stowing practices and another contains general guidelines on the under-deck stowage of logs.

International Code for the Safe Carriage of Grain in Bulk

The Code applies to all ships, including those of less than 500 tons gross tonnage.

Grain has been carried at sea for thousands of years, but has always presented problems because of its tendency to shift when carried in bulk. Measures to counter this were included in the 1960 version of SOLAS and in equivalent measures adopted in 1969.

The 1969 rules formed the basis of Chapter VI of the 1974 SOLAS Convention, and were known as the IMO Grain Rules. They are based on the recognition that, in a compartment nominally filled with grain, there

exists a void space between the surface of the grain and the deckhead. The Rules require demonstration by calculation that at all times during a voyage the ship will have sufficient intact stability to provide adequate residual dynamic stability after taking into account the adverse heeling effects caused by an assumed pattern of grain movement.

Temporary fittings to reduce grain shift, such as shifting boards, depend entirely upon achieving the correct relationship between the intact stability characteristics of the ship and the heeling effects of a possible grain shift within the various compartments.

The Rules require a minimum level of acceptable stability for the carriage of grain in terms of angle of heel due to assumed grain shift, residual righting energy and initial metacentric height.

In the new Chapter VI, the carriage of grain is dealt with in two general regulations and detailed grain rules have been transferred to the mandatory Code.

Code of Safe Practice for Solid Bulk Cargoes (BC Code)

The BC Code is IMO's basic instrument dealing with bulk cargo carriage. It was first adopted by the IMO Assembly in 1979 and has been revised several times since then.

Chapter II-2: Construction - fire protection, fire detection and fire extinction

Two of the amendments apply to all ships. They affect regulations 20 and 21, which deal respectively with fire control plans and ready availability of fire-extinguishing appliances. The remaining amendments concern passenger ships built on or after 1 January 1994 and are particularly concerned with fire safety on ships, such as modern cruise liners, on which large open spaces such as atriums are commonly provided.

Atriums are defined as public spaces which span three or more decks and contain combustibles such as furniture and enclosed spaces, such as shops, offices and restaurants. Regulation 28 has been revised to make it mandatory for such spaces to be provided with two means of escape, one of which gives direct access to an enclosed vertical means of escape.

Regulation 32 requires that such spaces be fitted with a smoke extraction system, which can be activated manually as well as by a smoke detection system, which is required under the amended regulation 40. Regulation 36 has been amended to make it mandatory for such spaces to be fitted with automatic sprinkler systems.

Chapter III: Life-saving appliances and arrangements

Regulation 18, which covers abandon ship training and drills was amended to cover emergency training and drills. The changes deal with fire drills and on-board training and instructions.

Chapter V: Safety of navigation

The amendments are concerned with arrangements for transferring pilots. The new regulation 17 applies to all arrangements for pilot transfer installed on or after 1 January 1994. Existing ships will continue to be covered by the original text but "due regard shall be paid to the standards adopted by the Organization". Reference is then made to Assembly resolution A.667(16), a recommendation on pilot transfer arrangements adopted by the IMO Assembly in 1989, to which the technical requirements previously contained in the Convention have been transferred.

Chapter VII: Carriage of dangerous goods

Regulation 5, which deals with documents, has been revised to make it necessary for those packing dangerous goods in containers to provide an appropriate certificate. Ships must also carry lists showing the dangerous goods carried and their location.

A new Regulation 7-1 has been added making it mandatory for the loss overboard of dangerous goods to be reported to the nearest coastal State. Reference is made to an IMO resolution which outlines procedures for doing so.

The April 1992 Amendments

Measures to improve the damage stability of passenger ships came into force on 29 April 1990 and the April 1992 amendments to regulation 8 of Chapter II-1 mean that a slightly modified "SOLAS 90" standard will be phased in for ro-ro passenger ships built before that date during an 11-year period beginning on 1 October 1994. The phase-in period allowed depends upon the value of a ratio A/Amax, determined in accordance with a calculation procedure developed by the Maritime Safety Committee to assess the survivability characteristics of existing ro-ro passenger ships.

Those with an A/Amax value of less than 70% for example, had to comply with the amendments by 1 October 1994, the date on which the amendments entered into force. The complete phase-in period and degree of compliance is shown below:

Compliance	
A/Amax value	**Date**
Less than 70%	1 October 1994
70%-less than 75%	1 October 1996
75%- less than 85%	1 October 1998
85%- less than 90%	1 October 2000
90%- less than 95%	1 October 2005

The application of the modified SOLAS 90 standard to existing ships means that a large part of the world's ro-ro fleet will have to be altered. In some cases the changes could be extensive and the high cost involved could lead to some of them being scrapped and replaced with new tonnage.

The improved fire safety measures for existing passenger ships which are introduced through amendments to Chapter II-2 include mandatory requirements for smoke detection and alarm and sprinkler systems in accommodation and service spaces, stairway enclosures and corridors. Other improvements involve the provision of emergency lighting, general emergency alarm systems and other means of communication. The new measures are being phased in between 1994 and 2000.

The amendments are particularly important because they apply to existing ships. In the past, major changes to SOLAS have been restricted to new ships by so-called "grandfather clauses". The reason for this is that major changes involve expensive modifications to most ships. Because of the financial burden this imposes on the industry, IMO has in the past been reluctant to make such measures retroactive.

On this occasion the MSC decided that the new stability and fire safety standards are so important that they should not be restricted to new ships. The *Herald of Free Enterprise* disaster of 1987 and the *Scandinavian Star* fire of 1988 respectively both influenced the Committee in making this decision.

The December 1992 Amendments

The amendments are concerned primarily with construction requirements for new tankers and fire safety standards for new passenger ships built on or after 1 October 1994, the date on which the amendments entered into force under the Convention's "tacit acceptance" provisions.

The amendments dealing with tankers affect two regulations in Chapter II-1, which deals with construction.

A new regulation 12-2 was added which lays down requirements for access to spaces in the cargo area of oil tankers. A new requirement was also added to regulation 37 dealing with communications between the navigation bridge and machinery spaces.

Major changes were made to the requirements of chapter II-2 dealing with fire protection of new passenger ships. Several regulations are affected, dealing with such matters as fire pump sizing, the release mechanism of carbon dioxide fire-extinguishing systems, the prohibition of new halon systems, and fixed fire-

detection and fire-alarm systems.

A new regulation 20-4 was added, making it mandatory for ships carrying more than 36 passengers to have plans providing information on fire safety measures. These are based on guidelines developed by IMO and contained in Assembly resolution A.756(18). Regulations dealing with the fire integrity of bulkheads and decks were amended. Regulation 28 (means of escape) was considerably altered: corridors from which there is only one route of escape are prohibited on ships built after 1 October 1994. All means of escape must be marked by lighting or photoluminescent strip indicators placed not more than 0.3 m above the deck. The lighting must identify escape routes and escape exits.

Requirements for fire doors (regulation 30) were also improved.

Passenger ships carrying more than 36 passengers will have to be equipped with an automatic sprinkler, fire-detection and fire-alarm system.

The amendments made it mandatory for new passenger ships carrying more than 36 passengers to be fitted with fire-detection alarms centralized in a control station which must be continuously manned and from which it is possible to control the fire-detection system, fire doors, watertight doors, ventilation fans, alarms, communications system and the microphone to the public address system.

Two codes which are mandatory under SOLAS and MARPOL were also amended. They are the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code) and the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code), both of which apply to ships built after 1986 under the SOLAS Convention. The amendments entered into force on 1 July 1994.

Other changes were made to the Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (BCH Code). This applies to ships built before 1986. The amendments also entered into force on 1 July 1994.

The most important changes to the IBC Code are to Chapter 8 (cargo-tank venting and gas-freeing arrangements), Chapter 17 (summary of minimum requirements) and Chapter 18 (list of chemicals to which the Code does not apply). In each case the existing text is completely replaced.

Many of the amendments made to the BCH Code are intended to keep it in line with the IBC Code. They include a new text of Chapter VI (summary of minimum requirements) and a new Chapter VIII dealing with the transport of liquid chemical wastes.

Although some of the changes to the IGC Code are of an editorial nature, others are intended to ensure that it keeps pace with technical changes that have been made since it was adopted in 1983.

The May 1994 amendments: the SOLAS conference

Although some of the 1994 amendments were adopted by the Maritime Safety Committee expanded to include all Contracting Governments (see below), for legal reasons, others were dealt with by a special conference. The changes made by the conference included the addition of three new chapters to the Convention.

The details are as follows:

Chapter IX: Management for the Safe Operation of Ships: the main purpose of the new chapter is to make the International Safety Management (ISM) Code mandatory. The ISM Code was adopted by the 18th session of the Assembly in 1993 as resolution A.741(18). This already gives it considerable force, since it was adopted unanimously and can therefore be regarded as having the full support of IMO's 155 Member States - but it is still only a recommendation. By adding the ISM Code to SOLAS it is intended to provide an international standard for the safe management of ships and for pollution prevention.

The ISM Code establishes safety management objectives which are:

- to provide for safe practices in ship operation and a safe working environment;
- to establish safeguards against all identified risks;
- to continuously improve safety management skills of personnel, including preparing for emergencies.

The Code requires a safety management system (SMS) to be established by "the Company", which is defined as the shipowner or any person, such as the manager or bareboat charterer, who has assumed responsibility for operating the ship. This system should be designed to ensure compliance with all mandatory regulations and that codes, guidelines and standards recommended by IMO and others are taken into account.

The SMS in turn should include a number of functional requirements:

- a safety and environmental protection policy;
  instructions and procedures to ensure safety and environmental protection;
- defined levels of authority and lines of communication between and amongst shore and shipboard personnel;
- procedures for reporting accidents, etc.;
- procedures for responding to emergencies;
- procedures for internal audits and management review.

The Company is then required to establish and implement a policy for achieving these objectives. This includes providing the necessary resources and shore-based support. Every company is expected "to designate a person or persons ashore having direct access to the highest level of management".

The Code then goes on to outline the responsibility and authority of the master of the ship. It states that the SMS should make it clear that "the master has the overriding authority and the responsibility to make decisions ..." The Code then deals with other seagoing personnel and emphasizes the importance of training.

Companies are required to prepare plans and instructions for key shipboard operations and to make preparations for dealing with any emergencies which might arise. The importance of maintenance is stressed and companies are required to ensure that regular inspections are held and corrective measures taken where necessary.

The procedures required by the Code should be documented and compiled in a Safety Management Manual, a copy of which should be kept on board. Regular checks and audits should be held by the company to ensure that the SMS is being complied with and the system itself should be reviewed periodically to evaluate its efficiency.

After outlining the responsibilities of the company, the Code then stresses that the responsibility for ensuring that the Code is complied with rests with the Government. Companies which comply with the Code should be issued with a document of compliance, a copy of which should be kept on board. Administrations should also issue a Safety Management Certificate to indicate that the company operates in accordance with the SMS and periodic checks should be carried out to verify that the ship's SMS is functioning properly.

The Chapter enters into force under the tacit acceptance procedure on 1 July 1998. It will apply to passenger ships, oil and chemical tankers, bulk carriers, gas carriers and cargo high speed craft of 500 gross tonnage and above not later than that date and to other cargo ships and mobile offshore drilling units of 500 gross tonnage and above not later than 1 July 2002.

Chapter X: Safety of High- Speed Craft: many new types of high-speed craft (HSC) are now being constructed and the new chapter is intended to provide mandatory international regulations dealing with the special needs of this type of vessel.

The HSC Code applies to high-speed craft engaged on international voyages and includes passenger craft which do not proceed for more than four hours at operational speed from a place of refuge when fully laden and cargo craft of 500 gross tonnage and above which do not go more than eight hours from a port of refuge.

The craft covered by the draft Code include, among others, air-cushion vehicles (such as hovercraft) and hydrofoil boats. The Code is intended to be a complete set of comprehensive requirements for high-speed craft, including equipment and conditions for operation and maintenance. A basic aim is to provide levels of safety which are equivalent to those contained in SOLAS and the International Convention on Load Lines, 1966.

The Chapter entered into force on 1 January 1996.

Chapter XI: Special Measures to Enhance Maritime Safety. The chapter entered into force on 1 January 1996 and contains four regulations.

Regulation 1 states that organizations entrusted by Administrations with the responsibility for carrying out surveys and inspections shall comply with the guidelines adopted by the IMO Assembly by resolution A.739 (18) in November 1993.

Such organizations are often used to carry out surveys and inspections required by SOLAS, the 1966 Load Lines Convention, MARPOL 73/78 and the 1969 Tonnage Convention. The guidelines are intended to

ensure that organizations employed in this comply with standards listed in an appendix to the guidelines.

Regulation 2 requires that bulk carriers and oil tankers shall be subject to the enhanced programme of inspection in accordance with the guidelines adopted in 1993 by Assembly resolution A.744(18).

The enhanced surveys should be carried out during the periodical, intermediate and annual surveys prescribed by the SOLAS Convention.

The guidelines on the enhanced programme of inspections were developed by IMO as a result of a high number of casualties in recent years and of increasing concern about the ageing of the world merchant shipping fleet. This is particularly true of tankers and bulk carriers, the majority of which are now between 15 and 20 years of age. An accident to a tanker can have disastrous environmental consequences while an accident to a bulk cargo carrier can result in the ship suddenly sinking or breaking apart: in the early 1990s there were many cases of bulk carriers sinking so suddenly that there was no time for a distress message to be sent out or the crew to be safely evacuated.

The guidelines pay special attention to corrosion. Coatings and tank corrosion prevention systems must be thoroughly checked and measurements must also be carried out to check the thickness of plates. These measurements become more extensive as the ship ages. The guidelines go into considerable detail to explain the extra checks that should be carried out during enhanced surveys. One section deals with preparations for surveys and another with the documentation which should be kept on board each ship and be readily available to surveyors. This should record full reports of all surveys carried out on the ship.

Annexes to the guidelines go into still more detail and are intended to assist implementation. They specify the structural members that should be examined, for example, in areas of extensive corrosion; outline procedures for certification of companies engaged in thickness measurement of hull structures; recommend procedures for thickness measurements and close-up surveys; and give guidance on preparing the documentation required.

Regulation 3 provides that all passenger ships of 100 gross tonnage and above and all cargo ships of 300 gross tonnage and above shall be provided with an identification number conforming to the IMO ship identification number scheme, as adopted by resolution A.600(15) in 1987.

Regulation 4 makes it possible for port State control officers inspecting foreign ships to check operational requirements "when there are clear grounds for believing that the master or crew are not familiar with essential shipboard procedures relating to the safety of ships".

Reference is made to the procedures contained in the annex to resolution A.742(18), which was adopted by the IMO Assembly in November 1993. The resolution refers to a number of earlier resolutions dealing with control procedures, management responsibilities and principles of safe manning but notes that none of these explicitly deals with the influence of the human element on maritime safety or pollution prevention.

It acknowledges the need for port States to be able to monitor not only the way in which foreign ships comply with IMO standards but also to be able to assess "the ability of ships' crews in respect of operational requirements relevant to their duties, especially with regard to passenger ships and ships which may present a special hazard".

The resolution agrees that, where there are clear grounds for believing that a ship's officers and crew are not familiar with essential shipboard procedures, then port State control should be extended to include operational requirements.

The "clear grounds" referred to are defined in the annex to the resolution. They include such factors as operational shortcomings, cargo operations not being conducted properly, the involvement of the ship in incidents caused by operational mistakes, absence of an up-to-date muster list and indications that crew members may not be able to communicate with each other.

The procedures refer to control procedures in three IMO Conventions. They are regulation 19 of Chapter I of SOLAS; articles 5 and 6 of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78) and article X of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978.

The procedures say that accidents involving passenger ships and ships carrying harmful substances have highlighted the need for good operational standards. These are primarily the responsibility of flag States but, the introduction to the procedures, observes: "It may be difficult for some Administrations to exercise full and

continuous control of ships entitled to fly their flag under certain circumstances, such as the cargo the ship carries and the familiarity of the crew with the ship, which can change completely between two successive flag State inspections and the fact that some ships do not regularly call at flag States' national ports."

Port State control inspections are normally limited to checking certificates and documents. The introduction says that if certificates are not valid or if there are clear grounds for believing that the condition of the ship or of its equipment, or its crew, does not substantially meet the requirements of a relevant instrument, a more detailed inspection may be carried out.

The annex then goes on to give guidelines on how to carry out control of operational requirements under the three conventions. It is not intended that all operational procedures would be checked during one single inspection.

The operations and procedures selected for special attention include ascertaining that crew members are aware of their duties as indicated in the muster list; communications; fire and abandon ship drills; familiarity with the ship's damage control and fire control plans; bridge, cargo and machinery operations; and ability to understand manuals and other instructions. The guidelines then cover operational requirements relating to anti-pollution activities.

Detailed guidance on how these factors should be assessed is given in an appendix.

The new Chapter XI was adopted after considerable discussion and a resolution adopted by the conference states that it is "undesirable, due to its special nature, that the provisions of the chapter be frequently amended".

The May 1994 amendments: the expanded MSC

The amendments entered into force on 1 January 1996 and include the following:

Chapter II-2: improvements have been made to regulation 15, which deals with fire protection arrangements for fuel oil, lubrication oil and other flammable oils.

Chapter V: a new regulation 8-1 has been added making it possible to introduce mandatory ship reporting systems.

The first paragraph of the regulation states that a ship reporting system shall be used by all ships or certain classes of ships or ships carrying certain cargoes in accordance with the provisions of each system when adopted and implemented in accordance with the guidelines and criteria developed by IMO.

The initiation of action for the establishment of a ship reporting system is the responsibility of the Government or Governments concerned. It was agreed that any system established shall be capable of interaction and be able to provide ships with information when necessary.

General principles for ship reporting systems were adopted by IMO in 1989. The systems are used to provide, gather or exchange information through radio reports. The information is used for search and rescue operations, VTS, weather forecasting and the prevention of marine pollution.

By making IMO-adopted ship reporting systems mandatory, the SOLAS amendments make it obligatory for ships entering or using a system to give their position, identity and other information. This will enable their journey through the system to be tracked.

All ship reporting systems must comply with international law, including the provisions of the United Nations Convention on the Law of the Sea and participation shall be free of charge to the ships concerned.

Two other changes have been made to Chapter V.

A new regulation 15-1 requires all tankers of 20,000 dwt and above after 1 January 1996 to be fitted with an emergency towing arrangement fitted at both ends of the ship. Existing tankers must be fitted with a similar arrangement at the first scheduled dry-docking after 1 January 1996 but not later than 1 January 1999.

A new regulation 22 has been added to improve bridge navigation visibility. It will apply to ships of not less than 45 metres in length constructed on or after 1 July 1998.

The IGC Code: the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code) and the Code for the Construction and Equipment of Ships Carrying Liquefied Gas (Gas Carrier Code) were both amended. The changes deal with the filling limits for cargo tanks. The IGC Code is mandatory under SOLAS and applies to ships built after 1 July 1986. The Gas Carrier Code is recommended and applies to ships built before that date.

The December 1994 amendments
The amendments, which entered into force on 1 July 1996, affect a number of regulations in Chapters VI and VII and make mandatory parts of the Code of Safe Practice for Cargo Stowage and Securing.

The May 1995 amendments
The amendments replace regulation 8 of Chapter V with a new text. It recognizes IMO as the only Organization responsible for developing criteria for ship routeing systems and defines how this should be prepared and submitted. The amendment entered into force on 1 January 1997.

The November 1995 amendments
Major changes to international rules designed to improve the safety of roll on/roll off passenger ships were adopted by a conference held to consider proposals put forward by a Panel of Experts set up by IMO in December 1994 following the *Estonia* disaster of September 1994, in which more than 850 people were killed.

The amendments entered into force under tacit acceptance on 1 July 1997.

The most important changes concerned the stability of ro-ro passenger ships. The *Estonia,* like the *Herald of Free Enterprise* in 1987, sank because so much water built up on the cargo decks that stability was impaired and the ship capsized.

A new regulation 8-1 of Chapter II-1 will mean that existing ro-ro passenger ships will have to fully comply with the SOLAS 90 standard that was adopted for new ships in 1988. Ships that only meet 85% of the standard will have to comply fully by 1 October 1998 and those meeting 97.5% or above by 1 October 2005.

The Panel of Experts proposed that SOLAS be changed so that the SOLAS 90 standard can be met with an amount of water on the vehicle deck. This was not supported by sufficient number of countries and instead the conference adopted a resolution which permits regional arrangements to be agreed by contracting Governments on specific stability requirements for ro-ro passenger ships.

These requirements include provisions that are designed to ensure that the SOLAS 90 stability standard can be achieved even with up to 50 cm of water on the vehicle deck.

Under a regional agreement, known as the Stockholm Agreement, ro-ro passenger ships operating in North West European waters now have to meet SOLAS 90 even with 0.50m of water on the vehicle deck.

A new regulation 8-2 was also adopted which requires that ro-ro pasenger ships carrying 400 persons or more shall be designed to survive with two compartments flooded following damage. This regulation is also intended to phase out ships which carry 400 persons or more, built to a one-compartment standard of subdivision.

The conference also adopted amendments to several other chapters in the SOLAS Convention.

The changes to Chapter III, which deals with life-saving appliances and arrangements, include the addition of a new section requiring ro-ro passenger ships to be fitted with public address systems, a new regulation providing improved requirements for life-saving appliances and arrangements and a requirement for all passenger ships to have full information on the details of passengers on board and requirements for the provision of a helicopter pick-up or landing area.

The June 1996 amendments
The amendments include the complete replacement of the existing text of Chapter III, which deals with life-saving appliances and arrangements. The amendments take into account changes in technology that have occurred since the chapter was last revised in 1983.

Many of the technical requirements have been transferred to a new International Life-Saving Appliance (LSA) Code. This will apply to all ships built on or after 1 July 1998. Some of the amendments to Chapter III apply to existing ships.

Other amendments apply to Chapter II-1 (which has been re- named as Construction - Structure, sub-division and stability, machinery and electrical installations) and include a new part A-1 dealing with the structure of ships. A new regulation 3-1 requires that ships shall be designed, constructed

and maintained in compliance with structural, mechanical and electrical requirements of a recognized classification society or with applicable national requirements by the Administration. A new regulation 3-2 deals with corrosion prevention of seawater ballast tanks and other amendments to chapter II-1 concern the stability of passenger and cargo ships in the damaged condition.

Chapter VI (Carriage of cargoes) was also amended. Regulation 7 has been replaced by a new text dealing with the loading, unloading and stowage of bulk cargoes. It is intended to ensure that no excessive stress is placed on the ship's structure during such operations. The ship must be provided with a booklet giving advice on cargo handling operations and the master and terminal representative must agree on a plan to ensure that loading and unloading is carried out safely.

A change was also made to Chapter XI dealing with the authorization of recognized organizations. The International Bulk Chemicals (IBC) and Bulk Chemicals (BCH) Code were also amended. The IBC Code is mandatory under SOLAS and applies to ships carrying dangerous chemicals in bulk that were built after 1 July 1986. The BCH is recommended and applies to ships built before that date.

The December 1996 amendments

The amendments concern three chapters of the Convention and the International Bulk Chemicals (IBC) Code and the International Gas Carrier (IGC) Code, both of which are mandatory under SOLAS.

Changes to Chapter II-1 (Construction - Subdivision and Stability, Machinery and Electrical Installations) include requirements for emergency towing arrangements which were transferred from Chapter V and arrangements for safe access to tanker bows. The amendments also include a new requirement for ships to be fitted with a system to ensure that the equipment necessary for propulsion and steering will be maintained or immediately restored in the case of loss of any one of the generators in service.

Chapter II-2 (Construction - Fire Protection, Fire Detection and Fire Extinction) was considerably modified, with changes being made to the general introduction, Part B (fire safety measures for passenger ships), Part C (fire safety measures for cargo ships) and Part D (fire safety measures for tankers).

The Committee adopted a new International Code for the Application of Fire Test Procedures which has been made mandatory on or after 1 July 1998 under the revised Chapter II-2. It is intended to be used by Administrations when approving products for installation in ships flying their flag. Two regulations in Chapter VII (Carriage of Dangerous Goods) were also amended.

The June 1997 Amendments

A new regulation on Vessel Traffic Services (VTS) was adopted and is due to enter into force on 1 July 1999. VTS are traffic management systems, for example those used in busy straits.

The new Regulation 8-2 of SOLAS Chapter V (Safety of Navigation) sets out when VTS can be implemented. It says Vessel Traffic Services should be designed to contribute to the safety of life at sea, safety and efficiency of navigation and the protection of the marine environment, adjacent shore areas, worksites and offshore installations from possible adverse effects of maritime traffic. Governments may establish VTS when, in their opinion, the volume of traffic or the degree of risk justifies such services, the Regulation adds. But no VTS should prejudice the "rights and duties of governments under international law" and a VTS may only be made mandatory in sea areas within a State's territorial waters.

Chapter II-I relating to stability requirements for passenger ships was also amended. The new Regulation 8.3 on "Special requirements for passenger ships, other than ro-ro passenger ships, carrying 400 persons or more" effectively makes these ships comply with the special requirements for ro-ro passenger ships in Regulation 8.2 which were adopted in November 1995, based on proposals from the panel of experts set up after the *Estonia* ferry disaster. The special requirements are aimed at ensuring the ships can survive without capsizing with two main compartments flooded following damage.

The November 1997 amendments (Conference)

The amendments add a new Chapter XII to the Convention entitled Additional Safety Measures for Bulk Carriers. The amendments are expected to enter into force on 1 July 1999 under tacit acceptance.

The new regulations state that all new bulk carriers 150 metres or more in length (built after that date) carrying cargoes with a density of 1,000 kg/m^3 and above should have sufficient strength to withstand

flooding of any one cargo hold, taking into account dynamic effects resulting from presence of water in the hold and taking into account the recommendations adopted by IMO.

For existing ships (built before 1 July 1999) carrying bulk cargoes with a density of 1,780 kg/m^3 and above, the transverse watertight bulkhead between the two foremost cargo holds and the double bottom of the foremost cargo hold should have sufficient strength to withstand flooding and the related dynamic effects in the foremost cargo hold.

Cargoes with a density of 1,780 kg/m^3 and above (heavy cargoes) include iron ore, pig iron, steel, bauxite and cement. Lighter cargoes, but with a density of more than 1,000 kg/m^3, include grains such as wheat and rice, and timber.

The amendments take into account a study into bulk carrier survivability carried out by the International Association of Classification Societies (IACS) at the request of IMO. IACS found that if a ship is flooded in the forward hold, the bulkhead between the two foremost holds may not be able to withstand the pressure that results from the sloshing mixture of cargo and water, especially if the ship is loaded in alternate holds with high density cargoes (such as iron ore). If the bulkhead between one hold and the next collapses, progressive flooding could rapidly occur throughout the length of the ship and the vessel would sink in a matter of minutes.

IACS concluded that the most vulnerable areas are the bulkhead between numbers one and two holds at the forward end of the vessel and the double bottom of the ship at this location. It proposed that during special surveys of ships, particular attention should be paid to these areas and, where necessary, reinforcements should be carried out.

The criteria and formulae used to assess whether a ship currently meets the new requirements, for example in terms of the thickness of the steel used for bulkhead structures, or whether reinforcement is necessary, are laid out in IMO standards adopted by the 1997 Conference.

Under the new Chapter XII, surveyors can take into account restrictions on the cargo carried in considering the need for, and the extent of, strengthening of the transverse watertight bulkhead or double bottom. When restrictions on cargoes are imposed, the bulk carrier should be permanently marked with a solid triangle on its side shell.

The date of application of the new Chapter to existing bulk carriers depends on their age. Bulk carriers which are 20 years old and over on 1 July 1999 will have to comply by the date of the first intermediate or periodic survey after that date, whichever is sooner. Bulk carriers aged 15-20 years must comply by the first periodical survey after 1 July 1999, but not later than 1 July 2002. Bulk carriers less than 15 years old must comply by the date of the first periodical survey after the ship reaches 15 years of age, but not later than the date on which the ship reaches 17 years of age.

The May 1998 Amendments

The amendments are due to enter into force on 1 July 2002, under the tacit acceptance procedure.

Amendments to **Chapter II-1 - Construction - Subdivision and stability, machinery and electrical installations** concern regulation 14 on *Construction and initial testing of watertight bulkheads, etc., in passenger ships and cargo ships.* Paragraph 3 is replaced to allow visual examination of welded connections, where filling with water or a hose test are not practicable.

In **Chapter IV - Radiocommunications,** the amendments include:

- a new regulation 5-1 requiring Contracting Governments to ensure suitable arrangements are in place for registering Global Maritime Distress and Safety System (GMDSS) identities (including ship's call sign, Inmarsat identities) and making the information available 24 hours a day to Rescue Co-ordination Centres;
- a new paragraph 9 to regulation 15 *Maintenance Requirements* covering testing intervals for satellite emergency position indicating radio beacons (EPIRBS)
- a new regulation 18 on *Position updating* requiring automatic provision of information regarding the ship's position where two-way communication equipment is capable of providing automatically the ship's position in the distress alert. Where manual updating of the ship's position is required, this should be done not less than every four hours when the ship is underway.

An aendments to **Chapter VI Carriage of Cargoes,** paragraph 6 of regulation 5 *Stowage and securing*

makes it clear that "all cargoes, other than solid and liquid bulk cargoes" should be loaded, stowed and secured in accordance with the Cargo Securing Manual. A similar amendment was adopted for Regulation 6 of **Chapter VII Carriage of Dangerous Goods**, also covering *Stowage and securing*.

The future of SOLAS

The SOLAS Convention is now so widely accepted that, to some extent at least, virtually every ship in the world complies with it.

Thanks to the tacit acceptance amendment procedure it has proved possible to keep the Convention up to date .

SOLAS will continue to evolve in the future as it has in the past. The whole of Chapter V on Safety of Navigation is currently being brought up to date, especially to take the human factor into account.

However, it is expected that the rate of amendments will slow down in the next few years. While it is important to keep instruments such as SOLAS up to date, many countries have experienced difficulty in coping with the changes that have been made in recent years.

In May 1991 the MSC agreed that future amendments would only enter into force once every four years. The normal date of entry into force (under tacit acceptance) is now on 1 July. Although the four-year rule is the norm, the IMO is able to adopt amendments at shorter intervals in exceptional circumstances.

How SOLAS has changed: the shading indicates which chapters were amended													
Year	**Chapter numbers**												
	I	II-1	II-2	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1974													
1978 Protocol													
1981													
1982													
1983													
1985													
1986													
1987													
1988 Apr													
1988 Oct													
1988 Nov Protocol													
1988 Nov GMDSS													
1989													
1990													
1991													
1992 Apr													
1992 Dec													
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1994 May													
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1996 June													
1996 Dec													
1997 Nov													
1998 May													