

INTERNATIONAL REGULATIONS FOR HIGH-SPEED CRAFT AN OVERVIEW*

Heike Hoppe

**International Maritime Organization (IMO)
4 Albert Embankment, London SE1 7SR, United Kingdom**

ABSTRACT

The paper presents an overview of the international regulations in force concerning high-speed craft, i.e. the Code of Safety for Dynamically Supported Craft (DSC Code) and the International Codes of Safety for High-Speed Craft 1994 and 2000. The historical background of the development of regulations for high-speed craft is briefly highlighted and the technical contents of the Codes are described. The status of the Codes, i.e. mandatory or recommendatory, is explained, together with their association with the International Convention for the Safety of Life at Sea (SOLAS) 1974. Finally, on-going work in IMO regarding the review of the Codes and the preparation of appropriate amendments is outlined.

INTRODUCTION

The international conventions ratified in respect of conventional ships and the regulations applied as a consequence of such conventions have largely been developed with construction and operation aspects in mind. Traditionally, ships have been made of steel and have been expected to operate on a world-wide basis with a minimum of operational controls.

The requirements for ships engaged on long international voyages are therefore framed in such a way that, providing the ship is presented for survey and a Ship Safety Certificate is issued, the ship may go anywhere in the world without any operational restrictions being imposed. Providing the ship is not involved in a casualty, all that is needed is to make it available to the Administration for the purpose of a satisfactory renewal survey before the Ship Safety Certificate expires and the Certificate will be reissued.

However, the traditional method of regulating ships should not be accepted as being the only possible way of providing an appropriate level of safety. Nor should it be assumed that another approach, using different criteria, could not be applied. Over a long period of time, numerous new designs of marine vehicles have been developed and have been in service. While these do not fully comply with the provisions of the international conventions relating to conventional ships built of steel, they have demonstrated an ability to operate at an equivalent level of safety when engaged on restricted voyages

under restricted operational weather conditions and with approved maintenance and supervision schedules.

1. HISTORICAL DEVELOPMENT OF HIGH-SPEED CRAFT REGULATIONS

1.1. General

The safety philosophy of the regulations for high-speed craft (HSC) is based on the management and reduction of risk as well as the traditional philosophy of passive protection in the event of an accident. Management of risk through accommodation arrangements, active safety systems, restricted operation, quality management and human factor engineering should be considered in evaluating safety equivalent to current conventions. The application of mathematical analysis to assess risk and determine the validity of safety measures is encouraged.

The regulations take into account that a high-speed craft is of a light displacement compared with a conventional ship. This displacement aspect is the essential parameter to obtain fast and competitive sea transportation and consequently the regulations allow for use of non-conventional shipbuilding materials, provided that a safety standard at least equivalent to conventional ships is achieved.

To clearly distinguish such craft, criteria based on speed and volumetric Froude number have been used to delineate those craft to which these regulations apply from other, more conventional, craft.

* Views expressed in this paper are those of the author and should not be construed as necessarily reflecting the views of IMO or its Secretariat.

1.2. Code of Safety for Dynamically Supported Craft (DSC Code)

The DSC Code was adopted by the IMO Assembly on 14 November 1977 by resolution A.373(X), recognizing that the design criteria for dynamically supported craft are often quite different from those of conventional ships, making the application of international conventions such as the SOLAS Convention inappropriate in respect to those types of ships. The provisions of the Code superseded a number of earlier IMO recommendations concerning hydrofoil boats and air-cushion vehicles.

The Code applies to craft engaged in international voyages constructed before 1 January 1996 and sets out minimum requirements for craft carrying up to a maximum of 450 passengers and operating within a distance of 100 nautical miles from a place of refuge.

1.3. International Code of Safety for High-Speed Craft (HSC Code) 1994

The 1994 HSC Code was adopted by IMO's Maritime Safety Committee (MSC) on 20 May 1994 by resolution MSC.36(63), recognizing the continual development of novel types and sizes of HSC which were not necessarily dynamically supported, including cargo craft and passenger craft carrying larger number of passengers or operating at greater distances from places of refuge than permitted by the DSC Code. It was further recognized that improvements in maritime safety standards since the adoption of the DSC Code needed to be reflected in the provisions for HSC in order to maintain certification and safety equivalence with conventional ships.

The Code applies to HSC engaged in international voyages and constructed on or after 1 January 1996 but before 1 July 2002. It introduces two differing principles of protection and rescue. The first is the concept of "assisted craft", forming the basis for "category A passenger craft", permitting a reduction in active and passive protection where rescue assistance is readily available and the total number of passengers is limited. The second concept recognizes the further development of HSC into larger craft and introduces "unassisted craft", forming the basis for "cargo craft" and "category B passenger craft", requiring additional passive and active safety precautions where rescue assistance is not readily available and/or the number of passengers is unlimited.

1.4. International Code of Safety for High-Speed Craft (HSC Code) 2000

The 2000 HSC Code was adopted by IMO's MSC on 5 December 2000 by resolution MSC.97(73), recognizing the development of novel types and sizes of HSC and improvements of maritime safety standards since the adoption of the 1994 HSC Code

which necessitated the revision of the provisions for the design, construction, equipment and operation of HSC in order to maintain the highest level of safety.

The Code applies to HSC engaged in international voyages and constructed on or after 1 July 2002 with a view to ensuring that safety is not compromised as a result of continuous introduction of state-of-the-art technology and innovative developments into the new and generally much larger and faster HSC.

1.5. Status of the Codes

The DSC Code as an IMO Assembly resolution is of a recommendatory nature, i.e. not a mandatory IMO instrument. IMO Member Governments are invited to take appropriate steps to give effect to the Code.

The 1994 HSC Code was made mandatory by Resolution 1 of the 1994 SOLAS Conference, adopted on 24 May 1994, which entered into force on 1 January 1996 and included a new chapter X on Safety measures for high-speed craft in the 1974 SOLAS Convention. Regulation 1 of chapter X states:

"1 *High-Speed Craft Code, 1994 (1994 HSC Code)* means the International Code of Safety for High-Speed Craft adopted by the Maritime Safety Committee of the Organization by resolution MSC.36(63), as may be amended by the Organization, provided that such amendments are adopted, brought into force and take effect in accordance with the provisions of article VIII of the present Convention concerning the amendment procedures applicable to the annex other than chapter I."

The 2000 HSC Code was made mandatory by resolution MSC.99(73), adopted on 5 December 2000, which entered into force on 1 July 2002 and amended SOLAS chapter X by, *inter-alia*, including the following new paragraph in regulation 1:

"2 *High-Speed Craft Code, 2000 (2000 HSC Code)* means the International Code of Safety for High-Speed Craft, 2000, adopted by the Maritime Safety Committee of the Organization by resolution MSC.97(73), as may be amended by the Organization, provided that such amendments are adopted, brought into force and take effect in accordance with the provisions of article VIII of the present Convention concerning the amendment procedures applicable to the annex other than chapter I."

The 1994 and 2000 HSC Codes contain in section 1.15 provisions for a regular review of the Codes, stating that they should be reviewed at intervals preferably not exceeding four years in order to take account of new developments in design and technology. Following that provision, IMO is currently undertaking a comprehensive review of the

Codes, also taking into account any knock-on effect this exercise might have for the DSC Code. A substantial set of amendments to the Codes is expected to be finalized in 2006. A detailed description of the amendments under consideration is contained in section 4 of this presentation.

2. TECHNICAL CONTENTS OF THE CODES

2.1. DSC Code

The DSC Code is comprised of 18 chapters and 3 annexes as briefly described in the following.

Chapter 1 – General

Contains provisions regarding application, definitions, survey and certification, equivalents and exemptions.

Chapter 2 – Buoyancy, stability and subdivision

Contains provisions regarding intact buoyancy and stability, buoyancy and stability after damage, stability in non-displacement mode, passenger loading.

Chapter 3 – Structures

Contains provisions for hull and superstructure providing longitudinal and other strength of the craft and other components such as foils and skirts.

Chapter 4 – Accommodation and escape measures

Contains provisions regarding passenger and crew accommodation, seats and safety belts, exits and means of escape, evacuation time, baggage, store and cargo compartments.

Chapter 5 – Directional control systems

Contains provisions regarding means for directional controls, their reliability, demonstrations and the craft's control position.

Chapter 6 – Anchoring, towing and berthing

Contains provisions regarding anchors, towing arrangements and berthing ropes.

Chapter 7 – Fire safety

Contains provisions regarding structural fire protection, fuel and other flammable fluid tank systems, ventilation, fire detection and extinguishing systems and special category spaces.

Chapter 8 – Life-saving appliances

Contains provisions regarding survival craft, life jackets, lifebuoys, distress signals and line-throwing apparatus.

Chapter 9 – Machinery

Contains provisions regarding engines, gas turbines, transmissions, propulsion and lift devices.

Chapter 10 – Auxiliary systems

Contains provisions regarding fuel systems, hydraulic systems, pneumatic systems, lubrication systems, bilge pumping and drainage systems, ballast systems, cooling systems, engine air intake systems, ventilation systems, exhaust systems.

Chapter 11 – Remote control and warning systems

Contains provisions regarding remote control, warning systems, safety systems.

Chapter 12 – Electrical equipment

Contains provisions regarding main and emergency source of electrical power, permissible voltages and distribution, cables and protective devices, steering and stabilization, main and emergency lighting, installation.

Chapter 13 – Radiocommunications and navigational equipment

Contains provisions regarding radio installation, emergency equipment, compasses, means for measuring speed, depth sounder, radar, other navigational aids, display and illumination, masts.

Chapter 14 – Operating compartment layout

Contains provisions regarding control position, operating compartment, instruments, lighting, windows, communication facilities.

Chapter 15 – Stabilization systems

Contains definitions and general provisions regarding design and parameters of stabilization systems.

Chapter 16 – Handling, controllability and performance

Contains provisions regarding scheduling, proof of compliance, weight and centre of gravity, effect of failures, controllability and manoeuvrability, change of operating surface and mode, surface irregularities, acceleration and deceleration, speeds, minimum water depth, hard structure clearance.

Chapter 18 – Maintenance requirements

Contains provisions regarding the operators' organization and inspection and maintenance.

Annex I – Sample of the dynamically supported craft construction and equipment certificate

Annex II – Use of probability concept

Contains a series of standardized expressions which can be used to convey the relative acceptable probabilities of various incidents, i.e. to perform a qualitative ranking process.

Annex III – Interpretation of the Convention on the International Regulations for Preventing Collisions at Sea, 1972, concerning DSC

Contains notes and observations regarding lights, shapes and sound signals as required by COLREG 1972* as they would affect DSC. Also contains three appendices, on ice accretion, intact stability investigation of hydrofoil boats and passenger loading.

2.2. 1994 HSC Code

The 1994 HSC Code is comprised of 19 chapters and 10 annexes as briefly described in the following.

Chapter 1 – General comments and requirements

Contains provisions regarding application, definitions, survey and certification, approvals, equivalents and exemptions, review of the Code.

Chapter 2 – Buoyancy, stability and subdivision

Contains general and special provisions for passenger and cargo craft regarding intact buoyancy, intact stability in displacement, non-displacement and transient mode, buoyancy and stability in the displacement mode after damage, inclining and stability information, loading and stability assessment, design waterline.

Chapter 3 – Structures

Contains provisions regarding materials, structural strength, cyclic loads, design criteria, trials.

Chapter 4 – Accommodation and escape measures

Contains provisions regarding public address and information system, design acceleration levels, accommodation design, seat construction, safety belts, exits and means of escape, evacuation time, baggage, stores, shops and cargo compartments, noise levels.

Chapter 5 – Directional control systems

Contains provisions regarding means for directional controls, their reliability, demonstrations and the craft's control position.

Chapter 6 – Anchoring, towing and berthing

Contains provisions regarding anchors, towing arrangements and berthing ropes.

Chapter 7 – Fire safety

Contains general and special provisions for passenger and cargo craft regarding classification of space use, structural fire protection, fuel and other flammable fluid tanks and systems, ventilation, fire detection and extinguishing systems, protection of special category spaces, fireman's outfits, fixed sprinkler systems, control stations, cargo spaces.

Chapter 8 – Life-saving appliances

Contains provisions regarding communications, personal life-saving appliances, muster list, emergency instructions and manuals, operating instructions, survival craft and rescue boat stowage, embarkation and recovery arrangements, line-throwing appliance, operational readiness, maintenance and inspections.

Chapter 9 – Machinery

Contains general and special provisions for passenger and cargo craft regarding engines, gas turbines, diesel engines, transmissions, propulsion and lift devices, special provisions for category B craft, essential machinery and control.

Chapter 10 – Auxiliary systems

Contains general and special provisions for passenger and cargo craft regarding arrangements for oil fuel, lubricating oil and other flammable oil, bilge pumping and drainage systems, ballast systems, cooling systems, engine air intake systems, ventilation systems, exhaust systems.

Chapter 11 – Remote control, alarm and safety systems

Contains provisions regarding emergency controls, alarm systems, safety systems.

Chapter 12 – Electrical installations

Contains general and special provisions for passenger and cargo craft regarding main and emergency source of electrical power, starting arrangements for emergency generating sets, steering and stabilization, precautions against shock, fire and other hazards of electrical origin.

Chapter 13 – Navigational equipment

Contains provisions regarding compasses, speed and distance measurement, echo sounding device, radar installations, electronic positioning systems, rate-of-turn and rudder angle indicator, other navigational aids, search light, night vision equipment, steering arrangement and propulsion indicators, automatic steering aid, performance standards.

Chapter 14 – Radiocommunications

Contains provisions regarding terms and definitions, exemptions, functional requirements, radio installations, radio equipment for different sea areas, watches, sources of energy, performance standards, maintenance requirements, radio personnel, radio records.

Chapter 15 – Operating compartment layout

Contains provisions regarding field of vision, operating compartment, instruments and chart table, lighting, windows, communication facilities, temperature and ventilation, colours, safety measures.

* Convention on the International Regulations for Preventing Collisions at Sea, 1972.

Chapter 16 – Stabilization systems

Contains definitions and general provisions regarding lateral and height control systems, demonstrations.

Chapter 17 – Handling, controllability and performance

Contains provisions regarding proof of compliance, weight and centre of gravity, effect of failures, controllability and manoeuvrability, change of operating surface and mode, surface irregularities, acceleration and deceleration, speeds, minimum water depth, hard structure clearance, night operation.

Chapter 18 – Operational requirements

Contains general and special provisions for passenger and cargo craft regarding operational control, documentation, training and qualifications, manning of survival craft and supervision, emergency instructions and drills, type rating training.

Chapter 19 – Inspection and maintenance requirements

Contains provisions regarding maintenance of the craft and the equipment to the satisfaction of the Administration.

Annex 1 - Form of High-Speed Craft Safety Certificate and Record of Equipment

Annex 2 - Form of Permit to Operate High-Speed Craft

Annex 3 - Use of probability concept

Contains a series of standardized expressions which can be used to convey the relative acceptable probabilities of various incidents, i.e. to perform a qualitative ranking process.

Annex 4 - Procedures for failure mode and effects analysis

Contains provisions for the analysis of failure performance to assist in the assessment of the safety of operation of HSC.

Annex 5 - Ice accretion applicable to all types of craft

Contains provisions for icing allowances, areas of icing conditions and special requirements.

Annex 6 – Methods relating to the intact stability investigation of hydrofoil craft

Contains procedures for guidance in dealing with stability of surface-piercing and fully submerged hydrofoils.

Annex 7 - Stability of multihull craft

Contains provisions for stability criteria in the intact condition, criteria for residual stability after damage and application of heeling levers.

Annex 8 - Definitions, requirements and compliance criteria related to operational and safety performance

Contains requirements for the verification of craft performance.

Annex 9 - Criteria for testing and evaluation of revenue and crew seats

Contains requirements for revenue and crew seats, seat anchorages and seat accessories and their installation to minimize the possibility of injuries if the craft suffers a collision.

Annex 10 - Open reversible liferafts

Contains provisions for construction, fittings, containers, markings, instructions and information of open reversible liferafts.

2.3 2000 HSC Code

The 2000 HSC Code was prepared taking into account experience gained with the application of the 1994 HSC Code and accommodating amendments to the SOLAS Convention which affected HSC, also realizing that the 1994 HSC Code failed to address some important issues which had come to the fore with the rapid development of bigger and faster craft.

The structure of both Codes is very similar. The main changes introduced in the 2000 HSC Code are briefly explained in the following.

The definition of HSC was modified to exclude craft the hull of which is supported completely clear above the water surface in non-displacement mode by aerodynamic forces generated by ground effect. Vehicles like wing-in-ground (WIG) craft* can not, therefore, be certified under the 2000 HSC Code.

The intact buoyancy part of chapter 2 (Buoyancy, stability and subdivision) was substantially expanded to include provisions for openings in watertight divisions; inner bow doors; other provisions for ro-ro craft; indicators and surveillance; doors, windows, etc. in boundaries of weathertight spaces; hatchways and other openings; scuppers, inlets and discharges; air pipes; freeing ports. Also in chapter 2, the provisions for buoyancy and stability in the displacement mode following damage and for marking and recording of the design waterline were expanded.

In chapter 4 (Accommodation and escape measures), additional provisions for the protection of the crew and passengers were introduced.

* For WIG craft provisions, refer to MSC/Circ.1054 - Interim Guidelines for wing-in-ground (WIG) craft.

In chapter 7 (Fire safety), a new Part D on Requirements for craft and cargo spaces intended for the carriage of dangerous goods was included.

In chapter 8 (Life-saving appliances and arrangements), provisions for helicopter pick-up areas for craft operating on voyages having a duration of 2 h or more between each port of call were included.

The title of chapter 13 was changed to “Shipborne navigational systems and equipment and voyage data recorders” and additional provisions for radar reflectors, sound reception systems and VDR were included.

In chapter 14 (Radiocommunications), provisions for GMDSS identities and position-updating were included.

An additional annex on Stability of monohull craft was added.

3. REVIEW OF THE CODES

3.1 General

Section 1.15 of the 2000 HSC Code (corresponding to section 1.15 of the 1994 HSC Code) contains provisions for a regular review, stating that “the Code shall be reviewed by the Organization at intervals preferably not exceeding four years to consider revision of existing requirements to take account of new developments in design and technology”.

In May 2002, IMO’s Maritime Safety Committee considered a proposal by Australia that amendments to the 1994 HSC Code and the DSC Code should be developed to align their requirements with those of the 1974 SOLAS Convention and the 2000 HSC Code. The Committee later approved MSC circulars dealing with relevant amendments and interpretations, i.e. MSC/Circ.1057 on “Proposed amendments to update the DSC Code and the 1994 HSC Code”, inviting Administrations to consider giving effect to the proposed amendments in advance of their formal adoption, and MSC/Circ.1102, containing interpretations to the 2000 HSC Code. It also included in the work programmes of its Sub-Committees on Radiocommunications and Search and Rescue (COMSAR), Ship Design and Equipment (DE), Fire Protection (FP), Safety of Navigation (NAV) and Stability and Load Lines and Fishing Vessel Safety (SLF) a high priority item on “Review of the 2000 HSC Code and amendments to the DSC Code and 1994 HSC Code”, instructing the sub-committees to commence the review in 2004.

Since then, the COMSAR and FP Sub-Committees have finalized their work on the issue, whereas the DE, NAV and SLF Sub-Committees are still working

on the amendments falling under their area of expertise. The DE Sub-Committee has been designated co-ordinator of the work and is expected to finalize the draft amendments in 2006, amalgamating its own with the contributions from the other Sub-Committees, for submission to the MSC for formal adoption.

3.2 Draft amendments to the Codes

3.2.1 Radiocommunication related amendments

The COMSAR Sub-Committee finalized a set of amendments in February 2005 (IMO document COMSAR 9/19). The Sub-Committee agreed to an amendment to chapter 14 (Radiocommunications) of the 2000 HSC Code, concerning maintenance requirements for satellite EPIRBs. With regard to the 1994 HSC Code, the Sub-Committee agreed to replace chapter 14 of the 1994 HSC Code with chapter 14 of the 2000 HSC Code, as amended, in order to bring the 1994 HSC Code in line with SOLAS radiocommunications requirements for existing ships.

It was also agreed that chapter 14 of the 2000 HSC Code should be incorporated in the DSC Code, since the relevant SOLAS requirements are applicable to all ships of 300 GT and above. The Sub-Committee further agreed that chapter 13 (Radiocommunications and navigational equipment) of the DSC Code should be amended to require craft to have a capacity of distress and safety communications in accordance with the provisions of chapter IV of the SOLAS Convention.

3.2.2 Fire protection related amendments

The FP Sub-Committee finalized a set of amendments in January 2005 (IMO document FP 49/17). Whereas the number of amendments to the DSC and 1994 HSC Code was limited, mainly concerning the installation of materials containing asbestos, the Sub-Committee agreed to 96 amendments to chapters 1 (General comments and requirements), 4 (Accommodation and escape measures) and 7 (Fire safety) of the 2000 HSC Code and a large number of changes to existing footnotes.

Main issues discussed in this connection were matters related to the use of asbestos on HSC, the determination of actual evacuation time, a simplified evacuation analysis for high-speed passenger craft and the inclusion of provisions of the IMDG Code with regard to the transport of dangerous goods on HSC.

3.2.3 Ship design and equipment related amendments

The DE Sub-Committee established a correspondence group to prepare relevant amendments to all three Codes and considered the progress report of the group

(IMO document DE 48/11) at its last meeting, DE 48 in February 2005. The report contains at annex a large number of draft amendments concerning, *inter-alia*, provisions for emergency source of power, cooking appliances, certificates, machinery spaces, seats, exits and doors, special category spaces, life-saving appliances, evacuation analysis, etc.

The report also contains draft amendments to the 1994 HSC Code and the DSC Code, mainly concerning life-saving appliances, in particular marine evacuation systems (MES), launching appliances and inflatable liferafts, and also voyage data recorders and automatic identification systems.

Members had also submitted proposals for further amendments to the Codes relating to the definition of machinery spaces, carriage of dangerous goods, test procedures for MES, requirements for handholds and rescue boat launching and recovery requirements. The proposals were referred to the correspondence group which will report to the next session, where a working group is expected to finalize the amendments to the Codes, also incorporating the contributions from the other sub-committees.

3.2.4 Navigation related amendments

The NAV Sub-Committee considered the matter at its last session in June 2004 (IMO document NAV 50/19) and was of the opinion that SOLAS chapter V (Safety of navigation), which applies to all ships on all voyages, should apply to all Codes and established a correspondence group to progress this work intersessionally and report to the next session (NAV 51 in June 2005). The correspondence group was instructed to develop draft amendments on shipborne navigational systems and equipment, which should be incorporated into the 1994 HSC Code and the DSC Code.

3.2.5 Stability and load line related amendments

The SLF Sub-Committee considered the matter at its last session in September 2004 (IMO document SLF 47/17) and finalized a set of draft amendments to chapter 2 (Buoyancy, stability and subdivision), relating to, *inter-alia*, mathematical simulation methods, buoyant spaces, shape and extent of damage, inclining experiments, and annexes 6 (Stability of hydrofoil craft), 7 (Stability of multihull craft) and 8 (Stability of monohull craft).

Regarding proposed amendments relating to damage stability and raking damage for high-speed craft, the Sub-Committee agreed that these matters needed further consideration and invited comments and proposals to the next session (SLF 48).

4. FUTURE WORK ON HIGH-SPEED CRAFT

It is quite clear that amending the HSC Codes will be a recurring item on the work programme of IMO's technical sub-committees, noting in particular the provision in the Codes that they shall be reviewed at intervals preferably not exceeding four years in order to consider a revision of the existing requirements to take account of new developments in design and technology.

The on-going revision work is expected to be finalized next year which means that the formal adoption of the amendments could take place at the end of 2006 with an expected entry into force in 2008.*

5. CONCLUSIONS

Mandatory IMO instruments, be it conventions, codes or guidelines, are living instruments. They are constantly reviewed and amended in order to keep pace with the developments in design and technology.

The basic aim is the development of practical, feasible and effective international requirements which ensure the safe and secure design, construction, equipment, operation and maintenance of ships, including high-speed craft.

REFERENCES

1. International Convention for the Safety of Life at Sea (SOLAS), 1974
2. Code of Safety for Dynamically Supported Craft (DSC Code) (IMO resolution A.373(X))
3. International Code of Safety for High-Speed Craft (HSC Code) 1994 (IMO resolution MSC.36(63))
4. International Code of Safety for High-Speed Craft (HSC Code) 2000 (IMO resolution MSC.97(73))
5. Interim Guidelines for wing-in-ground (WIG) craft (MSC/Circ.1054)

* The adoption of amendments to the 1994 and 2000 HSC Code must follow the amendment procedure applicable to SOLAS amendments (refer to Article VII of the 1974 SOLAS Convention).