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PROPOSED AMENDMENTS TO IMO HSC CODE

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PROPOSED AMENDMENTS TO IMO HSC CODE

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PROPOSED AMENDMENTS TO IMO HSC CODE

1. INTRODUCTION

This report outlines a proposed modification to the IMO 2000 HSC Code, relating to a change in scope of application, specifically to cover vessels with a lower maximum speed than currently required by the Code.

This report sets out the proposal, with technical justification, stakeholder submissions, an assessment of benefits and drawbacks and a suggested schedule of work to provide for its possible implementation.

This report has been prepared on behalf of the Interferry organisation (Interferry) by Seaspeed Marine Consulting Ltd (Seaspeed). The opinions expressed in the report, along with any errors or omissions, are the responsibility of Seaspeed.

2. DESCRIPTION OF PROPOSED CHANGE

2.1. BACKGROUND

The current 2000 HSC Code was adopted in the year 2000 following a revision of the 1994 HSC Code, which itself was developed following a thorough revision of the Code of Safety for Dynamically Supported Craft (DSC Code). The DSC Code was originally introduced in 1977 via IMO Resolution A.373(X).

These Codes are based on the recognition that ship safety levels can be significantly enhanced by the infrastructure associated with regular service on a particular route, whereas the conventional ship philosophy relies on the ship being self-sustaining with all necessary emergency equipment being carried on board.

The safety philosophy of these Codes is based on the management and reduction of risk as well as the traditional philosophy of passive protection in the event of an accident.

These Codes take into account that a high-speed craft is (of necessity) of a light displacement compared to a conventional ship and thus allow for non-conventional shipbuilding materials and systems, provided that a safety standard at least equivalent to conventional ships is achieved.

These Codes also reflect the additional hazards caused by high-speed operations compared to conventional ship transportation. Thus, in addition to the normal requirements (LSA, evacuation facilities etc) provided in case of an accident occurring, further emphasis is placed on reducing the risk of hazardous situations arising (such as more stringent design, operational and navigational requirements and specially developed accommodation provisions).

These Codes have all specified that they should be regularly reviewed to consider revisions of existing requirements, to take account of new developments in design and technology.

It was as a result of this last point that the progressive updating of the Codes has taken place, primarily to account for the fact that HSC were increasing significantly in size, passenger capacity and speed. The last decade has also seen increases in terms of size and passenger capacity, although maximum speeds have not changed significantly.

In summary, these Codes have allowed the marine transportation industry to develop significantly by providing for high-speed operations, primarily through the provision for lightweight construction and overwhelmingly through the use of aluminium. This has been achieved with at least an equivalent level of safety to conventional shipping.

As further background information, it is considered important to make the reader aware of one of the primary benefits of lightweight ship construction: that is the ability to provide efficient marine transportation at virtually any vessel size and speed to suit the intended operation. For a conventional ferry to operate at 30 knots, its waterline length must be about 200 metres (since, for conventional shipping, it is not feasible to operate at Froude Numbers much above about 0.35). Such a length is a major restriction with respect to the ports and berths from which it can operate, not to mention the associated capital and operational costs and emissions associated with such a large and heavy vessel. Lightweight vessels, such as those that are currently regulated under the HSC Code, can be of virtually any length and operate at such a speed. This ability to largely disassociate vessel size and speed is one of the main reasons why HSC can offer such a competitive transport mode.

Other benefits include the ability to offer significantly lighter displacements and smaller drafts than conventional craft, thus, again, allowing operations from smaller and potentially more convenient ports and berths, and, due to marine grade aluminium construction, reduced costs of surface protection and maintenance.

In terms of the HSC Code itself, it is seen as providing the only practical approach to aluminium passenger vessel construction and, due to its stability assessment methodologies, the most appropriate for multi-hull craft – a vessel configuration that accounts for the vast majority of high-speed ferries worldwide and, potentially, for many medium speed lightweight ferries of the future.

2.2. MARKET DEVELOPMENTS

The HSC industry has been particularly successful with respect to the development of operationally efficient lightweight fast craft in a number of sectors including passenger and ro-pax vessels, crew boats, patrol craft and superyachts.

As the size and displacement of many HSC has increased, so has the threshold speed associated with the Codes increased. For example, a 110 metre fast ro-pax ferry at a displacement of 2,800 tonnes has an HSC speed threshold of about 27 knots. There have been, and are, craft designed with greater displacements, thus leading to yet higher threshold speeds.

However, with increasing pressure to significantly reduce costs and fuel consumption, many operators and designers are now looking at lower operational speeds in the region of 18 to 25 knots. This has led to two main frustrations – one, that the lower speed puts the vessel outside the HSC Code and hence into conventional (steel) ship regulations – which then makes them far less efficient due to the resulting higher displacement, and second, that it would seem logical that the safety of the HSC operation is actually likely to improve, rather than diminish, with reduced speed, thus highlighting a significant regulatory gap for lightweight lower speed craft. The expectation for the future is that this pressure to reduce propulsion power requirements will continue, whether based on fossil fuels or otherwise.

Thus, at this time of unprecedented need to reduce harmful emissions, it would seem both logical and timely to consider a modification to speed considerations within the HSC Code, allowing slower and more efficient craft to be brought into service.

2.3. PROPOSED CHANGES

It is recognised that the HSC Code provides an equivalent level of safety to that enjoyed by conventional shipping and that it does so by a focussed balance of specific design, operational and navigational restrictions. It is further recognised that it has been specifically formulated to provide suitable risk control measures for construction in a lightweight manner (both through the use of lightweight materials and an arrangement largely unencumbered by heavy systems) and for navigation at high speed.

The identification of whether a vessel can be regulated under this code has been provided for by a threshold formula based on a combination of both maximum continuous speed and maximum operational displacement (Reference: 2000 HSC Code, Section 1.4.30), as follows:

$$\text{Speed (m/s)} = 3.7 * (\text{max operational displaced volume, } m^3)^{0.1667} \quad \text{……… Equation 1}$$

This threshold formula is used by a range of shipping regulation to identify and regulate high speed craft (e.g. EU Directive 2009/45/EC - safety rules and standards for passenger ships, along with many domestic regulations). However, at present, if the threshold is not met then the HSC Code is not applicable.

It is suggested here that by adopting the full safety requirements of the HSC Code, but designing for a maximum speed lower than that required to meet the HSC Code threshold, the resulting operations would likely enjoy at least an equivalent level of safety, if not a higher level of safety, to HSC and conventional shipping.

Thus it is proposed that the scope of application of the HSC Code be broadened to accommodate lightweight craft, preferably without any speed threshold, whilst at the same time, maintaining the current HSC definition. The reason for specifying lightweight craft, which have greater reserve buoyancy in relation to displacement than conventional craft, is so that the Code's exemption from the International Convention on Load Lines is maintained.

Such a proposal would allow for the operation of commercially attractive craft, with fuel consumption and emissions considerably lower than possible with equivalent high-speed or conventional craft, by virtue of their reduced speed and lighter displacement respectively.

For avoidance of doubt, it is proposed that the current speed threshold be maintained for the definition and regulation of high-speed craft (HSC) as normal, but that a secondary definition of a lightweight craft be adopted, such that vessels that otherwise meet the HSC code requirements, apart from the current speed threshold, can also be regulated under this same code, possibly with an alternative notation such as Light Craft.

This does raise the possibility that some risk control measures within the HSC Code, designed specifically for high-speed navigation, may be able to be modified to account for lower speeds, whilst still maintaining those associated with lightweight construction, but such considerations could possibly be progressed during future revisions.

It is suggested that such a revised Code could be referred to as the High Speed and Light Craft Code (HSLC Code). It is further suggested that the definitions for a High-Speed-Light-Craft be retained as per Equation 1 above and that the definition of a Light-Craft be further developed within the industry, possibly using the approach outlined in Section 4.3.g. (Equation XX) below.

2.4. PRIOR CONSIDERATIONS

Before proposing the changes described above, engagement with a range of relevant stakeholders (including DNV, Lloyds Register, AMSA, UK MCA, BMT Group, Incat Australia, Austal Ships, Incat Crowther and a number of HSC operators) was undertaken in order to discuss various approaches to the inclusion of slower speed craft in the HSC Code. All those interviewed were supportive of the concept in general and of the selected proposal as described in Section 2.3 above. For interest, the alternative approaches that were discussed are described below:

a. Modified HSC Formula

The simplest approach was considered to be a modification of the existing speed/displacement threshold formula. It was felt that the coefficient in this formula could be reduced by up to about 15% and still provide adequate differentiation between medium speed light-craft and conventional ships. However such a speed reduction was subsequently considered not to be sufficient to address the future needs and expectations of this industry sector.

Due to the typical relationship between length and displacement for lightweight craft, such a change would also relate to a speed regime which is generally considered to be inefficient (i.e. designing for speeds relating to Froude Numbers between about 0.35 and 5.0 is normally avoided due to high wave-making drag - see Figures 1 and 2). The existing nominal HSC speed threshold is shown in relation to these Froude Numbers in Figure 1 below. This line has been generated using a trendline relationship between length and full load displacement for a range of HSC.

Another suggested simple modification to the existing HSC formula was to use lightship displaced volume rather than full load displaced volume in the formula. The nominal effect on the speed threshold in using this lightship value is also shown in Figure 1 and indicates only a minor threshold speed reduction, and so was also considered not to be an adequate modification.

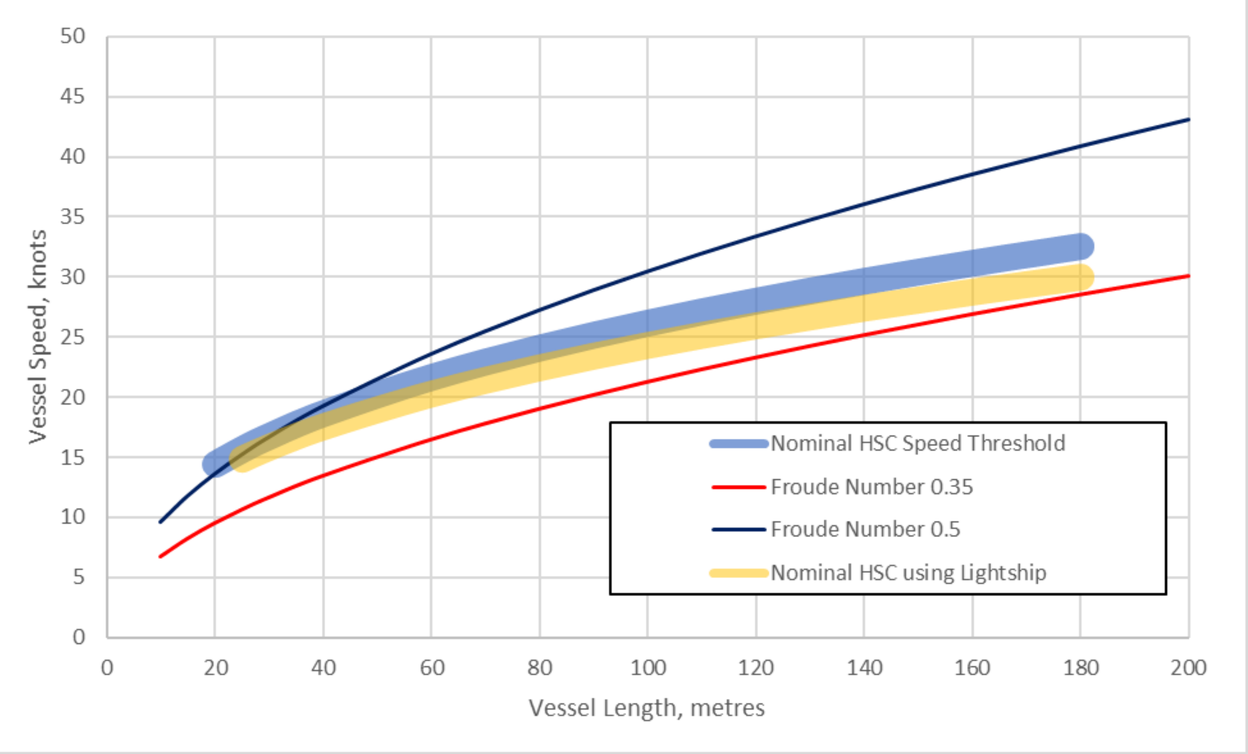

Figure 1 – Speed vs Length Relationships

b. Froude Number Formula

Another simple modification considered was the substitution of the current speed threshold with a Froude Number threshold of approximately 0.35, below which the vast majority of conventional ships operate (see Figure 2). This could also potentially differentiate between conventional shipping and medium to high speed craft.

However, this is the lower boundary of an inefficient design zone and there are a number of projects currently under consideration for lightweight ferries operating at Froude Numbers even lower than this. In addition, it would not necessarily ensure that the vessels adopting the revised code would be lightweight craft.

It is interesting to note in Figure 2 that there are a small number of conventional craft with speeds in excess of the HSC speed threshold. HSC are defined here as lightweight craft with a speed greater than the HSC speed threshold, but not necessarily regulated under the HSC Code.

It is also noted here for interest that the original DSC Code used Froude Number as a basis for a speed threshold, although at that time the value used was 0.9.

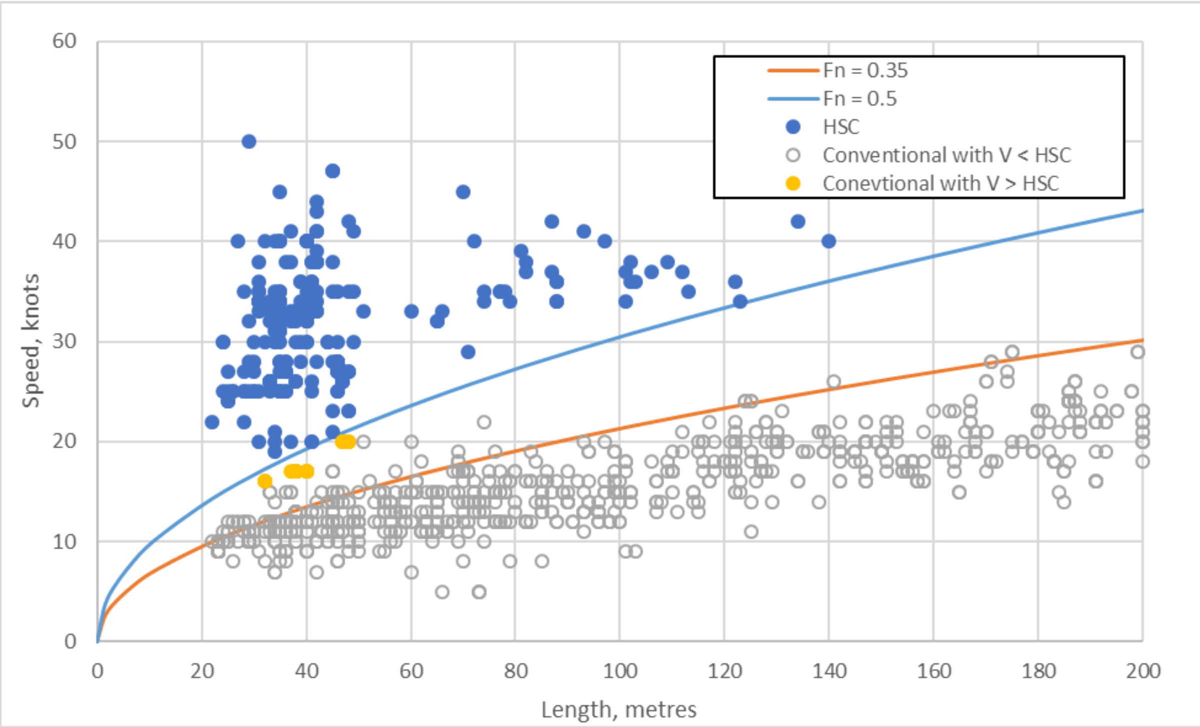

Figure 2 – Speed vs Length data for conventional and HSC vessels.

c. Use of a Restricted Service Code

Looking at the issue from a very different perspective, and since the primary risk control measure that differentiates the HSC Code from most other regulations is the imposition of restricted service requirements (e.g. limited distance from a place of refuge and restricted environmental conditions), it has often been suggested in the past that the code could have been conceptualised as a restricted service code. This could be implemented by retaining the high speed and lightweight construction risk control measures where these are appropriate and then to open up the code to other vessels on the basis of the restricted service conditions. This would be a particularly useful approach – possibly being known as the Restricted Service Craft

(RSC) Code – as there are a very large number of passenger and ro-pax ships that operate on such short sea services where the infrastructure associated with regular service on a particular route could provide for acceptable safety. There would be the issue of whether the new code would still provide an exemption from the load line requirements, but this would be one of the many considerations required in order to implement this option. This approach has generated considerable interest, although could be expected to take considerable time to prepare and adopt due to the numerous craft that could potentially move from one regulatory environment to another. Whilst of interest, it was not considered here a viable approach in the present circumstances.

d. Ships Constructed of Aluminium

Another alternative view proposed was that the Code could be made applicable to just ships built of aluminium, this representing the vast majority of ships of lightweight construction. Whilst this has some merit in terms of simplicity and broad applicability, it does not seem to be a logical threshold definition since lightweight and high speed ships can also be built of steel in a lightweight configuration and it would not promote the development of other lightweight non-combustible material construction methods.

Whilst the above options were of interest, it was felt that the a more focussed approach was required which would allow vessels constructed with the lightweight design technology enabled by the HSC Code, to operate at any speed. This would broaden its applicability considerably, whilst requiring only minor changes to the existing Code. Three approaches to defining lightweight craft were considered – one using a displacement density coefficient, another using a displacement-to-length coefficient, and a final one using a displacement to length and beam coefficient, as follows:

e. Displacement Density

Based on the original work undertaken during development of the 1994 HSC Code, this approach uses a displacement density formula based on displacement per unit volume of craft.

The nominal volume of a craft would normally be established by a coefficient x Length x Breadth x Depth. However, Depth is a difficult term to define on a consistent basis. It does however bear some relationship to both the Length and Beam of a vessel for reasons of structural stiffness and roll stability.

Thus, by omitting Depth and raising Length times Beam to the power of 1.5, a consistent set of parameters can be used to give the required units of volume, giving the formula:

Displacement Density $< \text{Displ}\ (m^3) / (\text{Length}\ (m) * \text{Beam}\ (m))^{1.5}$ …..... *Equation 2*

It had previously been found that the majority of lightweight craft had a Displacement Density below 0.04 with the majority of conventional craft having values above this threshold.

In support of this proposal, a graph indicating the spread of data for conventional and HSC craft vs vessel length is provided in Figure 3. However, it is clear that there is considerable cross over between the two vessel types, and whilst not shown on this graph, it has also been found that this formula is not appropriate for HSC under 20 metres.

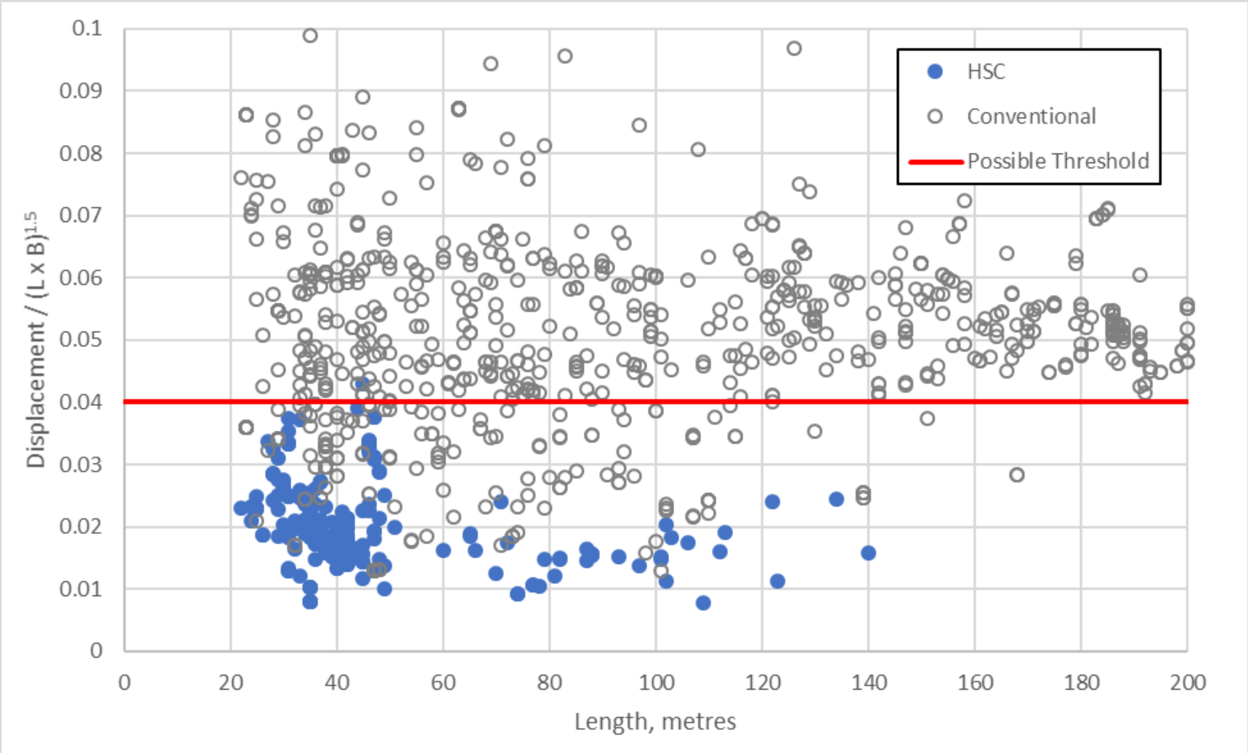

Figure 3 – Full Load Displacement / $(L \times B)^{1.5}$ vs Vessel Length

f. Displacement to Length Formula

It was considered that a length vs displacement formula might offer a more straightforward approach to differentiate light construction methods from conventional steel construction, although acknowledging there would probably be a bias in favour of high length to beam ratio vessels (e.g. monohull craft). The use of both lightship and full load displacement was investigated and it was found that full load displacement provided a better differentiation between conventional and HSC craft, possibly because of the difficulty in obtaining accurate lightship data.

In support of this threshold, a graph indicating the range of full load displacement data vs vessel length is provided in Figure 4. This appears to provide a sensible differentiation between light-craft and conventional craft, although as noted above, must include some bias towards high length to beam ratio vessels. The threshold line shown uses length to the power of 2.3 which is typically the relationship found between lightship displacement and length for HSC. The coefficient of 0.06 was selected so as to just include all HSC, such that:

*Full Load Displacement (tonnes) < 0.06 * (Length (m))$^{2.3}$.............. Equation 3*

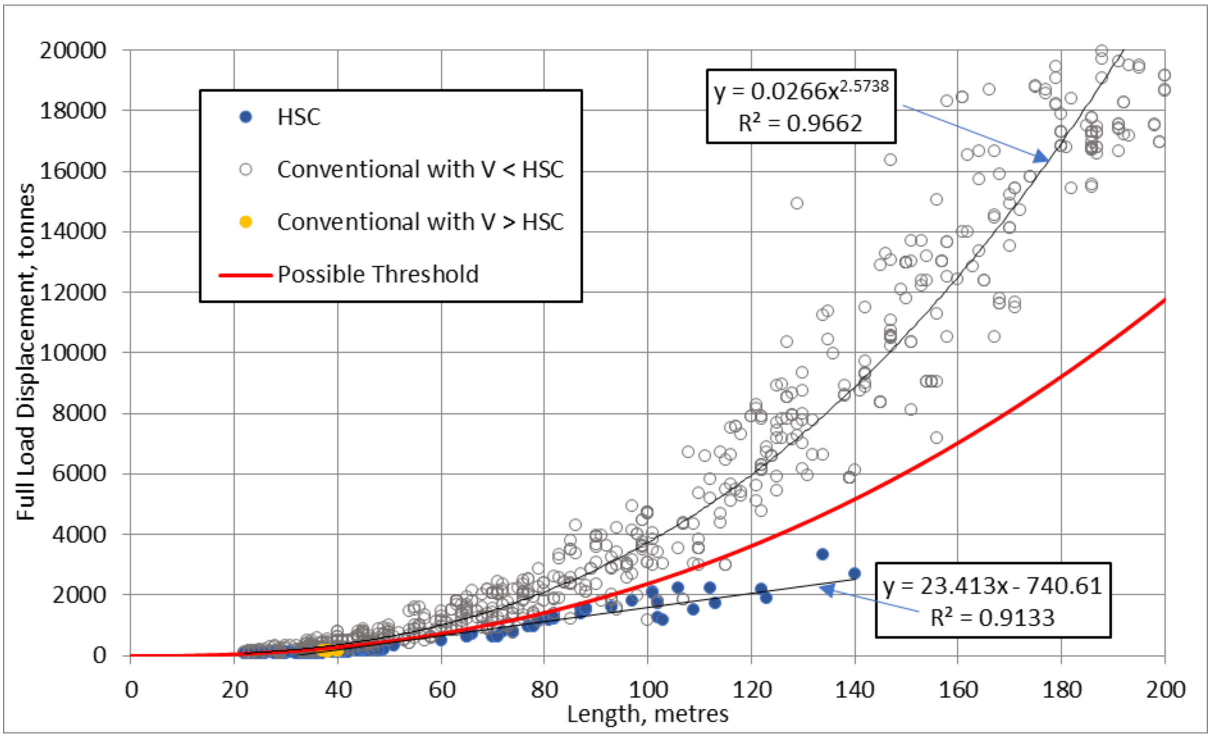

Figure 4 – Full load Displacement in tonnes vs vessel Length (L) in metres (where the possible threshold line is Displacement = 0.06 x $L^{2.3}$)

g. Displacement x Length-to-Beam (L/B) Ratio

Using an alternative approach to allow for the effect of length to beam ratio, a plot of length against displacement x L/B ratio is provided in Figure 5.

The use of L/B ratio in this assessment clearly improves the fit of the data as compared to that in Figure 4. Again, the proposed threshold line was selected to just include all HSC, although the length parameter was raised to a power of 2.5 to follow the revised trend more closely.

Whilst there is still some crossover between HSC and conventional vessel data, this arrangement appears to offer the most appropriate threshold formulation studied to date in the quest to differentiate between light-weight and conventional craft. It was also found to provide a good fit for craft of less than 20 metres in length, although this data is not shown here.

This approach has been assessed by both Austal Ships and Incat Australia and found to be acceptable for not only their existing HSC but also their expeced future medium and slow speed light craft projects. Whilst it covers all existng HSC (which are by necessity light-weight craft) it also excludes about 90% of all conventional craft. This formula is analysed in greater detail in Annex B of this report.

In terms of parameter definitions for this database, length (L) is length overall in metres, beam (B) is beam overall in metres and displacement is full load displacement in tonnes. For this Displacement L/B approach:

*Displacement (tonnes) < 0.12 * $L^{2.5}$ / L/B ……………..………………….. Equation 4*

or simplified to

*Displacement (tonnes) < 0.12 * $L^{1.5}$ * B ….……………………………. Equation 5*

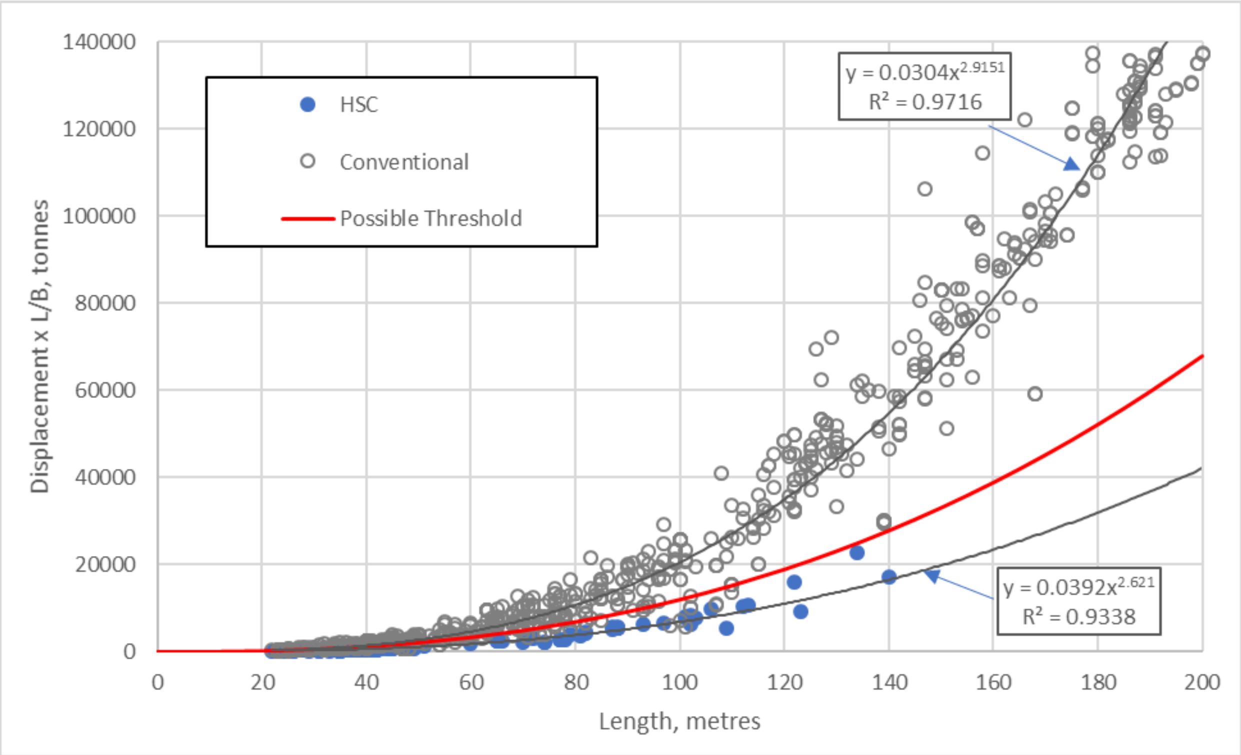

Figure 5 – Full Load Displacement x L/B ratio vs Vessel Length
(where the threshold line is Displacement x (L/B) = 0.12 x $L^{2.5}$)

This proposed approach appears to provide the most appropriate form of differentiation between light-craft and conventional craft, and this could be improved further by reducing the constant coefficient from 0.12 to 0.11 or possibly 0.10, although at this lower value there may be some current HSC that would not quite fit the light-craft formula.

3. TECHNICAL JUSTIFICATION

Whilst it is accepted that the above proposals would benefit from further and wider discussion, it is proposed here that the introduction of lower speed craft into the scope of the HSC Code is undertaken through a secondary threshold, discriminating between lightweight and conventional craft, but without a lower limit to operational speed – thus opening up the Code to lightweight craft of any speed. For HSC, the current speed/displacement threshold and all associated regulations would be expected to remain as they are.

With respect to the motivation to undertake this change, the justification is the urgent need to reduce fuel consumption and emissions within the international marine transportation industry. Whilst it is acknowledged that the current HSC sector represents a very minor part of this industry, it is none the less an important one for the transportation of passengers, competing on some routes with aircraft, and making use of a far wider range of ports, harbours and applications than commercially or technically feasible with conventional craft.

The potential to design lightweight craft for lower speeds and to complement or compete with conventional tonnage on short sea routes has been recognised for a number of years and there are a range of projects worldwide considering this. However, it is currently not a feasible undertaking on international routes. The proposed change to the HSC Code would make this possible.

In terms of fuel efficiency, it is important to note that HSC are particularly sensitive to the relationship between their operational condition and the vessel's design condition. Operating an HSC more slowly will have some effect on fuel consumption per nautical mile, but designing for the lower speed will have a significantly greater effect. For example, a 100 metre catamaran reducing speed from 35 knots to 25 knots might save 25% to 30% in fuel consumption, but the same vessel actually designed for 25 knots might save more like 50% in fuel consumption. On a typical 50 nautical mile route, taking into account harbour manoeuvring and slow speed near-shore operations to minimise wash, this significant speed reduction would add about 30 minutes to a normal 2 hours berth-to-berth voyage. Whilst such assessments are sensitive to vessel size and route characteristics, it is calculations such as this that are attracting owners of the larger HSC vessels to consider lower speed aluminium catamaran ferries.

As an aside, it has been pointed out that whilst the HSC Code does not accept any exemptions, it may accept equivalencies and if a design speed lower than the threshold is proposed, then, since the basic safety principles of the Code are maintained, this might be an acceptable equivalence for some Flag States. The problem here is that this may not be widely accepted by other Flag or Port States, thus restricting the regions in which the craft could operate. Since this uncertainty would also compromise the residual value of the vessel, it would be unrealistic to expect broad investment in such an approach.

With respect to safety, the justification is quite simply that, by inspection, the vast majority of hazards associated with high-speed operations become less of a risk as speed is reduced. In order to provide a level of confidence to this assertion, each section of the HSC Code has been considered in detail within the context of reduced operational speed, outlining any changes that might appear to be appropriate. The results of this are summarised below and, whilst this review should be considered more as a scoping exercise than a comprehensive risk assessment, it does indicate that there are only likely to be very few and very minor changes necessary.

This summary of expected modifications and associated issues provided below is taken from a more detailed study presented in Annex A to this report. The section headers reflect the chapter headings in the HSC Code.

a. Preamble

The preamble of the HSC Code sets out the basis on which the code has been developed to offer an equivalent level of safety to conventional ship regulations. The present proposal is to provide for craft of reduced speed but still of lightweight construction, in order that the exemption from the International Convention on Load Lines is still maintained. It is expected that the wording of the preamble would need to be updated to reflect the increased scope, covering all light-craft of any speed, but that such a change in scope would remain strictly in line with the approach to safety already taken within the HSC Code.

b. Chapter 1 – General comments and requirements

This chapter would need to reflect the change in application of the code and provide a definition of a light-craft, probably through an additional threshold formulation successfully discriminating between lightweight and conventional craft (see section XX). Otherwise, the wording remains fully applicable. It should be noted that any reduction in vessel speed would also mean that the permissible distance from a safe refuge would reduce, since there is no proposal to change the prescribed time of travel from the vessel route to a place of safety. For HSC, the current speed/displacement threshold and all associated regulations would be expected to remain as they are.

c. Chapter 2 – Buoyancy, stability and subdivision

This chapter, along with HSC Code Annexes 5, 6, 7 & 8, could remain applicable without change. It has been suggested that the extent of raking damage should be reviewed for light-craft that are not HSC, although there are mixed views on whether such a review would result in a lesser raking damage requirement. The present raking damage regulations were introduced as result of two significant incidents – the groundings of the 78m catamaran *Condor 11* during trials in 1994 and the 42m catamaran *St Malo* in 1995 – and further research work undertaken for the UK MCA into HSC raking damage (Reference MCA Project 501, April 2004).

d. Chapter 3 – Structures

This chapter is particularly non-prescriptive and would apply as acceptably to low speed light-craft as it does to HSC, without change.

e. Chapter 4 – Accommodation and escape measures

This chapter could remain applicable without change. However, since the collision acceleration (g_{coll}) of a slower speed light-craft is likely to be lower than the minimum for an HSC, it maybe that this factor could be reduced. Likewise, the seating construction requirements and the fitting of seat belts may also benefit from review with respect to light-craft that are not HSC.

f. Chapter 5 – Directional control system

This chapter is unlikely to require any modification, although there could be some new interpretations with respect to reliability for non-HSC. (It should be remembered that the content of this chapter was influenced heavily as a result of the *Apollo Jet* incident in Hong Kong in 1989 where loss of control at high speed resulted in devastating consequences). There may be an opportunity here to review this for lower speed craft, possibly with respect to the scope of the FMEA required.

g. Chapter 6 – Anchoring, towing and berthing

This chapter is unlikely to require any significant modification since a reduction in design speed has minimal influence.

h. Chapter 7 – Fire safety

This chapter is unlikely to require any modification since a reduction in design speed has no negative influence on the risk of fire.

i. Chapter 8 – Life-saving appliances and arrangements

This chapter is unlikely to require any modification since a reduction in design speed has no negative influence on the requirements for life-saving arrangements.

j. Chapter 9 – Machinery

This chapter is unlikely to require any significant modification, although some acknowledgement of the lower power to displacement ratio of non-HSC vessels may be appropriate.

k. Chapter 10 – Auxiliary Systems

This chapter is unlikely to require any significant modification.

l. Chapter 11 – Remote control, alarm and safety systems

This chapter is unlikely to require any significant modification.

m. Chapter 12 – Electrical installations

This chapter is unlikely to require any significant modification, although some acknowledgement of possibly reduced scope for the FMEA for non-HSC vessels may be appropriate.

n. Chapter 13 – Shipborne navigational systems and equipment and VDRs

This chapter is unlikely to require any significant modification, although the performance specification for the radar, night-vision, automatic steering aid and possibly the extent of approvals needed for some equipment, would benefit from review for light-craft that are not HSC.

o. Chapter 14 - Radiocommunications

This chapter is unlikely to require any significant modification.

p. Chapter 15 – Operating compartment layout

This chapter is unlikely to require any significant modification.

q. Chapter 16 – Stabilization systems

This chapter is unlikely to require any modification and is, anyway, probably not specifically relevant to non-HSC craft.

r. Chapter 17 – Handling, controllability and performance

This chapter is unlikely to require any significant modification, although it is considered sensible to provide some minimum performance criteria for harbour manoeuvring/berthing due to the possibility of non-HSC light-craft having restricted power for berthing in the wind strengths normally associated with their worst intended conditions.

s. Chapter 18 – Operational requirements

This chapter is unlikely to require any significant modification apart from the re-wording of some documentation (such as the Permit to Operate) to reflect whether relevant to an HSC or non-HSC light-craft. There may be a case for the route manual to include consideration of wash generation for craft operating at critical speeds with respect to water depth, since operations at medium speeds may more frequently be associated with shallow water critical speeds.

t. Chapter 19 – Inspection and maintenance requirements

This chapter is unlikely to require any modification.

u. Annexes

- Annex 1: Form of high-speed craft safety certificate and record of equipment

Apart from differentiating between HSC and non-HSC, this Annex is expected to remain fully applicable.

- Annex 2: Form of permit to operate high-speed craft

As with Annex 1, apart from differentiating between HSC and non-HSC, this Annex is expected to remain fully applicable.

- Annex 3: Use of probability concept

This section is thought to remain applicable, although it is clearly written with the objective of minimising risks associated with high-speed craft. It may be possible to modify the requirements for light-craft that are not HSC.

- Annex 4: Procedures for failure mode and effects analysis

This section is thought to remain applicable as written. However, it may be possible to reduce the scope of the FMEA for light-craft that are not HSC.

- Annex 5: Ice accretion applicable to all types of craft

This section is unlikely to require any modification.

- Annex 6: Stability of hydrofoil craft

This section is unlikely to require any modification.

- Annex 7: Stability of multihull craft

This section is unlikely to require any modification.

- Annex 8: Stability of monohull craft

This section is unlikely to require any modification.

- Annex 9: Definitions, requirements and compliance criteria related to operational and safety performance

This section is thought to remain applicable as written. However, it may be necessary to introduce minimum manoeuvrability standards to avoid future light-craft being fitted with low power propulsion systems that are unsuitable for safe close-quarter manoeuvring in high winds.

- Annex 10: Criteria for testing and evaluation of seats

This section is thought to remain applicable as written. However, it may be possible to reduce the performance requirements for seats for light-craft that are not HSC.

- Annex 11: Open reversible liferafts

This chapter is unlikely to require any modification since a change in design speed has no influence.

- Annex 12: Factors to be considered in determining craft operational limitations

This section is unlikely to require any modification.

4. STAKEHOLDER SUBMISSIONS

4.1 GENERAL

To date a limited number of organisations have been approached in order to ascertain their views on the subject of broadening the scope of the HSC Code to include lower speed craft. These include: Incat Australia, Austal Ships, Incat Crowther, DNVGL, MCA, Lloyds Register (LR) and BMT Group, all organisations closely associated with the design, build or regulation of lightweight, generally high-speed, craft of all sizes from under 10 metres to well over 100 metres. Other consultant HSC naval architects have also been consulted, including a now retired consultant, Andrew Blyth MBE, CEng, FRINA, who was involved in the development of the original HSC Code.

All respondents, without exception, have been fully supportive of the concept of introducing light-craft of any speed into the HSC Code regulatory environment. The majority have been, and currently are, involved in projects in which operators have requested operational speeds for lightweight craft which are below that currently allowable under the HSC Code. For some projects an exemption for domestic operations has been provided by the Flag State Administration and in others the vessel has been designed to just, or to theoretically just, make the speed required by the Code but then operate at a lower speed – the latter clearly being an inefficient approach from the perspective of fuel consumption and emissions.

All respondents could be described as experts in the application of the HSC Code to aluminium vessels and all see the code as a useful, logical and relatively transparent, stand-alone code for the design and construction of aluminium craft. Some highlighted that it provided the only internationally accepted stability assessment approach for multihull passenger craft and some noted the specific advantage of providing an exemption from the International Convention on Load Lines (see MSC/Circ 1028).

4.2 STAKEHOLDER CONCERNS

The respondents also outlined a number of other comments and concerns and these are highlighted below:

a. **Overall approach to regulating lower speed lightweight craft**

   The provision of a set of regulations specifically for lightweight craft is seen as a significant step forward in the move towards more cost-effective and fuel-efficient shipping.

   The technique of modifying an existing code rather than introducing a new set of regulations is seen as advantageous from the point of view of simplicity and timeliness. The need for a reduction in fossil fuel consumption will not wait and so the use of a simple and logical modification to an existing code, particularly one that stresses the need for review every few years, appears to offer the most appropriate solution.

However, there were strong views from some that, on the basis any change will take a lengthy period to be processed by the IMO, it would be better to go down the route of a Restricted Service Craft Code, since the number of craft that would be involved, and could benefit, would be far larger and thus would likely have a far greater effect on emission reduction overall than by considering lightweight craft only.

b. The need for the application of ISM

It has been stated that the need for application of the ISM Code has been used as an argument by some operators wishing to avoid the use of the HSC Code. This appears to be related to the application of the HSC Code for domestic operations since for international operations the ISM Code would be applicable irrespective of whether it was a conventional or high-speed passenger vessel.

c. Damage stability requirements

It was suggested that the extent of raking damage should be reviewed for light-craft that are not HSC, to establish whether there could be relaxations made to these requirements. Whilst there are mixed views as to whether such a review would result in a lesser raking damage requirement for slower speed craft, the commercial benefit could be significant and thus it is considered important to confirm.

d. Energy efficiency design index (EEDI)

All stakeholders expressed concern that providing for lower speed craft within the HSC Code might confuse or blur the reasons why HSC are currently exempt from EEDI considerations, particularly if the new scope allowed some conventional craft to be designed under the code. However, the high-speed and light-craft sector is destined to remain a minor part of the passenger and cargo ship industry, operating routes that in many cases are not commercially feasible using conventional craft, due to length, draft and/or speed, and where operational criteria vary considerably (e.g. for commuter, tourist and crew-boat applications). Whilst the reduction in GHG is of particular interest to all within the industry, it is thought that such varied passenger craft applications make formulation of an EEDI for lightweight craft particularly challenging. Despite this, there is the possibility of a conventional vessel operator choosing to opt into the lightweight craft section of the revised code either to try to avoid the EEDI – or possibly to benefit from lightweight construction thus improving the vessel's EEDI. It is understood that from a MARPOL perspective, HSC passenger ships will only need to calculate their attained EEDI and that this project is unlikely to impact on EEDI discussions. However, it is expected that the light-craft sector (HSC or not) will need to find a viable solution for regulating operational CO_2 emissions.

e. Unmanned machinery spaces

Many of the HSC Code requirements relate to the use of unmanned machinery spaces. This is seen by many as a beneficial requirement and not one that would need to be changed significantly for slower speed craft. There may however be a case for reducing the extent of monitoring on machinery which is not of such a high-performance rating as that on HSC.

f. Failure mode and effect analysis (FMEA)

Whilst not strictly required for many conventional ship designs, the FMEA is seen as a beneficial and not overly onerous requirement for lower speed lightweight craft, particularly since unmanned machinery spaces are still envisaged. However, it is considered that the scope of the FMEA could be reduced for the slower speed craft in light of the reduced speed related risks.

g. Shallow water effects

Operating at medium speed in coastal water depths can lead to critical speeds (in relation to water depth) being achieved, where wash wave heights can become greater than normal. Whilst this also applies to HSC, it is noted that some historical wash incidents concerned HSC when operating at reduced speed. Thus, it may be advantageous to provide relevant guidance in the Route Manual required in Section 18.2.2 of the code.

h. Field of vision

A full 360 degree field of vision from the bridge is a requirement of the HSC Code which has a direct impact on the layout of the vessel, often requiring an extra half deck height in way of the bridge. Whilst such a range of vision is seen as a distinct benefit, the increasing use and development of cameras and other electronic sensing equipment for situational awareness, being led by the move towards autonomous craft, may ultimately be the way in which the 360 degree field of vision is provided.

i. Manoeuvring

With craft that are light and with less propulsive power than existing HSC, there is potential for the compromise of manoeuvring performance in wind in restricted areas (e.g. berthing in port). It is suggested that at least some form of relevant requirement be considered, such as ‘it shall be shown that the vessel can dock safely at any relative wind angle, in wind strengths up to and including those associated with the worst intended conditions’. This could be based on calculation to avoid extensive sea trial demonstrations.

j. Unforeseen risks

There is always the potential for unforeseen risks, even when making small and considered modifications to an already well-established regulatory code.

4.3 POTENTIAL BENEFITS AND DRAWBACKS

The respondents identified a number of benefits and drawbacks as follows:

a. Benefits

The primary benefit would be that a regulatory code enabling the design and build of lightweight ships of any speed would become available, leading to a new, internationally acceptable class of vessel where reductions in operating costs and emissions, compared to both conventional ships and existing high-speed craft, become possible.

With lower speeds being acceptable for lightweight craft, this would avoid the hard cut-off of the current speed/displacement threshold, thus avoiding the inefficiency of designing for high speed (in order to use lightweight construction via the HSC Code) but then operating at a lower speed.

If appropriate changes to the code, addressing the reduced risks of operating more slowly, are implemented then it is likely that additional commercial benefits will accrue for this new class of lightweight craft. Such changes could be expected to include reductions in the scope of the FMEA, reductions in the performance and/or specification of some equipment and a review of raking damage requirements,

There are many examples of projects where a light-craft code would have been, or would be, beneficial, covering the full range of HSC sizes, from a pair of small 15 metre, 12 knot, personnel transfer Swath craft to large 160 metre, 20 knot, catamaran passenger ferries, primarily concerned with provision of an approved method of constructing lightweight aluminium craft. In the two cases mentioned here, both are associated with saving operational costs (fuel and maintenance costs), with minimal difference, or even some benefits, in construction costs. The above mentioned 15 metre craft were built in aluminium with larger engines than were operationally required, so as to meet the HSC Code. The 160 metre project is also to be built in aluminium but currently under domestic regulatory arrangements.

Other projects noted by respondents that would have been likely to have benefitted from a revised code included a pair of 14 knot, 70 metre LNG catamaran ferries built in aluminium to achieve a strict draft requirement for operations in shallow water ports; a 100 metre, 18 knot aluminium catamaran ferry currently undergoing detail design to replace a fast ferry operation in the Mediterranean; an 85 metre, 16 knot catamaran ferry built in steel with an aluminium superstructure; a 40 metre, 18 knot aluminium monohull fitted with installed power to enable it to fit the HSC Code at 25 knots; an 80 metre, 20 knot, aluminium catamaran ferry, replacing a previous fast ferry operation, and a 74 metre, 22 knot catamaran ferry built of steel. Other relevant projects are known to be under discussion but details cannot be provided for reasons of commercial sensitivity.

Further, interest has been shown by ship brokers with regards to the re-engining of older HSC, with lower power installations for more efficient operations. This could, in effect, represent a re-purposing exercise, since there are a number of old HSC that would be uneconomical to refit as high-speed craft but would likely have a commercial application if outfitted with lower power, and hence lower cost, propulsion systems. This would require regulators to recognise the need for craft built under past versions of the HSC Code, or possibly the DSC Code, to be free to operate at lower speeds than originally intended.

b. Drawbacks

Subject to the satisfactory definition of the additional technical threshold discussed above and to agreements relating to the relaxation of some requirements in the code for slower speed craft, and possibly to confirmation as to the likely development of energy efficiency requirements, there do not appear to be any particular drawbacks. Clearly there would be administrative work associated with the introduction of the revised code and with respect to revision of associated regulation in which the HSC Code is referred to.

5. SUMMARY

In summary, the proposal is to broaden the scope of the HSC Code to include lower speed lightweight craft, whilst still retaining the current definition and associated requirements for high-speed craft.

The following points have been highlighted as a result of this study:

a. The motivation and justification for the change is to provide for a new class of lightweight vessel which potentially has significantly lower fuel consumption characteristics than equivalent conventional or high-speed passenger craft, by nature of reduced displacement and reduced speed respectively.

b. It is important to note that the fuel consumption of HSC is particularly sensitive to the relationship between the operational condition and the vessel's design condition. Running an HSC at lower speeds does not necessarily result in significant fuel savings compared to an equivalent lightweight vessel specifically designed to operate at this slower speed.

c. The safety justification for the change in scope of the HSC Code is that the risks associated with operation at high-speed only reduce at lower speeds, thus there are few, if any, areas where the code would strictly need revision – apart from the addition of a threshold statement limiting the applicability of the code to lightweight craft.

d. There are, however, two particular areas which may need to be better defined if lower speed craft are to be incorporated. Firstly, the performance for berthing and manoeuvring in harbour in strong winds. With lower installed power in lightweight craft, possibly with greater use of propeller rather than waterjet propulsion, there may need to be minimum manoeuvring criteria stated relating to the worst intended wind conditions. Secondly, operating at medium speed in shallow water can mean that critical speeds (related to water depth) may be achieved more frequently, leading to greater wash wave heights than normally expected. Guidance in this respect, possibly within the vessel's route manual, might be advantageous.

e. A new, additional, threshold providing for the increased scope of the HSC Code is required, which successfully discriminates between lightweight craft and conventional vessels. A number of options have been proposed within this study and it is suggested that more detailed assessments are undertaken and formal feedback sought from designers prior to selecting an appropriate version. It will be important that the threshold is both logical and reliable such that it can be adequately justified within the IMO.

f. In addition to this, and in order to maximise the commercial viability of this new class of lower speed vessel, it is expected that some consideration be given to the relaxation of some specific regulations. The main considerations in this respect are expected to be a reduced scope for the FMEA, reduced requirements for some machinery specification and monitoring and possibly a review of the raking damage requirements.

g. For ease and timeliness of obtaining adoption of this proposal through IMO it is suggested that two main areas be addressed initially – to agree the compelling need for the proposed change (understood to be required by IMO in order to initiate a New Work Item) and to proposed a definitive secondary threshold, discriminating between lightweight and conventional craft. If these and a straight-forward change to the name of the Code (e.g. High-Speed and Light-Craft Code) were proposed and adopted in an initial phase, then this would serve to open up the code to lightweight craft of any speed for the immediate future.

h. Work to identify the most appropriate further modifications to the code could then be progressed, aiming for adoption at a later stage. This would also benefit from experience gained from early craft designed under the initial phase of the revised code.

i. It is thought that in order to support the determination of the compelling need, some quantitative outline of the benefits that could be accrued across the industry might be required.

j. The main technical unknown is related to the use of EEDI and whether the revised Code might be used to avoid EEDI, or indeed to benefit from aluminium construction, or that it might be imposed somehow for craft regulated under the Code. Whichever way it is viewed, it is an issue that should be considered further, keeping in mind that adoption of this revised scope of the HSC Code is itself a beneficial move with respect to energy efficiency.

k. As an aside, it was noted that the HSC Code is rather different in nature from many of the older, generally more traditional, regulations in one particular way – and that is that the logic for the regulations is still relatively clear to the user, making application and interpretation of the Code simpler and safer. It is hoped that future modifications are arranged to retain this clear link between relevant risks and their associated regulation.

ANNEX A – IMPACT ASSESSMENT ON HSC CODE

Impact assessment of proposed inclusion of lightweight craft of any speed within current HSC Code

Note: This impact assessment has been undertaken by examining each regulation within the current high-speed craft (HSC) code and considering what impact there should or would be if the application of the Code was widened to include lightweight craft (or light-craft, LC) of speeds lower than the current threshold. For vessels with speeds equal to or exceeding the current speed threshold, it is assumed that the current regulations continue to apply in full and that the craft would still be known as HSC.

For reference, a ranking factor (RF) is introduced in this table to indicate the level of modification expected to be required to each regulation: 1: no change, 2: minor wording change, 3: minor regulatory change, 4: major regulatory change, 5: new regulation expected to be required.

ID	Regulation	Expected Impact	RF
Chapter 1 - General Comments and Requirements			
Notes	This section would clearly need to be updated to cover the broader scope proposed. However the modifications would be minor since there is no intention to depart from the requirements of the existing code except from the inclusion of similar craft with lower speeds. Suggest all craft in the revised code be known as light-craft (LC), with those whose speeds equal or exceed the current threshold retaining the HSC category, possibly known as high-speed-light-craft (HSLC).		
1.1	General comments	This section remains comprehensively applicable subject to words ‘high speed craft’ being replaced with ‘light-craft and high-speed-light-craft’.	2
1.2	General requirements	These requirements apply comprehensively to light-craft of any speed and so only minor changes might be necessary, as per 1.1 above.	2
1.3	Application	These requirements apply comprehensively to light-craft of any speed and so only minor changes might be necessary, as per 1.1 above.	2
1.4	Definitions	These definitions remain comprehensively applicable, subject to the introduction of the definition of a ‘light-craft’ (LC).	3
1.5	Surveys	This section remains comprehensively applicable subject to words ‘high speed craft’ being replaced with ‘light-craft and high-speed-light-craft’.	2
1.6	Approvals	This section remains comprehensively applicable.	1
1.7	Maintenance of condition after survey	This section remains comprehensively applicable.	1
1.8	High-speed craft safety certificate	This section remains comprehensively applicable subject to words ‘high speed craft’ being replaced with ‘light-craft and high-speed-	2

		light-craft'. It is also suggested that it would be appropriate to define whether the craft was HSC or not.	
1.9	Permit to operate high-speed craft	This section remains comprehensively applicable subject to words 'high speed craft' being replaced with 'light-craft and high-speed-light-craft'. It is also suggested that it would be appropriate to define whether the craft was LC or HSLC.	2
1.10	Control	This section remains comprehensively applicable subject to words 'high speed craft' being replaced with 'light-craft and high-speed-light-craft'.	2
1.11	Equivalents	This section remains comprehensively applicable.	1
1.12	Information to be made available	This section remains comprehensively applicable.	1
1.13	Further developments	This section remains comprehensively applicable subject to words 'high speed craft' being replaced with 'light-craft and high-speed-light-craft'.	2
1.14	Circulation of safety information	This section remains comprehensively applicable.	1
1.15	Review of the Code	This section remains comprehensively applicable.	1
Chapter 2 – Buoyancy, Stability and Subdivision			
Notes	There is no specific need or intention to modify the buoyancy, stability and subdivision regulations. However, many regulations in this chapter relate specifically to risks associated with operations at high speed and so the wording would benefit from being modified to be inclusive of slower speed craft also. It is expected that in the future, some acknowledgement of raking damage dependence on vessel speed may be beneficial.		
Part A – General			
2.1	General	This sub-section is aimed at the risks associated with high speed craft. It would need to be re-written to be inclusive of light-craft.	2
2.2	Intact buoyancy and watertight and weathertight integrity	This is aimed primarily at the risks associated with lightweight craft. It may benefit from some re-emphasis to include references to LC and HSLC.	1-2
2.3	Intact stability in the displacement mode	This is aimed primarily at the risks associated with lightweight craft. It may benefit from some re-emphasis to include references to LC and HSLC.	1-2
2.4	Intact stability in the non-displacement mode	Whilst this is clearly aimed at HSC, if an LC does not have a non-displacement mode then the sub-section would not be applicable anyway. It may benefit from some re-emphasis to include references to LC and HSLC.	1-2

2.5	Intact stability in the transitional mode	Whilst this is clearly aimed at HSC, if an LC does not have a non-displacement mode then the sub-section would not be applicable anyway. It may benefit from re-wording to allow differentiation between HSLC and LC.	1-2
2.6	Buoyancy and stability following damage	This is aimed primarily at the risks associated with lightweight craft. It may benefit from re-wording to allow a differential between HSLC and LC.	1-2
2.7	Inclining and stability information	This section remains comprehensively applicable.	1
2.8	Loading and stability assessment	This section remains comprehensively applicable.	1
2.9	Marking and recording of the design waterline	This section remains comprehensively applicable subject to words 'high speed craft' being replaced with 'light-craft and high-speed-light-craft'.	2
Part B – Requirements for passenger craft			
2.10	General	This section remains comprehensively applicable.	1
2.11	Intact stability in the displacement mode	This section remains comprehensively applicable.	1
2.12	Intact stability in the non-displacement mode	Whilst this is clearly aimed at HSC, if an LC does not have a non-displacement mode then the sub-section would not be applicable anyway. It may benefit from re-wording to allow differentiation between HSLC and LC.	1-2
2.13	Buoyancy and stability following damage	This is aimed primarily at the risks associated with lightweight craft. It may benefit from re-wording to allow differentiation between HSLC and LC.	1-2
2.14	Inclining and stability information	This section remains comprehensively applicable.	1
Part C – Requirements for cargo craft			
2.15	Buoyancy and stability following damage	This section remains comprehensively applicable.	1
2.16	Inclining	This section remains comprehensively applicable.	1
Chapter 3 – Structures			
Notes	This chapter is particularly non-prescriptive and would apply as acceptably to low speed light-craft as it does to HSC, without change.		
3.1	General	This section remains comprehensively applicable.	1
3.2	Materials	This section remains comprehensively applicable.	1

3.3	Structural strength	This section remains comprehensively applicable.	1
3.4	Cyclic loads	This section remains comprehensively applicable.	1
3.5	Design criteria	This section remains comprehensively applicable.	1
3.6	Trials	This section remains comprehensively applicable.	1
Chapter 4 – Accommodation and Escape Measures			
Notes	This chapter could remain applicable without change. However, since the collision acceleration (g_{coll}) of a slower speed light-craft is likely to be lower than the minimum for an HSC, it maybe that this factor could be reduced. Likewise, the seating construction requirements and the fitting of seat belts may also benefit from review with respect to light-craft that are not HSC.		
4.1	General	No additional comments since regulations are relevant to all light-craft.	1
4.2	Public address and information system	This section remains comprehensively applicable.	1
4.3	Design acceleration levels	It is expected that consideration will need to be given to the g_{coll} relevant to craft that are not HSLC and for Table 4.3.3 to be updated accordingly.	1-3
4.4	Accommodation design	No additional comments since regulations are relevant to all light-craft.	1
4.5	Seating construction	It is expected that 4.5.6 will be made specific to HSLC. Non-HSLC seating may benefit from an alternative standard.	1-2
4.6	Safety belts	It is expected that 4.6.2 will be made specific to HSLC. Non-HSLC arrangements may benefit from an alternative standard.	1-2
4.7	Exits and means of escape	No additional comments since regulations are relevant to all light-craft.	1
4.8	Evacuation time	No additional comments since regulations are relevant to all light-craft.	1
4.9	Baggage, stores, shops and cargo compartments	This section remains comprehensively applicable.	1
4.10	Noise levels	No additional comments since regulations are relevant to all light-craft.	1
4.11	Protection of the crew and passengers	This section remains comprehensively applicable.	1
Chapter 5 – Directional Control Systems			
Notes	This chapter is unlikely to require any modification, although there could be some new interpretations with respect to reliability for non-HSC. (It should be remembered that the content of this chapter was influenced heavily as a result of the Apollo Jet incident in Hong Kong in 1989 where loss of control at high speed		

	resulted in devastating consequences). There may be an opportunity here to review this for lower speed craft, possibly with respect to the scope of the FMEA required.		
5.1	General	This section remains comprehensively applicable.	1
5.2	Reliability	Reliability of directional control systems is important for all ships – but particularly for HSLC. There may be an opportunity to make some new interpretations for non-HSLC.	2-3
5.3	Demonstrations	This section remains comprehensively applicable.	1
5.4	Control positions	This section remains comprehensively applicable.	1
Chapter 6 – Anchoring, Towing and Berthing			
Notes	This chapter is unlikely to require any significant modification since a reduction in design speed has minimal influence.		
6.1	General	The wording may need to reflect all LC rather than just HSLC.	2
6.2	Anchoring	This section remains comprehensively applicable.	1
6.3	Towing	This section remains comprehensively applicable.	1
6.4	Berthing	The wording may need minor modification since there is an assumption of high relative wind speeds over the stowed mooring lines during operations.	2
Chapter 7 – Fire Safety			
Notes	This chapter is unlikely to require any modification since a reduction in design speed has no negative influence on the risk of fire.		
Part A – General			
7.1	General requirements	These regulations are relevant to all light-craft.	1
7.2	Definitions	These regulations are relevant to all light-craft.	1
7.3	Classification of space use	These regulations are relevant to all light-craft.	1
7.4	Structural fire protection	These regulations are relevant to all light-craft.	1
7.5	Fuel and other flammable fluid tanks and systems	These regulations are relevant to all light-craft.	1
7.6	Ventilation	These regulations are relevant to all light-craft.	1

7.7	Fire-detection and extinguishing systems	These regulations are relevant to all light-craft.	1
7.8	Protection of special category spaces and ro-ro spaces	These regulations are relevant to all light-craft.	1
7.9	Miscellaneous	These regulations are relevant to all light-craft.	1
7.10	Firefighter's outfits	These regulations are relevant to all light-craft.	1
Part B – Requirements for passenger craft			
7.11	Arrangement	These regulations are relevant to all light-craft.	1
7.12	Ventilation	These regulations are relevant to all light-craft.	1
7.13	Fixed sprinkler system	These regulations are relevant to all light-craft.	1
Part C – Requirements for cargo craft			
7.14	Control stations	These regulations are relevant to all light-craft.	1
7.15	Cargo spaces	These regulations are relevant to all light-craft.	1
7.16	Fixed sprinkler system	These regulations are relevant to all light-craft.	1
Part D – Requirements for carriage of dangerous goods			
7.17	General	These regulations are relevant to all light-craft.	1
Chapter 8 – Life-Saving Appliances and Arrangements			
Notes	This chapter is unlikely to require any modification since a reduction in design speed has no negative influence on the requirements for life-saving arrangements.		
8.1	General and definitions	These regulations are relevant to all light-craft.	1
8.2	Communications	These regulations are relevant to all light-craft.	1
8.3	Personal lifesaving appliances	These regulations are relevant to all light-craft.	1
8.4	Muster list, emergency instructions & manuals	These regulations are relevant to all light-craft.	1
8.5	Operating instructions	These regulations are relevant to all light-craft.	1

8.6	Survival craft stowage	Minor wording change in 8.6.10 changing high-speed craft to all light-craft. Otherwise no additional comments.	2
8.7	Survival craft and rescue boat embarkation and recovery argmts.	These regulations are relevant to all light-craft.	1
8.8	Line-throwing appliance	These regulations are relevant to all light-craft.	1
8.9	Operational readiness, maintenance and inspections	These regulations are relevant to all light-craft.	1
8.10	Survival craft and rescue boats	These regulations are relevant to all light-craft.	1
8.11	Helicopter pick-up areas	These regulations are relevant to all light--craft.	1
Chapter 9 – Machinery			
Notes	This chapter is unlikely to require any significant modification, although some acknowledgement of the lower power to displacement ratio of non-HSLC vessels may be appropriate.		
Part A – General			
9.1	General	These regulations are relevant to all light-craft.	1
9.2	Engine (general)	This is aimed primarily at the risks associated with lightweight craft. It may benefit from re-wording to allow differentiation between HSLC and LC.	2
9.3	Gas turbines	Whilst this is clearly aimed at HSLC, if an LC does not have a gas-turbine then the sub-section would not be applicable anyway.	1-2
9.4	Diesel engines for main propulsion and essential auxiliaries	This is aimed primarily at the risks associated with high power engines. It may benefit from re-wording to allow differentiation between HSLC & LC.	2
9.5	Transmissions	This is aimed primarily at the risks associated with high power transmissions. It may benefit from re-wording to allow differentiation between HSLC & LC.	2
9.6	Propulsion and lift devices	This remains comprehensively applicable, although it is acknowledged that LC are less likely to have propulsion and lift devices.	1
Part B – Requirements for passenger craft			
9.7	Independent means of propulsion for category B craft	These regulations are relevant to all light-craft.	1
9.8	Means for return to a port of refuge for category B craft	These regulations are relevant to all light-craft.	1

Part C – Requirements for cargo craft			
9.9	Essential machinery and control	These regulations are relevant to all light-craft.	1
Chapter 10 – Auxiliary Systems			
Notes	This chapter is unlikely to require any modification.		
Part A – General			
10.1	General	These regulations are relevant to all light-craft.	1
10.2	Arrangement of fuel, LO and other flammable oil	These regulations are relevant to all light-craft.	1
10.3	Bilge pumping and drainage systems	These regulations are relevant to all light-craft.	1
10.4	Ballast systems	These regulations are relevant to all light-craft.	1
10.5	Cooling systems	These regulations are relevant to all light-craft.	1
10.6	Engine air intake systems	These regulations are relevant to all light-craft.	1
10.7	Ventilation systems	These regulations are relevant to all light-craft.	1
10.8	Exhaust systems	These regulations are relevant to all light-craft.	1
Part B – Requirements for passenger craft			
10.9	Bilge pumping and drainage systems	These regulations are relevant to all light-craft.	1
Part C – Requirements for cargo craft			
10.10	Bilge pumping systems	These regulations are relevant to all light-craft.	1
Chapter 11 – Remote Control, Alarm and Safety Systems			
Notes	This chapter is unlikely to require any modification.		
11.1	Definitions	These regulations are relevant to all light-craft.	1
11.2	General	These regulations are relevant to all light-craft.	1
11.3	Emergency controls	These regulations are relevant to all light-craft.	1
11.4	Alarm systems	These regulations are relevant to all light-craft.	1

11.5	Safety systems	These regulations are relevant to all light-craft.	1
Chapter 12 – Electrical Installations			
Notes	This chapter is unlikely to require any modification, although some acknowledgement of possibly reduced requirements for the FMEA for non-HSLC vessels may be appropriate.		
Part A – General			
12.1	General	These regulations are relevant to all light-craft.	1
12.2	Main source of electrical power	These regulations are relevant to all light-craft.	1
12.3	Emergency source of electrical power	These regulations are relevant to all light-craft.	1
12.4	Starting arrangements for emergency generating sets	These regulations are relevant to all light-craft.	1
12.5	Steering and stabilization	These regulations are relevant to all light-craft.	1
12.6	Precautions against shock, fire and other electrical hazards	These regulations are relevant to all light-craft.	1
Part B – Requirements for passenger craft			
12.7	General	These regulations are relevant to all light-craft.	1
Part C – Requirements for cargo craft			
12.8	General	These regulations are relevant to all light-craft.	1
Chapter 13 – Shipborne Navigational Systems and Equipment and VDRs			
Notes	This chapter is unlikely to require any significant modification, although the performance specification for the radar, night-vision, automatic steering aid and possibly the extent of approvals needed for some equipment, would benefit from review.		
13.1	General	These regulations are relevant to all light-craft.	1
13.2	Compasses	These regulations are relevant to all light-craft. However it is thought sensible to reconsider the need for approval of an HSC gyro-compass (Resolution A.821(19)) for LC.	1-3
13.3	Speed and distance measurement	These regulations are relevant to all light-craft.	1
13.4	Echo-sounding device	These regulations are relevant to all light-craft.	1

13.5	Radar installations	These regulations are relevant to all light-craft. However it is thought sensible to reconsider the need for approval of an HSLC radar (Resolution A.820(19)) for LC.	1-3
13.6	Electronic positioning systems	These regulations are relevant to all light-craft.	1
13.7	Rate of turn indicator and rudder angle indicator	These regulations are relevant to all light-craft.	1
13.8	Nautical charts and publications	These regulations are relevant to all light-craft.	1
13.9	Searchlight and daylight signalling lamp	These regulations are relevant to all light-craft.	1
13.10	Night vision equipment	These regulations are relevant to all light-craft.	1
13.11	Steering arrangement and propulsion indicators	These regulations are relevant to all light-craft.	1
13.12	Automatic steering aid	These regulations are relevant to all light-craft. However it is thought sensible to reconsider the need for approval of an HSLC Autopilot (Resolution A.822(19)) for LC.	1-3
13.13	Radar reflector	These regulations are relevant to all light-craft.	1
13.14	Sound reception system	These regulations are relevant to all light-craft.	1
13.15	Automatic identification system	These regulations are relevant to all light-craft.	1
13.16	Voyage data recorder	These regulations are relevant to all light-craft.	1
13.17	Approval of systems, equipment and performance standards	These regulations are relevant to all light-craft, although there may be some benefit in reviewing whether all approval required for HSLC are still required for LC.	1-3
Chapter 14 – Radiocommunications			
Notes	This chapter is unlikely to require any modification.		
14.1	Application	These regulations are relevant to all light-craft.	1
14.2	Terms and definitions	These regulations are relevant to all light-craft.	1
14.3	Exemptions	These regulations are relevant to all light-craft.	1
14.4	GMDSS identities	These regulations are relevant to all light-craft.	1

14.5	Functional requirements	These regulations are relevant to all light-craft.	1
14.6	Radio installations	These regulations are relevant to all light-craft.	1
14.7	Radio equipment: general	These regulations are relevant to all light-craft.	1
14.8	Radio equipment: sea area A1	These regulations are relevant to all light-craft.	1
14.9	Radio equipment: sea areas A1 and A2	These regulations are relevant to all light-craft.	1
14.10	Radio equipment: sea areas A1, A2 and A3	These regulations are relevant to all light-craft.	1
14.11	Radio equipment: sea areas A1, A2, A3 and A4	These regulations are relevant to all light-craft.	1
14.12	Watches	These regulations are relevant to all light-craft.	1
14.13	Sources of energy	These regulations are relevant to all light-craft.	1
14.14	Performance standards	These regulations are relevant to all light-craft.	1
14.15	Maintenance requirements	These regulations are relevant to all light-craft.	1
14.16	Radio personnel	These regulations are relevant to all light-craft.	1
14.17	Radio records	These regulations are relevant to all light-craft.	1
14.18	Position-updating	These regulations are relevant to all light-craft.	1
Chapter 15 – Operating Compartment Layout			
Notes	This chapter is unlikely to require any modification.		
15.1	Definitions	These regulations are relevant to all light-craft.	1
15.2	General	These regulations are relevant to all light-craft.	1
15.3	Field of vision from the operating compartment	These regulations are relevant to all light-craft.	1
15.4	Operating compartment	These regulations are relevant to all light-craft.	1
15.5	Instruments and chart table	These regulations are relevant to all light-craft.	1

15.6	Lighting	These regulations are relevant to all light-craft.	1
15.7	Windows	These regulations are relevant to all light-craft.	1
15.8	Communication facilities	These regulations are relevant to all light-craft.	1
15.9	Temperature and ventilation	These regulations are relevant to all light-craft.	1
15.10	Colours	These regulations are relevant to all light-craft.	1
15.11	Safety measures	These regulations are relevant to all light-craft.	1
Chapter 16 – Stabilization Systems			
Note	It is acknowledged that LC that are not HSC are unlikely to have stabilization systems - apart from motion reduction or ride control systems which are excluded from such a definition anyway.		
16.1	Definitions	These regulations are relevant to all light-craft, although less so for non HSLC.	1
16.2	General requirements	These regulations are relevant to all light-craft, although less so for non HSLC.	1
16.3	Lateral and height control systems	These regulations are relevant to all light-craft, although less so for non HSLC.	1
16.4	Demonstrations	These regulations are relevant to all light-craft, although less so for non HSLC.	1
Chapter 17 – Handling, Controllability and Performance			
Note	Whilst this Chapter has been formulated primarily to highlight risks associated with HSLC, there are no requirements that stand out as being inappropriately onerous for LC that are not HSLC. However there is the possibility, albeit unlikely, of some LC having too low, or inappropriately arranged, installed power to provide for safe manoeuvrability. Thus it is suggested that some minimum manoeuvring capabilities would benefit from being defined. In this regard, the use of tugs for pushing onto light-weight structures has proven to be problematic in practice.		
17.1	General	These regulations are relevant to all light-craft.	1
17.2	Proof of compliance	These regulations are relevant to all light-craft.	1
17.3	Weight and centre of gravity	These regulations are relevant to all light-craft.	1
17.4	Effect of failures	These regulations are relevant to all light-craft.	1
17.5	Controllability and manoeuvrability	These regulations are relevant to all light-craft, possibly subject to consideration of minimum manoeuvring standards as per note above.	1-3

17.6	Change of operating surface and mode	These regulations are relevant to all light-craft.	1
17.7	Surface irregularities	This section is thought to remain applicable. although clarification that it is intended for amphibious craft would be helpful (as per the text in regulation 17.11 for example)	1-2
17.8	Acceleration and deceleration	These regulations are relevant to all light-craft.	1
17.9	Speeds	These regulations are relevant to all light-craft.	1
17.10	Minimum depth of water	These regulations are relevant to all light-craft.	1
17.11	Hard structure clearance	These regulations are relevant to all light-craft.	1
17.12	Night operations	These regulations are relevant to all light-craft.	1
Chapter 18 – Operational Requirements			
Part A – General			
Note	The wording of this chapter is largely appropriate for light-craft of any speed. However, it would be appropriate to reference the documentation in terms of light-craft rather than just high-speed craft (such as a Light-craft Safety Certificate and a Light-craft Permit to Operate) and then specify whether the vessel was an HSLC.		
18.1	Craft operational control	This sub-section is thought to remain applicable to all light craft subject to reference being made to light-craft rather than just high-speed craft.	2
18.2	Craft documentation	These regulations are relevant to all light-craft.	1
18.3	Training and qualifications	These regulations are relevant to all light-craft.	1
18.4	Manning of survival craft and supervision	These regulations are relevant to all light-craft.	1
18.5	Emergency instructions and drills	These regulations are relevant to all light-craft.	1
Part B – Requirements for passenger craft			
18.6	Type rating training	These regulations are relevant to all light-craft.	1
18.7	Emergency instructions and drills	These regulations are relevant to all light-craft.	1
Part C – Requirements for cargo craft			
18.8	Type rating training	These regulations are relevant to all light-craft.	1

Chapter 19 – Inspection and Maintenance Requirements			
Note	This chapter does not have sub-section headings. The headings used below are for guidance only as to the content of that subsection.		
19.1	General	These regulations are relevant to all light-craft.	1
19.2	Craft and equipment	These regulations are relevant to all light-craft.	1
19.3	Administration	These regulations are relevant to all light-craft.	1
ANNEX 1 – Form of HSC Safety Certificate and Record of Equipment			
Note	It is thought that this Form of Certificate would remain the same, subject to the title of the form changing to' Light-craft Safety Certificate and Record of Equipment' and the definition of whether the craft was LC or HSLC.		2
ANNEX 2 – Form of Permit to Operate HSC			
Note	It is thought that this Form of Certificate would remain the same, subject to the title of the form changing to' Permit to Operate Light-craft' and the definition of whether the craft was LC or HSLC.		2
ANNEX 3 – Use of Probability Concept			
Note	This section is thought to remain applicable, although it is clearly written with the objective of minimising risks associated with high-speed craft. It may be possible to modify the requirements for light-craft that are not HSLC.		1-3
ANNEX 4 – Procedures for Failure Mode and Effect Analysis			
Note	This section is thought to remain applicable as written. However, it may be possible to reduce the requirements for FMEA for light-craft that are not HSLC.		1-3
ANNEX 5 – Ice Accretion Applicable to all Types of Craft			
Note	This section is thought to remain comprehensively applicable.		1
ANNEX 6 – Stability of Hydrofoil Craft			
Note	This section is thought to remain comprehensively applicable.		1
ANNEX 7 – Stability of Multihull Craft			

Note	This section is thought to remain largely applicable.	1-3
ANNEX 8 – Stability of Monohull craft		
Note	This section is thought to remain largely applicable.	1-3
ANNEX 9 – Definitions, Requirements and Compliance Criteria Related to Operational and Safety Performance		
Note	This section is thought to remain applicable as written. However, it may be necessary to introduce minimum manoeuvrability standards to avoid future light-craft being fitted with low power propulsion systems that are unsuitable for safe manoeuvring.	1-3
`ANNEX 10 – Criteria for Testing and Evaluation of Seats		
Note	This section is thought to remain applicable as written. However, it may be possible to reduce the requirements for seats for light-craft that are not HSLC.	1-3
ANNEX 11 – Open Reversible Liferafts		
Note	This section is thought to remain comprehensively applicable.	1
ANNEX 12 – Factors to be Considered in Determining Craft Operating Limitations		
Note	This section is thought to remain comprehensively applicable.	1

ANNEX B – ASSESSMENT OF THRESHOLD PROPOSAL

The proposal made in Section 2.4.g. of this report is highlighted here in further detail.

In the figures below, Figure B.1. is a duplicate of Figure 5 of this report and Figure B.2. is an enlargement of this same figure over a range of lengths between 20 and 80 metres, providing a clearer view of the data in this range. Length (L) is defined as length overall in metres, beam (B) as beam overall in metres and displacement as full load displacement in tonnes.

If the Ordinate (y axis) 'Displacement x (L/B)' is divided by the threshold line of $L^{2.5}$ then the coefficient of the threshold line can be better assessed.

Displacement * (L/B) / $L^{2.5}$ = Displacement / (B * $L^{1.5}$)

This quantity (Displacement / (B * $L^{1.5}$)) has been plotted against vessel length in Figure B.3. and gives a clearer view of the distinction between HSC and conventional craft that this formula provides. The currently proposed coefficient of 0.12 is highlighted on this figure, although it could possibly be reduced still further to exclude a larger number of conventional craft.

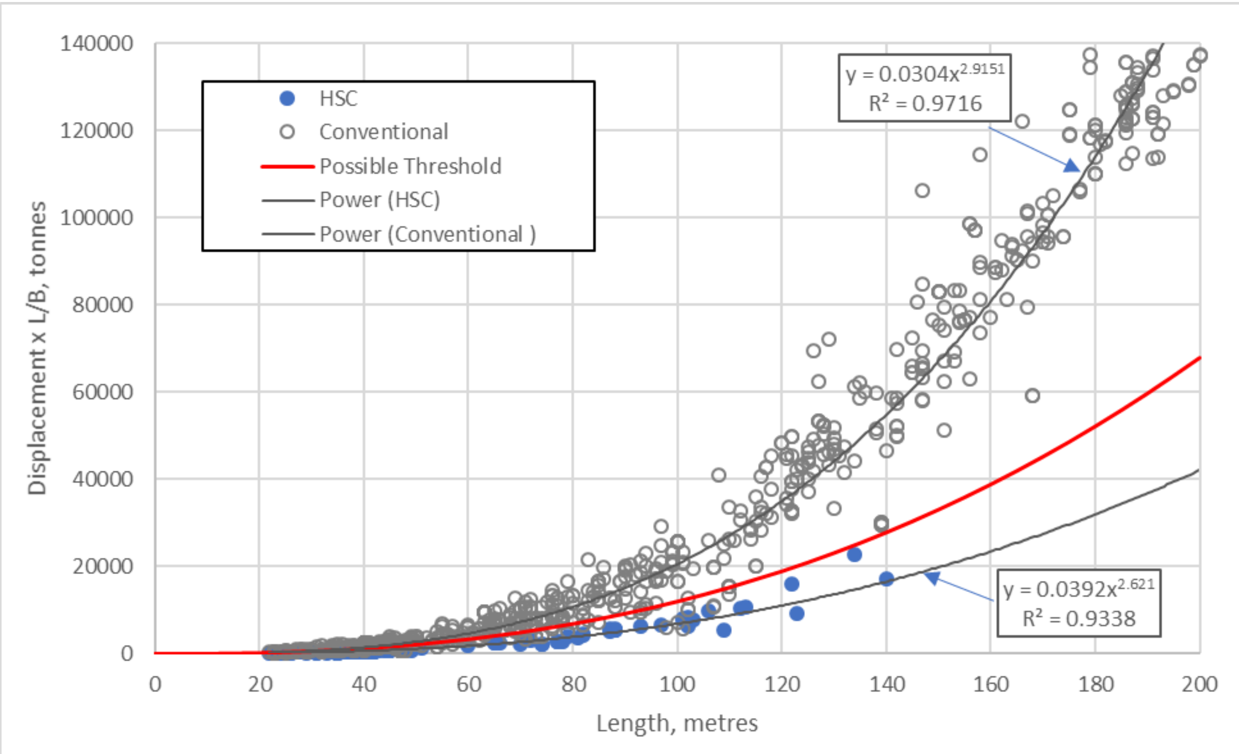

Figure B.1. Displacement x (L/B) vs Length for Conventional and HSC Ferries with a proposed threshold line of 0.12 x $L^{2.5}$ shown in red

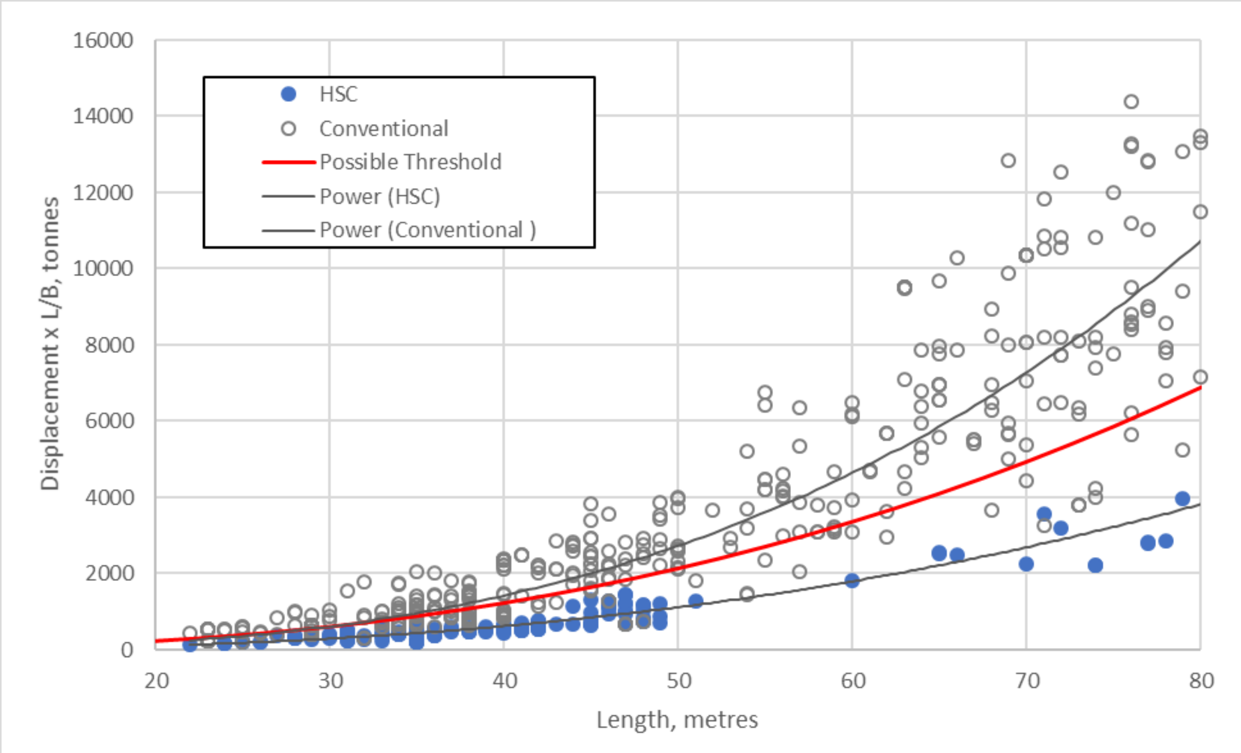

Figure B.2. Detail of Figure B.1. with Length from 20 to 80 metres

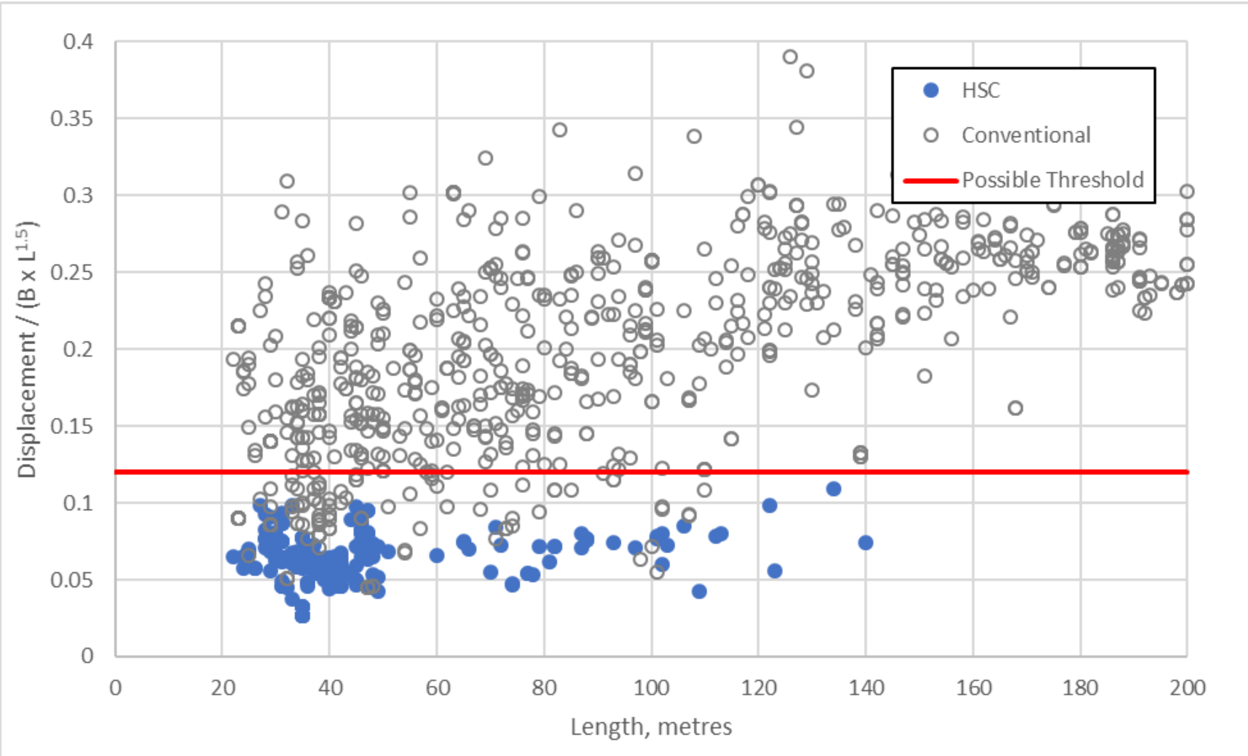

Figure B.3. Displacement / (B x $L^{1.5}$) vs Length showing proposed threshold coefficient of 0.12 in red