# A New Risk-Based Standard for Domestic Fast Craft in Australia

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## Abstract:

*The last thirty years has seen the development and widespread use of commercial craft that operate at speed. This paper gives an overview of the new standard for domestic Fast Craft that has been developed by the Commonwealth, State and Territory Governments of Australia as part of the National Standard for Commercial Vessels. The reasons for the new standard are first explained with reference to a set of overarching strategic principles. Existing standards for similar vessels are examined, with reasons given as to why they have not been simply adopted. The distinction between a Fast Craft and a High Speed Craft is highlighted and a Category F2 Fast Craft defined. An explanation is given as to the methodology used to develop the standard including the roles of incident statistics, the High Speed Craft Code, a risk management workshop, and stakeholder input via reference groups and public comment. A description is given of the structure of the fast craft standard and how it is to be used in conjunction with the standards for conventional vessels. The incrementalist approach is introduced and its practical application to grade requirements within the standard demonstrated by example. Substantive changes to the standard that resulted from public comment are described. The cost of implementing the requirements in the public comment draft and the final standard are then examined and compared.*

Figure 1: Pride of Airlie / Sun Paradise collision November 2001

## 1. Introduction

The National Marine Safety Committee Inc is reviewing standards for domestic commercial vessels on behalf of the State, Territory and Commonwealth Governments of Australia. The current standards are contained in the Uniform Shipping Laws Code *USL Code (1991,1993)*. A new standard called the National Standard for Commercial Vessels (NSCV) is being developed to replace the USL Code.

Risks associated with today's vessels that operate at relatively high speeds are not sufficiently addressed under the USL Code, the content of which was largely developed 30 years ago. The National Marine Safety Committee (NMSC) identified at an early stage that the new national standards contained in the NSCV would include standards to control the risks associated with high speed craft.

The standards writing activities of the NMSC are governed by a Strategic Plan *NMSC (2003)* that arose from a Council of Australian Governments agreement and has been endorsed by the Australian Transport Council.

The Strategic Plan contains a number of principles that shape the revision of standards for commercial vessels, including standards that apply to vessels operating at high speeds.

These include:

- Incorporate recognized and relevant national and international standards;
- Encourage professional competence;
- Incorporate a performance-based approach;
- Facilitate approval of new technologies;
- Incorporate OH&S principles;
- Encourage recognition of duty of care; and
- Develop the safety system based on sound information.

The process for developing standards requires input from key stakeholders at crucial stages in accordance with Council of Australian Governments' Guidelines for Standards Setting Bodies. Stakeholders provide input in the drafting, public comment and review of public comment phases.

Work on the standards for fast craft commenced with a workshop in 2000 *NMSC (2000)*. Two Subsections that specify General Requirements *NSCV Part F 1A (2005)* and standards for Category F1 fast craft *NSCV Part F 1B (2005)* were completed in 2002. Work on the standards for Category F2 fast craft (the topic of this paper) commenced in 2001 but was postponed pending further progress on the standards for conventional vessels. Recommenced in 2005, the standard for Category F2 fast craft *NSCV Part F 1C (2006)* has now been completed and is going through a process of final approval by the Australian Transport Council.

## 2. Why not adopt existing standards used overseas?

The NMSCs strategic plan calls for the adoption of relevant national or international standards wherever possible. So why has the NMSC developed a new standard for Category F2 fast craft?

Many countries ostensibly apply the High Speed Craft Code (HSC Code) *HSC Code (2000)* to domestic vessels, for example Hong Kong *HKMD (1999*), but rely on surveyor discretion to vary those requirements where they would be inappropriate. Unfortunately, reliance on discretion is inconsistent with the NMSC's objectives of mutual recognition. One surveyor's interpretation of what is acceptable will invariably differ from another surveyor's. Moreover, the designer, builder or operator cannot determine the exact nature of requirements, until after discretion has been exercised.

The objective of the NSCV standards is to clearly state in writing a set of deemed-to-satisfy solutions that reflect what a competent surveyor would accept under such discretion. The standard must also be consistent and transparent.

Applying the HSC Code and relying on surveyor discretion to make it work will not suffice. There are many issues that arise when trying to apply the HSC Code in full to Category F2 fast craft, particularly vessels at the smaller end of the fleet. These include:

- The threshold speed to determine whether high speed provisions should apply
- Prohibition on passenger berths.
- Limitation to 4hrs operation from a port of refuge.
- Failure mode and effect analysis.
- Extent of damage for subdivision.
- Protection against accelerations.
- Operating compartment requirements.
- Need for a permit to operate.
- Compliance within the maximum specified evacuation time.

For example, consider the prohibition on berths for passengers. There are vessels that have been accepted under the USL Code that carry berthed passengers at speeds of 25 knots or more. Should such a vessel no longer be allowed to operate? If the prohibition on berthed passengers is to be applied, to which vessels should it be applied?

Similarly, the HSC Code 2000 has onerous requirements for damage survivability, requiring standards for the extent of damage far higher than those required for conventional vessels under the USL Code. Applying the full HSC Code to many smaller fast craft could effectively eliminate whole existing industries. What standards should be applied to coastal or sheltered waters domestic craft that arguably are exposed to higher probabilities of collision and grounding than craft that may operate on international routes? What limitations are there in the balance between cost and benefit over the range of domestic vessels?

Our close neighbours in New Zealand have already implemented standards for fast craft. They have adopted a four-tiered approach *MNZ (2000).* The first tier is essentially similar to Category F1 under the NSCV in that it adopts the HSC Code. Tiers 2, 3 and 4 all fall within the proposed application of Category F2 and represent their approach to the grading of requirements. The standards for these three tiers are largely performance-based without specifying in detail the deemed-to-satisfy solution, e.g.; practical demonstrations and the provision of essential information for reference by the operator. Some of the requirements are expressed in the form of safety outcomes. The details of the solution and the criteria for verification are left open.

The US Coast Guard (USCG) has issued guidance for enhancing the operational safety of domestic high-speed vessels *USCG (2001)*. The guidance applies to passenger vessels of speed 30 knots or more and is also recommended for vessels of speed 30 knots or more that do not carry passengers. The guidance material is not intended to be limiting or all-inclusive. USCG has discretion to impose additional safety measures under US Law. The circular appears to provide guidance as to the exercise of that discretion to apply requirements additional to those specified for conventional vessels under the US Code of Federal Regulations. There appear to be three main limbs to the guidance—

- Training based on a risk management review being done on the particular vessel identifying position prerequisites and a formal process being established for training.
- Content of the vessel operation manual is specified in the guidance material and includes operating procedures, service and maintenance procedures and emergency procedures.
- Minimum requirements for bridge navigation & communications equipment are specified.

Hence, in considering the options available in terms of existing standards, the NMSC came to the conclusion that existing requirements for similar domestic fast craft would be insufficient to fulfill the NMSC’s objectives.

**3. Why use the term Fast Craft and not High Speed Craft?**

The term High Speed Craft is widely associated with the HSC Code. Referring to Figure 2, the lower curve is the threshold speed for application of the HSC Code. As can be seen, the HSC Code definition would capture many vessels that operate at relatively "conventional" speeds such as motor cruisers used for charter and charter fishing operations, water taxis and ferries, especially those of smaller size.

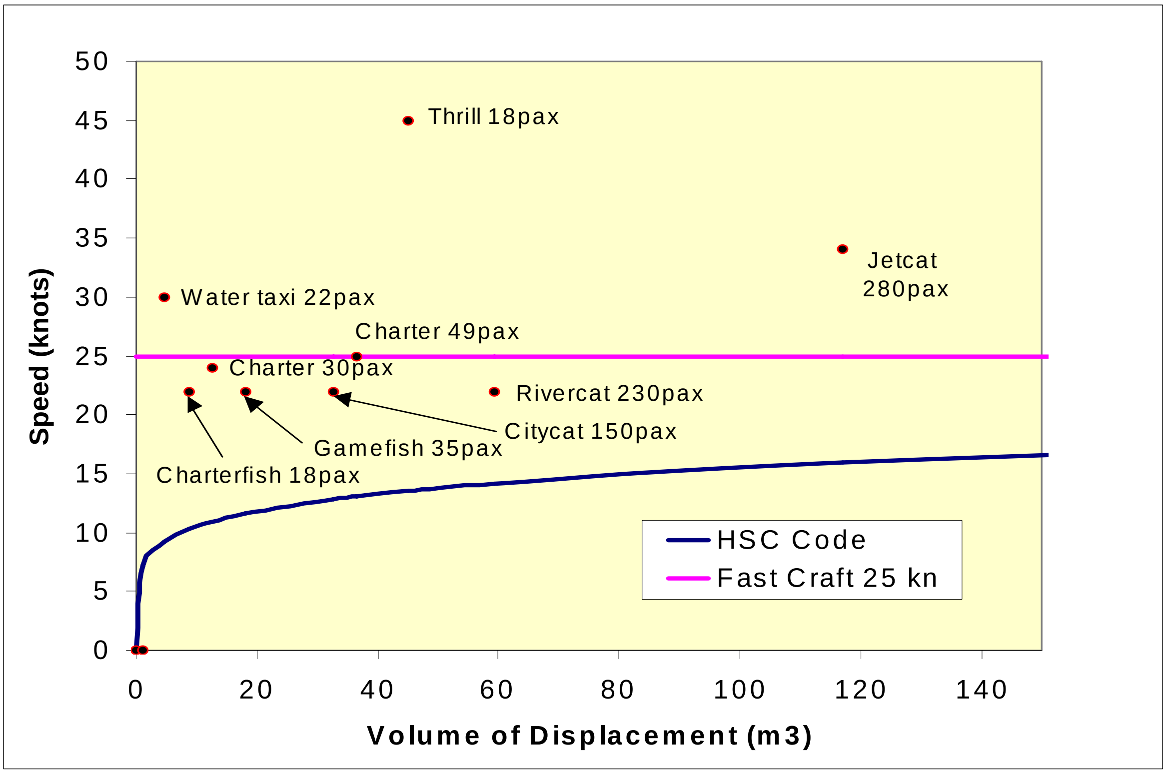


Figure 2: HSC definition compared to NSCV definition

A concern with applying the HSC Code speed criterion to domestic vessels was that it could overburden the industry by picking up some conventional vessels that have been served sufficiently well by conventional standards.

The NMSC decided to use the term “Fast Craft” to differentiate the NMSC’s standards from the HSC Code. The definition of a fast craft under the NSCV differs from that of a high speed craft under the HSC Code. A fast craft is defined as a vessel of maximum speed equal to or exceeding 25 knots.

The threshold speed of 25 knots was determined by negotiation between various stakeholders including government, operators and builders. Public comment on the draft of Subsection 1A General Requirements suggested thresholds that varied from 20 knots to 35 knots. It should be noted that the 25 knot threshold is the same as that adopted by Det Norske Veritas for their High Speed and Light Craft Rules.

Part F Subsection 1A establishes two categories of Fast Craft, Category F1 and Category F2. Figure 3 illustrates a flowchart contained in Subsection 1A for determining the category of fast craft.

The key point to note from this flowchart is the defining criterion for a fast craft-i.e., a speed greater than 25 knots, and that two Categories of fast craft are defined, Category F1 and Category F2.

Category F1 fast craft are seagoing passenger and/or cargo vessels (Class 1 or Class 2) that have a measured length of 35 metres and more and are capable of 25 knots or more. The standards for Category F1 have already been determined are contained in Part F Subsection 1B which calls up the HSC Code (2000).

## 4. Definition of a Category F2 Fast Craft

Category F2 fast craft are vessels that carry more than 12 passengers (Class 1) that do not fall within the definition for Category F1. Category F2 fast craft are either seagoing passenger vessels of length less than 35 metres, or sheltered water passenger vessels of any length.

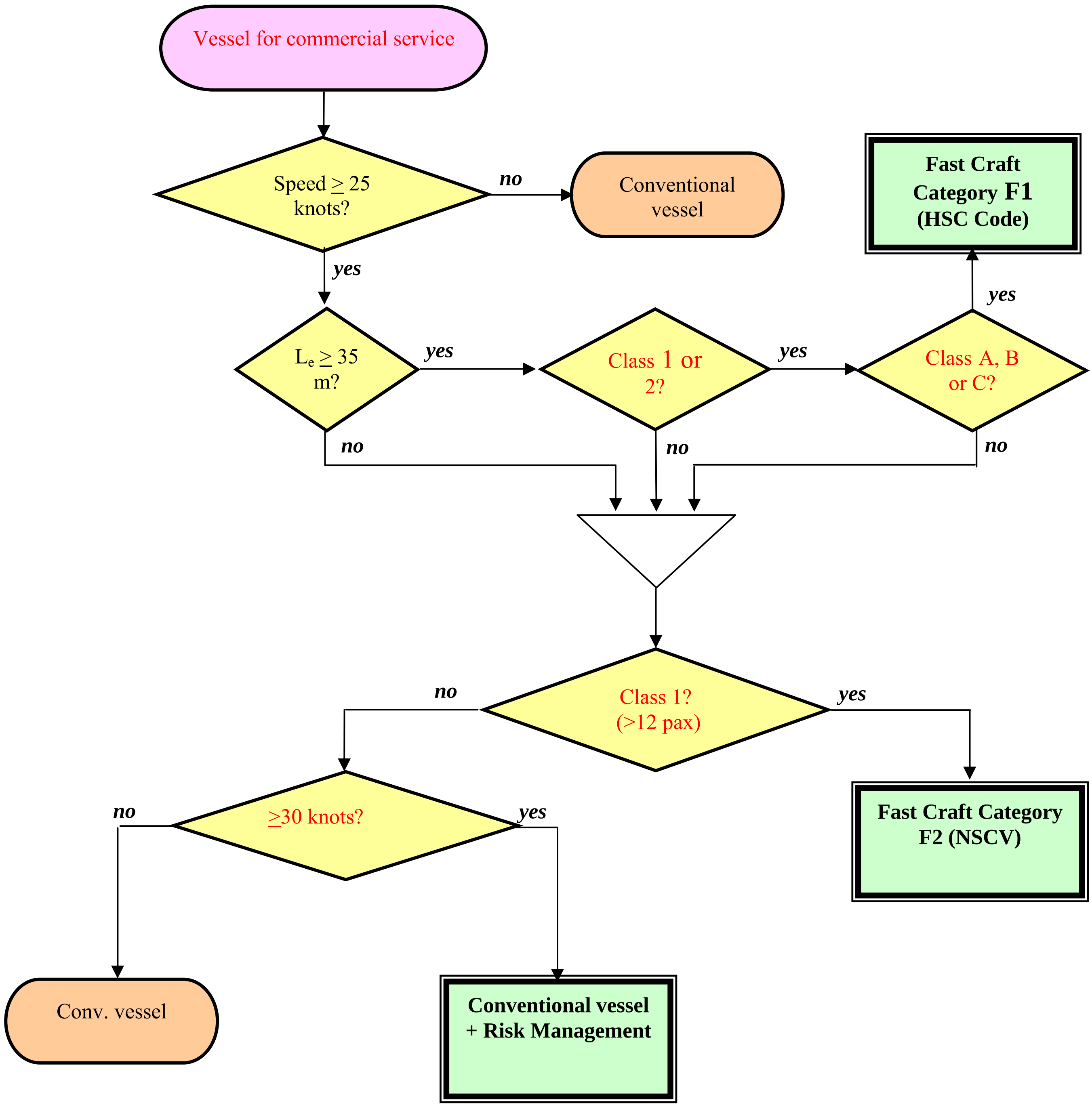


Figure 3: Flowchart for determining Category of Fast Craft.

As an example of Category F2, consider a high speed catamaran used for the Sydney-Manly commuter service.

Working through the flowchart in Figure 3—

- Is the speed is 25 knots or more? Yes it is (32 knots)
- Is the vessel 35 m or more in length? No it is not (34.9 m)
- Does the vessel carry more than 12 passengers? Yes it does. (280 passengers)
- Is the vessel is for Class A, B or C service (seagoing)? No it is not. (Class D—partially smooth waters)

Thus, the catamaran is Category F2.

## 5. Analysis of incidents

Accidents in Australia involving fast craft do happen, though these are often not widely known nor systematically recorded. Table 1 lists just a few of the more serious accidents involving Fast Craft in Australia and New Zealand.

In November 2001 the high speed passenger vessel *Sun Paradise* ran into and sank the 18 metre sailing catamaran *Pride of Airlie* in the Whitsunday Islands. The accident happened at 18-20 knots in clear conditions. Fortunately, no-one was seriously injured, but 50 people on the *Pride of Airlie* had to be rescued. Among the reasons listed for the collision were inadequacies in navigation equipment, crew knowledge and safety management on both vessels involved .*QGBOI (2003)*.

At this stage, there is insufficient data to confirm statistically that fast craft are any more dangerous than conventional vessels. The history of fast craft is still relatively recent and the population size is comparatively small. While historical data provides useful insights into risks associated with fast craft, it is not conclusive and should not be relied upon in isolation.

Table 1: Some Australian and New Zealand fast craft incidents

| | |
|---|---|
| 1980's | Hydrofoil / yacht collision Sydney |
| 1986? | "Spirit of Victoria" nosedive |
| 1987 | "Reef Link II" fire |
| 1988 | "Tassie Devil 2001" nosedive |
| 1995 | "Condor 11" grounding |
| 1996 | "Mack Attack" / dinghy collision |
| 1999 | "James Kelly II" grounding |
| 2001 | "Suzie O'Neil" nosedive |
| 2001 | "Pride of Airlie"/"Sun Paradise" collision |
| 2002 | "Sir David Martin" / "Infinity III" collision |
| 2003 | "Harbourjet.com" windscreen shattered |

Table 2: Summary of hazard likelihood and consequences for high speed craft

| **Accident category** | **Percentage of total incidents** | **Percentage of equivalent fatalities** | **Ratio of e-fatalities to incidents** |
|---|---|---|---|
| Collision | **24%** | **39%** | **1.63** |
| Contact | 21% | 13% | 0.62 |
| Machinery or electrical failure | 17% | 0% | 0.00 |
| Grounding or stranding | **12%** | **24%** | **2.00** |
| Other/unknown | 12% | 12% | 1.00 |
| Fire | 7% | 9% | 1.29 |
| Loss of hull integrity (LOHI) | 3% | 2% | 0.67 |
| Accident to personnel | 1% | 0% | 0.00 |
| Flooding or leakage | 1% | 0% | 0.00 |
| Explosion | 1% | 1% | 1.00 |
| Total | 100% | 100% | |

An Australian incident database is being compiled as part of the NMSC's work plan. However, this project is yet to be fully realized. Data so far obtained on Australian fast craft incidents was forwarded to an international study on High Speed Craft undertaken by Seaspeed Technology on behalf of the UK Marine and Coastguard Agency *MCA (2004)*.

The study was based on data containing records of 679 high speed craft incidents involving 99 fatalities, 558 major injuries and 1344 minor injuries.

The report uses the concept of equivalent fatalities to compare the relative severity of different consequences. 10 major injuries equates to one equivalent fatality or e-fatality. Similarly, 10 minor injuries equates to an equivalent major injury. This assumption as to relative severity allows the data on consequences to be aggregated into a single measure of e-fatalities.

Table 2 is a summary of the results of the MCA study. Various accident categories are listed on the left. The percentage of total incidents each hazard represents and the percentage of the total equivalent fatalities that arose from the hazard is also given. Thus, for example, collision incidents represented 24% of total incidents and gave rise to 39% of equivalent fatalities.

Navigation related incidents of collision, contact, grounding or stranding represented 57% of incidents and 76% of e-fatalities. Collision and grounding or stranding show a high proportion of e-fatalities relative to the frequency that such incidents have been recorded.

The authors of the report suggest that the importance of these accident categories is justification for focusing on stability and buoyancy requirements of the HSC Code. However, the data could also be interpreted more holistically. Stability and buoyancy are secondary factors in the context of collision, contact, stranding and grounding. They serve to mitigate the consequences after exposure to the relevant hazards. There are many other aspects of vessel design and operation that play a much more direct role in the likelihood and consequences of collision, contact, stranding and grounding incidents.

A reasonable proposition from the data is that the requirements for fast craft should focus on reducing risks associated with collision, contact, stranding and grounding.

## 6. The overall safety objective and reverse-engineered required outcomes

Given the limits of historical data in determining requirements for fast craft, alternative methods had to be found to develop the Category F2 Fast Craft standard. The first step taken was to review the overall safety objectives and then to consider specific safety outcomes within the context of the overall objective.

The specified objective of the Fast Craft standard is as follows:

> *The objective of this Subsection is to specify standards for the design, construction and operation of Category F2 fast craft so that the overall risk to persons from a Category F2 fast craft is no greater than that from a conventional vessel under the NSCV.*

It is important to note that this objective does not seek an overall risk for a fast craft that is less than for a conventional vessel. But to achieve this objective, one could argue that the risks to a fast craft from 'conventional' hazards should be less than for a conventional vessel so that, when added to the additional risks associated with speed, there is no overall increase in risk above those of a conventional vessel.

What makes fast craft different from vessels that operate at conventional speeds? Three key differences were identified—

- Increased speed means increased energy and larger accelerations.
- Craft operating at high speed tend to have their design optimized; weight and structural redundancy being kept to a minimum.
- Increased speed means less time for operational responses; less time to identify hazards; analyse risks and control risks.

The NSCV is being written to allow a more performance-based approach to achieving safety outcomes. For this to be achieved it was necessary to generate a series of performance-based required outcomes that specified in more specific terms the means by which the overall objective could be achieved.

The HSC Code was used as a starting point. A series of required outcomes were reverse-engineered from the content of the HSC Code. Some of these closely reflected actual clauses, while others were deduced from specific solutions that were specified. While expressed within the standard in absolute terms, in practice, most required outcomes are achieved in relative terms. Thus, for example, a required outcome might specify that stability must be sufficient to withstand the loading and overturning moments to which a vessel might be subjected. However, that does not mean that stability must be sufficient to withstand all foreseeable combinations of loading and overturning moments. There comes a point where the combination of probability and consequence of a risk are such that the risk becomes acceptable, even though it has not been eliminated entirely. The challenge is to determine the levels at which that risk becomes acceptable.

## 7. Qualitative risk management workshop

A risk workshop for Category F2 fast craft was held in Sydney in September 2001 to progress the standard to the next stage. Representatives from industry and government went through a risk assessment process by which they identified special risks associated with vessels that would fall inside the definition of Category F2 *NMSC (2002)*. The workshop was facilitated by Det Norske Veritas.

The objectives of the workshop were to identify the main hazards, assess the relative levels of risk, identify the key risk factors and determine if there would be a need for specific standards applicable to Category F2 fast craft. The report on the workshop can be downloaded directly from the NMSC website.

The workshop came to the following conclusions:

- Many hazards applicable to Category F2 fast craft are not adequately addressed by conventional vessel standards.
- Specific Category F2 Fast Craft standards are needed.
- Standards should take an incrementalist approach between the conventional vessel standards and IMO HSC Code 2000.
- The incrementalist approach should be determined by 5 dominant risk drivers as follows:
    1. Speed;
    2. Number of passengers;
    3. Area of operation;
    4. Vessel design (size, configuration, layout, etc); and
    5. Mode of operation (routes, rest periods, human factors, etc)

It should be noted that four of these dominant risk drivers were already reflected in the definitions for Categories F1 and F2 Fast Craft.

The recommendation that an incrementalist approach be applied was especially significant because the Preamble to the HSC Code 2000 contains the following paragraph:

> *It is important that an Administration, in considering the suitability of a high-speed craft under this Code, should apply <u>all sections of the Code</u> because non-compliance with any part of the Code could result in an imbalance which would adversely affect the safety of the craft, passengers and crew….*

Authorities applying the HSC Code have been very reluctant to apply a graded approach in the light of such an all-encompassing motherhood statement. The reference group acknowledged the IMO approach might be appropriate where the differences between conventional ships and HSC under SOLAS were so marked. However in the smaller domestic vessel industry, the physical differences between fast craft and conventional vessels were in some cases non-existent. The all-or-nothing approach created an artificial barrier that could not be justified by the changes in exposure to risk as one crossed the fast craft speed threshold.

The Risk Workshop's recommendation that an incrementalist approach be applied meant that the standards for Category F2 would bridge the gap between the requirements for conventional vessels under the NSCV and the full application of the HSC Code that is required for Category F1 (Figure 4). In doing this the recommendation essentially set two important benchmarks for determining acceptable risk. On one side there are the conventional vessel NSCV standards that are deemed to be sufficient to control risk on conventional vessels. On the other side there are the HSC Code standards which are deemed to be sufficient to control risks on large seagoing fast craft.

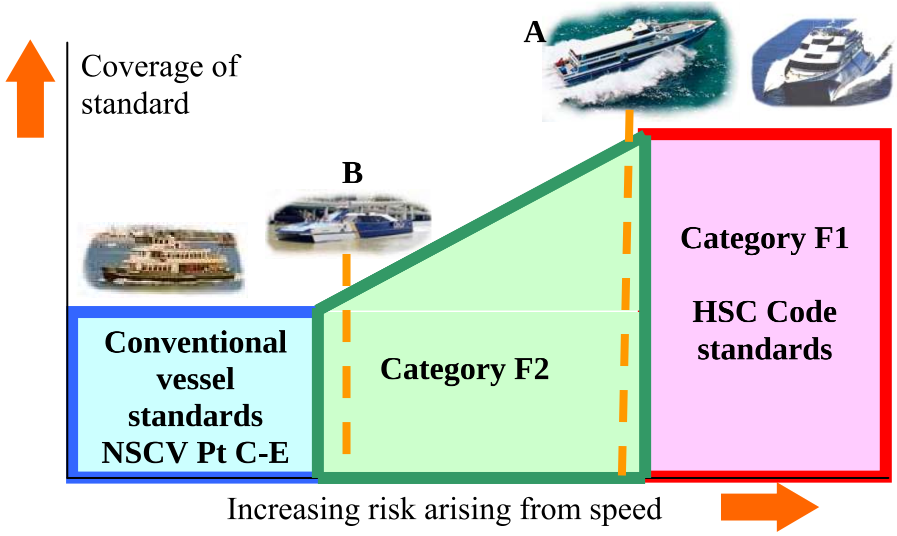


Figure 4: Schematic illustration of the proposed graded approach to standards for fast craft

Using this approach, a vessel just below the Category F1 threshold (Vessel A in Figure 4) in would be subject to most of the HSC Code requirements. A vessel just over the conventional threshold (Vessel B in Figure 4) would be subject to little more than the conventional requirements.

Another important decision of the Risk Workshop was that the requirements for Category F2 Fast Craft should be mandatory regardless of the vessel's configuration. This contrasts with SOLAS where the HSC Code is an optional alternative to compliance with SOLAS. The reason for mandatory application was because many of the issues that are speed related will apply to a vessel whether it is a full scantling steel ferry capable of high speed or a light high speed aluminium catamaran.

## 8. Developing the draft for public comment

The draft for public comment was developed by a reference group comprising both industry and government participants. The reference group decided that the draft would be formulated starting with the conventional standards in the NSCV and working up, rather than starting from the HSC Code and working down.

The standard was to specify requirements for fast craft that were additional to or modified those of the conventional vessel standards, unlike the HSC Code which replaces the requirements for conventional vessels.

The structure adopted for the draft is as follows—.

- Chapter 1 Preliminary
- Chapter 2 Required outcomes
- Chapter 3 Deemed-to-satisfy solutions—Design and Construction
- Chapter 4 Deemed-to-satisfy solutions—Crewing and Competencies
- Chapter 5 Deemed-to-satisfy solutions—Operational Requirements

Chapter 1 specifies the scope, application and objective of the standard. It also contains definitions and referenced documents and explains the application of key parameters.

Chapter 2 specifies required outcomes. These were based on the required outcomes that were reverse-engineered from the HSC Code, but with modifications to keep the standard within the specified scope. For example, the reference group determined that the fire safety provisions in the HSC Code were not applicable to the Fast Craft standard because the risks of fire were not significantly affected by increased speed relative to the risks associated with conventional vessels under the NSCV. For details of the structure of the NSCV including an explanation of required outcomes, deemed-to-satisfy solutions and equivalent solutions, refer to *NSCV Part B (2005).*

Chapters 3, 4 and 5 specify deemed-to-satisfy solutions that align with the structure of the NSCV Parts and Sections for conventional vessels.

Chapter 3 has provisions for

- Operational performance
- Arrangement, accommodation and personal safety
- Watertight and weathertight integrity
- Construction
- Engineering
- Stability and subdivision
- Equipment
- Provision of essential safety equipment

Chapter 4 specifies fast craft competencies, training and assessment methods.

Chapter 5 requires fast craft to be suitable for operation in the particular locality, and provides for a safety management system and route operational manual.

Table 3: Damaged Stability

| **No of passengers** | **Operational area** | | | | |
|---|---|---|---|---|---|
| | **A** | **B** | **C** | **D** | **E** |
| ≤ 36 passengers | Maximum 20% longitudinal | NSCV Subsection 6C | NSCV Subsection 6C | NSCV Subsection 6C | NSCV Subsection 6C |
| > 36 passengers and < 150 passengers | Maximum 20% longitudinal | Maximum 20% longitudinal | NSCV Subsection 6C | NSCV Subsection 6C | NSCV Subsection 6C |
| ≥ 150 passengers and < 450 passengers | HSC Code | Maximum 20% longitudinal | Maximum 20% longitudinal | Maximum 20% longitudinal | NSCV Subsection 6C |
| ≥ 450 passengers | HSC Code | HSC Code | HSC Code | Maximum 20% longitudinal | Maximum 20% longitudinal |

KEY:

*Maximum 20% longitudinal* means that the craft shall comply with the HSC Code criteria for buoyancy and stability in the displacement mode following damage, but assuming a maximum required raking longitudinal extent of damage 20% of the measured length.

*NSCV Subsection 6C* means that the damaged stability shall comply with the requirements for the equivalent vessel operating at conventional speeds specified by Part C Subsection 6C of the NSCV.

*HSC Code* means that the craft shall comply with the HSC Code criteria for buoyancy and stability in the displacement mode following damage assuming the extent of damaged specified in the HSC Code.

Individual required outcomes and their corresponding deemed-to-satisfy solutions were assessed to identify the key factors that determine the magnitude of risk, both in terms of likelihood and consequence. Given that a fast craft requirement does not apply to a vessel below the fast craft threshold, and that for a Category F1 fast craft, the full HSC Code requirement does apply, these were used as the benchmarks for grading individual provisions by varying the key factors. One or more of the key risk parameters identified by the Risk Workshop were frequently found to be amongst the key factors that were used to grade the application of provisions.

Table 3 illustrates how the incrementalist approach recommended by the Workshop was used to develop a graded set of deemed-to-satisfy solutions for damaged stability criteria. A matrix approach was applied along lines similar to those adopted by Det Norske Veritas in their High Speed and Light Craft Rules for the application of those rules to domestic vessels.

The solutions are customized to take into account the magnitude of risks relative to conventional vessels and vessels under the HSC Code 2000 and vary according to the key risk parameters. Three grades are specified: Conventional requirements; HSC Code requirements and an intermediate level.

The key risk parameters are craft operational area and number of passengers. Damaged stability criteria and extent of damage continue to be issues of controversy within the HSC Code. So how is the issue approached in the fast craft standard? As a starting point, the reference group considered the safety of equivalent conventional vessels. The current requirement for conventional vessels under the USL Code provides only for a one compartment standard of subdivision for vessels less than 70 metres in length. So the probability of a conventional vessel remaining afloat after grounding or collision is far from certain. The probability of survival would probably lie between 60% and 90%. As the speed of a vessel increases the energy also increases. Couple this with the lighter scantlings of the craft, the lightweight materials used and the increased likelihood of incident because of the reduced time for operational responses and it is clear that the likelihood and consequences of damage are likely to increase with speed. However, that does not mean that the vessel has to be almost 'unsinkable' to achieve safety similar to that of a conventional vessel.

In considering the best approach to deal with the risks of collision and grounding, the following aspects need to be taken into account:

- The NSCV specifies minimum required standards. These standards are not intended to be standards that provide acceptable safety in every circumstance *Flapan, M.P. (2003)*
- The damaged stability requirements for conventional vessels do not guarantee safety in the event of a collision, contact, grounding or stranding.
- In the hierarchy of risk control measures, those measures that avoid hazards are generally preferable to measures that mitigate consequences.
- The MCA study acknowledged that a large proportion of the equivalent fatalities attributed to collision, contact, grounding and stranding were due to inertial effects rather than stability and buoyancy issues. These consequences are not adequately addressed by damaged stability criteria.
- The Fast Craft standard provides for a defense-in-depth approach whereby a series of risk avoidance and risk mitigation measures are applied that together act to provide acceptable levels of risk.
- A balance needs to be struck between risk avoidance and risk mitigation measures to achieve safety outcomes in a cost effective manner. Excessive reliance on damaged stability to control risks may not be the most cost effective approach to controlling risk.

  NOTE: Each additional kilogram in weight carries a penalty of the weight of hull to support it and the machinery and fuel to drive it. A penalty of higher fuel consumption continues for the entire life of the craft.

The key risk parameters of operational area and number of passengers provide a measure of the likely consequences in the event of an incident. Operational area determines the likely availability of sufficient rescue services and their response time. Passenger numbers provides a measure of the time for evacuation and the demands on the capacity of rescue services with particular emphasis on the number of persons that may have been injured through inertial effects.

Thus, for craft with risk levels similar to those of current conventional craft, the conventional NSCV requirements apply. For relatively high risk vessels, the full HSC Code requirements apply. For craft having a magnitude of risk somewhere between the two extremes, the modified HSC Code requirements apply.

By means of the key risk parameter matrix, a more graded approach is achieved. The approach has already been applied to the new fire safety standards of the NSCV.

## 9. The important contribution of public comment and stakeholder review

The draft standard was made available for public comment from January to June 2006. Submissions were received from a wide range of stakeholders including designers, builders, operators, owners and marine authorities.

A reference group comprising stakeholders was convened to review the public comment. The reference group recommended significant changes to the public comment draft *FCRG (2006)*. The following list some of the more substantive modifications.

1. The application clauses were modified to avoid the loophole where a dummy fully laden condition would be employed to avoid application of the fast craft standard.

2. The application clauses were modified to allow craft to be limited to operational speeds less than 25 knots by physical or operational controls so that the fast craft requirements would not apply to the craft when operating in accordance with these controls. This allows a vessel to operate as a fast craft under certain circumstances and as a conventional vessel under other circumstances. It also provides for a take home option in the event of equipment failure or other misadventure.

3. The safety aspects of ride control systems (where fitted) are to be added to the scope of the Failure Mode and Effect Analysis (FMEA) to ascertain whether there were specific risks associated with such equipment that need to be controlled.

4. The criteria for application of the various Design Levels of Accommodation have been changed from the design collision acceleration to a combination of vessel length and speed. The reference group noted that inertial hazards are largely influenced by kinetic energy of the body as it contacts solid objects. This was not taken into account by the collision acceleration methodology. Also, from the point of view of the vessel operator, accommodation design is as much influenced by the need to limit injuries from operational horizontal accelerations. While the consequences from operational acceleration injuries are unlikely to be catastrophic, they could easily lead to major injuries and would therefore be classed as hazardous. Relatively frequent exposure levels to risks that are hazardous are also considered to be unacceptable risks. The reference group took into account the seating and features of accommodation applied to other forms of transport such as buses and trains. The standard now specifies that a modified Design Level 2 is the minimum deemed-to-satisfy solution for craft that have both a length less than 35 metres and speed of 35 knots or more. All other Category F2 fast craft are required to apply a modified Design Level 1. A note has been added to remind the designer of broader safety obligations that apply that are specified elsewhere in the NSCV *NSCV Part A (2005)*. Annex A to the the Category F2 fast craft standard provides guidance on relevant design and operational responses to horizontal operating accelerations and collision accelerations.

5. The difference between back-up directional control and emergency directional control was clarified. The former was a system that allowed control of the craft to be regained after a failure in directional control while the craft was operating at speed. Emergency directional control on the other hand was a system designed to take the craft home after a steering failure and frequently could not be engaged quickly enough to be of any benefit in avoiding an incident due to an instantaneous loss of control.

6. The reference group recommended that FMEA be applied to all Category F2 fast craft. FMEA was an important step in verifying the safety of all systems. The cost of undertaking FMEA should be commensurate with the complexity of the craft and the cost of the systems. The reference group also noted that FMEA provides inputs that are essential for establishing and documenting a Safety Management System (SMS). An example of FMEA was added to the standard as Annex C in accordance with the recommendations of the reference group.

7. Stability criteria in the non-displacement mode for fast craft that are neither hydrofoils nor ACVs were reduced to just the turning criteria.

8. Significant modifications were made to the requirements for navigation and collision avoidance equipment. These mainly involved changing the threshold values of key risk parameters. The changes applied to AIS and VDR. Instead of VDR on certain lower risk fast craft, a data logger has been

substituted. The latter will record similar vital information without having to survive the worst case scenarios of fire or sinking. A specification for a data logger has been added in Annex D of the standard.

9. The requirement for night vision equipment was eliminated from the standard on the basis that it would have needed an additional trained crewmember to use it. Use of such equipment by the helmsman would be a distraction and would interfere with night vision.

10. The requirements for crew competencies were altered from a combination of generic and craft specific to craft specific. This enabled the competencies to be delivered by the operator within a program of type rating. A training needs analysis was added to the standard to avoid duplication of already existing competencies.

11. Proposed adoption of the ISM Code for higher risk fast craft was replaced by the requirement to apply *NSCV Part E (2005)* to all fast craft. It was agreed that the benefits of applying ISM did not warrant the additional cost relative to applying Part E for this class of vessel.

## 10. What price for safety?

The NMSC is required to prepare a Regulatory Impact Statement (RIS) to accompany a new standard for approval by the Australian Transport Council. The RIS provides a tool to assist decision-making by systematically and consistently examining the potential impacts that may arise from the standard and communicating this information to decision-makers. It helps provide government with an assurance that the proposals have been subject to proper analysis and scrutiny as to their necessity, efficiency, and net impact on community welfare.

The RIS for the Category F2 fast craft standard *NMSC RIS (2006)* was prepared with the assistance of a consultant economist. It incorporates in more depth many of the matters presented in this paper and includes an assessment of costs and benefits of the standard. A draft RIS accompanied the draft standard as a part of the public comment phase. The draft RIS indicated that the overall cost/benefit of the proposals in the draft standard might be marginal.

The RIS was subsequently updated to take into account the changes that arose after public comment. The final RIS indicates that the revision of the Category F2 fast craft standard achieved significant reductions in the cost of the proposal amounting to 47%. The NMSC believes that this reduction in cost has been achieved with minimal change in safety outcomes by applying risk management principles to a graded approach.

The RIS concluded that:

> *"The total quantified costs represent an average of about $2,850 per year for each Category F2 Fast Craft. The costs to some craft will be significantly higher or lower than the average because the proposal is risk based; the higher the risks the higher the costs. ….. The up front cost per craft varies from $11,000 for a small monohull (Craft 6) to $314,000 for a large catamaran operating in Operational Area C (Craft 5). The proposals will mean an increase in the cost of constructing fast craft ranging from 1.8 per cent for a medium sized monohull (Craft 1) to 4.8 per cent for the large catamaran (Craft 5). When spread over the 20 year life of a craft, the largest increase represents about $25,000 per year."*

## 11. Tools for applying the standard

While a more risk-based approach has the potential to provide better and more efficient safety solutions, it also tends to make a standard more difficult to apply. The risk model behind the standard takes into account many risk factors in determining requirements, as would a competent surveyor in applying discretion as to the application of requirements. Inevitably this increases the complexity of the provisions. Concerns have been raised that there might be a 'glass ceiling' beyond which users might not be prepared to accept complexity, notwithstanding the benefits.

The NMSC is addressing the matter by creating Standards Assistants that help the user apply a standard. The Standards Assistant is a computer based tool that asks the user a series of questions. Based on the answers, it generates what is effectively a customized table of contents of the standard for the particular vessel. Time is saved by not having to read through and interpret clauses to find that they don't apply. The Standards Assistant also does any calculations that are applicable and applies the risk parameters to provisions where a risk matrix is used so that the correct outcome is identified. The Standards Assistant is intended to be used in conjunction with the standard. It does not replace the standard.

The Fast Craft Standards Assistant was developed as part of the drafting process. It provided a test for the logic of the standard by requiring that the provisions be converted into the mathematical algorithms of the spreadsheet. It also enabled the drafting group to test the application of the standard on a number of actual vessels. The Standards Assistant was released with the public comment draft standard to allow stakeholders to quickly determine the impact of the proposals on their own operations, encouraging and improving public submissions.

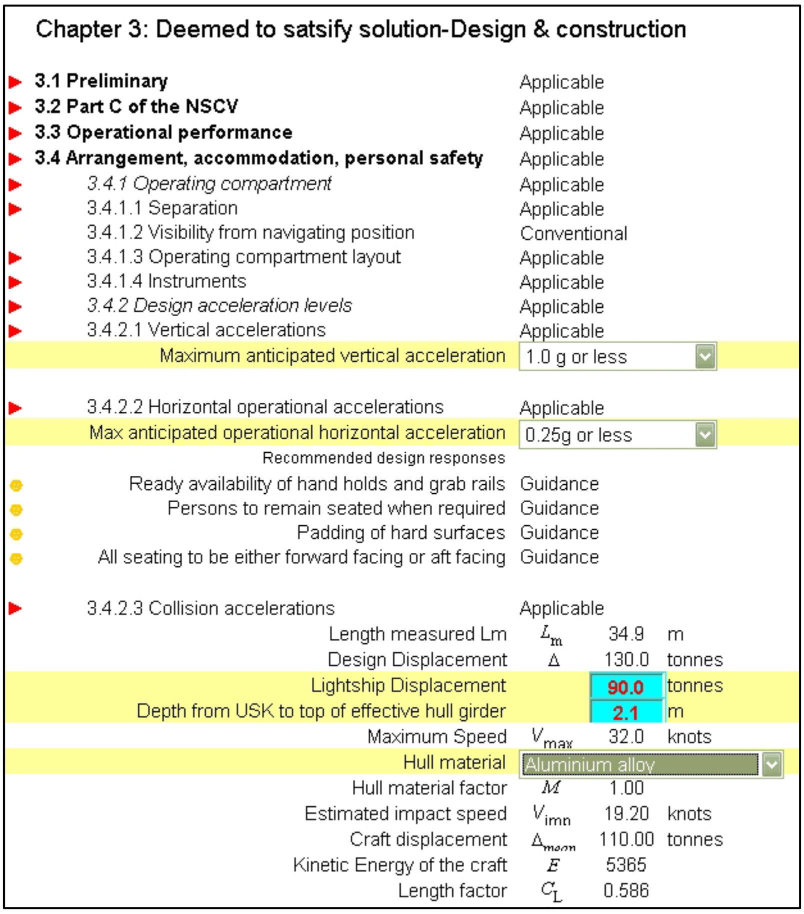


Figure 5: Screen view of Fast Craft Standards Assistant

## 12. Conclusions

The success or otherwise of this new standard for Fast Craft is yet to be realized. The NMSC has attempted to strike a balance between the many conflicting needs of stakeholders to produce requirements that can be consistently and uniformly applied by the various governments without the need for undue interpretation and discretionary application. A standard that aims at too high a level of safety will invariably be undermined by discretionary application. A standard that specifies standards below community expectation will be found wanting should incidents occur. Only time will determine how well this standard will perform. However, there has already been some positive feedback. A recent application of the draft standard by a jurisdiction to review the special needs of thrill-ride vessels at a policy level has indicated the potential of the final standard in determining safety solutions that are both practical and effective for this type of craft *Lugg, D. (2006)*.

## 13. Acknowledgements

The NMSC gratefully acknowledges the contributions of the large number of industry and government stakeholders and other participants in the preparation of the Category F2 Fast Craft standard. Contributions included participation in drafting and review reference groups and workshops, and providing public comment.

## 14. Disclaimer

The opinions expressed in this paper are those of the author. They do not purport to represent the views of the National Marine Safety Committee Inc., nor the views of the Commonwealth, State or Territory Governments of Australia.

**15. References**

USL Code (1991,1993). “Commonwealth of Australia Uniform Shipping Laws Code”. www.nmsc.gov.au/uslcode_1.htm

NMSC (2003). “National Marine Safety Committee Strategic Plan 2003-2008”. www.nmsc.gov.au/documents/NMSC_strategic8pp

NMSC (2000) “National Marine Safety Committee Fast Craft Workshop 4th-5th May 2000” www.nmsc.gov.au/fastcraft.html

NSCV Part F 1A (2005). “Australian Transport Council National Standard for Commercial Vessels Part F Special Vessels Section 1 Fast Craft Subsection 1A General Requirements”. www.nmsc.gov.au/documents/NSCV/PARTF1A.PDF

NSCV Part F 1B (2005). “Australian Transport Council. National Standard for Commercial Vessels Part F Special Vessels Section 1 Fast Craft Subsection 1B Category F1 Fast Craft”. www.nmsc.gov.au/documents/NSCV/PARTF1B.PDF

NSCV Part F 1C (2006) “Australian Transport Council. National Standard for Commerical vessels Part F Special Vessels Section 1 Fast Craft Subsection 1C Category F2 Fast Craft” (to be released October 2006 on www.nmsc.gov.au).

HKMD (1999). “Hong Kong Marine Department. Instruction for the Guidance of Survey - Survey of Hong Kong High Speed Passenger Craft.”.

MNZ (2000). “Maritime Rules Part 40A Design, Construction & Equipment – Non-SOLAS Passenger Ships”. http://www.msa.govt.nz/publications/rules/Mr040a.pdf

USCG (2001). “United States Coast Guard. Guidance for enhancing the operational safety of domestic high-speed vessels”. *Navigation and vessel inspection circular No. 5-01.* http://www.uscg.mil/hq/g-m/nvic/5_01/n5-01.pdf

HSC Code (2000) “International Maritime Organization. Code of Safety for High Speed Craft”.

QGBOI (2003) “Report of the Board of Inquiry into the collision between Sun Paradise and Pride of Airlie”. Brisbane. 2003. Queensland Government Board of Inquiry. www.msq.qld.gov.au/qt/msq.nsf/index/msq_boi

MCA (2004) Seaspeed Technology Ltd. “MCA Research Project 504 HSC Incident Database Analysis Summary Report”. *Report STL/284/05.*

NMSC (2002). "National Marine Safety Committee, Risk Workshop on Category 2 Fast Craft " www.nmsc.gov.au/documents/DNV%20Risk%20assesment.pdf

NSCV Part B (2005) "Australian Transport Council. National Standard for Commercial Vessels Part B General Requirements". www.nmsc.gov.au/documents/NSCV/PARTB.PDF.

Flapan, M.P. (2003) "The Safety Gap". *Marine Safety 2003 Conference.* http://www.nmsc.gov.au/documents/safety_gap.pdf

FCRG (2006) "Fast Craft Reference Group Outcomes from the review of public comment on draft standard NSCV Part F Subsection 1C".

NSCV Part A (2005) "Australian Transport Council. National Standard for Commercial Vessels Part A Safety Obligations". www.nmsc.gov.au/documents/NSCV/PARTA.PDF

NSCV Part E (2005) "Australian Transport Council. National Standard for Commercial Vessels Part E Operational Practices". www.nmsc.gov.au/documents/NSCV/PARTE

NMSC RIS (2006) "Regulatory Impact Statement National Standard for Commercial Vessels Part F Section 1 Fast Craft Subsection 1C – Category F2 Fast Craft".

Lugg, D. (2006) "High Speed Thrill Boat Rides, the Safety Dilemma". *Marine Safety 2006 Conference*.