FIRE SAFETY STANDARDS FOR COMMERCIAL VESSELS

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SUMMARY

The National Marine Safety Committee is developing a new fire safety standard applicable to domestic commercial vessels in Australia. The process involves applying the terms of reference for the standard, reviewing incident data, identifying issues and developing solutions to those issues.

This paper discusses observations arising from a study of fire incident data. Specific issues pertaining to fire safety are listed, as well as proposed solutions to those issues.

INTRODUCTION

Safety standards applicable to domestic commercial vessels in Australia are contained in the Uniform Shipping Laws (USL) Code, a document that was first published in 1979. Standards for fire safety are contained in Sections 5F and 11 of the Code. The National Marine Safety Committee (NMSC) was formed in 1997 to review marine standards and legislation in Australia with a view to improving national uniformity and consistency. A major component of the NMSC's work has been the review of the USL Code. The Code is being rewritten as the National Standard for Commercial Vessels (NSCV) following principles set out in the NMSC Strategic Plan[i]. The Strategic Plan identifies a number of actions supporting the strategy applicable to standards reform including:

(a) Develop and promulgate standards based on recognised and approved national and international standards for the design, construction and operation of vessels.

(b) Encourage the development of professional competence in vessel design, construction, operation and survey.

(c) Introduce and support performance based standards as an alternative to prescriptive standards.

(d) Establish practices for assessing new technologies or operations in a timely manner and facilitate rapid transfer into standards.

(e) Incorporate Occupational Health and Safety principles into the standards for design, construction and operation of vessels.

(f) Incorporate public accessibility standards into the standards for the design, construction and operation of vessels.

(g) Adopt world's best practice for competency based crew training, navigational aids, communications and dangerous goods.

(h) Encourage vessel operators to recognise their duty of care to employees and passengers.

(i) Develop and implement the safety system on the basis of sound information and analysis that is monitored regularly.

(j)

FIRE SAFETY INCIDENTS

It will be noted that among the actions specified above, action i) requires that the safety system be developed and implemented on the basis of sound information and analysis. A project to record and analyse marine incident data is contained within the NMSC's workplan. However, data from that project was not available in time so an informal analysis of fire incidents was carried out considering some 150 fire incidents in Australia over a 15 year period. The study was not exhaustive nor could it be said that the data source was consistent and reliable. However, it provides a means to qualitatively assess gross trends. Table 1 contains a summary of the results of the study.

Table 1—Analysis of fire incidents in Australia 1987-2001

	Class 1 Passenger	Class 2 Non-Passenger	Class 3 Fishing	Class 4 Hire and Drive	Total
Class % of fleet	12%	31%	37%	20%	100%
Total incidents by class	16	22	25	3	66
% total incidents	24%	33%	38%	5%	100%

Source of cause	**Class 1 Passenger**	**Class 2 Non-Passenger**	**Class 3 Fishing**	**Class 4 Hire and Drive**	**Total**
Machinery	9	11	8	0	28
Electrical	4	4	6	0	14
Petrol	0	2	4	1	7
Refit/Building	0	0	5	1	6
Gas	1	0	0	1	2
Galley	0	2	0	0	2
Accom/Stores	0	1	1	0	2
FFE discharge	1	0	1	0	2
Other	1	1	0	0	2

Consequence	**Class 1 Passenger**	**Class 2 Non-Passenger**	**Class 3 Fishing**	**Class 4 Hire and Drive**	**Total**
Total loss/ serious injury	2	3	8	1	14
Major conseq/ minor injury	2	3	8	1	14
Minor consequence	8	15	3	0	26

Machinery space fires	**Consequence**	**Class 1 Passenger**	**Class 2 Non-Passenger**	**Class 3 Fishing**	**Total**
With FFE being activated	Total loss	1	0	0	1
	major conseq	2	2	1	5
	minor conseq	3	0	0	3
Without FFE	Total loss	0	0	4	4
	major conseq	0	0	2	2
	minor conseq	1	1	2	4

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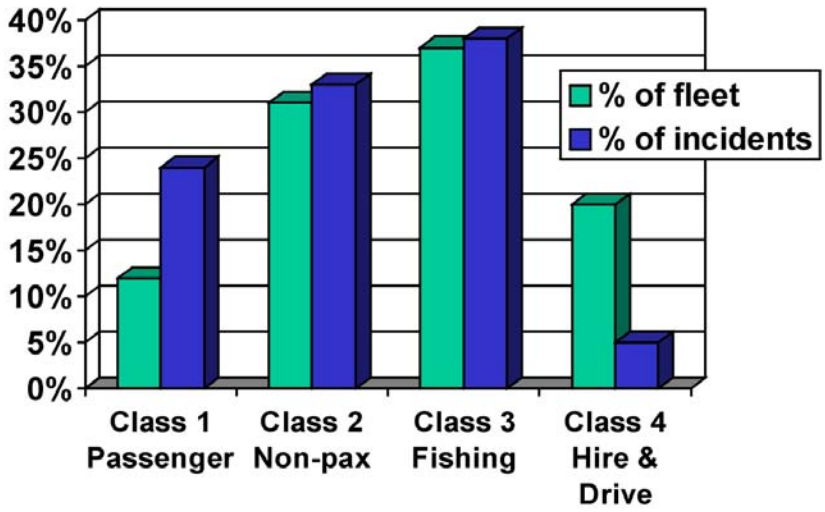

Figure 1—Fires by vessel class relative to proportion of fleet

A number of observations can be drawn from the results of the study. Referring to Figure 1:

(a) the number of Class 4 hire and drive incidents is far less than the percentage of hire and drive vessels in the fleet—5% compared to 20%. This may be due to their relative simplicity when compared to many larger Class 1, 2 and 3 vessels..

(b) The number of Class 1 (more than 12 passengers) vessel incidents is significantly greater than the percentage of Class 1 vessels in the total fleet—24% of incidents for 12% of the fleet. The figures for Class 2 (up to 12 passengers) and Class 3 (fishing) vessels seem to be lower than would be expected given that the figures for Class 4 are so low: Class 2: 33% of incidents for 31% of the fleet and Class 3: 38% of incidents against 37% of the fleet. At first instance it might appear that the safety record of Class 1 vessels is significantly worse than for Class 2 and Class 3. However, this might not be the case as many minor incidents may not have been recorded for Class 2 and 3 vessels, particularly Class 3 fishing vessels.

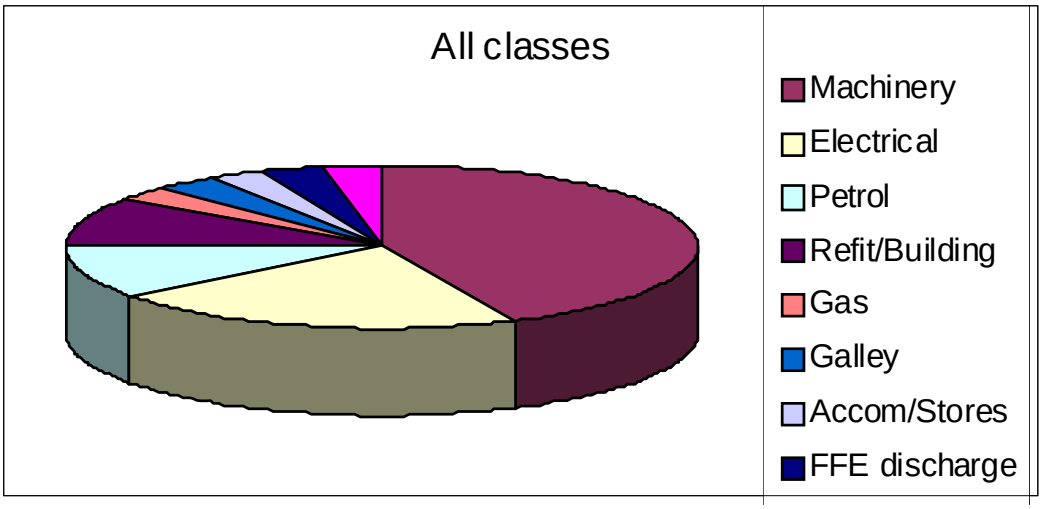

Figure 2 Sources of fire

Referring to Figure 2, by far the major source of fires on board vessels occurs from machinery, mostly machinery in the engine room (43%). The next most frequent source is electrical fires (22%) followed by fires and explosions arising from petrol fumes. Less frequent sources of fire were galleys, gas installations and accommodation or stores spaces.

It is useful to compare the data for sources of fire from the NMSC study against those of the classification society NK[ii] covering 162 serious fires between 1980 and 1992. In that study, machinery space fires represented 45% of the total number of fires.

While it is outside the scope of the National Standard for Commercial Vessels, fires and explosions associated with the building or refitting of vessels would appear to be a significant OH&S issue. The majority of these incidents were caused by a combination of petrol fumes and improper procedures for hot work.

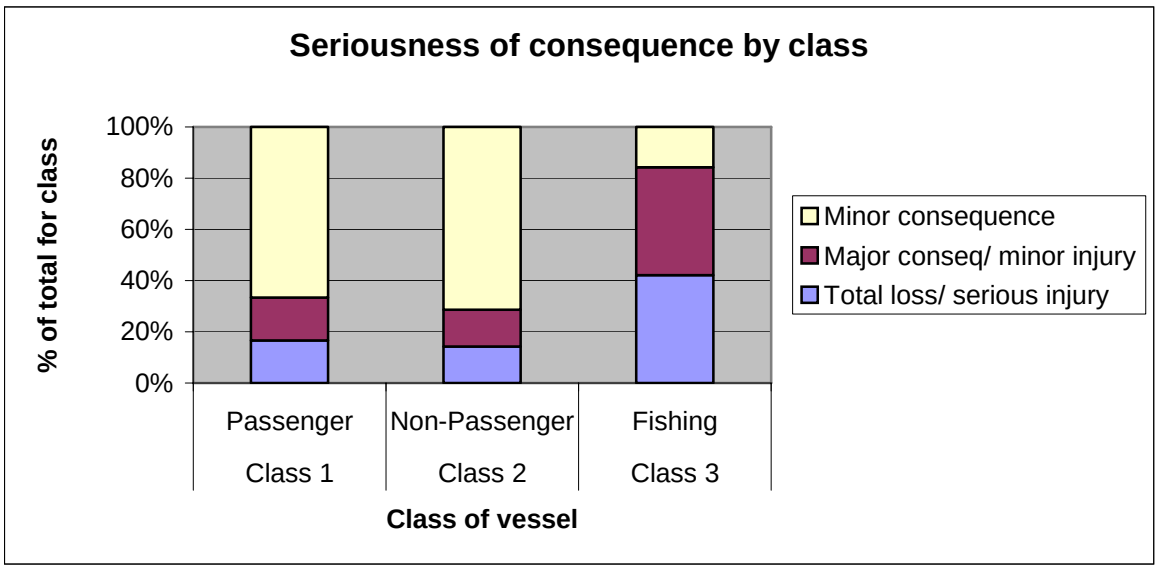

Figure 3 Seriousness of consequence by class

Referring to Figure 3, the analysis of consequence by Class of vessel shows an interesting anomaly. One might expect, with measures to prevent and fight fires already required for commercial vessels, the majority of fire incidents should have relatively minor consequences. This pattern is followed by the results for Class 1 and Class 2 vessels. However, for Class 3 vessels, the opposite pattern is observed with the majority having serious consequences. There are a number of possible explanations for this:

(a) Only the most serious incidents are being reported for fishing vessels, while minor incidents are being reported for Class 1 and 2 vessels. There would appear to be some basis for this in that incident's investigated by the Australian Transport Safety Bureau (ASTB) provide a comprehensive source of information on minor incidents and contain few references to fishing vessels, these latter not normally being under Commonwealth jurisdiction.

(b) The fact that the vast majority of fishing vessels are without structural fire protection and frequently do not have fixed fire extinguishing systems means that machinery space fires may tend to result in more serious consequences.

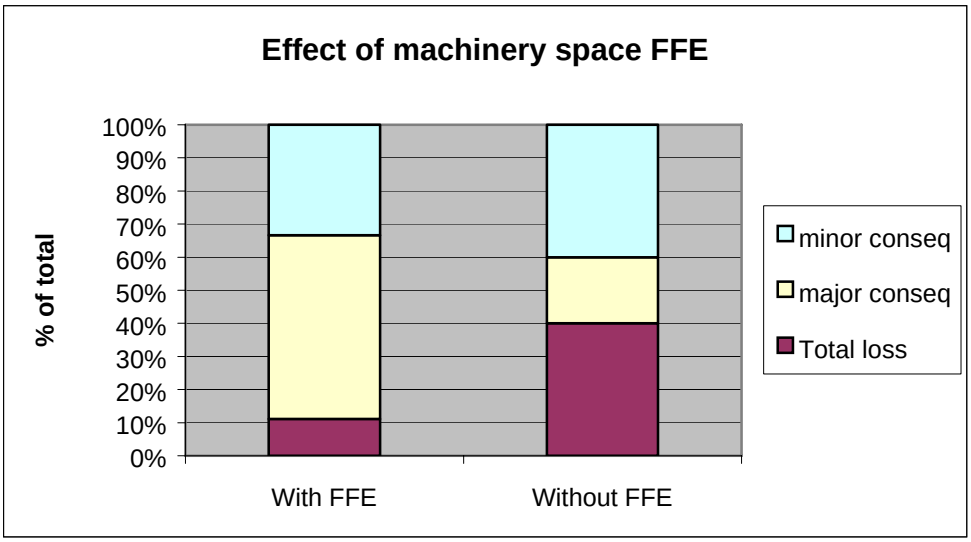

Figure 4—Effect of machinery space FFE

The latter suggestion finds some support in Figure 4 that illustrates how the provision and proper use of a fixed fire extinguishing system for the machinery space of a vessel would appear to be a significant factor in preventing total loss of the vessel. It is noted that, for Class 1 and 2 vessels (most of which are fitted with FFE systems) total loss due to a machinery space fire is relatively infrequent. For Class 3 vessels (the majority of which are not fitted with a FFE system), total loss is a more likely consequence of a machinery space fire. It should be noted that, under the USL Code, the requirements for structural fire protection and fixed fire extinguishing for the machinery space of fishing vessels are generally to a lesser standard than for other commercial vessels.

Fire safety issues

The review of the Fire Safety Standard follows a process that has been developed to comply with Council of Australian Governments Guidelines[iii]. A discussion paper was distributed for public comment prior to commencing the review of the Standard. The discussion paper identified a number of issues and sought public comment on these or other issues that might not have been identified.

The following general fire safety issues were identified:

(a) The USL Code is arranged with fire safety split in two. Subsection 5F—Structural Fire Protection and Section 11—Fire Equipment. These roughly equate to passive and active fire safety systems respectively. The separation of sections works against the application of a holistic approach to fire safety, the design of the total fire safety system being a combination of active and passive systems.

(b) Subsection 5F and Section 11 of the USL Code was written in a format that is largely prescriptive in nature concentrating on specifying the solution without referring to the safety outcome that is to be achieved. Thus the safety outcomes intended by specific clauses was sometimes unclear and open to wide interpretation, especially when considering exemptions and equivalents.

(c) The design of vessels had developed in the 30 years since the Code was first published. For example, with the development of catamarans, the number of

persons that can be carried for a vessel of a given length has increased significantly. The current USL Code fire safety provisions are largely based on length as the key risk parameter. Concerns have been raised that the current provisions are not sufficient to properly model relative risks. This could result in high risks being insufficiently controlled and low risks being over controlled.

(d) Since the USL Code was written, a major source document, SOLAS has been subject to many revisions and clarifications of interpretation. A new Chapter II-2 of SOLAS come into force July 2002. There are a number of significant changes including a more performance-based approach. Many of the prescriptive technical requirements were removed and placed into separate Fire Test Procedures and Fire Systems Safety Codes.

(e) The USL Code provisions for fire equipment for vessels of similar area of operation or class of service contain small differences in requirements that may be omissions or errors in the original document or may have some subtle rationale that has been lost over time.

(f) The USL Code fire safety requirements for fishing vessels are of a lesser standard than requirements for non-passenger vessels engaged in similar operations. Should the difference be retained in the new standard given the data from the study of fire incidents that indicated fishing vessel fires were subject to significantly more serious consequences than other vessels, the safety obligations that arise from modern occupational health and safety law and the need to have a consistent safety outcome in a standard that provides for performance-based compliance.

Active fire safety systems

(g) The requirements for acceptable portable fire extinguishers differ between jurisdictions administering the USL Code. Since the USL Code was written, various relevant Australian Standards pertaining to fire equipment have been revised.

(h) The use of halon for fire extinguishing systems on vessels has largely been prohibited by legislation throughout Australia. The USL Code contains provisions on Halon and other types of fixed fire extinguishing systems that have been superseded. Moreover, the current USL Code provisions cannot be applied to some modern types of fixed fire extinguishing systems. The prohibition on halon gases for new construction and, in most jurisdictions, for existing vessels in the mid 1990's saw an urgent need to develop and approve alternative fixed fire extinguishing systems, both for large and small vessels. A problem that arose was that some local protocols developed within some jurisdictions were not mutually recognized by other jurisdictions concerned that the safety outcomes are not equivalent to the current USL Code requirements or to the international protocols.

(i) The current USL Code requires fireman's outfits on vessels on seagoing Class 1 vessels of length greater than 50m and seagoing Class 2 vessels of greater than 500GT. Concerns were raised that persons on board some of these vessels may not have the appropriate training to use this equipment.

Passive Fire Systems

(j) The current USL Code referred to Fire Divisions based on SOLAS requirements for steel vessels and, in the absence of an existing applicable standard, introduced a new type of fire division applicable to non-steel vessels based on the "Basic Fire

Test". Since that time, international standards applicable to fire divisions on steel and non-steel vessels have been developed within the IMO High Speed Craft Code.

(k) The current USL Code basic fire test allows small scale testing of fire divisions. This small scale testing is not compatible with the larger scale testing contained within SOLAS and the HSC Code.

(l) The USL Code classifications of spaces on a vessel for the purposes of fire protection and tables for fire protection were developed from the SOLAS requirements for large international vessels. Since the USL Code was published, the High Speed Craft Code has been developed. This fire protection provisions of this code may be more applicable to smaller or inshore domestic craft than the conventional SOLAS requirements. In particular, it includes reference to smoke divisions that are not part of the current USL Code.

(m) The USL Code contains provisions that give alternatives to Structural Fire Protection. These alternatives have been interpreted in different ways by the various jurisdictions resulting in significantly differing standards. In particular, some jurisdictions interpret the addition of smoke detectors outside the machinery space of a vessel to be a valid alternative to the fitting of structural fire protection to the boundaries of the machinery space. Other jurisdictions do not accept this interpretation. Also the USL Code gives the Authority the discretion to require certain surfaces to be low flame spread without clarifying the requirement.

(n) The USL Code gives requirements for the size and locations of escape routes. These are sometimes modified by jurisdictions, in particular escape hatch sizes on small vessels, multiple escapes from small machinery spaces, width of stairways to a space, etc. Not all jurisdictions have agree with the resultant solutions.

(o) The USL Code contains requirements for the fitting of non-combustible material adjacent to galley stoves that are impractical for smaller vessels. Thus, jurisdictions have substituted their own requirements that vary between jurisdictions.

(p) The USL Code contains no specific limits on the quantity of petroleum or other dangerous goods that might be carried on a vessel. Concerns have been raised that there is no quantified limit on the size of petrol fuel tanks for main propulsion, nor are there provisions for the storage of petroleum on a large vessel for the use of tenders carried on that vessel.

PROGRESS TO DATE

As at the date of writing (November 2003), the draft of the new fire safety standard is nearing completion before being sent out for public comment. The draft is being prepared in close consultation with a reference group comprising industry and government representatives, including representatives of the Australian Shipbuilders Association, the Fire Protection Association of Australia as well as the Commonwealth, State and Territory Authorities.

The draft attempts to address each of the above issues.

(a) The USL Code is arranged with fire safety split in two. The draft combines both active and passive fire systems in a single document.

(b) Chapter 2 of the draft lists fire safety outcomes identifying the key performance requirements.

(c) A more risk based approach to fire safety has been proposed. Vessels are assigned a risk category based on the area of operation, type of operation, number of passengers and number of berthed passengers. The approach provides a more customized solution to the fire safety needs of a vessel, taking into account both the likelihood and consequence of fire.

(d) The proposed fire safety standard is based upon the latest version of SOLAS Chapter II-2. Requirements are graded so that a seagoing domestic vessel having risks equivalent to that of a vessel engaged in international voyages is required to comply with standards similar to SOLAS, while a simple vessel with relatively low risk both in terms of likelihood or consequence would have fire safety standards similar to that of a recreational vessel.

(e) Differences in requirements without different risk are being eliminated to facilitate a consistent performance-based approach.

(f) It is proposed to remove differences in standards applicable to Class 3 fishing vessels compared to Class 2 non-passenger carrying vessels, consistent with the approach in paragraph e) above. In particular, it is proposed that fishing vessels be provided with structural fire protection in way of high risk machinery spaces to reduce the high consequences of fire in machinery spaces applicable to fishing vessels, as indicated in Figure 3.

Active fire safety systems

(g) Requirements for portable and semi-portable fire extinguishers are being updated to take into account modern extinguishing media. Reference is being made to relevant Australian Standards pertaining to fire extinguishers.

(h) Halon systems have been omitted from the new standard. Aqueous, gaseous and aerosol fire extinguishers are required to comply with relevant IMO standards in the Fire Safety Systems Code or Australian Standards.

(i) Requirements for fireman's outfits are being modified. They are only being specified for vessels of higher risk, for which there is an increased likelihood that there will be persons on board qualified in their use.

Passive Fire Systems

(j) The 'basic fire division' has been replaced by 'fire-resisting divisions', that incorporate fire resisting divisions already approved under the HSC Code or Class A divisions under SOLAS.

(k) The testing protocols specified for both passive and active fire systems are largely based on relevant international and national standards to reduce the cost of testing and approval and to provide for a wide choice of acceptable products.

(l) The proposed classifications of spaces are based upon the high speed craft code. The scope of each space has been clarified and widened to take into account modern arrangements and operations. In particular, provision has been made for ro-ro spaces, spaces containing dangerous goods, machinery spaces of moderate fire risk and helicopter facilities.

(m) Deemed to satisfy alternatives to structural fire protection have been removed on the basis that the arrangements previously adopted were unable to provide equivalent safety. However, provision is made for equivalent solutions that may

differ from the deemed to satisfy solution, provided it can be proven that the equivalent solution provides equivalent safety to the deemed to satisfy solution.

(n) The requirements for dimensions and location of escape routes has been removed from the fire safety section will be dealt with in another Section of the NSCV (Part C Section 1 Arrangement, accommodation and personal safety).

(o) Three graded categories of galleys are proposed, small, intermediate and large. The requirements applicable to each are intended to reflect relative risk. Small galleys are intended to be compatible with the arrangement of galleys on small vessels.

(p) Specific requirements are specified for vessels carrying dangerous goods. Tankers carrying fuel of flashpoint less than 60°C are required to comply with SOLAS.

APPROPRIATENESS VERSUS SIMPLICITY

An issue that has arisen while preparing the fire safety draft is the apparent conflict between providing simplicity of use and ensuring that fire safety measures are appropriate to the particular vessel being considered.

The better the risk model that is used within the standard, the more likely that the fire safety measures will fit the needs of the particular vessel. However, to achieve a good risk model, the standard needs to take into account an increased number of the factors that drive risk relevant to the particular vessel. Hence, there is an increase in complexity.

However, consider the alternative. A simple standard is likely to have a relatively coarse risk model. Provisions arising from a coarse risk model are likely to specify safety measures that do not properly apply to the vessel, necessitating surveyor discretion and giving rise to uncertainty. Arguably, with a simple standard, there is also complexity, not in reading the standard, but in interpreting and modifying the standard to make it fit.

The main problem with a more complex standard is the difficulty that arises when an applicant has a relatively simple boat. The applicant has to wade through a complex standard just to find that only 10% of the clauses are relevant.

It is proposed to develop computer-based tools to assist users to quickly identify those clauses that apply to a particular vessel and where appropriate, to make calculations. The reference group in their deliberations over the draft is currently testing such a tool. It is hoped to have a similar tool available for use by those making public comment. The advantages of such a tool include quick and accurate application of the standard and a reduction in interpretation. The user need only refer to those clauses applicable to the particular vessel.

CONCLUSIONS

The fire safety standards applicable to commercial vessels in Australia are currently going though a comprehensive revision.

The NMSC, guided by the Strategic Plan, has put in place a process for review that is intended to be robust and transparent.

A draft fire safety standard is being developed that takes into account relevant incident data, changes in relevant national and international standards and issues that have been identified as needing to be addressed.

The draft fire safety standard will be more comprehensive, applying to a wider variety of vessel arrangements and space uses.

Concerns over increased complexity will be addressed by providing tools to assist the user in applying the standard.

It is planned that the draft fire safety standard will be released for public comment, together with a regulatory impact statement and the computer assessment tool, early in 2004. Public comment from all stakeholders is most welcome. The Fire Safety Reference Group comprising representatives from industry and government will review the public comment, and will provide recommendations for amendments to the NMSC.

[i] NMSC Strategic Plan 2003-2008 at http://www.nmsc.gov.au/documents/NMSC_strategic8pp.pdf
[ii] Thomas, Roger. The Treatment of Risk: Case Study 1: Fire Safety. Presented at Marine Safety 2003 Conference 2003.
[iii] Council of Australian Governments Principles and Guidelines for National Standard Setting and Regulatory Action by Ministerial Councils and Standard-Setting Bodies Amended November 1997.