

SAFETY IN BULK CARRIERS

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INTRODUCTION

Australian concern for the safety of bulk carriers was heightened following the loss of 6 bulk carriers which sank in 1990 and 1991 after sailing from Australian iron ore ports, with the death of over 130 seafarers. These casualties provided a major catalyst for an investigation into ship safety by the House of Representatives' Standing Committee on Transport, Communications and Infrastructure and its subsequent report *Ships of Shame*.

World-wide, a total of 37 bulk carriers was lost or seriously damaged in 1991 and 1992. Casualty numbers fell in 1993, but rose again in 1994. An unusually high proportion of these casualties involved hull damage, or the strong possibility of hull damage as the main cause. These casualties sparked a major review of structural and operational standards for bulk carriers. Given the reliance on bulk mineral exports for a substantial segment of our export earnings it is easy to understand why Australia played an active role in the discussions addressing the safety of these vessels.

This paper will address how the problems with bulk carriers have been addressed from both a structural and operational perspective.

GLOBAL FACTORS IN BULK CARRIER LOSSES

There are a number of discrete operational and structural factors impacting on bulk carrier safety. However, underlying these are other, broader influences, many of which affect the maritime industry in general. It may be argued that they have a more critical effect on bulk carriers because many bulk carriers operate at the lower end of the market and are thus likely to be older and more cheaply operated, crewed and maintained.

Perhaps the most important of these influences is as follows:

- many shipowners who maintained a long term interest in particular ships have been replaced by financial entities that appear to view ship operations mainly from the perspective of the bottom line
- the demise of crewing practices that allowed and encouraged crews to take a long term interest in their ships
- the inconsistent and ineffective performance of survey and inspection
- the move from traditional flag states to open and off-shore registers.

The American Bureau of Shipping (ABS), in an analysis of bulk carrier losses from an economic perspective has suggested that bulk carrier casualties seem to follow fluctuations in the freight market and states that the correlation "... leads to the disquieting suggestion that ship maintenance programmes are a dispensable convenience of intangible value. This philosophy may be

driven for commercial circumstances, but it is also fuelled by a failure to appreciate the cumulative effect of corrosion and fatigue on the structure of the vessel.”

The focus on structural issues

From 1994 onwards the IMO, and particular its Secretary-General, was very conscious of the need to pursue the matter of bulk carrier safety. During 1996 both the industry and the IMO directed substantial resources into the specific issue of structural integrity.

A number of the member societies of IACS took practical steps of identifying problems in existing ships and reviewed their design procedures for new ships, especially in relation to their integrated design/classification programs and procedures. IACS published in 1994 a comprehensive guide to the identification of problem areas in existing ships, pointing out the main areas within the structure in which damage had occurred, illustrating structural deterioration and giving recommendations on inspections.

Summarising the work of IMO and the classification societies on bulk carrier structural safety, and drawing some additional conclusions, the most important underlying factors can be identified as follows:

- bulk carriers increased in size in the 1960s beyond the area of direct design knowledge and operational experience;
- the structure of bulk carriers contains very little redundancy, thus making of critical importance the maintenance of structural integrity and the prevention of corrosion. In hindsight it is clear that the use of design optimisation programs without considering long term factors affecting scantlings (and in particular corrosion) led to the development of structural designs having limited reserve strength as the ships aged;
- in operation, the corrosive nature of many cargoes can lead to accelerated corrosion leading to structural failure;
- bulk carriers are difficult to survey effectively due to their size and the inaccessibility of critical elements of the structure.

The above factors, in various combinations, have led to many of the recorded casualties. While there are many possible modes of structural failure, work by classification societies established that the most common is as follows:

- corrosion and cracking of critical structural elements leading to failure of side framing and/or shell plating and the loss of plating, normally in forward holds.
- flooding of one or more holds, leading to:
 - ‡ high stresses in double bottom and hull girder;
 - ‡ liquefaction and shifting of cargo;

‡ possible collapse of the main transverse bulkhead(s) and the consequent progressive collapse of other bulkheads;

- catastrophic structural failure or major loss of stability and consequent loss of the ship.

DEVELOPMENT OF THE REGULATIONS ON STRUCTURAL MATTERS

As a result of the work of the IMO, in May 1995 it was decided to proceed with draft SOLAS amendments in accordance with four general principles as follows:

- bulk carriers should be able to meet at least a one compartment standard of subdivision for any cargo hold in all relevant loading conditions with high density cargo;
- all transverse bulkheads should have sufficient strength to withstand flooding of any single cargo hold;
- if above 10 years of age, they should have successfully undergone surveys of all cargo holds to the minimum extent specified for the five yearly periodical survey according to the enhanced program of inspections during surveys (ESP);
- and the Cargo Ship Safety Construction Certificate should be endorsed to confirm that these conditions have been fulfilled.

Draft regulations were considered by the IMO's Maritime Safety Committee (MSC) and took account of the requirements then being developed by IACS. However, neither the proposed regulations, nor requirements being developed by IACS were universally agreed. Some governments and influential industry representatives argued that it was enough to require ships to meet the standards of a classification society. They also argued that the enhanced survey program would be sufficient to maintain the integrity of the hull without introducing requirements for a "second line of defence" against flooding.

A major element in the opposition to the proposals based on the MSC principles was the view that a large number of existing bulk carriers could potentially be affected by the proposals and require extremely extensive and expensive structural modifications. The view was expressed that any requirement likely to involve significant structural modification was an excessive reaction to the current problems. It was said that IMO should look carefully at the effectiveness of the available "software" solutions, including enhanced survey and the International Safety Management Code (which has yet to enter into force), before requiring extensive structural work on existing ships, especially as no ship at that time had been lost after having undergone an enhanced survey.

Between 1996 and 1997 the proposed regulations went through a number of iterations, leaving open the possibility that IMO might be forced into adopting the "minimal regulation" approach.

In October 1996 IACS submitted to MSC 67 the requested information, which became known as the "Ramification Study". IACS estimated that there were 4,200 bulk carriers in the world fleet over 150 metres in length to which its new standards and those of IMO would apply. It identified the ramifications of adopting each of the many proposals, including the minimal regulation and structural approaches. The submission was a major contribution to the debate and enabled the IMO to make some key decisions and thus reduce the areas of uncertainty in the proposed regulations. It was agreed that application of the structural strength standards for **new** vessels developed by IACS would be adequate and that there would be no need to develop a specific IMO standard. IACS advised IMO that it would not be possible to submit the final outcome of its work on the bulkhead strength of **existing** ships (or the scope of its application) until 1997.

MSC agreed that a Diplomatic Conference should be convened in November 1997 to consider and adopt the new regulations.

One of the main arguments for relying on enhanced survey and other non-structural upgrade measures was that no ship having undergone an enhanced survey had been lost. In February 1997 the *Albion 2* and *Leros Strength* were lost with all hands. *Albion 2* is understood to have undergone a normal enhanced survey prior to the casualty and the *Leros Strength* had been the subject of an enhanced survey for the purpose of transfer of class between two IACS member societies.

Following these casualties, at MSC 68 in May 1997 the relevant governments and organisations ceased pursuing the alternatives to structural measures and allowed the latter to pass almost unchallenged.

The principal features of the proposed regulations for vessels of 150m and greater in length, of single skin construction and carrying high density cargoes were:

- **Damage stability:**

- ‡ new bulk carriers when loaded to the summer load line must be capable of withstanding flooding of one cargo hold and remain afloat in a satisfactory condition of equilibrium;
- ‡ existing bulk carriers when loaded to the summer load line must be capable of withstanding flooding of the foremost cargo hold and remain afloat in a satisfactory condition of equilibrium;

- **Structural strength**, taking into account the dynamic effects resulting from the presence of water in the hold:

- ‡ new bulk carriers, however constructed, shall have sufficient strength to withstand the flooding of any one cargo hold. The draft regulations referred to the IACS Unified Requirements for single

side skin bulk carriers through a draft resolution. It was accepted that the rules of classification societies were adequate for other types of new ship construction;

‡ in existing bulk carriers, the transverse watertight bulkhead between the two foremost holds and the double bottom of the foremost hold shall have sufficient strength to withstand the flooding of the foremost hold. Specific IMO standards for the structural assessment of existing ships were based on the relevant Unified Requirements of IACS;

- **Loading instruments:** all bulk carriers are to be provided with a loading instrument capable of providing information on hull girder shear forces and bending moments;
- **Self-unloading ships:** self-unloaders and other ships that are unable to meet the damage stability requirements must comply with alternative safety measures as assessed by the Administration;
- **Interim measures:** after the entry into force of the new provisions ships are not allowed to load high density bulk cargoes until their cargo holds have undergone a survey equivalent to the enhanced survey of resolution A.744(18).

The draft regulations also provided for operational alternatives to structural measures, for example restrictions on the amount and distribution of high density cargo. Where such alternatives are adopted ships must be marked with a distinctive triangle on the hull at the side.

ECONOMIC AND COST ANALYSES

Using these estimates and independent figures on the make-up of the world fleet, assuming an average modification cost, the total cost to owners of the world fleet is estimated to be in the region of USD 200 million. Det Norske Veritas made a contribution to the debate by conducting and publishing the results of a formal safety assessment of the cost of modifying bulk carriers to meet the new IACS requirements. The assessment found that the costs were broadly equivalent to the cost, in human terms, deemed acceptable for the adoption of safety measures in other fields.

CONFERENCE DECISIONS

In general the Diplomatic Conference adopted the broad approach as outlined in the draft regulations. For the technical minded and in order to understand and interpret the agreement reached by the Conference on the regulations it is necessary to take into account the resolutions adopted by the Conference. Apart from the purely procedural resolutions (resolutions 1 and 2), they dealt with:

- the design and structural standards for new ships (ie, ships built after entry into force of the regulations), referring to the Unified Requirements of IACS (resolution 3)
- the standard for strength of the transverse bulkhead between the two foremost holds and the associated double bottom structure of existing ships. This standard is an adaptation of IACS Unified Requirements S19 and S22 in the form of an IMO standard (resolution 4);
- IMO standards for loading instruments, again based on IACS standards (resolution 5);
- the interpretation of "bulk carrier" (resolution 6);
- confirmation that prior surveys carried out under the Enhanced Programme of Surveys may be recognised for purposes of the new regulations (resolution 7);
- recommendations on future work of the MSC, including a proposal for additional work on ships less than 150 m in length, ships of other than single side skin construction, bulk carriers that are unable to meet damage stability requirements and the safety of ships other than bulk carriers when carrying bulk cargoes (resolution 8).
- A further plea to governments and industry, supplementing resolution A.848 (20), to implement the International Safety Management Code for bulk carriers by 1 July 1998 (resolution 9).

LOCAL OPERATIONAL ASPECTS

In Australia, issues affecting the loading, unloading and carriage of bulk cargoes are discussed with industry on a regular basis within the Bulk Cargoes Advisory Group (BCAG). This body provides both the forum for discussion of these important matters as well as providing a focus for coordination and cooperation on industry/Government action within IMO on relevant issues. Many of the industry members on the BCAG are also involved with the National Bulk Commodity Group (BCAG) and provide a valuable communications link in relation to the broader bulk cargo sector.

In any discussion of the Australian situation it is important to recognise the operation of our Federal system of government. Whilst the Federal Government has general jurisdiction over foreign vessels in Australian waters, port matters are the responsibility of the States. As a result while AMSA, as the Federal authority, has control over shipping under the Navigation Act, our influence on ports is, of necessity, primarily exercised through cooperation and consultation. These processes involve State and Territory Governments and the industry. In this regard our links with industry through the BCAG and with individual companies and port authorities, is extremely important to the achievement of Australia's maritime safety objectives.

Conscious of the risk associated with the loading and unloading of bulk carriers and carriage of bulk cargoes, the Australian Government legislated in 1987 by Marine Orders No 34 to make application of the *Code of Safe Practice for Solid Bulk Cargoes* (BC Code) mandatory for ships loading in Australian ports. This code focuses primarily on cargo specific related aspects of bulk carrier safety. Of particular note is the requirement to comply with the

provisions of the Code concerning moisture content, the method of establishing it and provision of this information to ships' masters. The legislation was developed with the assistance of, and in close consultation with, the Australian shipping and minerals industries.

The most substantive recent advance in operational safeguards has been the development of the *Code of Practice for the Safe Loading and Unloading of Bulk Carriers* (BLU Code). Australia was a major contributor to the development of this Code which focuses not only on the operational requirements of the ship but also on the interface between the ship and the terminal. It provides a realistic and pragmatic risk management framework and covers all cargo except grain. Guidance on such matters as the suitability of ships, procedures between ship and shore, cargo transfer and ballast handling is included in the Code.

AMSA fully endorses the use of the Code in the belief that it makes a practical and substantial contribution to safety and environmental protection and recommends its use by ships, terminals and cargo shippers. Marine Orders are currently being adapted to ensure that bulk carriers are loaded in a responsible manner – Using the Code would be one way of ensuring compliance with this requirement.

As a comment AMSA is pleased to be associated with the Australian Maritime College and the Australian Coal Exporting Terminals in the development of the Certificate in Safe Bulk Loading Practice. This will be an external course available to terminal staff as a means of ensuring a higher degree awareness of maritime and bulk carrier issues.

The International Safety Management Code (ISM Code) became mandatory for certain classes of ships from July 1, 1998. The ISM Code provides the broad regulatory framework for the safe management of vessels by bringing the requirements of the existing international conventions into a safety management framework. In addition the code clearly identifies the fact that shore management has a critical role in ensuring the development and operation of the vessel's safety culture and operational performance.

However regardless of the introduction of these codes and the enhanced survey and structural standards any advantage gained will be minor if the previously accepted industry standards and practices are not applied to the vessel's operation. The nature of shipping has permanently changed. However it must not simply become a new field for asset players intent on maximising the greatest return on their investment. Ships require qualified management, adequate freight rates, competent and experienced crews and proficient shore services such as agency, bunkering and legal advice (eg thorough P&I Clubs). If these requirements are lacking then the potential exists for the development of the factors that can lead to circumstances where safety and environmental protection standards are seen as discretionary issues that can be abandoned.

CONCLUSION

Australia maintains a close interest in, and concern for, safety aspects associated with the loading, unloading and the carriage of bulk cargoes. The recent structural and operational changes agreed through the IMO will ensure a substantial enhancement of the safety parameters in which these vessels operate.

However it makes little difference how good the regulatory framework is if some of the operators of bulk carriers continue to disregard accepted international practice in relation to safety and operational management. Unfortunately incidents of bulk carriers being detained in Australian ports are not uncommon. In most cases the detention could have been avoided had the operator exercised a reasonable level of oversight and responsibility for the operation of the vessel.

Regulation is no substitute for good management and common sense. Now that the structural and operational issues have been addressed perhaps it is about time that the operators of substandard bulk carriers, and those who gain financially through their operations, should be made more accountable.
