

## Going Forward with Safe Return to Port

Jane Dodman,

Lloyd's register EMEA

### ABSTRACT

In 2000 the IMO agreed that future large passenger ships should be designed based on the principle that a ship is its own best lifeboat. It was recognised that with vessels carrying ever increasing numbers of passengers the task of retrieving people in lifeboats from the ocean is a significant problem. The instruction from the IMO was that vessels should either be capable of returning to port or able to survive for three hours to allow for a timely evacuation.

The new SOLAS requirements will be applicable to all passenger ships built on or after July 1, 2010, having a length of 120 metres or having three or more Main Vertical Zones. A substantial part of these regulations deals with the complexities of system requirements for retaining people on board a distressed ship with the additional capacity to return to port. There are two casualty categories; namely, fire and flooding

Discussions concerning the fire casualty are virtually complete. However, work is ongoing at the IMO to provide guidance information to support the Master in the event of a flooding casualty and on time to flood. The adoption of the harmonised methodology for assessing ship survivability from flooding following damage does not provide information relevant to the Master in a real casualty situation. It is the intention that the guidance will provide support in ascertaining the immediate condition of the vessel for a possible safe voyage back to port. This is a step away from the original discussions which included a design concept. There are several reasons for not having moved forward with this. Most notably, the agreed view, that any new requirement should not impact the level of safety imposed by the harmonised damage stability requirements. Further, there is limited available data on how damaged ships operate in a real sea way.

This introduction paper is presented to open up discussions on what information should be presented on board to effectively support the Master in the uncharacteristic and possibly distressing situation of a damage casualty. Also, should ships be designed with a 'safe return to port' concept in mind and if so, how is this achieved?

### KEYWORDS

Safe return to port; Stability; Passenger ship

### INTRODUCTION

The purpose of this inaugural paper is to open up the debate on the 'Large Passenger Ship' initiative taken by the International Maritime Organisation (IMO) in 2000 to

address concerns that increasing ship sizes and passenger numbers might increase risk to above acceptable levels.

It is a resume of what has transpired based on familiarity gained at IMO from investigations into a safe return to port index and explains

certain practical aspects of the systems in order to maintain a certain holistic focus.

## HISTORY

The original instruction from IMO was that vessels should either be capable of returning to port or able to survive for three hours to allow for timely evacuation.

During this period there were also significant developments in stability regulations with the introduction of probabilistic damage stability for passenger ships.

The basic theme of the initiative was that future passenger ships should be designed for improved survivability so that in the event of a casualty persons can stay onboard as the ship proceeds to port.

In 2004 it was decided at IMO to drop 'large' from the title in order to extend the benefits to a larger number of passenger ships. Clearly many smaller ships operate in remote arctic and tropical areas which are equally susceptible to the difficulties of passenger retrieval in the event of a casualty. Ships of less than 120metres or three main fire zones are considered to have insufficient subdivision to implement system redundancy in flooding cases.

Amendments to SOLAS Chapters II-1 and II-2 were subsequently finalised and adopted at the 82<sup>nd</sup> session of the IMO's Maritime Safety Committee (MSC) in December 2006, with requirements applicable to passenger ships built on or after the 1<sup>st</sup> July 2010.

## CASUALTY THRESHOLD

As it would be unreasonable to require that a passenger ship should be able to return to port following any possible casualty, the concept of casualty threshold was introduced.

There are two casualty thresholds defined for each of the two accident categories, fire and flooding; the threshold for safe return to port and the threshold for safe evacuation.

The casualty threshold for safe return to port is the envelope of the accident scenarios that the ship is expected to survive and be able to return

to port afterwards. The threshold for safe evacuation is similarly the envelope of the accident scenarios following which the ship is expected to provide a safe platform for evacuation for at least three hours.

The above casualty thresholds have been clearly defined in the regulations only for fire. In the flooding case a casualty threshold has yet to be defined and is only implicitly included in Regulation II-1/8-1 to facilitate designers but does not correspond to a specific accident scenario.

As the debate on time to flood has not yet been resolved at the IMO there is currently no casualty threshold for orderly evacuation in the flooding case.

## FLOODING CASUALTY THRESHOLD

In case of flooding it has been specified that the systems required for return to port shall remain operational following the loss of any one watertight compartment. As mentioned previously this is not related to a specific damage scenario or associated with stability requirements. It has been put in place only to ensure a reasonable degree of equipment redundancy. Figure 1 shows the application according to the extent of a flooding casualty.

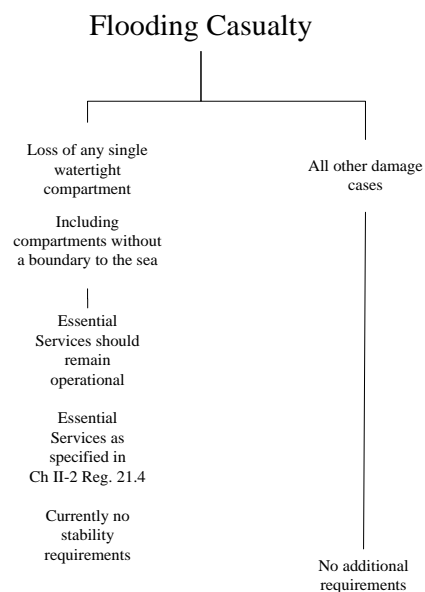


Fig. 1 Flooding casualty

## **ESSENTIAL SYSTEMS**

For a ship to be considered to have the capability to return to port, new SOLAS Regulation II-2/21 contains a list of systems considered essential. The list only describes the systems; both the Regulation and the corresponding performance standards contained in MSC.1/Circ.1214 are intentionally vague and lacking any reference to specific values or other determinants of performance. The essential systems for return to port are:

- Propulsion
- Steering
- Navigational systems
- Fuel transfer systems
- Internal and external communications
- Fire main system
- Fixed fire extinguishing systems
- Fire detection systems
- Bilge and ballast systems
- Basic services to support safe areas
- Flooding detection systems and
- Other systems determined by the Administration to be vital to the damage control efforts.

The basic services to be provided to support safe areas, as mentioned above, are the following:

- Sanitation
- Water and food
- Space for medical care
- Shelter from the weather
- Means of preventing heat stress and hypothermia
- Light and ventilation.

## **RETURN TO PORT PERFORMANCE REQUIREMENTS**

The new rules for return to port briefly described above are not prescriptive but are essentially performance requirements. There is

an element of intentional ambiguity in their formulation necessary to cater for the many different types of passenger ship operating in very different circumstances.

A cruise ship in a remote area days from the nearest ship and a cross channel ferry that is always within easy reach of Search and Rescue services should be treated differently. Requiring the cross-channel ferry to carry fuel, food and water to survive days does not make sense.

This has created some problems for designers as well as for the Flag Administrations and Classification Societies that have to verify compliance with the new requirements.

This is why it was decided at the IMO not to have an explicit reference for example to required speed, range, available power or capacities in either the regulations or the related MSC circular.

It is for the same reason that there is a consensus forming to restrict the appraisal to the measurement of the ship's capabilities to return to port and have specific and possibly area of operation related information contained in the ship's safety documentation.

## **REGULATIONS**

SOLAS2009 Chapter II-1, Regulation 8-1 'System capabilities after a flooding casualty on passenger ships' is placed in Part B-1 'Stability' and has sat as a placement for future developments on the stability aspects of safe return to port.

At IMO SLF 52 in March this year, the Sub-Committee reiterated its support of the United States' proposal (SLF 51/11/3) that only operational guidance should be developed; and that the draft amendments to SOLAS regulation II-1/8-1 should be finalized when the above guidance is developed, together with amendments on mandatory requirements for onboard computers.

This is move away from the initial intent of adopting design criteria but this may be re-introduced in the future if there are practical, robust solutions. Also, completion of the work

done on ‘time to flood’ carried out at IMO is awaited with interest as it may also have some bearing.

However, the question remains as to what is considered a suitable threshold of stability when considering a return journey to port, whether that be under power or under tow.

The complexity increases when considering the variety of ship types such as large cruise ships, mega yachts, ro-ro passenger ships and interesting multi hulls.

## DESIGN CRITERIA PROPOSAL

Discussions on benchmarking stability criteria for safe return to port tend to result in ‘something’ between the s-value and the intact stability requirement. Clearly the s-value parameters are insufficient since it is designed on the assumption of a damaged ship remaining in a location static position.

In 2008 a paper was presented at IMO Sub-Committee on Stability load Lines and on Fishing Vessel Safety (SLF) titled ‘Results of an investigation into the casualty threshold methodology by Lloyd’s Register’. This was completed in co-operation with several of the major passenger ship building yards in Europe.

The aim of the study is to define an acceptable level of residual stability for safe return to port after damage and to provide an indication of the ability of the vessel to do this by design.

The proposal is based on the same results as the damage calculations for compliance with SOLAS II-1, Regulations 4 to 7-2. It considers a measure of the ability of a vessel to return to port safely is the sum of the p factors associated with the damages that comply with adequate stability criteria for safe return to port. This is represented by a safe return to port required and attained index as shown in

Figure 2.

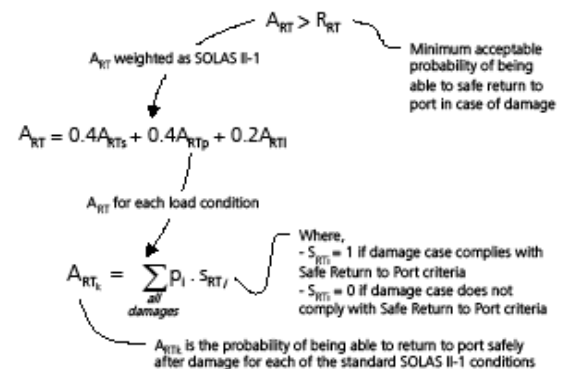


Fig.2 Return to port attained and required index

One aspect clearly identified by the paper is the notable effect of the range on defining a criteria threshold.

Figure 3 provides a graph taken from the paper showing the GZ Curve Range. The reference proposed is to have a GZ curve range of not less than 30°, as a minimum from the IS Code requirements. It can be noted in the graph that it is a quite onerous requirement that few cases comply with.

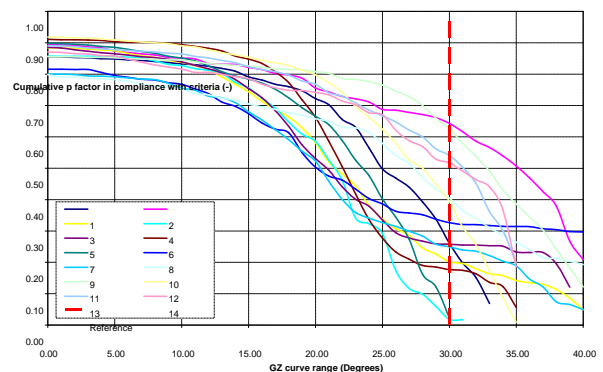


Fig. 3 GZ Curve range

This approach is based on zones as opposed to watertight compartments and therefore not immediately in line with the application of system redundancy. The positive side is the methodology is simple and aligned with the established SOLAS damage stability requirements.

As it stands, there is insufficient ship data to consider this as a robust proposal. Also, the ship designs are from an early period in the adoption of the probabilistic methodology. Therefore, it is possible the data will be impacted on as more experience is gained in application and interpretation of the regulations.

## **DEVELOPMENTS BY GERMANY**

In 2009 Germany submitted a paper to IMO SLF going forward with an approach based on that mentioned above but in relationship to compartments as opposed to zones. It embraces a wider variety of available and acceptable damage cases.

This proposal provides results for four ships together with a practical solution in graphical form for visual support to the Master.

Since the opinion at the time of submission to IMO was focussed on support to the Master, this paper was not discussed in detail.

## **GUIDANCE**

Guidance or rather support information for the Master is currently being developed at IMO for incorporation into MSC.1/Circ.1245.

The objective is to provide the Master with assistance on how to ascertain the immediate condition of the ship and, if satisfactory, what actions may be taken to improve the safety for the voyage back to port.

It is generally decreed that the information should not contain decision criteria but there are views that reference points for the master which could provide information on certain parameters, e.g., stability characteristics associated with the s-value or intact requirement value, could be useful for comparison to the ship's residual stability. A slight majority was against providing such reference points because these could not provide for all actual parameters and could be misleading. A particular reason for not including references is that at present there are no predominant solutions presented that have been rigorously debated.

Defining a level of stability in the traditional sense is not straight forward bearing in mind the numerous permutations and combinations of damage scenario, prevailing weather conditions and areas of operation. There is a lack of statistical information of how a damaged ship manoeuvres in a real sea way. Traditional methods of applying the roll period coefficients are not applicable. Although a damaged ship generally provides more damping there are other associated factors to consider such as the time to restore equilibrium following imposed angles of heel.

## **ALTERNATIVE APPROACHES**

SSRC propose a ship specific method which determines the likelihood of capsizing associated with the global range of damages using numerical simulations. This product is used by some owners to support confidence with early implementation of safe return to port in new designs. The complexity in this approach makes it more difficult to encompass into the regulatory framework but is none the less a method to investigate in providing viable solutions.

## **CONCLUSIONS**

To move forward with a design criteria or reference points for stability under specific casualty situations we need to identify under what conditions a vessel should be capable of returning to port and the level of acceptable risk. This may well be variable depending on operations and ship types.

More immediately, what support can be offered to the master? Diagrams similar to those proposed in the German paper are already supported in certain areas of the shipping industry. Any supporting information has to be clear and immediately available.

In designing solutions, the practicalities of implementation by the industry as a whole, should be considered but this does not mean moving ahead with technology.

Measuring the ability of a ship to safely return to port as a function of the damages cases

forming the subdivision index in Chapter II-1 SOLAS2009 is clean and efficient. Perhaps this is an easy way to measure the future design trend.

We should question whether a return to port requirement should be imposed that can override the safety levels assumed by the subdivision requirements currently adopted. Perhaps this philosophy is more relevant.

This remains a complex concept to embrace and there is no obvious and easy solution. Novel approaches and an open mind are required in the ultimate aim to turn potential accidents into controlled incidents.

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