

## PRESENTATION OF “SAFE RETURN TO PORT” RULES FOR PASSENGER SHIPS.

**Jean-Jacques Juenet**, Bureau Veritas / Head Office - DCM

### INTRODUCTION:

In 2000 IMO started to work with the aim of evaluating whether the current regulations were still adapted with respect to the growth in tonnage as well as to passenger capacity of modern cruise vessels, and development of operation in more remote areas.

More than 50% of cruise ships presently under construction are of the over-panamax type with a total number of persons onboard over 5,000 (sometimes up to 8,000), and a rescue operation concerning such a great number of persons would be a unique challenge with very few chance of total success.

Several amendments to SOLAS were adopted during the 82<sup>nd</sup> session of the Maritime Safety Committee in December 2006 with the aim of improving prevention of casualty but also to improve survivability of the vessels in the event of a casualty in order that everybody may safely remain onboard while the vessel proceed to a safe port.

As per these amendments, passenger ships shall be able to proceed to a safe port under their own power after a fire or a flooding casualty not exceeding a “casualty threshold” defined in these new regulations. During this “safe return to port” (SRtP) period, all persons onboard shall be accommodated in a “safe area” where basic services for their safety and health are available. If the “casualty threshold” is exceeded, SOLAS now requires some essential systems to be still operational for three hours in order to support the “orderly evacuation” of the vessel, considering one entire main fire zone lost.

These new concepts of “casualty threshold”, “safe area”, “safe return to port” and “orderly evacuation” have now to be applied to new ships having their keel laid on or after 1 July 2010, and having a length of 120m or more, or having 3 or more Main Vertical Zones (MVZ).

It is obvious that these so-called “safe return to port” rules will have an impact on design, not only on large cruise ships (as originally thought), but also on small or medium size cruise ships and passenger ferries. Increased redundancy for propulsion, el-production and steering systems as well as new adapted architecture of safety systems will certainly have consequences on the design and most probably also on the cost.

The necessity to assess the capability of each concerned system to remain operational after a flooding or a fire casualty will require new studies from the yards at a very early stage of design, and will also need from the Administration or from the Class Societies working on their behalf a new system-based approach philosophy for the assessment of the design taking into account the foreseen operational pattern of the vessel.

## SAFE RETURN TO PORT REQUIREMENTS

As per new SOLAS regulation Ch II-2/21.1, passenger ships constructed on or after 1 July 2010 having a length of 120m or more, or having 3 or more main vertical fire zones, shall comply with the provisions of regulation II-2/21.

It is understood that all main vertical zones in the ship should be counted for the purpose of this regulation, irrespective of whether they contain accommodation spaces or not. Nevertheless, horizontal fire zone (special category and ro-ro spaces) should not be included in this count of main vertical zones.

These new SOLAS amendments are introducing several new concepts which are detailed in the next paragraphs, such as: “Casualty Threshold”, “Essential Systems”, “Safe Area” and “Orderly Evacuation”.

### New SOLAS regulations II-1/8-1, II-2/21 and II-2/22

- **Ch II-1 Reg 8-1** requires that “**essential systems**” listed in Ch II-2/21.4 remain operational after flooding of any single watertight compartment. It is important to note that both internal compartments and compartments having a boundary to the sea are concerned.

- **Ch II-2 Reg 21** provides design criteria for a “**safe return to port**” of the ship under its own propulsion after a fire casualty that does not exceed the “**casualty threshold**”. The fire casualty threshold is defined in §21.3 as being the loss of the space of origin up to the nearest A-class boundary if the space is protected by a fixed fire-fighting system, or the loss of the space of origin and adjacent spaces up to the nearest A-class boundaries which are not part of the space of origin.

As can be seen from the regulation text, the requirement was relatively vague and more detailed explanatory documents were needed by the industry for a proper and uniform implementation. Initial explanatory notes were developed by five leading classification societies (BV, DNV, GL, LR and RINA) with the assistance of major European Shipyards and some Operators, and were submitted by Italy and CLIA to the IMO Fire Protection subcommittee in October 2008. After review by a correspondence group and drafting of a proposal in April 2010 by IMO FP, the Maritime Safety Committee, at its eighty-seventh session in May 2010, approved the Interim Explanatory Notes for the assessment of passenger ship systems' capabilities after a fire or flooding casualty, to provide additional guidance for the uniform implementation of SOLAS regulations II-1/8-1, II-2/21 and II-2/22. These notes were published as interim explanatory notes in June 2010 as **MSC.1/Circ.1369**.

Regarding extend of casualty threshold in the case of the space of origin not being protected by a fixed fire-extinguishing system, the following interpretation was approved with the explanatory notes:

- Casualty threshold may include spaces one deck above (considering that fire is spreading upwards, the deck below has been excluded from such extension).
- Only spaces within the same Main Vertical Zone have to be considered.

§ 4 of Regulation 21 also lists all “**essential systems**” which are required to ensure propulsion and maneuverability after a casualty not exceeding the casualty threshold, and also to maintain

safety in all parts of the ship not affected by the casualty, as well as to ensure services needed to be available in safe areas.

These essential systems are:

*(Text in italics refers to interpretations as per IMO.1/Circ 1369):*

- Propulsion systems with their necessary auxiliaries
- Electrical power plant with their auxiliaries
- Steering systems with their power and control systems
- Systems for filling, transfer and service of fuel oil

*Full redundancy for propulsion and electrical production will be required as well as for steering system. Propulsion engines and electrical generators will have to be distributed in two separate engine rooms, as well as main switchboards and all auxiliaries for propulsion and electrical production. Two steering gear rooms have to be arranged and fitted with a fixed extinguishing system if they are adjacent. Tunnel thruster is not to be considered for emergency steering.*

*It has also to be taken care that necessary fuel for remaining main engine(s) and diesel generators is still available in sufficient quantity for the whole safe return to port operation. Operating pattern of the vessel will have an important impact on this last issue as a worldwide cruise ship will have different need than a ferry certified for short international voyages.*

- Navigation systems

*In case of casualty affecting the bridge, an alternative place shall be arranged where essential equipment (fixed or portable) for navigation and detection of risk of collision shall be available for the duration of SRtP.*

- Internal and external communication systems

*P.A system shall remain operational in all main vertical zones not affected by the fire.*

*Portable communication system is acceptable for internal communication, provided repeater system remains operational and charging facilities are available in more than one main vertical zone.*

- Fire main system

*It is accepted to have the fire main isolated in the main fire zone affected by the casualty. Affected main fire zone can then be served from hydrants of adjacent zones or watertight compartment. Fire hoses may be extended for fire fighting within the affected main fire zone using maximum two lengths of hoses from each hydrant.*

*Manual local start of remaining fire pumps may be accepted after a casualty.*

- Fixed fire extinguishing systems

*Lay-out of the sprinkler or equivalent system will have to be carefully reviewed and pumps will have to be duplicated and installed in separate compartments. Each section should not serve more than one deck in one main vertical zone.*

*CO2 total flooding extinguishing system capacity to be sufficient to protect the largest and the second largest spaces.*

- Fire and smoke detection system

*Architecture of smoke detection system will have to be modified in order to remain operational in spaces not directly affected by the fire casualty. It will be acceptable to loose detection in maximum one deck in one fire zone.*

- Bilge and ballast systems

*Proper distribution of bilge and ballast pumps will be necessary, as well as careful routing of the piping. Extra manual controlled section valves will be necessary when crossing watertight compartment bulkheads to segregate any flooded compartment.*

- Watertight and semi-watertight doors

*Position indication of the doors shall remain available for any fire casualty within the casualty threshold except for doors in the boundary of spaces directly affected by the casualty.*

- Flooding detection system as per SOLAS II-1/22-1 requirement
- Basic services to support “safe areas” as indicated in SOLAS II-2/21.5.1.2  
*Detailed in next paragraph*
- Other systems deemed to be vital by the Administration for damage control efforts.

“**Safe area**” is defined in II-2/21.5 as being generally any internal space(s) which is not flooded and outside the main vertical zone affected by the fire. It shall provide all occupants with the following basic services to ensure the health of all persons onboard (*text in italics refers to interpretations as per IMO.1/Circ 1369*):

- Sanitation  
*Minimum one toilet required for every 50 persons or fraction of.*
- Water  
*Minimum 3 liters per person per day drinking water, plus water for food preparation and hygiene.*
- Food  
*Food could be of any kind including dry food.*
- Alternate space for medical care  
*The alternate space for medical care to be in a different MVZ than the hospital, and to have lighting and power supply from the emergency source of power.*
- Shelter from the weather:  
Internal spaces required unless otherwise accepted by the Administration  
*Use of exterior spaces as safe areas might be evaluated taking into account possible current operation of the vessel in warm climates and short duration of SRtP operation.*
- Means of preventing heat stress and hypothermia  
*Temperature within safe areas should be maintained in the range of 10° to 30°C.*
- Lighting  
*Portable rechargeable battery operated lighting may be acceptable for use in spaces not covered by the ship’s emergency lighting system.*
- Ventilation  
*Minimum ventilation volume available should be not less than 4,5m<sup>3</sup>/H per person.*

The above list will require a number of systems to be possibly evaluated as essential systems, in order to support these above listed basic services such as:

- Black & grey water system (although it is accepted that grey and black water could be disposed of into the sea during SRtP operation, as allowed by MARPOL Annex V, Reg 3).
- Potable water system
- Refrigerating system and galley system
- HVAC system (depending of the operation pattern of the vessel)
- Lighting distribution.

It is well understood that Safe Areas should preferably be arranged in accommodation spaces, and sizing could be based on the time needed for safe return to port operation. Interpretation 42 of Circ.1369 is asking for a minimum space of 2m<sup>2</sup> per person for a SRtP operation longer than 12 hours.

An important issue related to the safe areas is the requirement asking for means of access to life-saving appliances which shall be ensured from each safe area taking into account that internal transit through the affected main vertical zone might not be possible. This requirement will be achieved easily on cruise ships having embarkation deck running the entire length of the vessel, but will have to be closely investigated for ferries or small and medium size cruise ships where each main vertical zone do not have direct access to external embarkation deck. For this purpose, it is accepted that external routes are considered to remain available also in the portion of the ship containing the main vertical zone affected by the casualty.

- **Ch II-2 Reg 22** provides design criteria for systems required to remain operational to support an “**orderly evacuation**” and abandonment of the ship if the casualty threshold is exceeded. The following systems will then be required to remain operational for at least 3 hours in all main vertical zones not affected by the casualty:

- Fire main
- Internal communication for passenger and crew notification and evacuation
- External communication
- Bilge system for removal of fire-fighting water
- Lighting along escape routes, at assembly stations and embarkation stations
- Guidance systems for evacuation (e.g. Low Location Lighting).

To achieve the above requirement, proper distribution of pumps for fire main and bilge systems will have to be taken care of, as well as careful routing and protection of concerned piping and cables.

It is important to remind that SOLAS Ch III Regulation 21.1.4 requirement stating that all survival crafts shall be capable of being launched with their full complement of persons within a period of 30 minutes from the time the abandon ship signal is given, remains fully applicable.

#### Assessment of systems capabilities

Process of verification of the ship’s design with respect to Safe Return to Port requirements is detailed in MSC.1/Circ.1369, and is primarily intended to be performed with a system-based approach.

Documentation required for such assessment shall contain as a minimum the following:

#### **Ship’s description**

- Information about the intended area of operation and operating pattern in order to define intended speed and maximum distance for safe return to port.
- The list of all systems considered as essential and subject to required assessment.
  - This list shall include as a minimum all systems referred to in SOLAS regs II-2/21.4 and 22.3 for “safe return to port” and “orderly evacuation”.
- The design criteria for each individual essential system or group of systems to achieve compliance
  - e.g. separation, duplication, redundancy, protection or a combination of the above.
- Drawings showing basic lay-out of the vessels with necessary information
  - Drawings describing watertight boundaries, A-class fire boundaries, tank arrangement, fire category of spaces, etc...
  - Submitted documents shall also show the spaces protected by fixed fire extinguishing systems and spaces considered having negligible fire risk if any.
- Drawings showing location, arrangement and connections of essential systems, as well as a description of their power supply.

- Criteria adopted for the selection of safe areas and intended locations.  
Position and size of selected safe areas, as well as number of persons accommodated during SRtP operation for each safe area in the different fire scenarii (each scenario corresponding to one MVZ affected by a fire casualty).
- Data regarding the minimum speed vs. weather and sea conditions  
e.g. results of model tank tests in sea keeping conditions including consideration of wind forces.

### **Assessment of required ship system's capabilities**

The assessment method is detailed in MSC.1/Circ.1369 and consists in a two-steps study:

- Overall assessment of all essential systems:  
This assessment is a systematic study of each essential system to demonstrate their capability to remain operational after a flooding or fire casualty. Essential systems identified as being fully redundant for all concerned casualties need not be further analyzed.  
Manual action by the crew may also be possible under certain conditions detailed in the Circular.  
If a system is identified during this overall study as having a possibility to fail to operate as a consequence of a fire or flooding casualty not exceeding the casualty threshold, then this system is considered as being "critical".  
If no critical system has been identified during this study, the overall assessment is considered acceptable without the need for further study.
- Detailed assessment of critical systems:  
Each identified critical system shall be subject to a detailed assessment. Such assessment may require additional detailed information regarding installation of the equipment, manual action required to restore the system's functionality, and on any operational procedure to be implemented to achieve the desired results.  
Quantitative analysis may be required such as fire engineering analysis and/or fire testing, failure mode effect analysis (FMEA) of a system or detailed analysis of possibility of flooding of a particular compartment with its consequences on the system components.  
If the system's capability cannot be ascertained for all casualties not exceeding the casualty threshold, the design will have to be modified and a new assessment will have to be performed.

### **Final approval and documentation to be kept onboard**

When the assessment of all essential systems' capability to fulfill SRtP requirement has been successfully completed, the assessment report together with the ship's description file can be submitted to the Administration or to the Classification Society acting on its behalf for approval. Such approval will be valid taking into account the intended area of operation and operating pattern as defined in the ship's description.

During the vessel's life, any changes in the ship's design or in the way the vessel will be operated, will have to be evaluated with respect to compliance with SRtP requirements.

Therefore documentation as listed in MSC.1/Circ1369 §7.4 will have to be kept onboard and up-dated when necessary. This documentation shall include the ship's file and the assessment report, together with required operational information related to operation of essential systems and availability of safe areas, and description of tests, inspection and maintenance plan related to the concerned essential systems.

## CONCLUSIONS

Based on experience gained from actual projects under BV Class to be certified according to subject SRtP rules, such as one large passenger ferry under construction in Korea and one cruise vessel design developed in Europe, the following issues can be highlighted:

- Impact of these SRtP rules will certainly be more important on the design of small or medium size passenger ships, and specially passenger ferries, than on larger cruise vessels which were originally the main target. Most probably, totally new machinery arrangements will be developed for ferries, when for large cruise ships (generally already designed with two separate engine rooms) changes will mainly be related to necessary SRtP duration because of their worldwide operation, and availability of needed services in safe areas during this SRtP period.
- As shown above, approval will depend on the way the vessel will be operated. Therefore, eventual future operational changes should be as far as possible anticipated in order to avoid difficult re-assessment of the vessel's capability to meet SRtP requirements in case of changes in operational areas or operational pattern.
- Overall assessment of all essential systems as described above will have to be carried out at a very early stage of the project to define appropriate solutions and avoid later important changes in the design. Quality and degree of details of submitted documentation will be of great importance for an efficient and accurate review.
- The big challenge during systems assessment, but also during building of the ship, will be the control of routing of pipes and cables. Inspection procedures and extent of survey during building period will have to be re-evaluated between all involved parties.
- Onboard SRtP documentation will have to be kept up-dated during the vessel's life in case of modification in the vessel's design or in case of new operating pattern or operational area. This documentation will also be needed in case of change of Flag to provide necessary evidence of compliance with applicable SRtP rules.
- These new SRtP rules are certainly improving the safety level of passenger ship design by imposing new requirements for higher survivability of these vessels.

## REFERENCES

- Resolution MSC.216 (82) Annex 2 & 3 adopted on 08 Dec 2006:  
Amendments to the International Convention for the Safety of Life at Sea, 1974, as amended.
- MSC.1/Circ.1369 of 22 June 2010:  
Interim explanatory notes for the assessment of passenger ship system's capabilities after a fire or flooding casualty.
- Bureau Veritas Rules for the Classification of Steel Ships July 2010