

## **DOES SHIP SIZE AFFECT SAFETY? (Published in Cruise Industry News)**

Every time a new vessel exceeds earlier size and capacity records, the question of safety comes up. The large size itself does not make a ship less safe, but the high number of persons onboard can multiply the consequences of a disaster. On a ship, the most significant of possible disasters are fire and suffering a shipwreck. Both these may lead to an evacuation, which is a major challenge on any ship.

### **FIRE**

All passenger ships are today required to be equipped with ship-wide sprinkler system, which greatly reduces the risk of fire spreading uncontrollably. In addition, the requirements for structural fire protection, or fire insulation, are such that at least in theory the vessel would survive a fire for one hour even without sprinklers, giving time for passenger and crew to abandon the vessel.

The fire protection especially on new ships is at a very high level, and older passenger vessels are also today retroactively fitted with sprinkler systems. Thus the main risk does not usually come from inadequate fire protection, but from a non-working sprinkler system: it is possible that the ship's only sprinkler pump unit is destroyed in a collision. This risk is avoided on many new ships by dividing the sprinkler system between two or three redundant pump units. Another risk is always an installation or user failure: if a section valve is accidentally left closed after maintenance, the sprinkler system will not work as planned. When the systems get larger and more complicated, possibility of different failures normally increases.

A recent example of balcony fires has caused a rapid change in rules. However, there are also other spaces onboard that by rules are not required to, and thus usually do not have sprinklers: examples are the bathrooms, both in cabins and in public spaces and ship's air conditioning rooms. A fire is of course not so likely to start from these spaces, but so was the case with balconies as well.

### **SINKING OR CAPSIZING**

Sinking or capsizing is the other main risk on any ship. This could result from many reasons: collision with another ship or floating object, grounding, failure in seawater piping or losing stability by inadequate ballasting of the vessel. The main target is to avoid shipwreck at any cost, but in the event something happens, a "Titanic-like" slow sinking in upright position might not be the case: in heavy seas the vessel could capsize in an early stage of the distress, making evacuation all but impossible.

Today the number of persons onboard has only a small effect in the stability requirements of the vessel. However, the new damage stability regulations, which will come into force in 2009, define a required damage stability index, which is affected by the number of persons onboard. As an example, a vessel with 7,000 persons onboard needs to have 5% higher damage stability index than a vessel with 4,000 persons

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onboard. In the other words, the fewer persons there are onboard, the less safe the vessel needs to be against sinking or capsizing.

## **EVACUATION**

If the fire or flooding is serious enough, it can lead to an evacuation of the vessel. Evacuation consists of two parts: first getting the passengers to the assembly stations and then, if the situation so commands, to the lifeboats and life rafts in order to abandon the ship. The first part is mainly taken care of by providing adequate width on the escape routes, stairs and doors, taking into account the occupancy of public spaces and cabins. This method, however, has several flaws: one example is that the open deck spaces, such as sun deck where most of the passengers often are, need not be included into the escape calculations. If the sun deck had to be included, the doors and stairs leading from the sun deck to assembly stations would, on most today's ships be significantly wider than they presently are.

When the ships get larger, the stairs, doors and assembly areas get larger in proportion to the number of persons. Therefore the escape arrangements on larger ships should be as safe as on smaller ships. However, the main risk can come from the large number of persons: guiding everybody to the right location, and making them to obey the instructions in a panic situation can be a challenge due to psychological reasons alone. There has been discussion of using some other method, such as a computer simulation for modeling the evacuation more realistically, and some owners have already this done for their own information. In case of ferries, a more demanding evacuation analysis is required by SOLAS already now, but this is not yet the case with cruise ships.

For the last stage of evacuation, abandoning ship, the most important are the lifeboats. On vessels on international voyage lifeboats has to be provided for at least 75% of the persons onboard, the remaining using life rafts. As lifeboats can be very difficult and dangerous to board in heavy weather, some consider life rafts accessed by chutes or slides a better solution. In bad conditions successfully abandoning even a smaller ship can be very dangerous, if not impossible. Due to this, the safest way is always to make the ships so safe that abandoning ship does not become necessary. In this respect ships are very similar to aircraft: everything must be done to prevent an accident happening.

## **SPECIAL RULES FOR BIG SHIPS**

As the ships keep getting bigger, following the SOLAS regulations becomes more and more difficult. One example is the size of a fire zone: today the maximum size of a fire zone on any one deck is 1,600 m<sup>2</sup>, which would result in very short compartments on the planned very wide ships. Another example of a "difficult" rule is the maximum capacity of lifeboats: rules a maximum capacity of 150 persons per lifeboat. If a vessel had 7,200 persons onboard, she would have to have at least 36 normal size lifeboats. Accommodating these would be challenging except on very long vessels. Everyone who has seen the published side view of RCI's Genesis can notice the very low amount of

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lifeboats: only nine per side, which means each must accommodate much more than 150 persons. Due to these and other similar issues, the regulations today allow solutions deviating from SOLAS, providing the new solution is at least as safe as the one required by rules. There are set procedures how this equivalent safety needs demonstrated, but still this can be a challenge when all the aspects need to be taken into account. Demonstrating a very large lifeboat is as safe as a traditional 150 person boat should include the whole evacuation process: handling large embarkation groups, embarking the boat, probability and consequences of losing a boat, to mention few.

If the larger number of persons involved is set aside, the rules are such that larger ships should be at least as safe as smaller vessels. If the damage stability is considered, ships with more passengers are even safer, when they are designed according to new damage stability rules. The remaining risk, as always, are the unknowns the large size and new solutions may bring along. Allowing the deviations from SOLAS on the grounds of equivalent safety may also bring up something unexpected not considered in design and approval process. However, most accidents take place due to human factor: how this is affected by the larger number of crew and passengers is difficult to estimate.

Another question is if there is any other reason than economies of scale for the ships getting bigger and bigger: even the largest of the ships can never provide as good ice skating, golf, surfing, swimming or other features as land based attractions can. Maybe ships should again concentrate on the things special for the ships: being at sea and visiting exciting, interesting places.

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