

## **WHY SHIPS SINK? (Published in Cruise Industry News)**

Recent losses of two cruise ships, one near Greece and one in the Antarctic, both in calm weather, raise again the question: why, with all the regulations, do passenger ships still sink? Neither of these two ships was new, but stability regulations were similar to those used on recent newbuildings. While the exact details in these two cases are not known, the cause for sinking was obvious: too much water got inside the ships.

Both of the sunken vessels were reportedly so called two-compartment vessels, which means they had been designed to withstand a flooding damage of up to two adjacent compartments. Most of the cruise ships operating today, including the latest and largest delivered newbuildings, have been designed according to this same principle. The new probabilistic damage stability calculations have a more complicated approach than this, but they still will not necessarily survive a flooding of more than two compartments.

A vessel can sink or capsize due to several reasons. An obvious one is that the damage extent is more than the vessel was designed to withstand: for example, a flooding of three compartments can mean a very critical situation. Similarly, a smaller damage can spread inside the vessel and extend to a dangerous level if watertight integrity is, for some reason, compromised. Other reasons can be that the initial stability before damage was not adequate or the weather conditions were worse than regulations require the vessel to cope with. If the conditions are extreme, a vessel can capsize even without suffering any external damage, but in damaged condition the vessel has highly increased risk of capsizing and structural breakdown.

Ships can not be made unsinkable and thus certain assumptions are necessary. Requiring ships to withstand at least a two-compartment damage is natural: even a very small hole in the hull can flood two compartments if the damage occurs in the way of watertight bulkhead. A three-compartment damage needs a damage that is at least as long as the shortest compartment. The old damage stability rules defined a minimum compartment length, which is also the maximum damage length the vessel has to survive. This minimum compartment length is relative to vessel's length, and for a Panamax size ship it is approximately eleven meters, but for a 75 m ship only approximately five meters. Therefore a damage length which a Panamax ship will easily survive can sink a smaller vessel. In the new damage stability rules there is no minimum compartment length, but things are kept approximately at the same safety level with other means. However, in new damage stability rules the more persons there is onboard, the higher the safety level has to be.

Suffering a hull damage of more than two compartments is not very likely, but additional compartments can be lost without breaching the hull: progressive flooding through watertight doors left open or not closed quickly enough can be dangerous. There is an ongoing discussion whether or not watertight doors should be opened at sea. Similarly a badly made conversion work can be hazardous: if the installation of new piping, ducting, penetrations or equipment did not take into account watertight integrity, the damage can

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easily spread to the adjacent compartments. In these cases the bilge pump can sometimes only slow down the process but not save the ship.

One very important factor for vessel's ability to survive is the stability condition before damage: if initial stability is inadequate or draught is more than load line mark allows, the vessel may not withstand the damage as planned. For too many ships maintaining the adequate stability throughout the voyage has become a continuous challenge: after the delivery from the shipyard ships typically have some stability and weight margin, but when the effects of natural weight increase, conversions, upgrades and modifications all sum up, the stability almost always becomes an issue to watch later in ships service life. Specifying a weight and stability margin would be a good way to prepare for this already at the newbuilding stage.

As it would be unreasonable and impossible to require ships be unsinkable, it is up to the shipowner to minimize the risk of sinking. It all starts from not having an accident, which means proper navigation and avoiding too extreme weather conditions. There are also other important things to take care of, including making sure all the conversions are made professionally and that the vessel's weight and stability is constantly followed up. The new damage stability rules are not making this task any easier.

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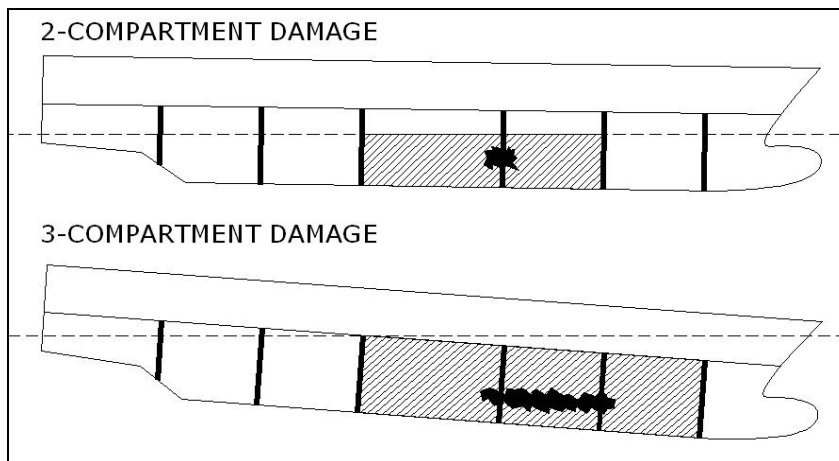


Figure 1: Example of minimum damage length causing two-compartment and three-compartment damages.