

# STORM WAVES

John Rousmaniere writes, in his excellent book *Fastnet Force Ten*, "The calamity in the Western Approaches (The Fastnet Tragedy) seems to be yet another indication that our positive faith in technology may be groundless. We appear to be led by transitory successes into the heresy that we can completely manipulate our environment". This view of the unworldly fury of a storm at sea has existed thru the ages. Fortunately it is no longer is pertinent.

When I started to work on the capsize problem I had no doubt that it would be possible, in the modern world, to provide equipment to bring a well found yacht thru a storm like the Fastnet or the Sydney Hobart. Water is a familiar fluid. Wave speeds and heights are well within engineering experience. Any competent Aerospace company has handled problems much more challenging. However, I was not at all confident that the required equipment would satisfy the constraints of size, weight, cost, complexity and ease of operation to an extent that it could be expected to gain acceptance by ocean yachting skippers. The series drogue has now earned that acceptance, but it took 15 years or so to get there.

In addition to a feeling of helplessness, there is another irrational attitude that countered our obtaining a solution to the capsize problem. The shape and motion of storm waves when viewed from the deck of a yacht are such that it can lead to optical illusions which confuse the skipper. A large storm wave approaching the boat appears to be a dangerous wall of water and the skippers instinctively tend to head up or run off to avoid being pooped. Actually the water in the wave is not moving towards the boat and will lift the boat harmlessly.

A second optical illusion is that a dangerous breaking wave comes from

a direction different from the prevailing wind and sea. The report of the Investigating Comm. for the Hobart Sydney disaster states "Exceptional waves were responsible for inflicting the damage or causing severe knockdown to yachts. These waves were 20 to 100% larger than the prevailing seas and came from a direction other than the prevailing wave pattern".

From physical considerations it is virtually impossible for a breaking storm wave to approach from a significantly different direction. Breaking waves are formed by the wind and by the addition of the energy of the smaller waves that they overtake. If a wave moved across a series of smaller waves it would lose all its energy in turbulence. We have many aerial views of the sea surface in the Sydney Hobart storm. If a large wave had moved across the smaller waves we would see a white streak running across all the other streaks. There is no such a streak. What actually happens is that if the boat is lying at some angle to the prevailing sea as the breaking wave approaches, the action of this wave yaws the boat until it is abeam. This yawing motion is not observed by the skipper and he thinks the wave direction has changed, whereas it is the boat that has moved. It is true, however, that the waves that caused the damage were "exceptional"

In gale force winds most of the waves can have breaking crests, but the speed and height of the waves are such that they do not constitute much of a threat.. However, in hurricane force winds the sea is generally blown "flat", but from time to time very large and dangerous waves appear, often moving in pairs or groups. A boat can ride for hours without encountering such a wave and then be destroyed in seconds.

Another optical illusion is that it is possible in a survival storm to reduce the hazard by running off before the waves and, by skillful seamanship, to out maneuver a dangerous wave. This is a particularly unfortunate choice. The waves are moving faster than the boat can go. A

40 ft .breaking wave will be moving at a speed of approximate 23 knots. The breaking wave is completely random. Furthermore, by far the most important concern is that, if the boat is moving through the water, the chance of being caught by the wave and surfing to a dangerously high speed is greatly augmented.

In the modern world we have an understanding of storm waves. There is no more mystery. Such terms as "rogue waves" serve to confuse the issue. For over a hundred years we have had an engineering grasp on non-breaking waves but it is only in the last 30 years or so that we have been able to determine the position, velocity and acceleration of every water particle in a dangerous breaking wave.

A final misconception is the belief that a breaking wave "strikes" the boat and that the moving water in the crest does the damage. Actually, the boat is lifted by the forward face of the wave with no impact. When it reaches the breaking crest the boat velocity is close to the wave velocity. The crest water is aerated and has little damage potential. Damage to the boat is incurred when the boat is thrown ahead of the wave and impacts the green water in the trough. The leeward side and the deck are struck. A careful reading of "Fastnet Force Ten" and "Fatal Storm" will confirm this conclusion.