

## SYNOPSIS

During the late evening of 2 February 2007, the owner and four crew of the Max Fun 35 yacht *Hooligan V* sailed from Plymouth towards Southampton following out of season repair and maintenance. At about 0320 (UTC) on 3 February, the boat's keel became detached and the boat capsized, causing the loss of life of one crew member.

*Hooligan V* was the first of 10 yachts in a class developed by the Dutch yacht designer Maarten Voogd, for use in Recreational Craft Directive (RCD) Category B waters. The yacht was apparently designed following the American Bureau of Shipping (ABS) standards. It was built by Breehorn BV in Woudsend in The Netherlands and marketed by Max Fun Boats BV.

Unbeknown to the designer, the builder sub-contracted construction of the hollow keel to a steel fabricator who had no marine experience. The fabricator changed the design of the keel to ease manufacture and to reduce costs but without adequately assessing the stresses to which the keel would be subjected in service.

In 2005, the owner of *Hooligan V* contracted a UK yacht designer to optimise the yacht for IRM and IRC<sup>1</sup> racing. This involved adding a further 160kg to the keel bulb.

At the end of a successful 2006 racing season, the yacht was delivered to Queen Anne's Battery in Plymouth for repairs and maintenance. When the boat was taken out of the water, a considerable amount of detachment of the keel's epoxy filler and anti-fouling was found. There was also evidence of the likelihood of fine cracking in the steel adjacent to the fillet weld, but this went undetected. At the end of January 2007, the boat was put back into the water for the delivery voyage from Plymouth to Southampton.

In the meantime, the owner of *Hooligan V* had interviewed a number of prospective new crew for the forthcoming 2007 season. He offered places on the delivery voyage to two of the more experienced candidates.

The owner met with his crew at Southampton at 1200 on 2 February 2007 and advised them that he intended to sail at about 0700 the following day. The two nominated watch leaders were very experienced and had frequently sailed in races with the owner. The group drove by car to Plymouth, arriving at *Hooligan V*'s berth at about 1630, then set about checking the boat over for the delivery voyage. The two new crew members were briefed on the safety gear, layout of the boat, equipment and sailing procedures.

At about 1830, the group went ashore for dinner when it was agreed to sail later that evening because of the favourable weather conditions. The group returned to *Hooligan V* at about 2200, made final preparations for sea and donned their foul weather gear. The owner allocated the 3 hour watches commencing at midnight, and decided that he would assume an "on call" role.

At about 2300 *Hooligan V* motored out towards the eastern entrance of Plymouth breakwater. Visibility was good and there was an 8-10 knot wind from the north-east. At 2335 the boat passed the breakwater and the mainsail and genoa were rigged. The boat was on a port tack, heeling about 15° to starboard and making about 7-8 knots over the ground. Just before midnight the wind freshened and the first reef was put in the mainsail. At midnight, one of the watch leaders and crew went to their bunks. The owner followed at 0045 after putting the second reef in the mainsail.

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<sup>1</sup> These acronyms have no official meaning

By 0245 the wind had increased to 25 knots, gusting 35 knots and the boat was heeling 25° to starboard. At 0300 the relief crew arrived on deck, and after a period of handover the offgoing watch leader went below, but the crew member remained on deck with his relief. At 0315 the heel increased to 30°. The off watch leader returned on deck and preparations were made to put the third reef in the mainsail, the genoa having already been 2/3 furled.

Before the mainsail could be reefed, the list rapidly increased and at about 0320 the boat very quickly inverted, trapping the skipper inside the cabin. Once in the water, three of the crew found their way to the transom and immediately noticed that the keel was missing. As they set about cutting the liferaft lashings, the skipper managed to push the flare box and grab bag out of the cabin. These floated to the surface and the flares were set off. At the third attempt, the skipper escaped from the cabin, but there was no sign of the fourth crew member. Despite repeated shouts, there was no response from him.

Fortunately, the crew managed to release the liferaft and set off more flares. The crew were finally rescued at 0430 by a nearby ship. The body of the missing crew member was recovered by Salcombe lifeboat at 0655.

*Hooligan V* was salvaged and brought into Plymouth. On investigation it was found that the fabricated keel had failed just below the fillet weld connecting the fin to the taper box which was inserted into the hull. Laboratory metallurgical analysis confirmed that the keel had suffered fatigue failure in the fillet weld area, which had been subjected to high bending stresses. Defects were also found in the keel taper box welds and two of the three keel bolts had also failed.

Independent analysis of the “original” design calculations confirmed that they did not achieve the required Safety Factor. Further analysis of the keel design, as built, showed this failed to achieve the required safety factor by an even larger margin and that the subsequent addition of extra bulb weight in 2005 had exacerbated the situation. *Hooligan V*'s fabricated keel was unable to withstand the “in service” bending stresses and this led to the conditions of fatigue failure and consequent capsizing of the boat.

*Who Cares*, a Dutch owned Max Fun 35 yacht had also suffered fracture of its keel, but in this case the cracking was noticed before the keel completely failed. The existence of this second case provided confirmatory evidence about the inadequacy of the keel design and construction.

As a result of the MAIB investigation, the Max Fun 35 yacht keel has been redesigned and now exceeds the minimum required safety factor. New keels have been fitted to 7 out of the 9 remaining boats.

**Recommendations include:**

- The need to ensure that the appropriate safety factor is applied to designs and that the build standard is fully documented.
- An amendment to be made to the Recreational Craft Sectoral Group Guidelines to include keel construction standards.
- The safety issues identified in this report to be promulgated to the marine industry.