MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

ACCIDENT REPORT

SERIOUS INJURY | REPORT NO 25/2011 | DECEMBER 2011

Serious injury on board the yacht *LIQUID VORTEX* 28 May 2011

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SUMMARY

On 28 May 2011, a 23 year old crew member on board the commercially operated sailing yacht *Liquid Vortex* **(Figure 1)** was seriously injured when the vessel gybed. The gybe occurred when the yacht was running downwind in the Myth of Malham offshore race in the English Channel.

The crew member was at the helm when she was knocked to the deck by the mainsheet. She sustained head and spinal injuries and was evacuated by helicopter to Plymouth, England where she was hospitalised for 2 months.

The MAIB investigation identified that the yacht's skipper had not adequately assessed the risks of leaving a relatively inexperienced crew member to steer the vessel unsupervised before he moved to the foredeck to help unwrap a spinnaker from around the forestay. It also identified weaknesses in the vessel manager's policies and practices when providing racing instruction.

A recommendation has been made to the vessel's owner intended to improve the safety of crew on board its yachts, particularly when undertaking activities such as offshore racing.

Figure 1

Liquid Vortex

FACTUAL INFORMATION

The accident (all times UTC)

At 0740 on 27 May 2011, the Myth of Malham offshore race was started off Cowes, Isle of Wight. The 230nm race to the Eddystone Lighthouse and back to Christchurch Bay **(Figure 2)** was organised by the Royal Ocean Racing Club (RORC). Among the 140 yachts competing in the race was *Liquid Vortex*, a Beneteau First 40.7. On board *Liquid Vortex* were her skipper, mate, and eight paying crew.

The crew were equally divided into two watches. It was planned that each watch would sail the yacht for 3 hours before taking 3 hours rest. The skipper and mate intended to work a similar system, but with the time of their handover staggered to occur halfway through each watch.

As the yachts cleared the sheltered waters of the Solent, the wind was west-north-west Force 4 but was forecast to increase to Force 5 to 6, and back to the south-west. During the passage towards the Eddystone Lighthouse, *Liquid Vortex* was sailed close to the wind, with a full mainsail and No.1 genoa rigged for much of the time. Most of the crew stayed on deck throughout the day, some to try to avoid the onset of seasickness; many took a turn at the helm under the supervision of the skipper.

At approximately 0600 the following morning, *Liquid Vortex* rounded Eddystone Lighthouse and her crew replaced the genoa with a light running spinnaker in order to make best speed downwind. The wind was now westerly at over 25kts and the sea was moderate to rough.

At about 0930, the yacht was sailing downwind, with the wind on the starboard quarter and the mainsail out to port **(Figure 3a)** when her spinnaker suffered a major tear.

The skipper took the helm and ordered the mate to replace the torn sail with a smaller but heavier spinnaker. He then deliberately gybed the yacht onto a heading of about 070° to put the mainsail on the starboard side **(Figure 3b)**. The mate and two of the crew went onto the foredeck, lowered the damaged sail and began to hoist the heavier spinnaker. As they did so, the spinnaker became wrapped around the forestay.

The skipper shouted instructions to the mate regarding how to unwrap the sail, but communication between them was difficult due to the noise of the wind and the flapping spinnaker. The skipper became frustrated by the foredeck crew's inability to resolve the problem, so he decided to go forward to take charge of the situation himself.

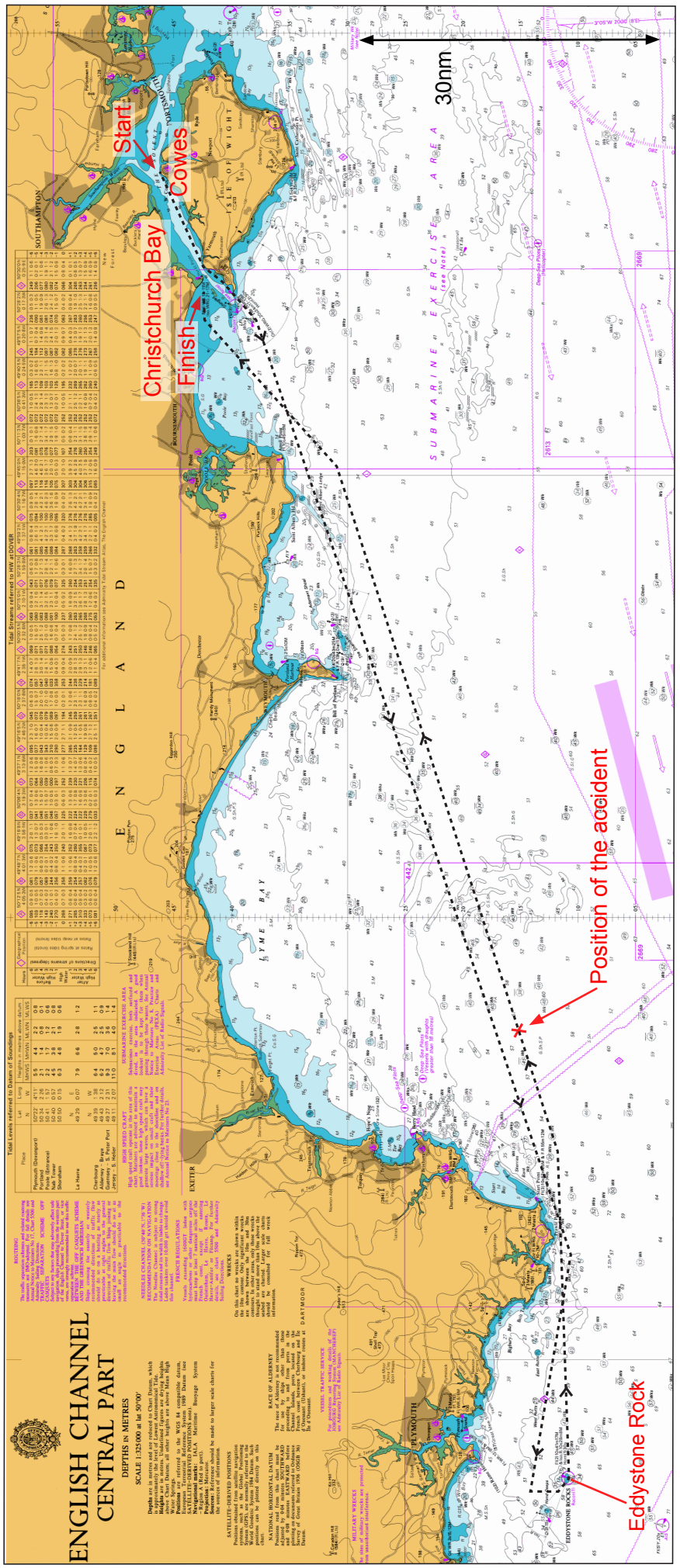
He handed the helm to the nearest member of the crew, a 23 year old female, and told her to "*alter course to 040°*". The helmswoman complied and brought the yacht's heading towards 040° **(Figure 3c)**. The helmswoman had steered the yacht the previous day but this was the first occasion during the race that she had steered the vessel when running downwind. Before the skipper left the cockpit, he noticed a fishing vessel on a westerly heading off the yacht's starboard bow, but he did not consider that it would present a hazard.

The helmswoman and a second crewman in the cockpit soon became concerned that there was a risk of collision with the fishing vessel. The helmswoman and the crewman shouted to the skipper on the foredeck and asked for guidance. In response, the skipper pointed over the port side and shouted "*go around the bow*". He also shouted several times "*do not gybe*".

The helmswoman was uncertain about the skipper's instructions. She put the helm to starboard and, without warning, the yacht gybed, causing the boom, mainsail and between 5m and 6m of the mainsheet to swing rapidly across the cockpit from the starboard side to its port side **(Figure 3d)**. The helmswoman was knocked to the cockpit deck **(Figure 4)**. The crewman in the cockpit immediately took over the helm and the yacht was again gybed unintentionally.

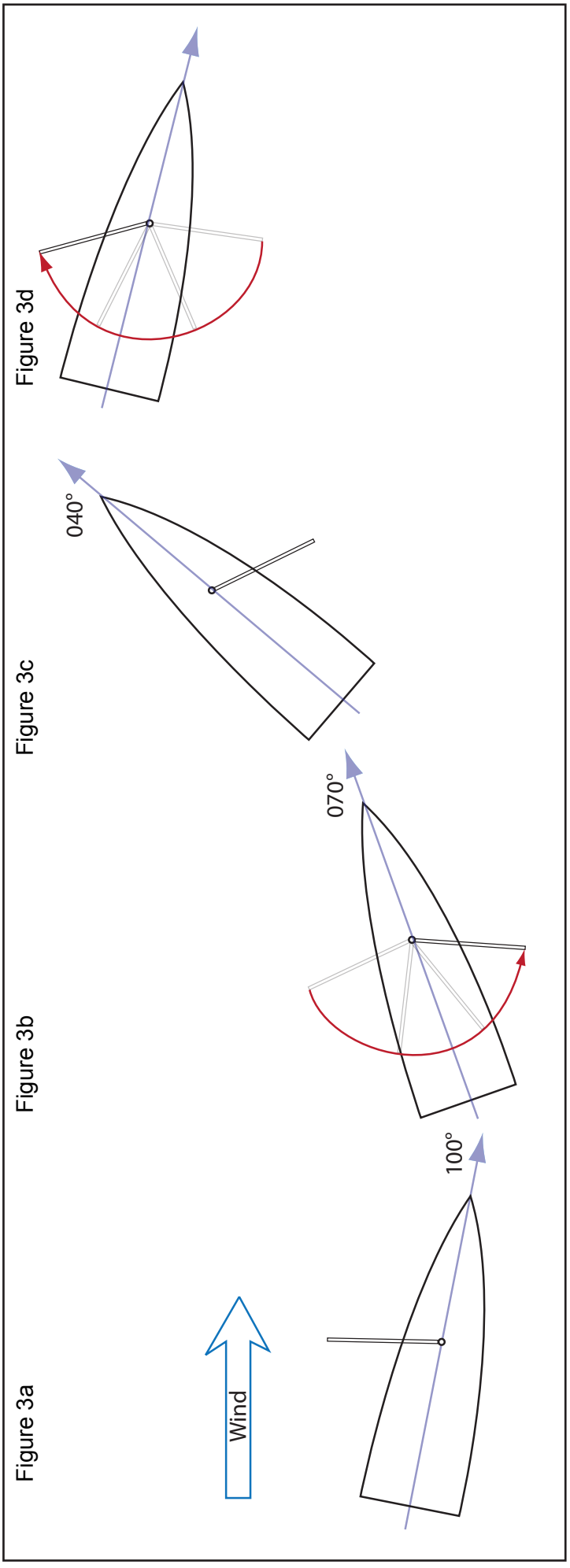
Reproduced from Admiralty Chart BA 2656 by permission of the Controller of HMSO and the UK Hydrographic Office

Figure 2



The RORC *Myth of Malham* offshore race

Figure 3



Movement of the vessel and effect on boom position

Figure 4

Cockpit deck behind the wheel where the helmswoman lay after the accident

Post accident actions

The skipper quickly returned to the cockpit and transmitted a “Mayday” call via VHF radio Channel 16, while the mate established that the helmswoman’s airway was clear, and tried to place her in the recovery position. The helmswoman was bleeding from a head wound and appeared to be unconscious. She also had a mark on the right-hand side of her jaw, later identified as a rope burn. The yacht’s sails were lowered and her engine was started; the skipper then began to steer *Liquid Vortex*, under power, towards the shore.

The “Mayday” call was heard by Brixham coastguard and, at 1019, a rescue helicopter was tasked to assist. It arrived on scene at 1047 and a winchman was lowered from the helicopter into *Liquid Vortex*’s cockpit **(Figure 5)**. After an initial assessment, the helmswoman was then repositioned on the cockpit deck and examined by the winchman who was concerned that she might have sustained a neck or spinal injury. He was unable to fit her with a neck brace as her foul weather clothing was in the way, and instead used a rolled up towel to support her neck.

An attempt was made to lower a stretcher from the helicopter but this was not possible due to the vessel’s motion. The winchman was concerned about the casualty’s condition, and opted to lift her using a double sling. Once the helmswoman was secured into the double-sling, the helicopter winch controller began to hoist her towards the helicopter. Almost immediately, the winchman’s harness caught on the winch wire lifting hook and he was pitched overboard. The helmswoman was safely lifted into the helicopter. The winch wire was then used to recover the winchman from the sea before the helicopter flew the helmswoman to Derriford Hospital in Plymouth. She had suffered a fracture of her upper cervical vertebrae that required her to remain in hospital for 2 months. She has no recollection of the accident.

Liquid Vortex was retired from the race and lay alongside in Weymouth overnight. During the yacht’s return passage to Southampton the following day, the wind speed was gusting up to 42kts, and a boom preventer[1] was rigged. When sailing downwind under full mainsail and No.1 genoa, the yacht was again accidentally gybed. On this occasion, the boom preventer stopped the boom from swinging across the vessel. Instead, the yacht broached heavily and the mainsail was damaged.

Crew

The skipper was 40 years of age and had held a Royal Yachting Association (RYA) Yachtmaster Offshore Certificate of Competence (CoC) since 1990. The certificate was not commercially endorsed. The skipper had worked in the marine industry for a number of years and had gained several thousand miles of yacht racing and cruising experience. He was competitive and expected the best from his boats and their crews.

The mate was 43 years of age and had held an RYA Yachtmaster Offshore CoC since 2010. The certificate was not commercially endorsed. The mate’s RYA logbook indicated that he had sailed 3000 miles as crew or skipper. He was trained in emergency life support, a qualification he had gained through his occupation ashore.

[1] Boom preventer - a mechanical device (usually a rope) on a sailing vessel which limits the boom’s ability to swing unexpectedly across the boat.

Image courtesy of Geoff Moore

Figure 5

Winchman attending to helmswoman after she was repositioned in the cockpit

The crew's previous sailing experience varied and their certification ranged from RYA Day Skipper to RYA Yachtmaster Offshore. The injured woman was French, but spoke good English. She had held an RYA Competent Crew certificate since 2010, and had qualified as a Day Skipper in early 2011. At the start of the Myth of Malham race she had sailed 550 miles as crew.

Many of the crew only managed to sleep between 2 and 3 hours during the 24 hours prior to the accident. Several were also seasick to varying degrees.

Vessel operation and management

Liquid Vortex was owned by Hot Liquid Sailing, a recognised RYA training centre based in Southampton. The company operated two yachts and also provided skippered or bareboat charters, corporate sailing events and participation in yacht races. Its 'Fastnet Campaign' package cost £2995 per person and included two sail training weekends, two shore-based safety courses, three RORC offshore qualifying races, of which the Myth of Malham race was the first, and the Fastnet Race itself.

Liquid Vortex was certified under the Code of Practice for the Construction, Machinery, Equipment, Stability, Operation and Examination of Sailing Vessels of up to 24m load line length, in commercial use and which do not carry more than 12 passengers (the Blue Code). The yacht was allowed to operate up to 60 nautical miles from a safe haven provided a skipper holding a commercially endorsed RYA Yachtmaster Offshore CoC and second experienced person were on board.

Yachts participating in recognised races are exempt from complying with the Blue Code, and for the duration of the race activity instead comply with the International Sailing Federation (ISAF) offshore regulations, and RORC's rules. During the Myth of Malham race, *Liquid Vortex* was required to operate to ISAF and RORC rules, but during non-racing commercial training activity was required to comply with the Blue Code.

Hot Liquid Sailing employed two full-time skippers, both of whom were qualified RYA instructors and taught the centre's RYA courses, but neither was available for the 'Fastnet Campaign'. Consequently, *Liquid Vortex*'s skipper was engaged by Hot Liquid Sailing solely for this purpose. This was the first occasion he had worked for the company and he was not provided with a contract of employment or a job description. Hot Liquid Sailing was not aware that *Liquid Vortex*'s skipper's CoC was not commercially endorsed. The mate was one of Hot Liquid Sailing's customers who had agreed to act as the mate in return for receiving the 'Fastnet Campaign' package free of charge.

Hot Liquid Sailing provided a safety policy and written operating procedures in accordance with guidelines produced by the RYA and the Maritime and Coastguard Agency (MCA) for persons participating in RYA training courses. No written procedures had been developed for other elements of the company's business, including inshore and offshore racing, and the company did not operate a safety management system.

The only significant previous accident involving a vessel operated by Hot Liquid Sailing occurred on 17 January 2011, when *Liquid Fusion*, a yacht on a skippered charter, grounded on the Goodwin Sands after passing the wrong side of a lateral mark. The crew were airlifted to safety and the yacht later sank while under tow by the local lifeboat.

Training

The first of the two training weekends on board *Liquid Vortex*, on 30 April and 1 May 2011, was aimed at familiarising the crew with onboard safety and sailing procedures. The weekend training programme was developed by the skipper, who was keen to establish a good team spirit. It included safety briefs covering boat management, personal management, the procedure for man overboard, and the use of lifejackets. A planned manoverboard drill was cancelled due to lack of time.

It was the skipper's policy that lifejackets, which incorporated safety harnesses, were to be worn from sunset to sunrise. During daylight hours, the wearing of lifejackets was left to personal choice. The use of safety harness tethers was also left to the discretion of each of the crew, but in extreme conditions it was the skipper's policy that all of the crew on deck were to be clipped on.

The skipper was assertive towards the crew during the training in order to try to improve their performance. However, some of the crew felt this had an adverse effect and so chose to ignore less helpful advice and failed to question when in doubt. Towards the end of the weekend, the skipper and mate discussed the sailing abilities of their crew. Although they recognised the crew's limited experience, they were not concerned.

During the training, a number of material defects were identified. Of those, a number were rectified but others, notably: the luff foil on the forestay, instrument illumination, and the rigging of a second mainsail reef, were fully not rectified before the Myth of Malham race.

The crew completed the ISAF safety, and sea survival courses on 14 and 15 May.

RORC Instructions and Guidance

The offshore races organised by the RORC, such as the Myth of Malham and the Fastnet races, are generally acknowledged as being some of the more demanding ocean races available to yachtsmen. The RORC publishes comprehensive instructions, rules and guidance for yachts competing in its races, but it is not a regulatory body and the onus is on the competitors to comply with RORC's rules.

The RORC requires yacht crews competing in its events to wear lifejackets and a safety harness when on deck between sunset and sunrise, when the mainsail is reefed, when the true wind exceeds 25 knots, when alone on deck or when the visibility is less than 1 mile. It also recommends that crews carry out manoverboard drills.

ANALYSIS

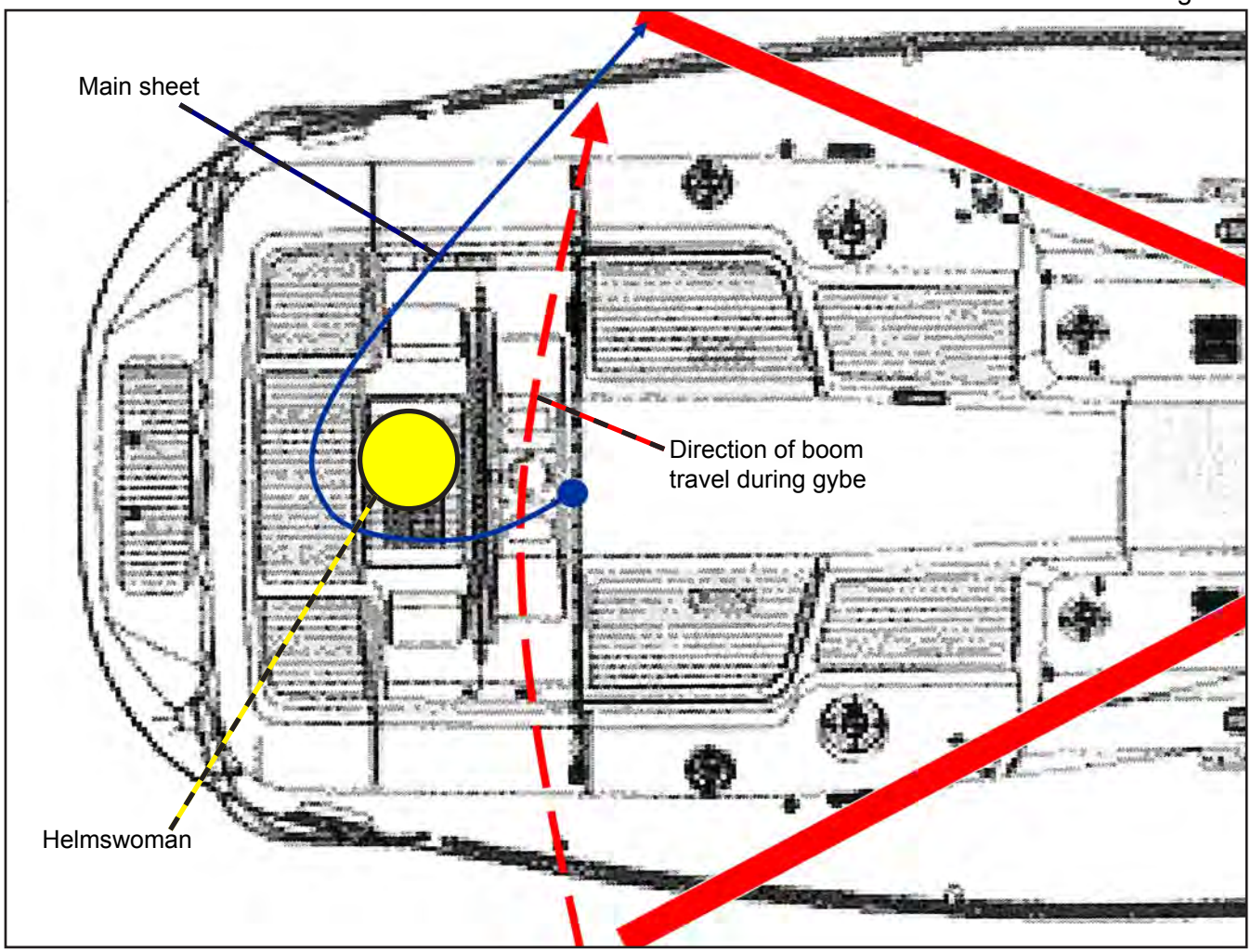
The gybe

As the helmswoman had no recollection of the accident, her reasons for putting the helm to starboard and putting the stern through the wind are not known. She had been told by the skipper not to gybe, and it is highly unlikely that she would have ignored this instruction. Moreover, if the gybe was intended, the helmswoman had sufficient experience to know that she needed to forewarn the rest of the crew.

During the gybe, the mainsail, boom and mainsheet swung rapidly through about 140° from the starboard side to the port side. By design, the aft end of the boom was forward of the helm position **(Figure 6)** and would have swung in front of the helmswoman. However, the speed and force of the swinging boom would have caused several metres of slack line in the mainsheet to be thrown outwards (aft) towards her. The rope burns on the helmswoman indicate that the mainsheet caught her jaw and then knocked her to the deck as it tensioned when the boom swung out onto the port side. Her spinal injury was consistent with her head striking the side of the cockpit with significant force.

The MAIB is aware of numerous injuries resulting from persons being struck by booms, trimming blocks and mainsheets. However, this is the first serious accident the MAIB is aware of involving a helmsperson being struck by a mainsheet. It therefore highlights the potential dangers posed by all running rigging, not just the boom when a yacht is gybed both intentionally and accidentally.

Figure 6



Accidental gybe - movement of the boom and the mainsheet

Decision-making

It is apparent that the skipper's frustration with the replacement spinnaker wrapping around the forestay, the mate's inability to resolve the problem, communication difficulties between the cockpit and the foredeck, and the continued loss of time, triggered him into leaving the cockpit to take charge on the foredeck. In doing so, he left the responsibility for steering the yacht in difficult wind and sea conditions to the helmswoman, whose ability in this respect was unproven.

It is evident from the skipper's precaution of telling the helmswoman to steer 40° before he left the cockpit, that he was aware of her potential limitations. On this heading, the relative wind was closer to the port beam, and the risk of an accidental gybe was reduced considerably. However, in his haste to move forward, the skipper did not fully assess how this change of heading might impact on the risk of collision with the fishing vessel. Consequently, instead of the helmswoman having the relatively straightforward task of keeping the yacht on a heading of 040°, she now had to manoeuvre to keep clear of the fishing vessel. This was a far more difficult task that was compounded by the ongoing communications difficulties between the foredeck and the cockpit. The helmswoman's uncertainty about the action the skipper wanted her to take could have been avoided had the skipper remained in, or returned to, the cockpit until the fishing vessel was past and clear.

Race training

Liquid Vortex's crews' participation in the 'Fastnet Campaign' was different to the mainstream sail training, which is usually focused on RYA sailing courses leading to recognised qualifications. The crew, who were all qualified to at least RYA Day Skipper level, had paid to undertake a package of training and offshore racing that would enable them to compete in the Fastnet Race. Therefore, the training necessarily included the use of racing techniques, and procedures that were intended to develop teamwork.

There can be a considerable difference between cruising and racing yachts in respect to the speed at which activities such as sail changes are undertaken, and the risks involved. Consequently, when training crews to race, it is important that the transition from cruising to racing techniques is progressive and takes into account individuals' abilities and the prevailing sea and wind conditions. Skippers need to balance effective training and crew welfare against the pressures to press on with maximum sail to achieve the best placing possible.

The use of time-saving practices frequently employed in yacht racing, such as hoisting a spinnaker without first hoisting a foresail as a wind break, and not using a boom preventer, were not unreasonable. However, they did require careful consideration and additional precautions to be taken. In this case, the skipper was an experienced sailor, and it is apparent that he drove his boat and his crew hard to try and achieve the best possible result. As some of the crew were inexperienced and many were demotivated due to, variously, lack of sleep, physical fatigue and seasickness, given the challenging weather and sea conditions a more cautious and encouraging approach was warranted.

Safety management

The 'Fastnet Campaign' was a commercial venture in which Hot Liquid Sailing aimed to gain financially. Therefore, the company had a responsibility to *Liquid Vortex*'s crew to ensure that they were trained in a safe environment, taking into account their differing abilities.

However, several shortcomings indicate that the company had not properly considered how the training of *Liquid Vortex*'s crew in offshore racing was to be conducted, including:

- The lack of risk assessments
- Not specifying the role and responsibilities of the skipper

- The failure to check that the skipper's CoC was commercially endorsed as required by the Blue Code

- The outstanding material defects on board *Liquid Vortex* at the start of the Myth of Malham race; and

- The failure to ensure that the RORC recommendation regarding the conduct of manoverboard drills was followed.

Instead, the training and welfare of *Liquid Vortex*'s crew was left almost entirely to the skipper's discretion.

Response and rescue

In view of the unconscious state of the helmswoman following the accidental gybe, the skipper's decision to broadcast a 'Mayday' was fully justified. The call enabled a rescue helicopter to be quickly on scene and evacuate the helmswoman to a hospital ashore. The problems encountered by the winchman when attending to the casualty clearly illustrate the potential difficulties in rescuing persons from confined decks in marginal sea conditions. In this case, the initiative shown by the winchman in using a rolled up towel in lieu of a neck brace possibly prevented further injury, particularly as the helmswoman could not be immobilised on a stretcher.

CONCLUSIONS

- The gybe that led to the helmswoman's injuries occurred when she was manoeuvring the yacht in order to avoid a fishing vessel, and was unintentional.

- The helmswoman was stuck by the mainsheet rather than the boom.

- When the skipper left the cockpit to help the mate unwrap a spinnaker from the forestay, he had not fully assessed the potential risk of collision with the fishing vessel.

- Communication between the skipper on the foredeck and the helmswoman in the cockpit was difficult, and possibly led to the helmswoman's misinterpretation over the action the skipper told her to take.

- Some of the crew were inexperienced, tired and lacking in motivation. Given the challenging sea and weather conditions, a more cautious and encouraging approach to their training was warranted.

- *Liquid Vortex*'s managers had not properly considered how the training of her crew in the 'Fastnet Campaign' was to be conducted.

ACTION TAKEN

Hot Liquid Sailing Ltd has:

Begun to develop operational procedures to cover the conduct of the training of its yachts' crews involved in racing.

RECOMMENDATIONS

Hot Liquid Sailing Ltd is recommended to:

2011/148 Establish a robust safety management system to ensure:

- The risks to its vessels and crews engaged in commercial operations are identified and thoroughly assessed
- Comprehensive operational procedures and guidance are developed to mitigate such risks
- Management oversight to ensure compliance with its procedures, once these are established.

YACHT PARTICULARS

Vessel's name	*Liquid Vortex*
Flag	UK
Classification society	Not applicable - coded under the MCA Code of Practice for small commercial sailing vessels
IMO number	Not applicable - SSR no. 113244
Type	Beneteau "First 40.7" sailing yacht - fractional sloop
Registered owner	Hot Liquid Sailing Ltd
Manager(s)	Hot Liquid Sailing Ltd
Construction	Glass reinforced plastic
Length overall	11.99m
Displacement	6900kg

VOYAGE PARTICULARS

Port of departure	Southampton
Port of arrival	Weymouth
Type of voyage	Yacht race
Manning	10

MARINE CASUALTY INFORMATION

Date and time	28 May 2011
Type of marine casualty or incident	Serious injury
Location of incident	Lyme Bay
Place on board	Helming position aft of the wheel
Injuries/fatalities	One crew member - fracture to upper vertebrae and head injuries
Damage/environmental impact	None
Vessel operation	Racing
Voyage segment	Mid-water
External & internal environment	Wind: SW 5-6 Sea state: moderate to rough Visibility: moderate
Persons on board	10