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“The sole objective of the investigation of an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 2012 shall be the prevention of future accidents through the ascertainment of its causes and circumstances. It shall not be the purpose of an such investigation to determine liability nor, except so far as is necessary to achieve its objective, to apportion blame.”

**NOTE**

This report is not written with litigation in mind and, pursuant to Regulation 14(14) of the Merchant Shipping (Accident Reporting and Investigation) Regulations 2012, shall be inadmissible in any judicial proceedings whose purpose, or one of whose purposes is to attribute or apportion liability or blame.

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## Vector 40R powerboat, contact with a navigation buoy

### in Southampton Water

13 May 2015

### SUMMARY

At 0817 (UTC + 1<sup>1</sup>) on 13 May 2015 a Vector V40R powerboat hooked, inverted and made contact with a navigation buoy near the entrance to the River Hamble, Southampton Water. As a result of the accident one of its four occupants was seriously injured and the others required hospitalisation.

The boat had been taken onto Southampton Water from its base on the River Hamble to test the performance of its engines following a refit. The boat had reached a maximum speed of 87 knots<sup>2</sup> (100 miles per hour) during the test and was being returned to its base when the accident occurred.

Three of the occupants escaped from the upturned boat but one, the driver's son, was unconscious inside the cockpit. The driver dived back under the boat and brought his son to the surface, where he was resuscitated.

No written risk assessment for the test had been undertaken and the control measures in place were insufficient. No notice of the intended high speed test had been given to the relevant harbour authority. None of the occupants were wearing seatbelt harnesses or helmets, although this equipment was available as its use was mandatory when the boat was participating in organised racing events.

A recommendation has been made to the vessel's owners designed to ensure that appropriate safety requirements are applied whenever the vessel is driven at planing speed.

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<sup>1</sup> UTC = Universal Co-ordinated time

<sup>2</sup> knots (kts) = a measure of speed, it measures nautical miles an hour (1 nautical mile = 1852metres)

## FACTUAL INFORMATION

### Vessel

The Vector V40R powerboat involved in the accident was a fully enclosed (or canopied) 13.1m length offshore racing boat, constructed of glass reinforced plastic. Its hull was stepped and had multiple strakes (**Figure 1**). The boat was powered by two Ilmor V10 engines, each producing 540kW (725hp), which gave a top speed of over 87kts (100mph).



**Figure 1:** Stepped hull with multiple strakes

There were four seats in the enclosed cockpit, two in the front for the driver and co-driver and two in the rear. Access to the seats was through two weathertight hatches located in the cockpit roof. Both hatches were fitted with emergency release mechanisms.

### Background

The boat was owned by Vector World Limited and raced by the Vector Martini Offshore Powerboat team in 2014, its first year of racing, when it won the Cowes Classic Offshore Endurance race. The boat was sponsored by several major companies.

The boat had been operated for about 85 hours in 2014, either racing or attending major sporting events on promotional duties for its sponsors, who had links with Formula 1 motorsport. During these promotional events it was used to take sponsors' guests on high speed rides.

At the end of the 2014 racing season the boat was stored in a workshop at Warsash for hull and engine maintenance. This included removal of the engines, which were returned to Ilmor Engineering Inc. in the USA for overhaul.

The engines were returned to Warsash and reinstalled at the beginning of May 2015, and were workshop tested on 12 May. Following the successful completion of these tests, the decision was taken to carry out a full-power engine commissioning test afloat the following day.

On 12 May, the operator of another powerboat based on the River Itchen, contacted the Southampton Harbour Authority to request its approval to undertake a high speed test run in Southampton Water. The harbour authority advised the operator that the test could take place but that the maximum speed should not exceed 40kts.

## Narrative

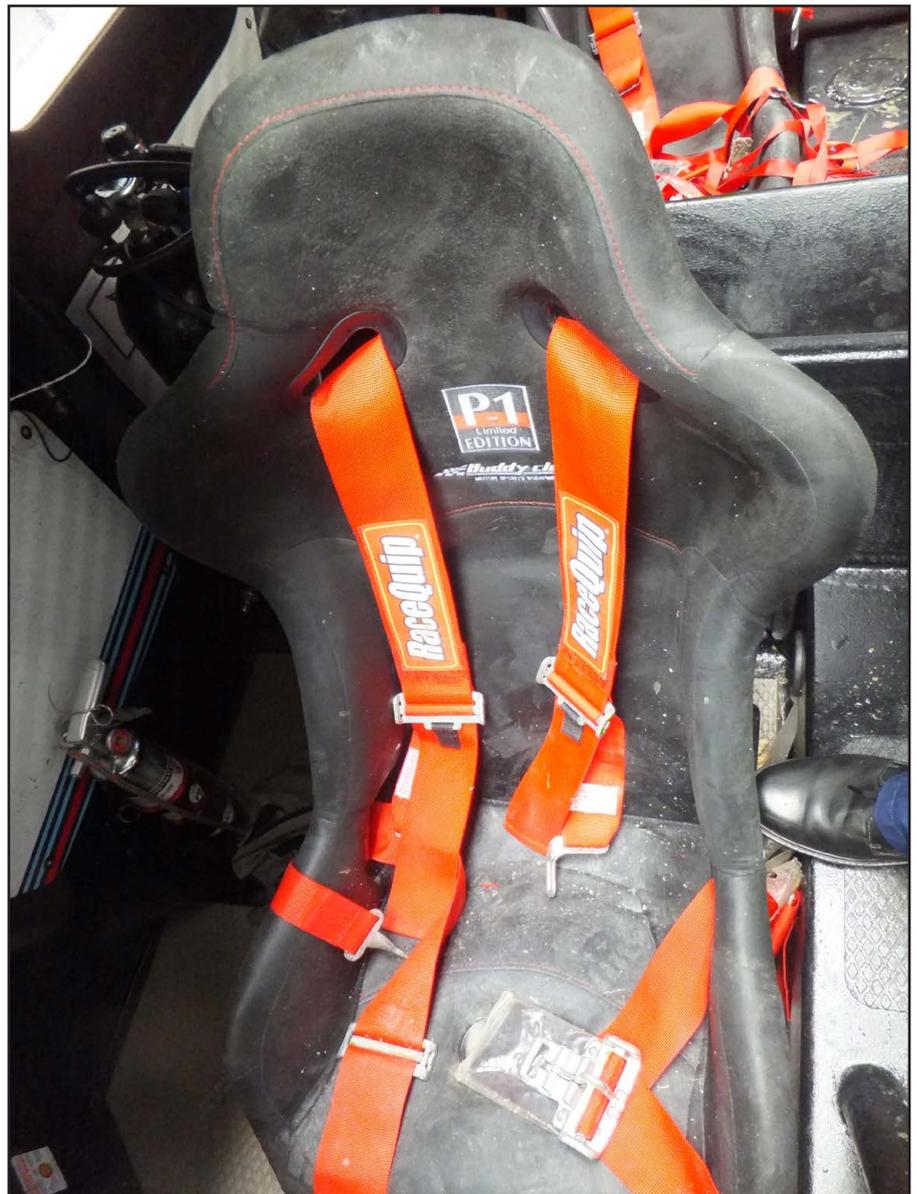
### Engine commissioning test

At 0700 on 13 May 2015 the two crew and their two passengers assembled at the boat's base, in Warsash on the River Hamble. The driver issued the crew and passengers, one of whom was his son, with manual inflation lifejackets and communications headsets. Inflated buoyancy bags were placed in the boat's forward compartment and the boat was then moved from the workshop to the quayside.

At 0740 the boat was craned into the water, checked for watertight integrity, the engines were started and it was manoeuvred to a pontoon where the final boat and engine checks were made. The boat's internal communications system was tested and found to be defective.

At 0755 the boat departed from the pontoon and headed down the River Hamble towards Southampton Water. The crews' and passengers' helmets had been left in the office store and none of the occupants were wearing the 5-point seatbelt harnesses that were fitted to each of the seats (**Figure 2**). During the passage downriver, the driver checked the operation of the engines using an internal camera system and the co-driver<sup>3</sup> monitored the various engine gauges and the boat's navigational systems.

At 0810 the boat passed number 2 Beacon, River Hamble (**Figure 3**), and the driver instructed the others to secure the cockpit hatches. He then turned the boat to starboard onto a north-westerly heading and increased speed to 65kts (75mph) as the boat proceeded up Southampton Water. The wind was light and the sea state was calm.



**Figure 2:** Harnesses (5 point) fitted to each seat

<sup>3</sup> When racing, the co-driver normally operates the throttle, however, on this occasion the driver was both steering and controlling the boat's speed.

Reproduced from Admiralty Chart BA 2038-0 by permission of the Controller of HMSO and the UK Hydrographic Office.

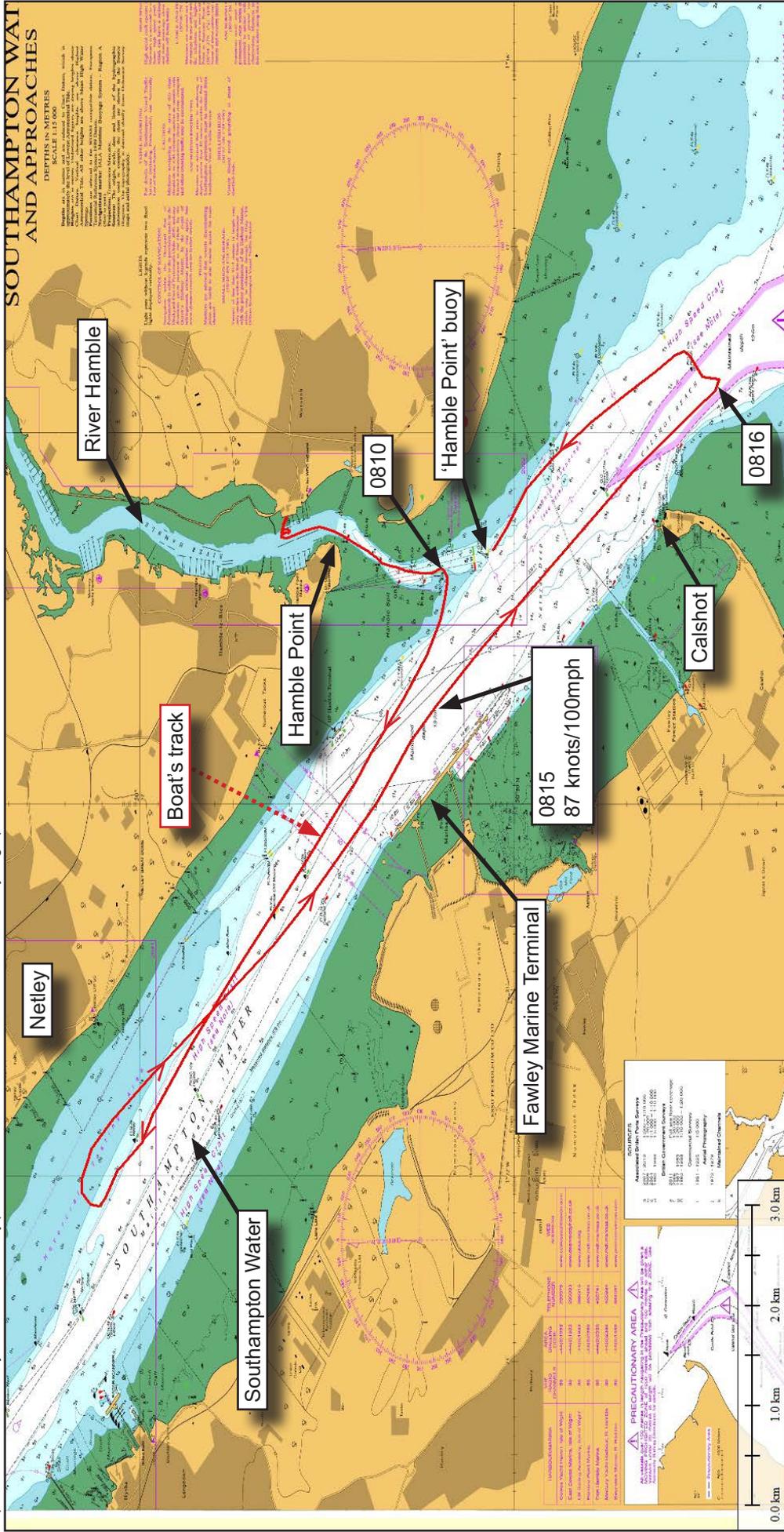


Figure 3: Boat's track during trial

Off Netley, the driver turned the boat to starboard onto a south-easterly heading and increased speed. At 0815 it reached a speed of 87kts (100mph) as it passed the Fawley Marine Terminal (**Figure 4**).



**Figure 4:** 100mph passing Fawley Marine Terminal

At 0816 the driver reduced the boat's speed to execute a turn to port around the *Reach* buoy. He then increased speed to approximately 80kts (92mph) on a north-westerly course to head the boat back towards the River Hamble (**Figure 3**).

At 0817, as the boat approached the *Hamble Point* navigation buoy at approximately 80kts (92mph), the driver began to decelerate and observed a long low wash, approximately 30-45 centimetres high, ahead.

## Accident

When the boat was north-west of the *Hamble Point* buoy the driver turned it to starboard. During the turn he saw two blue objects on the surface of the water ahead of the boat and, thinking that they could be divers' surface marker buoys, the driver applied more starboard helm to avoid them.

As the additional helm was applied the boat hooked<sup>4</sup> violently and turned and heeled to starboard towards the *Hamble Point* buoy. Although the driver reduced throttle speed, and eased the helm, the boat rolled violently back to port, inverted and became airborne, striking the *Hamble Point* buoy (**Figure 5**).

After the contact, still airborne, the boat began to roll to starboard until it landed heavily in the water on its port side. It then settled, inverted, on the surface of the water (**Figure 5**).

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<sup>4</sup> "The term hooking is used to describe a violent alteration of course and deceleration resulting in a significant, momentary, delivery of G-force being exerted on the craft and its occupants." RYA TG04-14 training guidance to powerboat instructors. <http://www.rya.org.uk/coursestraining/resources/keepingcurrent/Pages/TrainingGuidance.aspx>



**Figure 5:** Accident sequence

As a result of the contact, the aft hatch had sprung open allowing water to rapidly enter the inverted boat's cockpit. The driver opened the forward hatch and the co-driver pulled himself out and swam to the surface. The driver then left the cockpit via the forward hatch and confirmed that the aft hatch was open before he surfaced.

On the surface, the driver saw one of the passengers clinging onto a hull fitting, and he instructed him to inflate his lifejacket. He then shouted out his son's name and asked the co-driver, who was on the other side of the boat, if he could see him. The co-driver replied that there was no sign of the driver's son.

The driver then dived back under the surface to search for his son. He entered the aft cockpit hatch opening, pulled himself inside the boat and located his son, who he then pulled out and to the surface.

The driver's son appeared not to be breathing, and he had a compound fracture of his left arm. The driver and co-driver began CPR<sup>5</sup> and his son coughed and took a breath, after which the driver inflated his son's lifejacket. Then, while the co-driver waved to attract the attention of passing craft, the driver kept his son's head clear of the water until they were rescued.

## **Rescue**

The accident was witnessed by a number of people on the shoreline at Hamble Point, some of whom made emergency telephone calls to the coastguard. At 0821, the coastguard initiated a rescue mission, tasking lifeboats from Calshot and a rescue helicopter to attend the scene. Crews of other craft in the area also responded.

The crew of a catamaran workboat, who had heard the accident from their base in Warsash, proceeded to the scene, arriving at 0833. They recovered the driver, his son and the co-driver from the water and administered first-aid. The remaining passenger, who meanwhile had been recovered from the water by another craft, was also transferred onto the catamaran.

Paramedics from the Calshot lifeboats and the rescue helicopter transferred onto the catamaran at 0839 and provided triage to the casualties while en-route to Warsash, from where they were transferred to hospital.

The driver's son, who was initially in a critical condition, remained in hospital for several weeks, but eventually made a full recovery. The remaining crew were treated for head injuries, lacerations and minor fractures.

## **Crew**

### **Driver**

The driver held a commercially endorsed Royal Yachting Association (RYA) Yachtmasters' certificate of competency. He had over 30 years' experience as a powerboat driver and had extensive knowledge of the waters of the Solent. The driver was a former offshore powerboat racing world champion and held 21 powerboat speed and endurance records. He was the former manager of the RYA's powerboat racing and motor boat department, a post he held for a number of years.

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<sup>5</sup> CPR – Cardio pulmonary resuscitation is a first-aid technique involving rescue breaths and chest compressions

## Co-driver

The co-driver had 35 years' experience as a powerboat driver and had previously been the chairman of the RYA's powerboat racing committee. He also had extensive knowledge of the waters of the Solent.

## Passengers occupying the rear seats

The two passengers were seated in the rear seats at the time of the accident. They were the driver's son, aged 17 years, who had some experience of being on board canopied powerboats; and a hull fabricator who had assisted with the refit and was making his first trip in the boat. The hull fabricator was not familiar with being on board canopied offshore powerboats.

## Harbour Authority

The statutory harbour authority (SHA) for the area in which the accident occurred was Associated British Ports, Southampton.

## Speed limits

Southampton Harbour Byelaws prohibited the navigation of a vessel:

- *At a speed which endangers the safety of any person, other vessel, buoy, moorings, banks of the port or any other property.*
- *At a speed in excess of 6 knots north of an imaginary line between Hythe Pier and Western Shelf buoy.*

## Designated areas, Port of Southampton

Within the Port of Southampton there were designated areas for water-skiing and hovercraft testing. There were no designated areas for high speed powerboat tests.

## Requirements for the marking of fishing gear, Port of Southampton

On 2 January 2014, the harbour authority issued Notice to Mariners 21 of 2014<sup>6</sup> for the laying and marking of fishing gear within its area. This stated that:

*“All laid fishing gear must have a surface mark which is clearly visible, consisting of an appropriate buoy, on which is fitted a vertical standing pole with an identifying flag. The identity of the laying vessel (owner of the gear) is to be clearly displayed on the flag, which is to be visible at all times.”*

The harbour authority had introduced the requirement for fishing gear to be properly marked several years earlier and on occasions had removed gear which was not marked in accordance with its requirements. However, the harbour authority received legal advice that this action might be *ultra vires* its existing legislation.

## Fishing gear markers, 13 May 2015

The two floats seen by the driver as he turned the boat to starboard before the accident occurred, and which he thought were divers' marks, were in fact fishing gear markers that had been laid earlier that day

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<sup>6</sup> <http://www.southamptonvts.co.uk/admin/content/files/NTMs/2014%20No%2021.pdf>

by a fisherman to mark a string of pots. The fisherman had operated in the same area for several years and had used similar 5 litre plastic containers to mark the location of his fishing gear throughout that time (**Figure 6**).



**Figure 6:** Fishing gear marker

### **Port Marine Safety Code and associated Guide**

The Port Marine Safety Code<sup>7</sup> (the Code), states that an SHA is responsible for the safety of marine operations in its harbour area and should develop a marine safety management system to ensure that all risks are controlled. The more severe risks must either be eliminated or kept as low as is reasonably practicable.

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<sup>7</sup> The Port Marine Safety Code was published by the Department for Transport in 2000 [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/415007/Port\\_marine\\_Safety\\_Code.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/415007/Port_marine_Safety_Code.pdf)

In relation to recreational navigation, the Guide to Good Practice on Port Marine Operations<sup>8</sup> (the Guide) defines recreational navigation as involving a wide range of differing activities and craft types, including, inter alia, offshore powerboats, cabin cruisers and yachts.

The Guide states that “*the requirements and priorities of such sports are often at variance - both with each other and with other harbour users and interests. Good management, use of appropriate powers, and consultation are all needed to strike a balance*”.

## Risk assessment

In relation to recreational activity the Guide states that: “*A risk assessment is likely to identify potential conflicts between both commercial and recreational users; as well as between different classes of recreational user. Many of these conflicts are best managed by arranging some form of segregation, bearing in mind that an authority’s powers are to regulate – and not prohibit – the right of navigation*”.

## RYA Powerboat Race Rules

In the United Kingdom, offshore powerboat racing is administered by the RYA which, in association with affiliated powerboat racing clubs, organises and regulates the sport.

The RYA has developed race rules for offshore powerboat racing, which require that the crews of competing boats must:

- *Hold an RYA qualification.*
- *Hold an immersion test certificate (for canopied or partial canopied boats).*
- *Hold a sea survival certificate.*
- *Be over 18 years old.*
- *Wear protective helmets at any time when the boat is on the plane<sup>9</sup>, during the journey to and from the race / muster and during racing and practice or testing.*

In addition, international race rules issued by UIM<sup>10</sup> stated that: *while at an event safety equipment, including harnesses and helmets, must be worn when a boat is on the plane.*

## Previous accident

The MAIB has investigated a number of accidents that resulted in life changing injuries or fatalities that occurred because the vessel involved ‘hooked’ while being turned at high speed. These include:

- On 19 June 2005, a 13 year old boy suffered serious head injuries when the powerboat in which he was the co-driver hooked and was struck by another race boat during a K-200 class Junior Offshore National Championship race in Portland Harbour ([MAIB report 13/2006](#));

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<sup>8</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/417662/guide-good-practice-marine-code.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/417662/guide-good-practice-marine-code.pdf)

<sup>9</sup> When at rest or at slow speed, a speedboat’s weight is borne entirely by static buoyant lift (displacement mode). As a vessel’s speed increases hydrodynamic lift will start to support some of the vessel’s weight and the buoyant force decreases as the vessel partially lifts out of the water. As speed increases further, when the hydrodynamic lift becomes the predominant upward force, the vessel is said to be planing or on the plane.

<sup>10</sup> UIM = Union Internationale Motonautique, the international governing body of power boating.

- On 8 August 2009, a co-driver suffered serious head injuries and died when the race boat he was travelling in hooked and was struck by another race boat during an Offshore Circuit Racing Class A national championships race in Dover Harbour ([MAIB report 7/2010](#));
- On 5 May 2013, a father and his daughter died, and two other members of the family sustained life-changing injuries as the rigid inflatable boat (RIB) they had been travelling in circled out of control. All six members of the family had been violently ejected from the RIB when the boat hooked while undertaking a high speed turn ([MAIB report 5/2014](#)).

MAIB report 5/2014 includes an analysis of how a boat can hook while being turned at high speed. Further information can be found on the Royal Yachting Association website<sup>11</sup>.

## Speed and track information

Following the accident the MAIB recovered a hand-held GPS<sup>12</sup> device from the boat. Position and time data from the day of the accident was downloaded from the device for analysis. The data included some spurious positions where the boat was manoeuvring. However, the positions from straight parts of the track were consistent with other evidence and were used to calculate the boat's speed, where stated in this report.

## ANALYSIS

### Summary

The accident occurred when the boat was being driven back to its base following the engine test. The driver decelerated the boat as it approached the *Hamble Point* buoy and lost control when he increased a turn to avoid fishing gear markers, causing the boat to hook.

The control measures undertaken were insufficient in that the relevant harbour authority was not notified in advance and the passengers and crew were not wearing seatbelt harnesses or helmets for the test, during which the boat reached a top speed of 87kts (100mph).

### Analysis of the hook

The boat was being turned to starboard still travelling at high speed while on the plane when the driver saw the fishing gear markers, and tightened the turn. It is possible that this coincided with the hull coming into contact with the wash waves seen earlier by the driver but, in any event, the lateral forces generated went beyond the capabilities of the hull, causing the keel to lose traction with the surface of the water and the boat to hook.

The transverse acceleration forces generated when the slide stopped, as the keel regained traction with the water, caused the hull to roll violently back to port, become airborne and invert. It was while the boat was inverted that it struck the navigation buoy.

### Risk assessment - safety equipment

No formal written risk assessment had been undertaken before the test so the consideration given to the risks to passengers and crew and other harbour users was not recorded. However, it could be foreseen if the test was successful that the boat would be travelling at speeds of over 100mph on Southampton

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<sup>11</sup> <http://www.rya.org.uk/SiteCollectionDocuments/training/Web%20Documents/RYA%20Training/Instructors/Powerboat%20PW%20and%20IW/Guidance-Powerboat-Insts-on-avoiding-and-mitigating-the-effects-of-a-hook.pdf>

<sup>12</sup> GPS – Global Positioning System

Water and, at such speeds, should anything go wrong the consequences would be significant. Whether the risks to crew and passengers had been identified or not, insufficient control measures were put in place at commencement of the test to mitigate the hazards.

Travelling at high speeds during tests, or for the experience such rides provide, can exert forces on individuals similar to those experienced during racing. Had the boat been entered for a race, the use of harnesses and helmets would have been mandated by the race organisers: this requirement would have been well known to the driver and co-driver. The purpose of the helmets and harnesses is to help protect the boat's occupants from injury in the event of an accident. Had the crew and passengers of the Vector 40R been strapped in and wearing helmets during this accident, it is likely that their injuries would have been less significant.

### **Carriage of inexperienced crew in enclosed cockpits**

The driver and co-driver were both very experienced powerboat operators and were familiar with travelling at high speeds in the waters where the accident occurred. They were qualified to the standards required by the RYA's race rules for offshore racing. However, the two passengers in the boat at the time of the accident were not.

Additionally, during the 2014 racing season, a large number of guests had been carried as passengers on high speed promotional trips in the boat.

These guests were not trained prior to being taken on these trips and it is doubtful that many of them would have had the necessary knowledge or experience to exit the vessel safely in the event of an accident. They would probably have been disorientated and unable to release harnesses, utilise breathing apparatus or egress an upturned vessel without assistance.

Had the boat been entered in an RYA event, all the crew would have been required to be competent in boat-handling as well as trained in underwater diving and escape techniques.

Given the dangers associated with enclosed cockpit racing powerboats, the training and personal safety requirements of the race rules should be applied to all on board such boats whenever they are to be driven on the plane.

### **Harbour Authority requirements**

#### **Speed limits**

The Southampton harbour authority had informed another powerboat operator, also intending to undertake a high speed test in Southampton Water, that a speed of 40kts should not be exceeded. It is probable that the operators of the Vector 40R would have been given the same advice had they consulted the harbour authority before the test.

The Southampton Byelaws 2003 did not prescribe a speed limit for this area of the harbour. However, while the 40kt limit might have been prudent, it would not have been enforceable under the harbour authority's existing statutory powers.

Had there been an enforceable speed limit for the area where the accident occurred, the likelihood of this accident occurring would have been reduced.

#### **Marking of fishing gear**

The harbour authority had issued a local notice to mariners relating to the laying and marking of fishing gear in Southampton Water. However, the harbour authority had received legal advice that it is not able to effectively enforce this reasonable requirement under its existing statutory powers.

The markers that the driver saw did not comply with the harbour authority's requirements. Had the harbour authority been able to enforce its requirements there would have been a greater likelihood that the fishing gear would have been marked appropriately, making it significantly more visible.

Despite the boat's high speed, this accident might have been avoided had the harbour authority's requirements for the laying and marking of fishing gear in Southampton Water been complied with, as the markers might have been seen and recognised at an earlier stage.

### **Notification to the harbour authority**

Southampton Water is a busy waterway used by both commercial and recreational vessel traffic, yet there was no requirement for the driver to notify the harbour authority of the intended test.

While all craft have a right to freedom of navigation in the area, the harbour authority has a duty to regulate navigation in its waters, to ensure that safety is maintained for all harbour users at all times. Had the boat been involved in an RYA event, this would have been arranged in conjunction with the harbour authority so as to ensure that this duty was upheld.

In the interests of safety of navigation, harbour users intending to undertake high speed manoeuvres, or any other activity that could impact on the safety of other harbour users, should notify the harbour authority of their intentions. As recommended in the Guide, this notification should include a risk assessment of the proposed activity together with any control measures that have been identified to ensure the safety of the activity.

### **Driver's actions after the accident**

After the accident, when the driver realised his son was probably still inside the cockpit he did not hesitate in diving back under the boat to locate and rescue him. But for his swift action it is unlikely that his son would have survived.

The driver's actions in diving back into the upturned hull were selfless and commendable.

## CONCLUSIONS

- The driver lost control of the boat causing it to hook and invert while making a turn at high speed.
- No notification was given to the harbour authority regarding the high speed test.
- Insufficient control measures were put in place to mitigate the risks to crew and passengers in the event of an accident, and they were not wearing seatbelt harnesses or helmets for the test, during which the boat reached a top speed of 87kts (100mph).
- In order to safeguard all on board, there is a need for the training and personal safety requirements of the race rules to be applied to all racing powerboats involved in or preparing for organised racing events, including tests, and whenever inexperienced crew or passengers are carried.
- Harbour authority powers:
  - Had there been an enforceable speed limit in Southampton Water the likelihood of this accident occurring would have been reduced.
  - Had the harbour authority's requirements for the laying and marking of fishing gear in Southampton Water been complied with, the markers might have been seen and recognised at an earlier stage, and the accident avoided.
- In the interests of safety of navigation, harbour users intending to undertake high speed manoeuvres, or any other activity that could impact other harbour users, should risk assess the proposed activity and notify the harbour authority.
- The driver's actions in diving into the upturned hull to rescue his son were selfless and commendable.

## ACTION TAKEN

**Associated British Ports, Southampton** has:

- Issued a local notice to mariners regarding safe speed in Southampton Water.
- Liaised with the RYA to promulgate to powerboat operators that tests should be notified to the harbour authority in advance and undertaken in accordance with both harbour authority and race rules' requirements.
- Commenced the legal process to obtain statutory powers to issue Harbour Directions to facilitate its ability to regulate speed limits, the marking of fishing gear, et al, in its statutory harbour area.
- Engaged with local fishermen regarding the marking of fishing gear.

The **Royal Yachting Association** has:

- Liaised with the Southampton harbour authority to promulgate to powerboat operators that tests should be notified to the harbour authority in advance and undertaken in accordance with both harbour authority and race rules' requirements.
- Drafted advice for inclusion in its 2016 powerboat racing rules that operators of powerboats preparing for an organised racing event should follow the same safety principles while preparing their boats as would apply to their boats during the organised racing event itself.
- Reviewed PB1<sup>13</sup> Offshore Rules to include guidance on the safe conduct of tests.

## **RECOMMENDATIONS**

**Vector World Limited** is recommended to:

2016/105 Ensure that whenever its powerboats are driven on the plane, the activity is carried out in accordance with the safety requirements of UIM/RYA Race Rules.

Safety recommendations shall in no case create a presumption of blame or liability

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<sup>13</sup> PB1: The handbook for offshore Power Boat racing.

## SHIP PARTICULARS

Vessel's name	Vector V40R
Type	Offshore powerboat
Registered owner	Vector World
Year and place of build	2014, British Columbia, Canada
Construction	Glass Reinforced Plastic
Length overall	13.1m
Engines	2 x V10 Ilmor petrol engines
Power	540 kilowatts (725hp) each engine

## VOYAGE PARTICULARS

Port of departure	Warsash, River Hamble
Port of arrival	Warsash, River Hamble
Manning	4

## MARINE CASUALTY INFORMATION

Date and time	13 May 2015, 0817
Type of marine casualty or incident	Serious Marine Casualty
Location of incident	Southampton Water
Place on board	Whole vessel
Injuries/fatalities	1 serious injury, 2 minor injuries
Damage/environmental impact	Nil
Ship operation	Engine test
Voyage segment	Entering port
External & internal environment	Calm, smooth sea. Enclosed cockpit
Persons on board	4