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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 such an 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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Fatality following capsizing of Fletcher speedboat

Tor Bay

2 May 2015

SUMMARY

At approximately 1142 (UTC¹+1) on Saturday 2 May 2015, an unnamed Fletcher speedboat with one adult and three teenage children on board capsized after encountering a large wave. Three of the occupants managed to swim clear of the upturned hull but one of the children became trapped. Despite valiant attempts to free her, she was only recovered following attendance of the RNLI² lifeboat 25 minutes later. Although medical treatment then started immediately, she never recovered consciousness.

The investigation found that a strap on the back of the girl's buoyancy aid had become snagged on the speedboat's starboard aft mooring cleat. The buoyancy aid she wore was not a close fit, increasing the opportunity for it to become snagged. In addition to the speedboat's course and speed in the prevailing sea conditions,

¹ UTC Universal co-ordinated time

² RNLI Royal National Lifeboat Institution



Fletcher 155 speedboat

potential contributing factors that led to the boat's capsize were the fitting of a new propeller to the outboard engine, the small quantity of fuel in the bow tank and the manner in which the engine speed was increased prior to the accident.

The Royal Yachting Association and British Water Ski and Wakeboard intend to publicise the safety issues from this accident which include: the need to consult weather forecasts before taking craft to sea; potential shortcomings of boats constructed prior to 1996; the need for buoyancy aids and lifejackets to be a close fit and; the importance of wearing a kill cord when operating a speedboat. As a consequence, no recommendations have been issued with this report.

FACTUAL INFORMATION

Narrative

The Fletcher 155 speedboat involved in the accident was co-owned by two men, both in their 50s, who were part of a group of families and friends who were visiting Brixham over the May bank holiday weekend. One of the co-owners, who had taken his two jet skis to Brixham, had arrived the day before the other co-owner with the aim of getting afloat, but sea conditions were deemed unsuitable to launch the jet skis. On the day of the accident, the other co-owner had taken the speedboat to a local petrol station, where he put £20 of petrol in the boat's nearly empty fuel tank. Then, with his daughter and her two friends, one of whom was 14 year-old Emily Gardner, they proceeded to Brixham public slipway (**Figure 1**), which is adjacent to the RNLI lifeboat station, to launch both jet skis and the speedboat.

At 1100 the jet skis were launched and then ridden around and outside the harbour area while the speedboat was launched. The three girls were each wearing wetsuits and buoyancy aids. The co-owner/driver of the speedboat was wearing a semi-dry suit and a water ski impact vest, as the buoyancy aid he normally wore was being worn by Emily. As the speedboat departed the slipway (**Figure 2**), the co-owner was helming with his daughter sitting beside him, and the two other girls were sitting on the stern bench. The jet ski owner drove one of the jet skis while his 18 year-old son drove the other. The speedboat driver had forgotten to attach the kill cord after boarding the speedboat.

Shortly after 1134, the three vessels started to make their way slowly across the harbour, with one jet ski in front and the other behind the speedboat. A few minutes later, the vessels passed the end of the breakwater into rougher water that was described as 'lumpy', but with no 'white horses'³. The jet skis accelerated and the driver of the speedboat opened the engine throttle to almost full speed to accelerate the boat onto the plane.⁴

Less than a minute later, at approximately 1142, the speedboat's starboard side hit a large wave and the boat capsized to port. The speedboat initially floated in a horizontal attitude, inverted, and the driver and two of the girls were able to swim clear. However, the stern of the boat then started to sink under the weight of the engine, which had stopped running when the speedboat capsized.

Emergency response

The view of the speedboat from the jet ski behind had been obscured as the large wave had passed through. When the jet ski driver next saw the speedboat, it was inverted. He immediately went to assist those in the water, and was joined shortly afterwards by his father, the driver of the jet ski ahead, who

³ 'White horses' refers to the white foam seen on the tops of waves as they start to break; in general, the greater the wind strength the more white horses are visible.

⁴ 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 predominate upward force, the vessel is said to be planing or 'on the plane'.

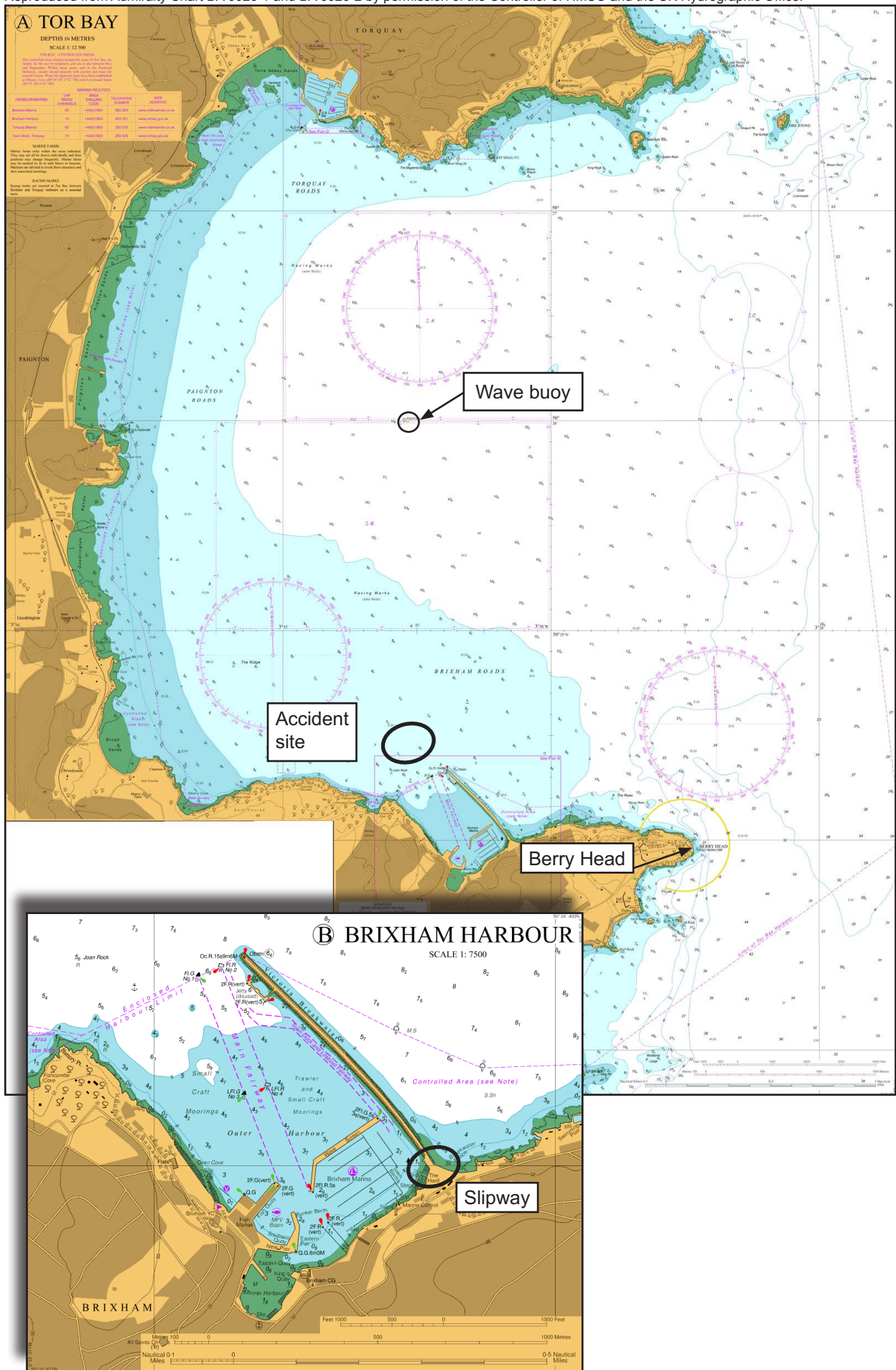


Figure 1: Brixham harbour and slipway location



Figure 2: CCTV screenshot of fletcher speedboat and two jet skis at 1134 on 2 May 2015

had glanced over his shoulder and seen the inverted speedboat. It quickly became apparent that Emily was missing, trapped under the boat, which sank by the stern until it settled floating in a vertical attitude with approximately 1m of its bow above the water (**Figure 3**). Numerous unsuccessful attempts were made by those in the water, including the jet ski drivers, some of whom removed their buoyancy aids to swim down, to try and release Emily.

At 1146, the alarm was raised following two reports from members of the public ashore and, at 1152, Solent Coastguard paged the Tor Bay inshore and all-weather lifeboats. Several vessel skippers also responded, including that of the yacht *Wavelet*, who recovered one of the girls, and the skipper of the Tor Bay ferry, *Silver Sea*, who secured

a line to the speedboat's bow and provided a lifebuoy to the speedboat driver, who was having difficulty staying afloat. After retrieving the jet skis, which had floated away during the efforts to free Emily, the son returned to the slipway to get help, arriving at 1156. This resulted in one of the family party calling for ambulances and another rushing to the adjacent lifeboat station where crew members were preparing to launch the lifeboats. The speedboat co-owner on his jet ski retrieved the other girl from the water and took her ashore before returning to the scene and recovering the speedboat driver.

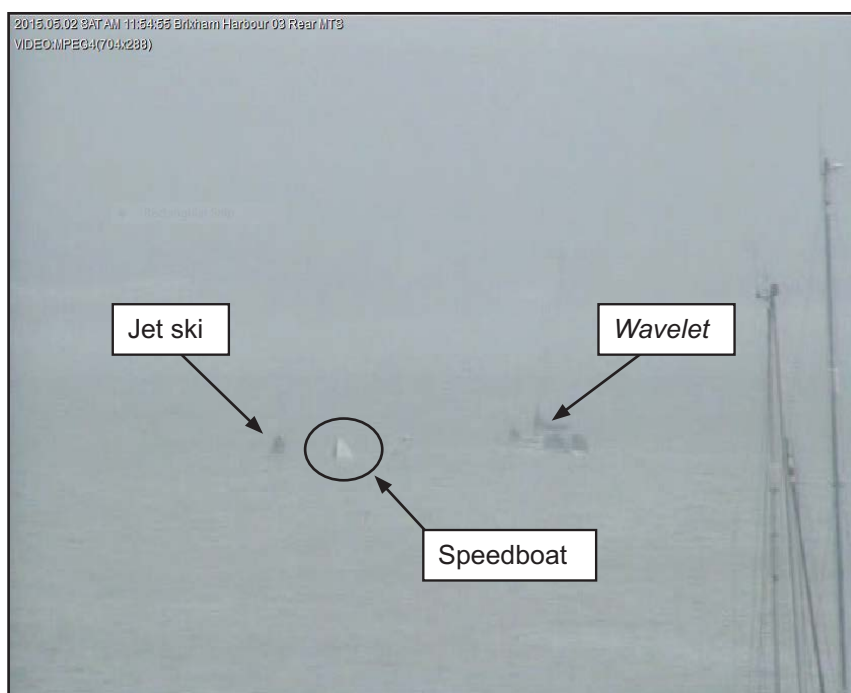


Figure 3: CCTV screenshot at 1155 on 2 May 2015

At 1200, the inshore lifeboat (ILB) was launched and, just over a minute later, the all-weather lifeboat (ALB) slipped from its berth and headed towards the end of the breakwater. Once on scene the ALB crew attached the speedboat's stem D ring to the Hyab crane on the stern of the ALB, and then lifted the speedboat enough for two lifeboat crewmen to release Emily's buoyancy aid strap from the aft starboard mooring cleat (**Figure 4**). By 1207, she was transferred onto the ALB, where cardiopulmonary resuscitation was carried out by a doctor and paramedic, both of whom were lifeboat crew members.

At 1214, the ALB arrived back at its pontoon and Emily was transferred immediately into a waiting ambulance, where treatment continued. The other casualties were assembled in the lifeboat station and then transferred to hospital to be treated for shock, hypothermia, water inhalation and other minor injuries. Emily was taken to hospital but sadly never recovered consciousness and was determined to have died from drowning.

Speedboat owners

The speedboat driver, who was a co-owner of the boat, had water skied and driven speedboats since the age of 25 years. He had owned water ski boats in the past and more recently owned a jet ski before buying the Fletcher speedboat. In 1997, he obtained a ski boat driver award from the British Water Ski Federation (BWSF) (now known as British Water Ski and Wakeboard). He had frequently operated in the Tor Bay area and other coastal locations, as well as on lakes.

The owner of the two jet skis, who was driving one of the jet skis at the time of the accident, was the

co-owner of the speedboat and had been a friend of the other co-owner for many years since meeting in Brixham when water skiing. He had water skied and driven speedboats for about 20 years and had attended the same BWSF ski boat driver's course in 1997.



Figure 4: Aft starboard mooring cleat

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The Fletcher speedboat

The 26-year old Fletcher 155 speedboat was bought second-hand on Ebay in August 2014. The builder's plate stated it was suitable for up to four persons and an outboard engine up to 85 horsepower (hp). The speedboat had a fixed fuel tank positioned in the bow. On first launch at Burnham on Sea, immediately after purchase, the boat performed satisfactorily although the steering was a little stiff and the outboard engine misfired occasionally, possibly due to old fuel in the tank that was later drained. One of the co-owners then used the boat for water skiing at Llangorse Lake while on holiday in August 2014.

Dials to display boat speed, engine revolutions per minute (rpm), engine trim and fuel level were situated in the dashboard. Following recovery of the boat, the engine rpm dial was found stuck at 4300rpm, however it is not known whether the dials functioned correctly before the accident.

The boat was fitted with an electric bilge pump and a manual back-up pump. No other safety equipment was carried as the intended journey was short and the three craft would be travelling together.



Figure 5: Throttle and kill cord

The outboard engine throttle had a kill cord (Figure 5) that, if fitted correctly, would stop the engine in the event of the driver being thrown out of the boat.

Outboard engine and propeller

The speedboat was fitted with a two-stroke Mercury 75hp outboard engine. The full throttle rpm range was 4750-5250, with an idling rpm of 650-700. When purchased in August 2014, the engine was fitted with a Mercury three-bladed aluminium alloy propeller (**Figure 6**) of 13-inch diameter and 19-inch pitch⁵. The propeller was right-handed, meaning the propeller rotated clockwise when propelling ahead and viewed from astern.

In September 2014, after researching the appropriate size, the owners bought on Ebay a 'HighFive' five-bladed stainless steel propeller (**Figure 7**). This propeller was 12.75 inches in diameter with a 19-inch pitch and was double the weight of the three-bladed aluminium alloy propeller, which had weighed 2.3kg. The owners had bought the new propeller to improve the boat's acceleration so that it would make it easier to pull a heavier water skier up and out of the water, though the new propeller would also have the effect of reducing the boat's top speed.



Figure 6: Three-bladed aluminium alloy propeller



Figure 7: 'HighFive' five-bladed stainless steel propeller

Maintenance

In April 2015, the speedboat was taken to a marine specialist in Wolverhampton, who examined the boat, serviced the outboard engine and replaced the steering system. The throttle was deemed satisfactory but the specialist recommended that it be replaced the following year. Once the speedboat was back with the owners, the three-bladed propeller was removed and replaced with the 'HighFive' propeller.

Brixham Harbour and services

Brixham Harbour is part of Tor Bay Harbour Authority and provided the slipway facility used by the speedboat and jet skis. Located at the slipway were several noticeboards. One displayed the local harbour byelaws, another tides and the local weather forecast, and a further two provided safety advice (**Figure 8**). The 72-hour marine forecast for the 'Off Tor Bay' area had been posted the previous day and covered Friday, Saturday and Sunday. For the period Saturday 2 May 0600-1200 it predicted:

⁵ The pitch of a propeller is theoretically the distance travelled forward with one revolution of the propeller. However, as water is not a solid substance the distance will be less in reality.

'Cloudy. Visibility good. Wind east south east (ESE) at 15-17 knots (Force 4-5). Significant wave height⁶ 1m. Air temperature 10°C'.

For the 1200-1800 period the wind and wave conditions were predicted to be the same, but light rain, moderate visibility and a temperature of 16°C were expected. The weather forecast posted later on Saturday was very similar to that provided the day before.



Figure 8: Brixham slipway noticeboards

Buoyancy aid

Emily's buoyancy aid was a water ski vest, approved by the United States Coastguard as a Type III⁷ personal flotation device. The vest labelling indicated it was an adult extra-large size, suitable for a chest of 44-50 inches. The vest was secured using three buckles on the front of the vest, two of which attached to straps that passed round the torso (Figure 9). There were loops on the vest for a third lower securing strap, but the strap was found to be missing following the accident. Two of the strap retaining-poppers were no longer attached.

Recreational craft directive

Although not in force when the Fletcher 155 speedboat was constructed, the Recreational Craft Directive (RCD) has imposed minimum standards for the safety of new vessels sold to the leisure market since

⁶ Significant wave height is defined as the mean wave height (trough to crest) of the highest third of the waves. It is possible for the occasional wave to be twice this height.

⁷ This category was required to supply 15.5 pounds of buoyancy (69 Newtons) but not to turn an unconscious person face-up when floating in the water.



Figure 9: Snagged buoyancy aid

swamped condition, harmonised standard ISO 12217-3 specifies that the boat should float horizontally when swamped.

ANALYSIS

Overview

The speedboat capsized after encountering a large wave on the starboard side after the driver opened the engine throttle to almost full speed ahead. In addition to the speedboat's course and speed in the prevailing sea conditions, other potential contributing factors to the capsize were the fitting of a new propeller, a low quantity of fuel in the bow tank and the manner in which the speed was increased prior to the accident. The extent to which these factors actually contributed depends on how advanced the speedboat was in its acceleration at the time of impact. It was reported the boat was already planing, but the degree to which this had occurred cannot be verified.

Emily drowned after her buoyancy aid became caught on a stern cleat of the upturned speedboat as it sank by the stern following its capsize. Despite the valiant efforts of those on scene, Emily was not freed until the RNLI lifeboat arrived about 25 minutes later.

Sea and weather conditions

Although there were no visible 'white horses', CCTV footage showed a sizeable swell in the vicinity of the accident. A wave buoy, positioned in the centre of Tor Bay (**Figure 1**) about 1.5 nautical miles (2.8km) away, recorded a significant wave height around midday of 1.22m with a corresponding maximum wave height of 2.15m. Waves of 2m or more in height could, therefore, have been present outside the breakwater. The actual height of the large wave encountered is unknown. For a vessel the size of the Fletcher 155, cautious helming would have been required for the speedboat to negotiate such waves safely.

Obtaining a maritime weather forecast, determining the tidal flow and assessing the likely sea conditions are all important issues to consider when preparing to go to sea. Local weather forecasts from the television and internet had been examined. However, the local maritime weather forecast, which was posted on the slipway noticeboard, was not seen by anyone in the group. 'White horses' or breaking waves are often regarded as a good indication of how rough sea conditions are, but can be misleading. Given the ESE wind and sea direction, Berry Head (**Figure 1**) provided relative shelter for the southern end of Tor Bay. This might have provided a misleading impression to those ashore of the sea conditions likely to be experienced once clear of Brixham's breakwater.

1996. The requirements vary depending on design category. The modern equivalents of the Fletcher water ski boats comply with RCD design category C requirements, corresponding to: *'Inshore: Designed for voyages in coastal waters, large bays, estuaries, lakes and rivers where conditions up to, and including wind force 6 and significant wave heights up to, and including, 2m may be experienced.'*

The RCD includes requirements for stability and freeboard, as well as buoyancy and flotation. Open boats certified under category C are to be provided with appropriate means of flotation in the

Once the likely sea conditions for an intended journey have been determined, this enables a better judgment of whether they are within the capabilities of the vessel and, if so, what precautions are necessary. For example, a speedboat driver may need to travel more slowly, alter the angle at which to negotiate waves and alter the vessel's trim to ensure its safety.

Vessel stability and the potential effect of the new propeller

The speedboat's relative course and speed when encountering the large wave contributed significantly to the capsize of the speedboat, but there were other potential contributing factors. The stability of a speedboat is related to the waterplane area of its hull in the water. During the transition from displacement to planing mode, the waterplane area will reduce as hydrodynamic lift increases.

While it is common practice to change a speedboat's propeller, the new propeller fitted to the outboard engine might have had a significant effect. The five-bladed propeller was intended to provide more thrust to improve acceleration and the boat's ability to pull a water skier up and out of the water. This greater thrust at the aft end of the speedboat would also have had a tendency to increase initial bow lift, reducing further the waterplane area during the transition to planing speed. The low quantity of fuel in the bow fuel tank would also have exacerbated this effect.

As well as providing more thrust, the new propeller would have generated more torque. The effect of this would have been for the boat to twist to port, in opposition to the propeller's direction of rotation, thereby assisting the boat's rapid capsize to port.

Given the variables involved it cannot be concluded with any certainty that the accident would not have occurred with the originally fitted three-bladed propeller. However, fitting a new propeller to an outboard engine can have a significant effect on a boat's performance and therefore should be approached with some caution.

Design limitations of the speedboat

Given the location of the speedboat's stern cleats and the means by which the strap of the buoyancy aid became snagged, it is concluded that Emily was conscious and was attempting to escape from under the speedboat when the strap became snagged.

While the Fletcher 155 speedboat was in good condition considering its age, what was not so readily apparent was the lack of buoyancy at the aft end of the vessel. If the Fletcher 155 speedboat had met the RCD harmonised standard to float horizontal when swamped it would not have sunk by the stern.

In this case, the speedboat ended up floating vertically in the water with the cleat hook aligned in this direction. This meant that as Emily's buoyancy aid tried to lift her to the surface it held her on the cleat. If the boat had remained horizontal after capsize it would have made her rescue easier and the cleat would have remained horizontal, reducing the snag hazard.

This accident demonstrates the need to fully consider the potential limitations of used leisure craft that have never met the requirements of the RCD or those built since 1996 that might have been substantially modified. While such vessels can appear to be well maintained and in good condition, design shortcomings or alterations may not be so readily apparent.

Safety equipment

Wearing appropriate clothing when going afloat is important to ensure everyone's safety. The weather on the day of the accident was not ideal but wetsuits or semi-drysuits were worn to prevent the onset of hypothermia. Buoyancy aids were also worn by everyone apart from the speedboat driver, who wore a water skiing impact vest. While providing some buoyancy this was found to be far from adequate when he found himself in the water for a prolonged period.

Although there is no legal requirement for buoyancy aids to be worn in privately owned pleasure craft, it was sensible for them to be worn. However, it is also important to ensure they are the right size and in good condition. Emily was wearing an extra-small 'shorty' wetsuit and an extra-large adult buoyancy aid. A buoyancy aid should be a close fit to prevent it rising up when floating in the water and to minimise the risk of it snagging (**Figure 10**).

It was very fortunate the accident was seen by members of the public ashore, who were able to raise the alarm. Had one of the drivers carried a waterproof VHF radio, which is recommended good practice, it would have enabled them to contact the coastguard directly to raise the alarm promptly with the most accurate information. Even if embarking on a short trip, it is better to be fully prepared, as minor emergencies can quickly escalate.

Experience and training

The co-owners of the Fletcher 155 speedboat were experienced at water skiing, as well as speedboat and jet ski driving. They both had attended a voluntary 1-day ski boat driver's course, approved by BWSF, which ensured they could tow water skiers safely. However, the course did not cover in any great depth considerations for operating at sea when not water skiing, elements of which are covered in the Royal Yachting Association's (RYA) voluntary powerboat courses.

Although he had operated in worse sea conditions in other boats previously, the speedboat driver had relatively limited experience in the Fletcher 155 speedboat. Coupled with this was the addition of a new propeller, the full effect of which was unknown to the driver. The sea conditions, while manageable, were also not ideal. All these factors should have suggested a more cautious approach when venturing out rather than applying almost full throttle as soon as the boat was in open water.

Although not contributing to the accident, since the outboard engine stopped when inverted, that the speedboat driver forgot to attach the kill cord is of concern. The kill cord is vital in ensuring a boat does not run out of control if the driver is thrown overboard. There have been numerous campaigns encouraging the wearing of kill cords, but this accident shows there remains a need to continue to reiterate this important safety message to boat users.

CONCLUSIONS

- Emily drowned as a result of the strap of her buoyancy aid snagging on the aft starboard mooring cleat of the speedboat after it capsized.
- The capsizing occurred after the speedboat encountered a large wave. The speedboat's relative course and speed in the prevailing sea conditions contributed to the capsizing but other potential contributing factors were the fitting of a new propeller, the low quantity of fuel in the bow tank and the manner in which the engine speed was increased prior to the accident.



Figure 10: Oversized buoyancy aid

- The weather, tidal and sea conditions were not investigated fully before setting out. The sea conditions visible from the slipway were probably deceptive given the relative lee provided by Berry Head.
- While the sea conditions were manageable, caution was needed to safely negotiate the waves.
- Despite the valiant efforts of those on scene, Emily was not freed until about 25 minutes after the capsizing.
- If the speedboat had met the RCD harmonised standard to float horizontal when swamped, it would not have sunk by the stern.
- Buyers should be cautious and aware of the potential shortcomings of leisure craft constructed before the introduction of the RCD in 1996, or those that might have been substantially modified.
- The adult extra-large buoyancy aid worn by Emily would not have been close fitting, increasing the risk of it becoming snagged.
- The speedboat driver was not wearing the kill cord and this highlights the need to continue raising awareness of the issue in the speedboat community.

ACTIONS TAKEN OR PLANNED

The **RYA** intends to continue to promote in its training syllabi, and published articles and editorials including:

- Local weather forecasts and likely sea conditions for the intended area of operation should be obtained before deciding on venturing to sea
- Lifejackets and buoyancy aids should be the correct size for the wearer and adjusted to be a close fit
- Kill cords should always be attached to the driver before operating the engine

In particular, the **RYA** intends to publish an article on boat design in the RYA Magazine (Winter 2015) that will include the potential shortcomings of boats constructed prior to the introduction of the RCD in 1996 and those that might have been substantially modified when sold second-hand.

British Water Ski and Wakeboard is developing its boat driver and examiner training and has undertaken to ensure the safety issues identified in this report will be incorporated in their training material. The findings of the MAIB report will also be publicised through its network and with the launch of its new driving syllabus.

As a consequence of the actions being taken, no recommendations have been issued in this report.

SHIP PARTICULARS

Vessel's name	Not applicable
Type	Fletcher 155 speedboat
Registered owner	Privately owned
Construction	Glass Reinforced Plastic
Length overall	5.2m
Beam	1.6m
Built	1989
Engine	Mercury 56kW ⁸ (75hp) 1.4 litre two- stroke outboard
Throttle	Morse cable
Steering	Morse cable
Propeller	HighFive 12.75" x 19", five-bladed, stainless steel

VOYAGE PARTICULARS

Port of departure	Brixham
Port of arrival	Brixham
Type of voyage	Coastal
Manning	4

MARINE CASUALTY INFORMATION

Date and time	2 May 2015 1142
Type of marine casualty or incident	Very Serious Marine Casualty
Location of incident	Tor Bay
Place on board	Deck
Injuries/fatalities	1 fatality
Damage/environmental impact	Outboard engine unserviceable
Ship operation	On passage
Voyage segment	Transit
External & internal environment	Wind: ESE 4-5 Sea state: slight/moderate Visibility: moderate
Persons on board	4

⁸ kW- kiloWatt