Marine Safety Investigation Unit

Transport Malta

SAFETY INVESTIGATION REPORT

201406/007 REPORT NO.: 11/2015 June 2015

The Merchant Shipping (Accident and Incident Safety Investigation) Regulations, 2011 prescribe that the sole objective of marine safety investigations carried out in accordance with the regulations, including analysis, conclusions, and recommendations, which either result from them or are part of the process thereof, shall be the prevention of future marine accidents and incidents through the ascertainment of causes, contributing factors and circumstances.

Moreover, it is not the purpose of marine safety investigations carried out in accordance with these regulations to apportion blame or determine civil and criminal liabilities.

NOTE

This report is not written with litigation in mind and pursuant to Regulation 13(7) of the Merchant Shipping (Accident and Incident Safety Investigation) Regulations, 2011, shall be inadmissible in any judicial proceedings whose purpose or one of whose purposes is to attribute or apportion liability or blame, unless, under prescribed conditions, a Court determines otherwise.

The report may therefore be misleading if used for purposes other than the promulgation of safety lessons.

© Copyright TM, 2015.

This document/publication (excluding the logos) may be re-used free of charge in any format or medium for education purposes. It may be only re-used accurately and not in a misleading context. The material must be acknowledged as TM copyright.

The document/publication shall be cited and properly referenced. Where the MSIU would have identified any third party copyright, permission must be obtained from the copyright holders concerned.

Ejection of three people from the Maltese registered powerboat *Barun* off Dwejra, Gozo 08 June 2014

SUMMARY

On Sunday 08 June 2014, four young adults left Wied il-Għajn, Malta on board *Barun*, a 7.52 m powerboat, and proceeded on a Northwesterly course towards Dwejra in Gozo, after visiting the Blue Lagoon in Comino.

Shortly after their arrival in Dwejra, they departed and started heading towards Comino again. While the powerboat was making way, it reportedly took an instant sheer to port and the three passengers, one female and two males, were ejected out over the side into the sea.

The safety investigation concluded that the immediate cause of the accident was the loss of control of the powerboat travelling at elevated speeds.

The MSIU has issued two recommendations to Transport Malta's Ports & Yachting Directorate designed to ensure better awareness of the hazards related to high-powered turns and hooking.

Barun

FACTUAL INFORMATION

Background

The powerboat *Barun* (Figure 1) was manufactured in 2014 by Chaudron Boats in Malta. She has a very sleek hull with a chined and transversely stepped bottom creating a deep V shaped hull with a deadrise angle of about 24°. The powerboat is designed as Category C[1] and is CE-marked.

Figure 1: Powerboat *Barun*

Barun is propelled by a powerful Mercury Optimax 300XS outboard engine rated at 224 kW. The outboard engine is mounted on a hydraulic jackplate, fitted onto the boat's transom (Figure 2). The outboard engine drives a right-handed stainless steel propeller.

Steering is provided by means of a 'SeaStar Solutions' single hydraulic cylinder and two piston rods acting on the engine via a (manual) hydraulic steering system (Figure 3). The system is operated at the conning console by means of a helm, which is fitted on the starboard side of the cockpit (Figure 4).

Engine throttle is controlled by means of a right foot pedal (Figure 5) which provided the possibility to the person behind the helm to keep both hands on the helm at all times.

Figure 2: Outboard engine's hydraulic jackplate

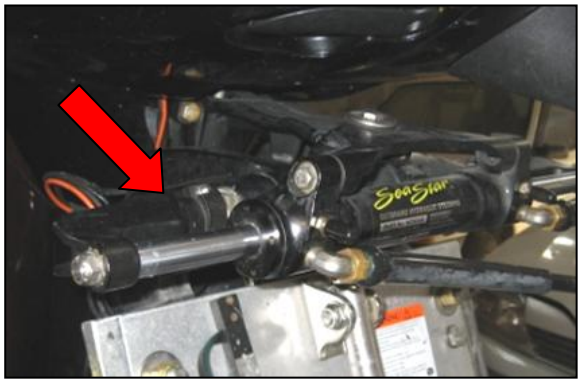


Figure 3: Steering hydraulic system

Figure 4: Helm on starboard side

Among other instruments, the conning console is provided with a GPS satellite navigation system.

[1] Subsidiary Legislation 427.61 defines a 'Category C' boat as one which has been designed for inshore use, *i.e.* 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, 2 m may be experienced.

The powerboat was privately owned and was only used for leisure purposes.

Figure 5: Engine speed control pedal

Nautical Licence holders

The person behind the helm was 24 years old at the time of the accident. He held a valid Nautical Licence issued by Transport Malta on 09 May 2011, expiring on 08 May 2021.

Nautical Licence holders may con any boat within Maltese territorial seas (extending, from Malta's baseline outwards to 12 nautical miles) with an engine capacity of 30 HP and above and up to 24 m in length, driven for pleasure purposes or to tow any person for the purpose of water skiing.

Weather conditions

At the time of *Barun*'s departure from Wied il-Għajn and while the boat was heading in a Northwest direction, the weather conditions were described to be good with high clouds at first. Visibility was good. The wind was variable mainly Southwest force 2 to 3 veering from the North. The sea was slight with negligible swell.

At the time of departure from Dwejra, (while the boat was heading in a generally Southeast direction and therefore shortly before the accident occurred), the wind was described as blowing from the stern with a low following sea.

Narrative

Four young adults departed from Wied il-Għajn, in the South of Malta, in the powerboat, with the intention of spending a day at sea around the Maltese Islands. The weather conditions were good.

Initially, after departure from Wied il-Għajn, *Barun* headed for the Blue Lagoon in Comino. Shortly after arrival there, all four decided to proceed towards Dwejra, on the Southwest coast of Gozo (Figure 6).

However, upon arrival off Dwejra, they communicated with friends who were in another boat and agreed to meet up at the Blue Lagoon in Comino. *Barun* resumed her passage towards Comino, as it had been previously agreed.

At the time, one of the passengers was sitting at the front (on port side, adjacent to the person behind the helm). A second (male) passenger was sitting at the back on starboard side (directly behind the helm) and the female passenger was sitting at the back on port side. None of the occupants was wearing a lifejacket at the time.

Shortly after departure from Dwejra, at about 1515, while the boat was making way approximately 200 m from the coastline, the person behind the helm stated that *Barun* took a sudden and instantaneous swing to port side, heading towards the rocks.

In an instant, the three passengers were ejected out of the powerboat into the sea from the starboard side. The person behind the helm managed to hold on board. The powerboat also came to a quick stop, partially swamped and with the engine still running.

Figure 6: Passage from Wied il-Ghajn to Dwejra (and Blue Lagoon)

The person behind the helm quickly gained an awareness of what had happened. He could see his three friends in the sea and since the outboard engine was still running, he attempted to steer the boat towards his friends. He stated, however, that the outboard engine was swinging loosely from side to side and therefore he had neither directional control over it, nor could he steer *Barun*.

Meanwhile, the person who had been sitting at the front on the port side was in the sea close to the powerboat and managed to swim towards the powerboat and climb back on board.

The two persons who had been sitting at the back of the powerboat were at a longer distance from *Barun*. While attempts were being carried out to steer *Barun* closer to the two persons at sea, another boat approached and recovered them from the sea.

The boat also took on board the person behind *Barun*'s helm and proceeded to Xlendi from where they were both taken to the Gozo's General Hospital by ambulance. The person who had swam and climbed back onto *Barun* remained on board to tend the boat. The powerboat and its occupant were eventually towed safely to Armier Bay in Malta.

The person who was behind the helm, the passenger sitting at the front, and the female passenger suffered no serious injuries and were discharged from hospital. The other male person, however, had to be admitted to the hospital's intensive care unit for specialised treatment. He recovered well and was released from hospital a few days later.

Post-accident inspection of the powerboat

Barun was inspected by the MSIU at the Police garage Malta on the day after the accident. The inspection did not include tests

to the outboard engine and steering systems but a thorough visual inspection of the hull, outboard engine and propeller was carried out.

It was observed that while static tilt of the powerboat had to be adjusted by the distribution of weight on board, power trim could be adjusted by the angle of the outboard engine relative to the transom of the powerboat. *Barun* is fitted with a power 'n' tilt system that adjusted the angle of the motor hydraulically. The trim would alter the direction of the propeller's thrust, relative to the water surface.

During the inspection at the Police garage, the outboard engine was found to be trimmed out by a few degrees, although the MSIU could not establish whether or not the trim had been adjusted after the accident. Considering that the weight distribution was towards the aft end of the powerboat, at that trim, the bow area would have been off the water, resulting in a reduction in drag and an increase in speed. There was no evidence, however, to suggest that the trim angle of the outboard engine contributed to the accident.

Damages

No evidence of damage was found on the hull or outboard engine with the exception of the rubber gunnel guard (Figures 7 and 8), shallow scratches on the side (Figure 9), the underwater portion of the hull (Figure 10) and a missing outboard engine cover.

Figure 7: Damaged rubber gunnel guard

Figure 8: Missing rubber gunnel guard

Figure 9: Shallow scratches

Figure 10: Damage to the underwater portion of the hull

It was reported to the MSIU that the damage to the rubber gunnel and the hull was done when the boat was being towed on the trolley after the accident and was therefore unrelated to the occurrence. Although the steering

system was not tested at the Police garage, the hydraulic cylinder and port and starboard pistons (Figure 3) neither revealed any visible damage nor had traces of leaking hydraulic oil which could have indicated leaking seals.

Basic seamanship and safe boathandling course and examination

The syllabus for the Basic Seamanship and Safe Boathandling Course was compiled by the Ports and Yachting Directorate of Transport Malta. Courses, which run over a number of days, are carried out by approved training entities.

The syllabus was divided in two modules. Module 1 was basically theory and conducted in a classroom whereas Module 2 was the practical part of the course. The syllabus incorporated basic safety knowledge, basic boat handling skills, safety awareness, COLREGs, basic coastal navigation, and boat handling.

The boathandling, which is part of the practical (in-water) module, is quite extensive and covers areas such as loading conditions, planing and high speed manoeuvring. The syllabus addressed the effect of loading on balance and trim, trim tabs and power trim, propeller angle and immersion. It also made reference to S- and U-turns.

An oral examination is conducted by Transport Malta officials and nautical licenses are issued to candidates who would have attended the course and successfully sat for the oral examination conducted by Transport Malta.

ANALYSIS

Aim

The purpose of a marine safety investigation is to determine the circumstances and safety factors of the accident as a basis for making recommendations, and to prevent further marine casualties or incidents from occurring in the future.

Broaching

At the time of the accident, *Barun*'s speed was reportedly to be around 47 knots. It was also reported that her bow was down and, as expected, planing.

At the time, *Barun* was being steered on a steady heading, with the land some 200 m on the port side and was not turning. Bearing in mind the prevailing low, following sea and the speed of the powerboat, it was considered very unlikely that the boat could have broached[2].

Failure of the steering system

The accident was described by the occupants of the power boat as sudden, instantaneous, and completely unexpected. The person behind the helm stated that he saw the outboard engine swinging freely from side to side. He claimed to have noticed this when *Barun* had stopped and came round broadside to the wind in an attempt to steer her towards his friends who had just been ejected off the powerboat.

The person behind the helm also recalled seeing the starboard side support bracket (holding the steering piston rod to the outboard engine) broken. The owner of the powerboat claimed that he was also aware of other SeaStar Solutions steering systems

[2] Broaching may occur when following sea creates loss of directional stability. The boat may be eventually caught broadside to the sea and in a vulnerable position. The change in direction brought about by broaching may be violent enough to eject persons overboard.

which had failed in way of the support bracket.

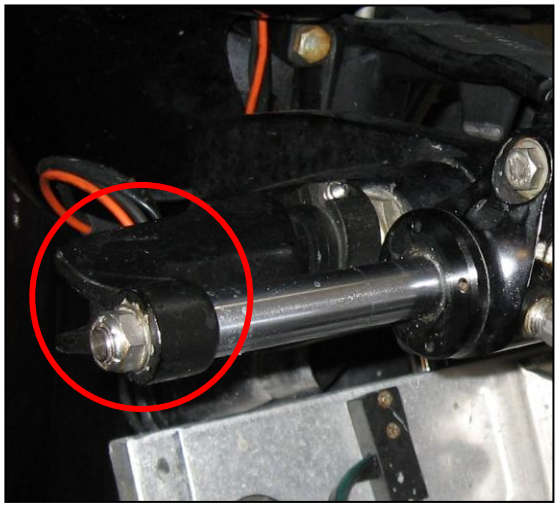
Notwithstanding the above claim, the inspection of the outboard engine and hydraulic steering arrangement carried out the day after the accident when the powerboat was still under the custody of the Police did not reveal any damage to the support bracket (Figures 9 and 10) which would correlate with the verbal evidence provided by the key witness.

However, in view of the claim made by the owner of the powerboat, the MSIU was concerned that there may be a potential issue with the design of the steering system. To this effect, SeaStar Solutions in Canada were approached following an intervention by the Transportation Safety Board of Canada. Photographs of the system were also provided to SeaStar Solutions.

SeaStar Solutions confirmed that over a period of 19 years, the Company had neither seen nor received reports / claims of support bracket failures[3]. SeaStar Solutions confirmed that the failure of one of the two main mounting brackets that resists the steering loads of the outboard engine would have resulted in a steering cylinder, which is unrestrained from moving in certain directions. This would have allowed the outboard engine to swing 'uncontrollably'.

The MSIU was also informed by the owner that following the accident, the steering system at the stern had been renewed (since it was claimed that it had failed). The owners were requested to forward the 'old' system to the MSIU for further metallurgical tests. However, it was claimed that this was not possible because the cylinder may have been discarded.

On the basis of the inspection outcome on the day after the accident and the information provided by SeaStar Solutions, the MSIU excluded the failure of the steering support bracket as the cause of the accident.



Figures 9 and 10: Port and starboard support brackets do not show structural damages (photos taken when the powerboat was still under Police custody).

Several months into the safety investigation, the MSIU was further informed by Chaudron Boats that the helm unit pump had been renewed, given that it was claimed that there

[3] SeaStar Solutions' only concern was that the support bracket could have failed if the installation of the jackplate interfered with the support bracket when the outboard engine was tilted out. SeaStar Solutions remarked that power trim and tilt units are capable of introducing very large loads, since they must be able to trim the outboard engine against thousands of Newtons of force generated at the propeller. SeaStar Solutions remarked that this force is magnified due to the mechanical advantage when considering the close distance of the support bracket to the tilt axis.

was no directional control on the outboard engine. No reports were available to the MSIU which could have assisted the safety investigation to elaborate further on the renewal of the helm. Chaudron Boats neither tested the helm unit pump before nor after replacing it and therefore it is hypothesised that it was changed as a precautionary safety measure taken by the boat manufacturers.

The MSIU was therefore unable to analyse this issue and the safety investigation can neither confirm nor discard the possibility of a mechanical failure within the helm unit.

As with regards to the alleged failure of the support bracket, Chaudron Boats did not indicate that the hydraulic steering mechanism at the stern of the powerboat had been renewed in its workshops.

High-powered turn

Given that it did not transpire that the steering mechanism (at the stern) had failed, and without the necessary details on the possible helm unit pump failure, the MSIU did not exclude that the persons on board *Barun* were ejected during a high-powered turn. That would mean that just before the accident, the powerboat heading had been changed and the course altered.

The MSIU was unable to determine the dynamics of the occurrence and why the course would have been altered; no engine data was available to analyse the manoeuvres made prior to the accident. However, it was confirmed that the persons were ejected over the starboard side since this was recalled vividly by all persons on *Barun*. That would be indicative that the high-powered turn was to port side and the three persons were ejected when the powerboat rolled back (violently) to starboard to regain its upright position.

It was not excluded that *Barun* was turned tightly at high speed, increasing the angle of heel to an extent that the aft end of the hull lost grip and slid sideways. This phenomenon is known as 'hook' (partial spin of the boat).

The dangers when a boat 'hooks' are the tendency to take the boat back to its original course during the time when the hull is sliding sideways across the water[4]. This transverse momentum will continue until eventually the speed drops and the boat's keel grips again – leading to a sudden stop, accompanied by a violent roll until the boat returns to its upright position.

Available literature suggests that the occupants of a powerboat which makes a tight high-powered turn leading to 'hooking' need to be well prepared for the sudden increase in the transverse acceleration forces which would be generated. Depending on the speed with which the powerboat would have been travelling, the generated transverse accelerations could be large enough to eject the persons overboard when the boat is heeled.

The MSIU was unable to estimate the actual angle of heel which the powerboat would have taken under these circumstances. However, it is not abnormal for the heel angle to exceed the hull deadrise angle.

Seating on board

High speeds expose persons on board to higher impacts. The risk of physical injuries increases (not to mention the reduced time available to mitigate an unexpected event). Comfort and safety are crucial to ensure an effective response by all on board. *Barun* was fitted with two sport seats at the front (Figure 11) positioned side by side. The rear seat was of a different style, wide and could accommodate at least three passengers (Figure 12).

[4] When a boat is hooked, it will make a partial spin in the water, leading to the sudden (and violent) alteration of the heading.

Figure 11: Front seats as fitted on *Barun*

Figure 12: Rear seat as fitted on *Barun*

Hand holds were fitted at the front (Figure 11) and at the back (Figure 13).

Figure 13: Rear hand hold on starboard side

Given that only the person behind the helm was not ejected, it was indicative that he may have been expecting that a transverse acceleration would be exerted on the powerboat during the turn. He may have been sitting down and holding tight to the helm, whereas the other persons were loose at the forward and aft seats and not holding to the fitted hand holds[5].

The two persons at the back would have occupied part of the seat and without a solid grip, they would have been unable to counteract the effect of the acceleration forces as the powerboat changed its heading.

The available evidence did not indicate that wash waves of nearby boats contributed to the accident, although this possibility was not excluded.

CONCLUSIONS

1. The immediate cause of the accident was determined to be the loss of control of the powerboat travelling at elevated speeds.

2. Considering the prevailing context, it was considered very unlikely that the powerboat could have broached.

3. The available information did not collaborate with the claim that the support bracket on the hydraulic steering system had failed.

4. The MSIU could neither confirm nor discard the possibility of a mechanical failure within the helm unit.

5. The MSIU did not exclude that the persons on board *Barun* were ejected during a high-powered turn.

6. It is probable that persons ejected from the powerboat were not expecting the high transverse acceleration forces generated when the powerboat heeled over.

[5] It is doubtful as to how much capable the persons would have been to hold on to the hand holds when subjected to elevated transverse accelerations.

RECOMMENDATIONS[6]

Transport Malta's Ports & Yachting Directorate is recommended to:

11/2015_R1 Review the syllabus for the Basic Seamanship and Safe Boathandling Course to ensure that more extensive guidance is provided to candidates who intend to operate powerboats at high speeds. The syllabus should be more specific on the hazards of high-powered turns and hooking.

11/2015_R2 Amend the 'Safety at Sea' flyer to make reference to the risks related to high-powered turns and hooking.

[6] **Recommendations should not create a presumption of blame and / or liability.**

SHIP PARTICULARS	
Vessel Name:	*Barun*
Flag:	Malta
Classification Society:	Not Applicable
IMO Number:	Not Applicable
Type:	Pleasure craft
Registered Owner:	(Private Person)
Managers:	Not Applicable
Construction:	GRP
Length Overall:	7.52 m
Registered Length:	7.52 m
Gross Tonnage:	2.20
Minimum Safe Manning:	Not Applicable
Authorised Cargo:	Not Applicable

VOYAGE PARTICULARS	
Port of Departure:	Wied il-Għajn, Malta
Port of Arrival:	Not Applicable
Type of Voyage:	Coastal
Cargo Information:	Not Applicable
Manning:	One

MARINE OCCURRENCE INFORMATION	
Date and Time:	08 June 2015 at 1515
Classification of Occurrence:	Serious Marine Casualty
Location of Occurrence:	Dwejra, Malta
Place on Board	Not Applicable
Injuries / Fatalities:	One serious injury
Damage / Environmental Impact:	None reported
Ship Operation:	In passage
Voyage Segment:	Departure
External & Internal Environment:	Good weather with high clouds at first. Visibility was good. The wind was variable mainly Southwest force 2 to 3, veering Northerly. The sea was slight with negligible swell.
Persons on board:	Four