Nō te rere moana Aotearoa
MARITIME NEW ZEALAND

Final Report
Platino Accident

13 June 2016

Contents

Foreword

Under the Maritime Transport Act 1994 (MTA), Maritime NZ, and its Director, have a number of statutory functions and powers.

Pursuant to section 431, the statutory functions of Maritime NZ (i.e. the Authority) include the following:

- the promotion of maritime safety and security, and protection of the marine environment in New Zealand: and
- the investigation and reviewing of maritime transport accidents and incidents and maritime security breaches and incidents.

The Director's general statutory functions include deciding whether to enforce the provisions of the MTA, monitoring adherence to safety and security requirements and ensuring regular reviews of the maritime transport system to promote the improvement and development of its safety and security (section 439).

Additionally, pursuant to sections 57 and 235, the Director has express statutory powers of investigation. Investigations are undertaken to support an evidence based approached to decision making. This ensures Maritime NZ can consider all of the facts in the context of its Compliance Operating Model and arrive at the most appropriate outcome, or outcomes. Those outcomes range from education to enforcement, but might also inform policy recommendations or internal processes. All of these outcomes are consistent with the statutory functions of the Authority and/or the Director.

The facts found during the ***Platino*** investigation were considered using the Maritime NZ Compliance Operating Model, and it was established that taking enforcement action was not an appropriate response in this instance. However information relating to the factors that contributed to the accident, if shared with other seafarers, has the potential to contribute to improved maritime safety in the future. As such, this report has been produced.

Maritime NZ's intention is that this fatal accident, and the recommendations that come from it, will make yachts sailing from New Zealand to overseas ports, and other recreational vessels safer. The recommendations will contribute to changes in how recreational vessels are inspected prior to departing to overseas ports, updates to organisations' manuals and training, and inform the recreational boating community.

Maritime NZ is taking the steps below in order to achieve this goal. The findings and recommendations contained in this report will contribute to these processes:

- reviewing the Director's guidelines for Yachting NZ Inspectors who carry out inspections of recreational vessels departing NZ.
- working with Yachting NZ and other boating organisations to have manuals and training amended where appropriate.
- providing education and publicity about the recommendations to the recreational boating community.
- reviewing the effectiveness of the current system and associated procedures used to certify vessels departing NZ for overseas ports.

The Transport Accident Investigation Commission (TAIC) did not investigate the ***Platino*** accident.

Executive summary

On 13 June 2016, two people died as a result of an accident that occurred onboard the yacht ***Platino***. This report documents the resulting investigation.

The investigation has identified a number of issues involving not only the owners of the yacht ***Platino*** but also other parties including service providers. A number of recommendations have been made including;

- Safety considerations for owners and operators.
- That Maritime NZ and Yachting New Zealand review the procedures used to evaluate recreational craft departing New Zealand on international voyages.

Platino is a twenty metre recreational sailing yacht originally built in 1997-98. The yacht was purchased by the owners in February 2014 and underwent an extensive refit, which was completed by December 2015. A "no expense spared' ethos was applied during the refit and the yacht was extremely well appointed. The investigation concluded that some of the work carried out during the refit contributed to the accident.

Platino was certified to Category 1 standard by Yachting New Zealand (YNZ) on 11 May 2016 and departed NZ bound for Fiji on 11 June 2016 with a total crew of five.[1] The owners had limited experience sailing the yacht which included a three to four hour practice sail where they were joined by the three men who completed the crew. All crew members had extensive offshore sailing experience on other vessels as described briefly in Appendix 1.

The investigation found that the safety culture onboard was casual and relaxed and the owners relied on the knowledge and experience of each individual crew member. Few steps were taken to ensure the safe operation of the yacht, or to ensure that the crew would be able to respond to emergencies. One of the owners was named as skipper but her statements indicated that she did not oversee all safety critical operations onboard.

On the morning of June 13, ***Platino*** was 305 nautical miles NNE of Cape Reinga and sailing downwind on a broad reach[2], in high wind, to gale conditions and a confused sea. The accident occurred when the yacht turned unexpectedly and dramatically to starboard. The turn was most likely caused by a combination of environmental conditions and a malfunction of the autopilot. The unintentional turn caused the mainsail to be backwinded, which led to several uncontrolled gybes and multiple failures of the rigging. ***Platino's*** crew was not able to restrain the boom and this eventually led to the total failure of and loss of the mast, boom and rigging.

One of the crewmembers was struck by hardware associated with the boom in the initial seconds of the accident and died immediately as a result of severe injuries. Another crewmember was lost overboard moments later and was never recovered. All three surviving crew members saw the crewmember in the water but no item was ever released from the yacht in an attempt to aid in his rescue. The crew's options were severely limited by the chaotic and dangerous situation on deck, and a lack of control over the yacht. However, it appears actions could have been taken in an attempt to assist the crewmember in the water, but were not.

Platino's crew did not effectively employ all of the equipment available to them, and difficulties and delays were experienced with the equipment that was used. The investigation concluded that the crew

[1] References to all persons in this report are anonymised for privacy reasons. The manner in which crewmembers are referred to throughout this report depends primarily on the context in which the reference is made. When referred to collectively, the two owners of ***Platino*** are referred to as "the owners". In order to differentiate between them when referred to individually, the male owner and the female owner are referred to, respectively, as "the owner" and "the skipper".

[2] A "broad reach" is a course sailed further away from the true wind than a beam reach but above a run. In a broad reach, the wind is coming from behind the sailing craft at an angle. This represents a range of wind angles between beam reach and running downwind.

was not sufficiently familiar with the yacht's equipment and appropriate training had not been carried out onboard.

The investigation concluded that many factors contributed to the accident and the severity of the outcomes. These factors are summarised above and covered in detail in the body of this report.

Introduction

The yacht ***Platino*** departed New Zealand on Saturday 11 June bound for Fiji with a crew of 5. On the morning of Monday 13 June the crew lost control of the yacht while sailing on a broad reach, 305 Nm NNE of Cape Reinga. In the initial moments of the accident, the boom swung across the stern of the yacht and rigging associated with it struck a crewmember, fatally injuring him. The mainsheet then broke free from the deck and the boom continued to swing, quickly causing substantial damage to the rear of the yacht. Another crewmember was lost overboard seconds after the initial turn and the remaining crew were unable to bring the boom or the yacht under control, or to rescue him. Though some control was eventually regained over the yacht, the boom was never restrained and continued to damage the rigging until the mast collapsed later that day.

Figure 1 Tuesday 14 July – ***Platino*** with surviving crew waiting in cockpit prior to rescue

The surviving crew were rescued by a container ship at around 1500 on Tuesday 14 June. ***Platino*** was left adrift with the EPIRB activated and the body of the deceased crewmember remained onboard. The search for the crewmember who had been lost overboard was officially abandoned on the morning of Wednesday 15 June and his body was never recovered. ***Platino*** was located and towed back to Whangarei by a tug, and arrived on Tuesday 21 June. The yacht was secured at Port Whangarei Marine Centre later that day and a scene examination was carried out.

Sailing Yacht *Platino* – Details and background information

This section provides background information relating to the yacht ***Platino***. The yacht's basic specifications and a summary of its history under its present ownership, prior to the voyage to Fiji, are included.

Sailing Yacht *Platino*

Design & build: Ron Holland 66' Sloop built by Yachting Developments, launched 1998

Registration: NZ2197 Part B registered New Zealand pleasure ship

MNZ Number	135556
Home port:	Gulf Harbour – Auckland
Length overall:	19.78 metres
Beam:	5.5 metres
Draft:	3.0 metres
Displacement:	36t
Accommodation:	6 in 3 cabins

Purchase and refit – February 2014 to December 2015

Platino was a Ron Holland designed sloop that was originally built by Yachting Developments Limited in 1997-98. ***Platino*** (then named Picasso) was purchased by the owners in February 2014. The yacht was berthed in a Sydney marina whilst negotiations were taking place and it was damaged when fire broke out on an adjacent boat. The damage sustained during the fire meant ***Platino*** was purchased for a much reduced sum before being shipped to Tauranga.

After being unloaded in Tauranga, ***Platino*** was motored to Gulf Harbour in Auckland, where the yacht underwent a major refit.

Figure 2 19 March 2014 (photograph metadata) – ***Platino*** arriving in Gulf Harbour Marina

By December 2015, almost $4,000,000 (NZD) had been spent on ***Platino*** including the original purchase. Some of the extensive work carried out during the refit included:

- Re-laminating the FRP hull
- New teak decking
- Major alterations to the interior spaces including the accommodation and the galley
- An all-new sail wardrobe

- New hydraulic roller furlers for the twin head sails
- New cockpit winches
- Adding a hydraulic furling motor to the boom and replacing the mandrel for the mainsail with a carbon fibre version.
- Removing the arch that had supported the mainsheet and replacing this with a traveller arrangement mounted across the coaming between cockpits.
- New hard top
- New main engine and generators
- Replacing the electronics including navigation and communication systems
- Replacing all the safety equipment carried

Platino was officially re-launched in April 2015 but the refit work continued until December 2015. During the commissioning phase for the refitted yacht, several short outings were made where one, or both, of the owners were onboard. During these short outings, representatives of the boat yard, and other technicians, were onboard to test systems, and demonstrate these to the owners.

Maiden voyage –December 2015 to March 2016

Following completion of the refit, the owners took ***Platino*** to the Bay of Islands and lived aboard for three months over the summer of 2015/2016. The yacht was motored from Gulf Harbour to the Bay of Islands because there was insufficient wind to sail on the day they departed. The owners spent between four and eight hours sailing the yacht on one day during the three month period spent in the Bay of Islands. The yacht was sailed back to Gulf Harbour in very light wind at the end of the trip. The passage back to Auckland took about 16 hours which was broken up with a stop at Kawau Island.

The total time spent sailing ***Platino*** over this three month trip was a maximum of 24 hours. The wind was light for all of this time and the yacht was motor-sailed for a large portion of it. The majority of the steering was performed by the autopilot, although the owners and some of their guests did experience hand steering the yacht at times.

This Bay of Islands voyage resulted in a work list of items that required attention on the yacht's return. The majority of these were warranty type items such as plumbing issues and none of the problems were safety related.

Category 1 inspection – 11 May 2016

Platino was inspected by YNZ and was certified as compliant with Category One[3] requirements and ready to depart on 11 May 2016. The YNZ inspector had been involved in the refit process and knew the yacht well. He had met with one of the owners on the boat on two occasions to ensure that requirements were met and specified some small changes to be made. This included fitting manual bilge pumps and purchasing additional safety lanyards for the harnesses onboard.

The yacht and its equipment met or exceeded requirements and the crew was found to be adequate for the intended voyage.

Practice sail – May 2016 (two weeks prior to departure)

Two weeks prior to the departure for Fiji, the crew met for a practice sail on ***Platino***. Three to four hours were spent sailing in the area between Gulf Harbour and Rangitoto Island in light wind. The main focus of this outing was to introduce the crew to each other and the yacht, and to show the crew

[3] New Zealand pleasure vessels departing for a foreign place are required to undergo a safety inspection. YNZ Yacht Safety Inspectors carry out these inspections to Category 1 standards. See more detail under Analysis – Category One Certification.

how the yacht's sail handling equipment was operated. The crew set and adjusted both of the twin headsails and the mainsail and discussed the general operation of the yacht. They had not all sailed together as a crew prior to this outing.

The operation of safety equipment was not discussed in detail.

No emergency procedures were practiced.

Narrative - 11 June to 14 June 2016

This section provides a narrative of the voyage to Fiji and includes the key events which took place between the yacht's departure from Auckland, on 11 June, to the evacuation of the crew on 14 June.

Departure to Fiji - 11 June 2016

Platino was entered in the cruising division of the Auckland to Denarau yacht race but did not depart with the race on 4 June 2016. Weather was the primary reason for delaying the departure. The owners had engaged a meteorologist in Australia to provide weather forecasts and unfavorable conditions had been predicted.

The departure was then set for Saturday 11 June and the weather forecaster predicted that generally favourable weather would predominate for the voyage. ***Platino*** was cleared out of New Zealand by NZ Customs at 1100 on 11 June at Marsden Wharf in Auckland.

The wind was insufficient for sailing on the first day and the yacht was motored through to the morning of 11 June. ***Platino*** was steered to a compass course via the autopilot and the crew kept a lookout. The navigational watch was shared by all crew from 8 AM to 8 PM. Four of the crew onboard covered the watch between 8 PM and 8 AM individually in two hour shifts. This resulted in a two hours on, six hours off roster that rotated each night. The order of the watches was agreed but no written roster was provided. The skipper was responsible for navigation and cooking and did not stand a rostered watch, or directly oversee the sailing of the yacht.

A light breeze began to build from the southwest on the morning of 12 June and the yacht motor sailed through the day. The sail setup was adjusted as the breeze filled in and, by nightfall, the mainsail and jib were set. Both sails were partially furled to reduce sail area in preparation for the stronger wind forecast to arrive later that night. ***Platino*** was sailing on the port tack and a preventer[4] was rigged to hold the boom out to the starboard side. Once the wind was sufficient to sail effectively, the motor was stopped and the yacht sailed on under autopilot. The crew kept watch and adjusted the compass course steered by the autopilot when required to maintain an appropriate angle to the wind. ***Platino*** was sailing a broad reach and the crew maintained a conservative angle to the wind of 120 degrees[5].

Platino sailed through the night without incident. Despite the building breeze and sea state, the yacht was performing well and the crew were comfortable. The surviving crewmember stated that he manually steered for a short time during his watch, but he quickly concluded that the autopilot was holding course more effectively than he was able to, and he soon reinstated automatic steering. By the morning of 13 June, the instruments indicated the wind was blowing from the south at 30 to 35 knots and the strongest gust noticed had been 48 knots. The strengthening wind had produced a two metre sea coming from the south and there was also a three metre swell coming from a northerly direction[6]. The swell and sea from opposite directions were combining to produce a confused and unpredictable sea state. However, by all accounts the crew remained comfortable and unconcerned with the way the yacht was handling the conditions.

The crew ate breakfast together in the cockpit between 09:30 and 10:30 AM on the morning of 13 June. During this time, they discussed how the watches had gone through the night and the plan for

[4] A rope rigged to hold the boom forward. See more detail under Analysis – Preventer Failure.

[5] The wind experienced onboard the yacht was maintained as coming from 120 degrees behind the yacht's bow (or heading), on the port side by adjusting the yacht's course when required.

[6] Approximate wave and swell height from crew statements.

the day. In order to maintain a safe angle to the wind the yacht's course had been altered through the night from north to north west, as the wind backed from south west to south. The current course was taking them toward New Caledonia not Fiji, and the crew discussed a plan to change to the starboard tack later in the day as the wind continued to back towards south east. The planned change would bring them back on course for Fiji and as the yacht was sailing downwind on a broad reach, this would normally be accomplished by gybing. However, the crew decided they would take a conservative approach and "granny gybe[7]" as this was the safer option.

The owners had engaged the meteorologist to provide personalised weather forecast information to cover the passage to Fiji. This included forecasts prior to the departure and updates to be delivered throughout the journey. The wind direction was similar to the forecasts provided by the weather forecaster, but the wind speed was higher than expected. However, the crew remained comfortable with the situation.

After breakfast, three of the crew went below, leaving only the skipper and one other crewmember in the cockpit.

The Crash Gybe – 13 June 2016 (11:00 AM approx.)

Platino then turned unexpectedly and substantially to starboard. The skipper believed the boat was turned by a rogue wave due to the sensation she experienced and the resulting turn, but did not recall seeing the wave.

The change in heading caused the mainsail to be backwinded, which resulted in the wind pushing the mainsail toward the back of the boat. The preventer failed and the boom swung violently across the back of the boat and out to the port side. The yacht was now out of control and the boom quickly swung back to the starboard side.

The mainsheet[8] was connected to the deck of the yacht via a traveler[9] car on a track mounted across the coaming between the cockpit and the steering position. This meant that to reach the wheel from the cockpit, crew had to cross the path of the rope. It appears that one of the crewmembers was making an attempt to reach the helm position when the boom swung across to the port side for the second time. At that point, rigging associated with the boom struck the crewmember, throwing him out of the cockpit to the port side deck. The crewmember sustained severe head injuries, most likely killing him instantly. The skipper stated she believed the injuries were directly caused by being struck by the mainsheet. It is also possible that parts of the broken preventer were involved or that he was propelled into other equipment.

The force of the swinging boom was sufficient to break the mainsheet traveler controller and the traveler car then broke free of the track. The complete failure of the traveler arrangement left the boom swinging from side to side with the mainsheet and traveler hardware hanging from its outboard end. The motion of the boom was now only restricted by the boom hitting the shrouds[10] on either side of the mast.

Person Overboard

The skipper then called for the others to come up on deck. Soon after arriving on deck, the first crewmember to arrive called out to the skipper to duck, which she did before glimpsing something going overboard on the port side. The skipper then saw the crewmember in the water some distance from the yacht with his arm raised as the yacht continued on out of control.

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[7] Granny gybe (or granny tack) is a colloquial term which refers to a safer way of turning the yacht so that the wind will come from the opposite side when sailing down wind. The yacht is turned the long way around so the bow passes through the wind, not the stern. This allows the boom to be controlled more easily as it moves from one side to the other.

[8] The rope that controls and adjusts the position of the boom.

[9] The arrangement that allows for adjusting the position where the mainsheet connects to the boat.

[10] The rods that lead from the deck to the masthead on either side to support the mast.

After hearing the skipper call out, the owner made his way to the cockpit from the forward cabin where he had been resting. He spoke briefly to the skipper and found that nothing could be done to help the crewmember who had been killed on deck before making his way to the helm to try to bring the yacht under control. The other crewmember was in the day head (toilet which is below the cockpit on the port side) when he felt, what he described as, a dramatic sideways movement, and rolling motion to port, which together resulted in him being thrown against the port side. He then heard the skipper call out and made his way out to the cockpit as quickly as he could. He saw the crewmember who had been killed on deck and briefly tried to comfort the skipper before moving aft to the helm area to join the owner.

The crewmember lost overboard was in the water before the other two crewmembers arrived on deck. Neither man witnessed him going over, but both did see him at different times during the next few minutes.

Loss of control

The owner was the first to make it to the wheel and attempt to take control and the surviving crewmember made his way to the aft deck behind him soon after. The Owner tried to steer while the surviving crewmember ensured there were no ropes in the water so that the engine could be used without risk of entangling the propeller. The two men worked to turn ***Platino's*** bow into the wind so the sails could be furled away and an attempt made to rescue the crewmember lost overboard. The owner found it very difficult to turn the wheel and impossible to effectively control the yacht. Despite this, ***Platino*** was held head to wind for short time and all but the last few metres of the mainsail was furled away.

The boom continued to swing from side to side across the rear of ***Platino*** where the owner and the surviving crewmember were located as the yacht rolled on the confused sea. The boom was 8.6 metres long and weighed 678kg with the mainsail furled inside it. A length of the mainsheet was hanging from the end of the boom and the traveler car (which had broken free of its track) was still attached to the end of the mainsheet. The traveler car was 350mm long, weighed just over two kg and the crew described it as acting like a wrecking ball as it quickly caused substantial damage to the rear of the yacht.

After making their way to the helm station, the Owner and the surviving crewmember watched the motion of the boom and lay on the deck each time it swung past. The damage that occurred in the initial few minutes included the following, which happened in close proximity to the two men:

- The helm console (where the hydraulic sail handling controls were mounted) was smashed off of its pedestal while the Owner was at the wheel. This happened before he was able to finish furling all of the mainsail or any of the headsail (the headsail remained half furled as it had been set). The surviving crewmember soon realised that the broken helm console was interfering with the steering wheel, making it even more difficult to turn. He used his legs to push the console away until he was later able to tie it back from the wheel.

- The bimini was smashed off while the two men were beneath it. This was left hanging by one webbing strap which the surviving crewmember cut to allow it to fall overboard and out of the way.

- The cockpit table was torn from the deck and propelled over the side.

- The steering wheel was buckled and one of its spokes was broken, adding to the difficulty in turning the wheel.

- The life lines at the rear of the yacht were knocked down on the starboard side.

The two men were unable to establish any form of effective control over ***Platino*** for some time after the initial crash gybes.

Communications

While the Owner and the surviving crewmember tried to bring ***Platino*** under control the Skipper went down below to raise the alarm and request assistance. The Skipper believed she had activated the Man Overboard (MOB) function[11] on the chart plotter. However she was unable to access the position information when communicating with the RNZAF Orion. The Orion arrived on scene within 90 minutes of communications reaching RCCNZ[12]. After establishing communications with the crew of ***Platino***, the Orion began to search for the crewmember lost overboard.

After pressing the MOB button, the Skipper made repeated distress calls on the yacht's VHF and MF/HF marine radios but did not receive a reply. She then moved to activate one of the yacht's two EPIRBs but found that she was unable to do so. The EPIRB was successfully activated by the surviving crewmember some minutes later. The EPIRB activation was first detected at 11:15 AM (NZS time) on 13 June.

After attempting to activate the EPIRB, the Skipper turned to making calls using her mobile phone via the satellite communications system. She first tried to call her two brothers but neither answered. The next call she made was to a naval architect involved in design work during the refit of ***Platino***. He answered and made contact with RCCNZ on the Skipper's behalf at 1124 AM. Communications continued to be relayed to RCCNZ by the naval architect and by the Skipper's cousin until the crew were safely aboard the container ship on the afternoon of the following day.

The rig collapse

Platino's crew were unable to regain control of the boom following the failure of the preventer and mainsheet traveler. The surviving crewmember did attempt to lasso the boom by throwing a line over it as it swung across the rear of the yacht. However, he was unsure what he would tie the line to, if he had been successful. The two men took turns at steering the yacht and were able to subdue the boom's motion somewhat at times. This was achieved by adjusting the yacht's heading in an attempt to both restrict the rolling motion and keep the boom in contact with the water on one side or the other.

Despite the crew's efforts, the boom continued to swing from side to side throughout the day. The surviving crewmember stated that the force was sufficient to cause the entire boat to shake as the boom repeatedly impacted on the shrouds. The crew felt sure that the rig would eventually fail and hoped it would come down during daylight. Unfortunately it lasted far longer than expected and stood until well after night fell.

The backstay was the first major part of the rigging to break and this happened while the surviving crewmember was standing at the wheel. The mast remained up for some time after the backstay failed and eventually fell over the port side at about 8 PM.

Once the mast had fallen and the swinging boom no longer presented a danger, the crew all went below deck to rest and talk. About an hour later, it was decided that the mast which was still hanging over the port side, would have to be cut free. The rigging could be heard knocking and scratching on the hull and the boat could potentially have been holed and sunk.

Prior to undertaking the work to cut the mast free, the surviving crewmember went forward to retrieve the life raft from where it was stowed on the cabin top. Its location, just behind the mast and under the swinging boom, meant the raft had been inaccessible prior to the failure of the rig. The 8 person life raft weighed 46kg and had no handles on its ridged canister. With no easy way to grasp the raft, the surviving crewmember proceeded to slide it down the side deck to the cockpit.

By now, both men were wearing combined life jacket/harnesses which they clipped to the jack lines[13] as they went forward to cut the rod rigging and any remaining ropes in order to jettison the mast. The

[11] The MOB function stores the current position when activated and displays information to assist with navigation back to the stored position.

[12] Rescue Coordination Centre New Zealand (RCCNZ) - New Zealand's national search and rescue organisation.

[13] A jackline is a line strung along the deck from a ship's bow to stern to which a safety harness tether can be attached.

surviving crewmember provided light with a torch while the Owner used an 18V cordless angle grinder to cut through the stainless steel rods that formed the shrouds. The rods were under considerable load and care had to be taken to avoid being hit as they were cut and sprung free.

After the shrouds had been cut, the mast fell away from the side of the yacht and was left hanging over the bow on the headstays. The immediate danger presented by the rigging rubbing against the hull was now gone. The mast seemed to be acting like a sea anchor[14] to subdue the motion of the yacht. It was decided to not to attempt to release the forestays and the two men made their way back to the cockpit. The helm was then tied off with the wheel hard over to port and the three crew members made their way to the saloon where they spent the night.

The rescue – 14 June 2016

The three surviving members of the crew were successfully evacuated from the damaged yacht at approximately 3 PM on the Tuesday 14th. The container ship then continued on to Auckland.

This investigation did not examine the circumstances of the rescue.

Comment and Analysis

This section provides a summary of the key information discovered during the investigation including analysis of the evidence gathered, findings and recommendations. The information included is presented under the following main headings

- **Certification for pleasure craft departing on international ocean voyages**
- **Autopilot failure**
- **Preventer failure**
- **Mainsheet traveler failure**
- **Person overboard**
- **Emergency communications**
- **Rig collapse**
- **Other considerations**

Certification for pleasure craft departing on international ocean voyages

Section 21 of the MTA requires masters of pleasure craft departing from any port in New Zealand for overseas to notify the Director of Maritime NZ of their proposed voyage. The Director must be satisfied that the pleasure craft and its safety equipment and crew are adequate for the proposed voyage. A certificate of clearance from Customs is also a pre-requisite for departure under section 21.

In order to meet the requirements of section 21, New Zealand pleasure vessels departing for a foreign place, whether racing or cruising, are required to undergo a safety inspection prior to obtaining Customs clearance to depart.

Category 1 (Cat 1) is a safety standard which is intended for recreational vessels making "Passages or races of long distances well offshore, where yachts must be completely self-sufficient for extended periods, capable of withstanding storms and prepared to meet serious emergencies without the expectation of outside assistance"[15]. YNZ sets the criteria for the Cat 1 standard in consultation with Maritime NZ. The standard is intended to ensure that the vessel and its crew are fit to safely undertake the voyage, and the criteria include minimum standards for the yacht's design, condition, equipment

[14] A device that creates drag through the water and is used to hold the bow or stern into the weather.

[15] This same definition is used by World Sailing for Category 1 standards.

and crewing. YNZ Yacht Safety Inspectors carry out inspections to Cat 1 standards under delegated authority from the Director of Maritime NZ.

The Cat 1 inspection involves a sampling process and not every requirement or recommendation of the standard is necessarily examined in detail. The Director's Guidelines to YNZ for the application of Section 21 of the MTA, contained within YACHT SAFETY INSPECTORS' MANUAL – 2009, allowed the inspector to act on information provided by the skipper and provides the inspector with some discretion. During an inspection, there is typically a substantial amount of discussion between the skipper and the inspector. This discussion is an important part of the process used to cover the issues outlined in the Cat 1 definition.

Platino's Category 1 Certification

Platino was inspected by a YNZ inspector. The investigation established that the inspector was properly appointed.

The inspector had been involved in the refit process and knew the yacht well. He met with the Owner on the ***Platino***, on two occasions, to ensure that Category 1 requirements were met and specified some small changes to be made. This included fitting manual bilge pumps and purchasing additional safety lanyards for the harnesses onboard.

The yacht and its equipment met or exceeded requirements and the intended crew was found to be adequate for the planned voyage. ***Platino*** was certified as compliant with Category 1 requirements and ready to depart on 11 May 2016.

The inspection appeared to have been performed to a standard consistent with normal practice for YNZ Category 1 inspections, and to have satisfied the requirements of section 21 of the MTA 1994.

There were areas where the Director's Guidelines provided in YACHT SAFETY INSPECTORS' MANUAL – 2009 were not followed. For example, the final paragraph on page 7 of that document reads "The master should provide information as to when crew training such as 'man-overboard' practice has been done. All boats on ocean voyages should have a written action-plan for emergencies such as Abandon Ship". No drills had been conducted onboard ***Platino***, nor was a written action plan available to the inspector. The investigation found that it was not common practice for inspectors to require vessels to provide information as to when drills had been completed, or to produce written action-plans, prior to the ***Platino*** accident.

Recommendations

Maritime NZ and YNZ

The version of this report sent out to interested persons for comment in June 2017 included a draft recommendation that Maritime NZ and YNZ conduct a review to examine the effectiveness of the current certification system, and its associated procedures. In July 2017, the Director of Maritime NZ commissioned a review of the process by which recreational craft are evaluated prior to departing New Zealand on international voyages. That review was completed on 20 July 2018.

YNZ introduces changes to the *Safety Regulations of Sailing*.

Since the time of the ***Platino*** accident, YNZ has made changes to Changes to Safety Regulations of Sailing with the learnings of the ***Platino*** accident in mind. These changes are listed below;

1. All vessels must have the required ratio of crew with an Advanced Sea Survival qualification[16] (SR APPENDIX 6). This requirement had previously been applied only to racing yachts. However the requirement is now being applied to cruising yachts which may be lightly crewed but are undertaking a long voyage.

2. All vessels seeking a category 1 safety certificate are to have a written manual available to all crew.

[16] ***Platino*** met this requirement with the Skipper and Owner having undertaken the Advanced Sea Survival Training within 5 years of the voyage.

3. Yacht Inspectors who have not attended the last conference or have not completed an inspection in the 12 months immediately prior are to be accompanied by another Inspector.

Autopilot Failure

An autopilot is a system on a boat used to maintain a chosen course without constant human intervention. It is also known by several other terms, such as self-steering gear and Autohelm (a trademark that is often used generically). Self-steering gear can be electronic or mechanical.

An electronic autopilot system generally consists of several core elements:

- A Central Processing Unit (CPU) to control the system.
- One or more controllers to allow the crew to command the system and, to provide system information to the crew.
- A heading Sensor to provide the CPU a reference to steer to.
- A drive unit to move the rudder as instructed by the CPU to achieve the desired course.
- A rudder sensor to provide rudder position information to the CPU.

The most common reference to which an autopilot steers is a magnetic compass bearing, which is usually provided by the autopilot's own integrated electronic compass. However, many autopilots can also steer to other references such as a gyro compass, wind direction, or position/track information provided by a GPS unit. The autopilot's CPU continually compares the current condition of the boat relative to the reference information. It then instructs the drive unit to move the rudder as required in order to hold or correct the boat's course.

Modern autopilots can react quickly to very small changes in heading and steer with high accuracy. Many are also capable of improving their performance, while in use, by "learning" what inputs have been required to correct given errors in the current operational environment. However, an autopilot's CPU is only capable of reacting to changes in the state of the boat compared to the reference. It could not, for example, steer into a large wave. It could only correct the heading after the boat was pushed off course by the wave.

Despite their limitations, modern autopilots are often able to hold a course more effectively than all but the most capable of crewmembers. However, best practice dictates autopilots should not be totally relied on in higher risk situations, such as when close to shore, other traffic or when other significant hazards are present (such as the possibility of an uncontrolled gybe). If an autopilot is used in higher risk situations, a crewmember should be positioned to take control immediately, if required.

Initial statements from the surviving crew suggested that the uncontrolled crash gybe(s) occurred when ***Platino*** was turned to starboard by a rogue or freak wave. A wave was assumed to have caused the turn based on the motion experienced by the crew but the Skipper, who was the only surviving crewmember to have been on deck at the time, did not see the wave. The extent to which wave action may or may not have contributed to the outcome could not be established.

Platino was being steered by the autopilot at the time, and evidence gathered suggested that the unplanned turn to starboard was not effectively controlled by the autopilot due to a malfunction of the rudder drive unit. This was mainly due to a lack of hydraulic oil due to an undiscovered leak in the system.

Platino's crew relied completely on the autopilot to maintain a safe heading. Generally, no crewmember was positioned to take immediate control if necessary, including at the time of the accident.

Platino's Autopilot

The electronic components of ***Platino's*** autopilot were replaced during the refit, prior to the maiden voyage commencing in December 2015. It was found that the electronics had been installed professionally to industry standards.

The autopilot fitted featured an Attitude Heading Reference Sensor (AHRS) unit, which replaces the typical compass in existing autopilot systems. The manufacturer claims "High accuracy — accurate course-keeping, to within +/- 2 degrees, in all conditions".

The main electronic components (EV - autopilot computer, AHRS - heading reference sensor and ACU - actuator control unit) were mounted within the wall between the saloon and the starboard cabin. One [remote] controller was fitted to the main helm station console (forward of the steering wheel) and a second was mounted in the console area at the front of the saloon. The autopilot could be controlled from either controller, or the main multifunction displays (MFDs).

Hydraulic rudder drive failure

Following the accident, the yacht was inspected at Port Whangarei Marine Centre. When the autopilot drive unit was inspected, the pump's hydraulic fluid header tank was found to be almost completely empty. There was staining present on the plastic tank to indicate that the tank had been filled at some stage. The remaining fluid (<5ml) was red in colour and is believed to have been automatic transmission fluid commonly used in hydraulic systems. The remaining fluid was insufficient to be accessible to the rudder drive's pump.

At the scene examination, no evidence of a leak from the system, or of lost fluid, was found. Sea water had been admitted to the area, due to damage that occurred during the crew's evacuation to the container ship on the day after the accident. Following the abandonment of ***Platino***, the water was continually pumped out by the automatic bilge pump until the batteries were exhausted some time later. The area then flooded until the yacht was hauled out several days later. The header tank had been filled to the appropriate level during the commissioning period, and it is presumed that any fluid that had leaked from the system had been washed away.

The hydraulic linear drive unit relies on the non-compressible nature of the hydraulic fluid in order to operate. The reversible pump forces fluid to move from one side of the hydraulic ram's piston to the other, which in turn forces the piston to move. Due to its compressible nature, even small quantities of air in the system will reduce its effectiveness. Larger quantities of air can render the drive unserviceable. The pump is particularly susceptible to malfunctioning due to the ingress of air.

As the reversible hydraulic pump moves fluid from one side of the ram (or rams) to the other, the total volume of fluid required does not change as the rams move. Once the system is installed and any air is removed (bled out), it is effectively a closed circuit. The purpose of the header tank(s) is to provide space for changes in fluid volume due to temperature changes, and to provide a reserve or buffer in case of a leak occurring in the system.

Any fluid lost from the system due to a leak is replaced from the reserve stored in the header tank via gravity feed. This protects the system from immediate malfunction should a leak occur. The level of fluid in the tank should be monitored to ensure this safety buffer is maintained and to provide advanced warning of any leaks from the system. Safety critical hydraulic systems may be fitted with a low level alarm in the header tank in order to provide an additional level of protection. No alarm was installed on ***Platino's*** autopilot header tank.

Without intervention, any ongoing leak in the hydraulic system will eventually exhaust the supply in the header tank and result in air being admitted to the system. Depending on the severity of the leak and the conditions, this may result in a gradual loss of performance or an immediate total malfunction.

The owners indicated that they had not checked the level of the fluid in the header tank of ***Platino's*** hydraulic linear drive at any time. Nor were they aware that the fluid level was low, or of the presence of a leak. They were not able to describe any checks that could have been carried out when interviewed.

Steering and Autopilot checks and tests

Platino's manual steering was found to be functional when tested at Port Whangarei Marine Centre following salvage of the yacht. One of the steering wheel's spokes was broken and the wheel was buckled which caused it to rub on the well at various points of its rotation. This did cause increased resistance at times, but when tested, the wheel could be turned from stop to stop consistently with relatively little difficulty.

The rudder answered to the wheel, had no obvious signs of damage and could be moved from full to port through to full to starboard by turning the steering wheel. Some items were found to be interfering with the steering but could be ruled out as having contributed to the difficulty experienced during the accident.

The owners and the surviving crewmember believed that a malfunction of ***Platino's*** main hydraulic system had effected the steering following the initial loss of control. However the yacht's hand steering arrangement was completely manual with no hydraulic assistance. The hydraulic rudder drive unit worked exclusively with the yacht's autopilot system and was designed to be disengaged (by fluid bypass) when the autopilot was not steering the yacht.

The Owner and the surviving crewmember found the wheel extremely difficult to turn during the accident, however the reason for the difficulty the men encountered could not be definitively established. It was considered most likely that the difficulty in turning the wheel was related to the autopilot's rudder drive, which is believed to have malfunctioned. It is likely that the drive was charged with compressed air, and it is also possible that the autopilot and rudder drive remained active and engaged throughout the accident.

The Owner stated the autopilot had "gone off", but when interviewed none of the surviving crew described switching the system to standby or off, or checking its status during the accident. The autopilot controller mounted on the helm console was found to be functional when tested, despite the severe and obvious damage to the console. However once the helm console had been damaged during the accident, this remote controller would have appeared to be unserviceable, and would not have been safely accessible to the crew. The autopilot could also be monitored and controlled via the second remote controller, or the master multifunction display (MFD). These were both mounted in the console area at the front of the saloon along with other communication and navigation equipment. The remote controller mounted in the saloon was found to be operational when tested[17] and was accessible at all times.

Had the rudder drive remained engaged, and malfunctioned due to fluid loss, it is likely that the hand steering would have been extremely difficult, but not completely impossible to move. This aligns with the experience described by the Owner and Crewmember. If the autopilot did remain engaged throughout the accident, it is likely that the crew's ability to move the steering would have been immediately and significantly improved if the unit had been disengaged. This could have been achieved by switching the autopilot to standby, or off, using the remote controller or MFD in the saloon.

However if the autopilot remained in automatic mode, the system should have recorded multiple alarms following the initial loss of control. No autopilot alarms were recorded by the system with times that correspond with the accident. Alarms were recorded by the system with time stamps prior to the time of the accident, and these alarms cannot be definitively explained. This is examined further in the 'Autopilot alarms' section on page 20.

The column which supported the wheel and the helm console was also substantially damaged during the accident, and parts of the hand steering system passed through this area. The difficulty the men experienced in moving the steering may also have been due to hardware or debris which temporarily fouled the steering mechanism, but had cleared by the time the yacht was examined.

The autopilot's independent rudder drive unit was designed to move ***Platino's*** rudder using two hydraulic rams. The rams were connected between frames on the hull of the yacht and the steering

[17] The multifunction displays had been removed at that time and were not tested.

quadrant[18]. They pushed and pulled on the front of the steering quadrant and worked together to turn the rudder as required.

The rams were hung under the front of the quadrant via brackets, which were spaced out using plastic blocks. Four 6mm (M6) bolts passed through each of the blocks and the quadrant, and were secured with Nylock[19] nuts with 12mm (approx.) washers on the top side. The installation of the drive unit's hydraulic rams, with the exception of the spacer blocks, predated the refit work.

Prior to the refit work, the mounting brackets, which connect the inboard end of the rams to the quadrant, were bolted directly against the underside of the quadrant. Spacer blocks were added during the refit and increased the clearance between the rams and the underside of the quadrant. Though it was not established conclusively, it appeared this change was made to reduce the interaction between the rudder stops and the rams. During inspection of the steering gear, it was found that the shackles on the rudder stops touched the hydraulic rams but did not appear to cause any damage. The possible interaction between the stops and the rams would have been greater prior to the addition of the spacers.

The quadrant was constructed of FRP[20] and did not appear to have been designed to accommodate the steering ram brackets as they were installed. The quadrant was not obviously reinforced in the area where the brackets for the rams were mounted and no doubler plates[21] were fitted on the upper side. This was in contrast to the plates which accommodated the rudder stops, which were mounted on the rear side of the quadrant and would have been subject to similar loads.

The addition of the spacers increased the leverage acting to produce a rotational force on the ram mounting brackets. It was not established whether, or to what extent, consideration was given to the possible affects and suitability of this change.

Damage was found where the starboard steering ram is bolted to the steering quadrant. The bracket and spacer block had been rotated away from the centerline, and the two most inboard bolts used to secure the block to the underside of the quadrant had been pulled through the FRP. The damage was consistent with a force acting to move the front of the quadrant to the port (left) and away from the starboard ram. This would have allowed the rudder to move to starboard which would have been consistent with the yacht turning to starboard. The likelihood of the mounting points failing in this manner was increased by the addition of the spacers.

The autopilot's electronics appeared to function correctly when tested. Both controllers were functional despite the severe damage to the helm console, where one of the two was located. When powered on, turned to automatic and given a large course alteration (greater than twenty degrees), the drive unit's pump was heard to run in an attempt to move the rudder as expected. However, the rudder did not move as the pump continued to run. An off course alarm sounded in the expected timeframe of twenty seconds.

The sound of the pump indicated that air had been admitted to the system and while tests were being carried out, a slow leak became evident on the port ram. The leak became apparent when pressure built up in the system while the pump was running. Tests were stopped and a hydraulics technician was called to attend.

Hydraulic fluid was then added to the header tank in 60ml increments and the system was tested for a short time after each addition of fluid. The drive began to effectively move the rudder after between 300 and 360ml of fluid were added to the header tank, though air was still audible in the system. No additional leaks were observed during continued testing.

The technician then removed the banjo bolt where the leak had been observed on the port ram to determine the cause. The bolt was judged to be tightened correctly. However, the sealing surface was found to be in substandard condition and this was judged to be the cause of the leak.

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[18] A plate arrangement connected to the rudder stock, which enables the steering ropes to turn the rudder.

[19] A kind of locknut with a nylon collar insert that resists turning to keep the nut from working loose.

[20] Fibre Reinforced Plastic (fiberglass).

[21] A strong plate (usually metal) to spread any load over a larger surface area.

GPS track information - Autopilot failure

Information recorded by ***Platino's*** GPS chart plotter system showed the path the yacht followed throughout the voyage. Data was recorded from the original departure on 11 June through to 17 June, which was three days after the crew abandoned the yacht. This was presumed to be when the yachts battery power began to be exhausted and the navigational equipment shut down.

The recorded track indicated that the autopilot's ability to maintain the yacht's heading was beginning to diminish in the hours before the crash gybe.

The recorded data included limitations which could be misleading if not properly understood. In summary, the track information consists of a series of recorded positions and does not include, speed, time or heading data. However, if the limitations are properly considered, the information is accurate and valuable.

It is clear that a confused sea state existed at the time of the accident due to swell and sea from opposing directions. However, this condition had existed for many hours and the track data indicated that the autopilot had been performing well up until approximately three hours before the accident. The track was generally very consistent and altered direction slowly as expected where the crew changed course to maintain an appropriate angle to the wind. Several events were located within the data where the yacht had deviated from the consistent path. All deviations, apart from the two detailed on the following pages, were explained by known events such as sail changes and one of the crew attempting to manually steer.

The following events (Figure 3 and Figure 4) were located in the GPS track data. The data logged did not include the time of the recorded positions and the times were estimated based on speed and distance. Distances from the accident site, as evident in the recorded track, were measured using the Google Earth path tool and verified by secondary calculation. Time was calculated based on a boat speed of 9 knots[22] and the distance from the first crash gybe, which was known to have occurred at approximately 11 AM. The events shown would not have activated the off-course alarm unless the yacht slowed significantly during these events, as the yacht would have returned to the programmed course within twenty seconds if a speed of 9 knots was maintained.

[22] Approximate average boat speed was based on crew statements.

Event 1

This event occurred 28.8 nautical miles before the position of the accident. The estimated time is approximately 0748 AM or 3 hours, 12 minutes before accident. The track alters from 334° to 295° for 63 metres before returning to 335°. This was a 39° deviation to port for 13 seconds based on an average speed of 9 knots.

Figure 3 Steering event 28.8Nm prior to the crash gybe

Event 2

This event occurred 6.9 miles before the position of the accident. The estimated time was approximately 1014 AM or 46 minutes before the accident. The track altered from 328° to 278° for 68 metres before returning to 327°. This was a 50° deviation to port for 15 seconds based on an average boat speed of 9 knots.

Figure 4 Steering event 6.9Nm prior to the crash gybe

Autopilot alarms

Platino's master chart plotter (multifunction display or 'MFD') was mounted in the saloon and stored any error/alarm messages recorded for the entire navigation suite. The data extracted from the error log included "Pilot – off course" alarms, which were inconclusive.

The "Pilot – off course" alarm was only triggered if the autopilot was actively steering (i.e. in automatic mode as opposed to standby or off), and the navigation equipment's manufacturer advised that "*The pilot has a hard coded 20 degrees off course alarm, meaning it will trigger an alarm if the boat is off the preset navigation course by 20 degrees for more than 20 seconds. This is not programmable from the end user."* The autopilot did sound an off course alarm as expected during tests of the system. However, at that time, the chart plotters had been removed meaning the recording of the alarm was not tested.

Platino's navigation system recorded forty five "Pilot – off course" alarms with time stamps between 9:55 PM[23,24] on 12 June and 12:50 AM on 13 June. These times were between approximately ten, and thirteen hours before the time that the accident occurred. The surviving crewmember was on watch for a large portion of the time that the system indicates the alarms were occurring, yet none of the surviving crew recalled noticing any Pilot – off course alarms being triggered when interviewed. The GPS track data was examined in detail and contains no evidence that ***Platino*** was off course prior to Events 1 and 2 (Figures 3 and 4 illustrated above), and following on from the accident site[25]. No further error messages were recorded until 17 June, three days after the crew abandoned the yacht.

The autopilot was actively steering ***Platino*** when the loss of control occurred. Following the initial turns ***Platino's*** heading was consistently greater than 20 degrees away from the programmed course for periods in excess of 20 seconds. When interviewed none of the surviving crew recalled disengaging the autopilot following the loss of control. The yacht remained out of control and its heading continued to be erratic for some time after the accident. Had the autopilot remained active, Pilot – off course alarms should have been recorded during this time. No Pilot - off Course alarms were recorded at times that correspond with the accident. It is possible that one of the crew members who were lost had disengaged the autopilot, but this could not be confirmed.

The Owner stated that the autopilot had "gone off" when he arrived at the wheel. However, had the system switched itself to Standby, a "Drive Stopped" alarm should have been triggered and recorded. When triggered, the Drive stopped alarm would sound until it was acknowledged by the crew. The system's memory contained no Drive Stopped alarms.

GPS based navigation systems receive time information from the global positioning network in UTC[26]. A user specified offset is then set to enable the correct local time to be used and displayed by the system. A correlation between the recorded time of the autopilot alarms, and the UTC time of the accident was noticed and this correlation was examined in detail.

The first off course alarm was recorded as being triggered at 9:55 PM on the 12th and the next is recorded as being triggered 49 minutes later at 10:44 PM. If these alarms were recorded in UTC time, they would have corresponded with local times of 9:55 AM and 10:44 AM on the 13th. The accident is known to have occurred at approximately 11:00 AM on the 13th but the exact time could not be conclusively established.

The first off course alarm recorded (9:55 PM) is one solitary alarm which was triggered and cleared in the same minute, meaning the yacht was off course for less than eighty seconds (twenty second

[23] When inspected the time zone offset on the master multifunction display was set to UTC+11 hours. The correct offset for ***Platino's*** position at the time of the accident was UTC+12 hours. This time zone was common to both NZ and Fiji. The actual times recorded by the system are quoted. It was also considered that the times recorded may be one hour behind the correct time due to the offset which was found in the systems settings.

[24] The actual time stamps were recorded by the system in 24 hour format.

[25] The track does show other deviations away from the programmed course but all can be explained by events such as sail changes and one of the crew steering.

[26] Coordinated Universal Time (UTC). New Zealand Standard Time (NZST) is UTC +12 hours.

system threshold, plus one minute). No further alarms were recorded for a further 49 minutes. Figure 4 (above) shows the yachts track altered substantially for a short period of time 6.9Nm before the accident site, and then continued on a consistent course. If ***Platino's*** average speed had reduced to 6.6kn or slower during the event shown in Figure 4 , the 20 second threshold required to trigger an off course alarm would have been reached, and a 'Pilot – off course' alarm would have been triggered. Had an alarm been triggered by the event shown at Figure 4, it would have been cleared automatically and short lived, as the yacht quickly returned to the programmed course.

The second off course alarm recorded (10:44 PM) marks the beginning of a sequence of off course alarms spanning over two hours. The track information and crew statements indicate that the yacht was out of control and its course was erratic for an extended period of time after the initial turns which represent the initial accident site.

The event in Figure 4 occurred 6.9Nm before the section of the track that represents the accident site. 6.9Nm travelled in 49 minutes equates to a boat speed of 8.5Kn. Crew statements indicate ***Platino's*** speed was approximately 9Kn.

If the off-course alarms were recorded in UTC, and the alarms represent the course deviation shown in Figure 4 (9:55), and the accident itself (10:44), then the time stamps indicate that the accident occurred at 10:44 PM UTC on June 12, which was 10:44 AM (local time) on June 13th. Four text messages were sent out from onboard ***Platino*** via the satellite communication system between 10:33 AM, and 10:40 AM on June 13th. Two text messages were sent to the yacht at 10:45 AM, and 11:01 AM respectively, but these messages were not replied to. No communications were sent out from onboard ***Platino*** between 10:40 AM, and 11:05 AM when phone calls began following the accident.

The Navigation system's manufacturer was consulted on this matter and confirmed that the alarms recorded by the system could match the behavior of the yacht based on the track information. However two problems remain unexplained;

1. The navigation system was designed to record alarms in system time. The alarms could have been recorded in UTC only if the system clock was set to UTC at the time the yacht was off course, i.e. only if no offset had been programmed into the system at the time the alarms occurred. For this to be true, the UTC + 11 hours offset had to have been set by the crew after the accident occurred. The surviving crew did not recall making this change when interviewed.

2. The sequence of off course alarms beginning at 10:44 PM on the 12th, and ending at 1:50 AM on the 13th could represent a period of time where the yacht's behavior matched that described by the crew, and that which is indicated by the yacht's recorded track. However the sequence of alarms being recorded would have ceased only if;

    1. ***Platino*** had begun to reliably point at the programmed heading. However, the evidence clearly demonstrates that ***Platino*** remained out of control and did not resume the programmed course following the accident. Or,

    2. The system stopped attempting to steer the yacht due to the lack of heading control, in which case a "Drive Stopped" alarm would have been recorded. The system memory did not contain any Drive Stopped alarms[27]. Or,

    3. The crew manually stopped the autopilot by switching it to Standby or Off, or by removing the unit's power supply. The surviving crew did not recall making this change when interviewed.

The series of "Pilot – off course" alarms which were recorded with time stamps prior to the actual time of the accident, and the lack of alarms recorded with time stamps that correspond with the time of the accident could not be conclusively explained.

[27] Individual alarms could not be removed from the system memory, only the entire history could be deleted.

GPS Track - Accident site

The GPS track information illustrated below shows the path ***Platino*** followed during the first few minutes of the accident. The yacht travelled along the line from the bottom of the picture and through the series of recorded track points (labelled A to J) before exiting at the top. The initial crash gybe occurred when ***Platino*** made a significant and unintentional turn to starboard (labelled A) while sailing at approximately nine knots. After this point, the yacht would have slowed, and is likely to have come to a complete stop at times. The distance between the track points was known but the time taken to travel between these could only be estimated based on assumed speed. The actual heading of the yacht was likely to be generally correlated with the path but cannot be assumed to be identical, especially at low speed.

To provide an indication of scale, the distance between points A and B is 42 metres, or two boat lengths.

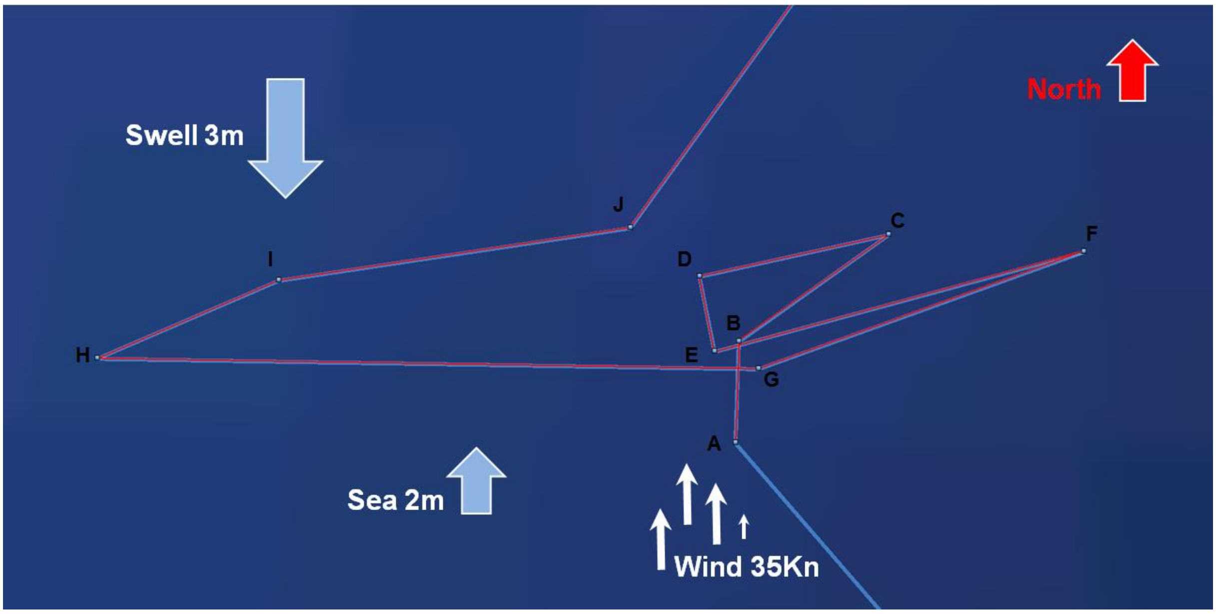


Figure 5 Detailed GPS track information showing ***Platino's*** path through the accident rate

Conclusions

The events recorded in the yacht's track data indicate that the autopilot's ability to maintain the required course was beginning to diminish in the hours preceding the accident. There was no evidence that the sea conditions had deteriorated dramatically over this time and statements taken indicate the crew remained comfortable with the performance of the yacht. The surviving crew were not aware of the recorded deviations from the path as shown above in figures 3 and 4.

The most likely explanation for the reduction in course keeping ability was that the performance of the drive unit was beginning to reduce due to the accumulation of air in the system. The slow leak evident on the port ram would have resulted in air being introduced slowly once the header tank had been emptied. The leak was due to a poor sealing surface, not a sudden component failure, and would have likely existed for some time. Neither the leak, nor the reducing fluid level in the header tank, was noticed by the crew.

A gradual reduction in the performance of the drive unit would have been likely to become increasingly evident in low demand situations, before a total loss of control occurred. If the yacht was motoring in calm conditions, for example, it would be likely to begin to increasingly wander off course. However, the wind, sea and swell conditions present at the time of the accident would have placed high demands on the autopilot. In this environment, even a momentary lapse of attention from an experienced and capable helm person could be unrecoverable and result in an uncontrolled gybe.

Platino was being steered by the autopilot at the time of the accident. However, when tested following the accident, the autopilot system was not capable of moving the rudder. This was due to insufficient fluid in the system at the time of the test.

When tested the slow leak from the hydraulic ram was present only when the system was under pressure. Therefore, it is considered likely that significant amounts of fluid could only be lost during long periods of operation. As discussed in the 'Autopilot alarms' section (above), the autopilot may have remained active for up to two hours after the initial loss of control. Fluid would have been lost during this time, but it was considered unlikely that this could account for the large volume of fluid missing from the system. Some fluid may have continued to leak after the drive was shut down due to the system being charged with compressed air. However this would not have drained the fluid from the header tank. Based on the evidence available, it was considered most likely that the lack of fluid, resulting in the drive being un-serviceable when tested, was due to fluid leaking before the accident.

Platino had sailed on the port tack, and under autopilot control, for over twelve hours prior to the crash gybe. The yacht was therefore consistently heeled[28] to starboard, meaning the port ram was higher than the drive pump and the starboard ram was lower. As the drive unit made rudder adjustments, air being gradually introduced to the system would have tended to accumulate to a greater extent in the port ram. The introduced air will have also displaced fluid from (particularly) the port ram and made this available at the pump, extending its serviceability as fluid continued to be lost from the system.

Any air introduced to the hydraulic system would have reduced the performance of the drive and the autopilot's ability to respond to and correct changes in the yacht's heading. The cushioning effect of the compressible air is also likely to have created uneven and unpredictable loading on the rams, increasing the risk of either ram failing.

The starboard steering ram had partially broken free from the steering quadrant, which would have immediately and significantly reduced the drive's control of the rudder, and the autopilot's ability to steer the yacht. The original installation of the hydraulic rams was substandard where the rams connected to the steering quadrant. This was worsened by the addition of spacers during the refit. It was impossible to determine when this mount failed, but it could be assumed the mount was intact before the accident occurred.

At the time of the accident, ***Platino*** made two large alterations of course to starboard, which resulted in the initial uncontrolled gybes. The evidence gathered suggested an external force (wave and/or wind) acted on the yacht to induce a turn, which the autopilot was unable to control, most likely due to reduced performance of the rudder drive unit. The damage found to the starboard ram mount would have allowed the rudder to move to starboard (which is consistent with the turn to starboard). This would have immediately and significantly further reduced the autopilot's ability to control the yacht. The design of the hydraulic circuit used in the twin ram drive installed on ***Platino*** meant that a failure of one ram, equally affected both rams.

Platino's crew consistently kept watch from the main cockpit area which was separated from the steering position by the coaming on which the mainsheet traveler arrangement was mounted. Though the main cockpit was relatively close to the wheel, the position was not conducive to taking control immediately should there be an urgent need to alter course or, to respond to a failure of the autopilot. The crew did not wear lifejackets or harnesses at any time prior to the initial crash gybe. Moving to the wheel and main helm console required leaving the relative safety of the main cockpit.

Recommendations

If an autopilot is used to control a vessel in situations where a loss of effective heading control may result in harm, precautions should be taken to safeguard against that risk. The extent of the precautions implemented should be appropriate to the severity and likelihood of the possible harm, i.e. the risk. If it is not possible to implement appropriate precautions, either the situation should be modified to reduce the risk (e.g. stow the mainsail) or the autopilot should not be used.

[28] To lean or tip under the influence of the wind on sails

It is recommended that:

Owners and skippers

- Ensure the skipper (and crew, where appropriate) are familiar with the correct use and required maintenance of the autopilot system prior to departure.
- Visually inspect the autopilot drive unit (and any other safety critical system) immediately prior to departure, then at reasonable intervals throughout the voyage. This may, for example, be once in every twenty four hour period.
- Consider steering manually during periods of heightened risk that cannot be avoided by other means.
- Position the person on watch so as to facilitate immediately taking control if the autopilot is used during periods of heightened risk. This could mean a crewmember is placed at the wheel, though not actively steering.

Owners and service providers

- Fully consider and assess the design of the installation of the autopilot drive (and any other safety critical system) prior to installing or modifying the equipment.
- Consider fitting a low level alarm to the hydraulic fluid header tank for the autopilot drive unit (or any other safety critical system) to provide advanced warning of any potential leak.

Preventer Failure

A preventer is a mechanical device (generally a rope arrangement) on a sailing vessel which pulls on the boom in the opposite direction to the mainsheet. When sailing normally, the force of the wind acts on the mainsail to hold the boom out and forward. The mainsheet holds the boom (and mainsail) back and in towards the centreline, opposing the force of the wind. The preventer is rigged to “prevent” the boom moving back toward the centreline if the force exerted by the wind does not for any reason. This can occur as the boat pitches and rolls over the surface of the sea (which may result in the boom flopping in and out slightly), or if a change in the relative wind[29] direction results in the sail being backwinded[30].

If the mainsail becomes backwinded, the full force of the wind can act to push the boom back toward the centreline and across the rear of the yacht to the opposite side. This usually occurs when the yacht’s heading changes[31] and can be very dangerous if it occurs unintentionally, and in an uncontrolled manner. It is most dangerous when sailing downwind angles where it can result in an uncontrolled gybe, often called a “crash gybe”.

An effective preventer is an important way to reduce the risk of an uncontrolled gybe. In order to be reliable in this situation, the preventer must be rigged in a manner strong enough to resist the full force of the wind acting on the mainsail.

There is no “one right way” to rig a preventer and in practice compromises must be made to suit the specific situation. However, it is generally recommended that the preventer is,

- Connected to a point on the boom as close to the outboard end as practicable. This can reduce the leverage acting to increase the force applied to the preventer.

[29] Relative wind is that experienced “relative” to the yacht (the observer) and is altered by the speed and direction of the yacht. True wind is measured relative to a fixed position on the surface of the earth.

[30] When the wind blows onto the opposite side of the sail to what is normally intended for the sail position and point of sail.

[31] It can also occur when the yacht rolls or the true wind direction changes.

- Connected to a point as far forward on the yacht as possible. This can contribute to more ideal angles.

- Rigged so the angle of the rope is as close as possible to perpendicular to the line of the boom, in line with and opposite to the force the rope resists. In practice, a 90° angle is very unlikely to be achieved. However, the more acute the angle, the more the force of the wind acting on the sail is multiplied to the preventer (mechanical advantage).

- Rigged using rope, hardware and fixing points suitable for the maximum load the preventer is likely to encounter during reasonably foreseeable circumstances.

Other things to consider include:

- The condition, type and characteristics (its strength and stretch) of the rope used.

- The potential of any knots used to weaken the rope.

- The mechanical advantage if the preventer line is to be turned around a block (pulley) and brought back to a winch to be adjusted. This is a typical arrangement but has the potential to apply up to twice the load on the preventer line, to the block and the point the block is fixed to.

- The position of the preventer on the boom relative to the mainsheet.

- A preventer is usually rigged when sailing downwind angles.

Preventer pennant

A shorter line (pennant) is often fitted with one end fixed toward the outer end of the boom and the other clipped to a point closer to the mast. The pennant is left in place while sailing and enables a preventer to be setup without the need to access the outboard end of the boom. A longer line is connected to the pennant and taken forward to a suitable strong point on the deck such as a padeye, a cleat or a winch drum. The preventer line can either be fixed directly to the strong point, or turned around a block to be brought back to a winch for adjusting.

Platino's **preventer**

A preventer was rigged on ***Platino*** toward the end of the second day as the crew were preparing to sail through the night. The whole crew, with the exception of the Skipper, played a part in rigging the preventer and were aware of how it was arranged. The Skipper did not oversee the work, but was aware of the general arrangement.

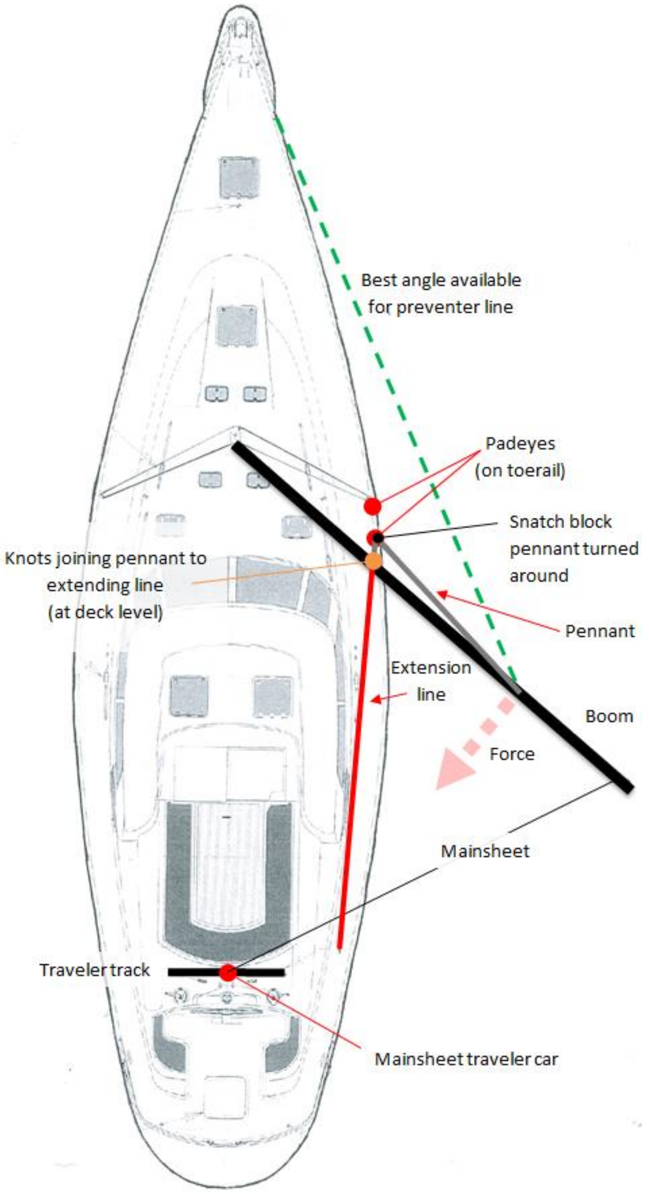


Figure 6 Actual deck plan of ***Platino*** showing an impression of the preventer rigged by the crew and a more ideal angle for strength

This illustration of the preventer arrangement (above) was created, based on the crew's statements and information gathered during examination of the yacht. The representation was confirmed as accurate by the surviving crewmembers.

A preventer pennant was fitted to ***Platino's*** boom during the refit. The inboard end of the pennant was unclipped from the boom and tied to a spare line to extend it. The pennant line was passed through a snatch block[32] and the snatch block was attached to a padeye[33] on the starboard toe rail[34]. The extending line was then passed back to the aft cockpit where it was tensioned on a winch. One of the crewmembers located the spare line and passed it to the Owner and another crewmember who made the connections. The extending line was then passed aft and tensioned on a winch.

32 A type of pulley that can open to allow a line to be inserted anywhere along its length.

33 A flat metal plate with a projecting loop used to provide an attachment point.

34 A narrow raised strip which runs along the edges of a boat's deck.

The preventer rigged by ***Platino's*** crew broke when the mainsail was back winded, after the yacht unexpectedly turned to starboard. This resulted in several uncontrolled gybes in which the heavy boom swung violently across the rear of the yacht. The force of the uncontrolled gybes was such that the mainsheet traveller arrangement failed and the traveller car broke completely free of the track. This left the boom able to swing freely until it hit the shrouds on either side of the mast. Hardware connected to the swinging boom fatally injured one crewmember and appears to have thrown another overboard. It quickly caused serious damage to the rear of the yacht, resulted in difficulty in regaining control, and eventually led to total failure of the rig. Had the preventer held, it is likely that the initial turn, though unexpected and possibly violent, would not have resulted in such serious harm.

The extending line broke first, most likely at the knot where it was joined to the pennant. The boom then began to swing back pulling the preventer pennant out through the snatch block until the knot(s) came up against it and were unable to pass through. This locked the line off and the load on the pennant was then again carried by the snatch block. The padeye which the snatch block was fixed to then sheared off the saddle on the toerail.

At this point, the preventer had completely failed, and the boom was able to swing through the full arc allowed by the mainsheet.

Arrangement of the preventer

The arrangement of the preventer rigged by the crew of ***Platino*** did not provide for the best possible mechanical advantage. This resulted in very high loads on the preventer's components.

A preventer is rigged to "prevent" the boom from swinging back toward the centreline if for any reason the wind no-longer does. The boom is a ridged spar that rotates around the gooseneck (the hinge at the mast end). As a result, the force resisted by the preventer is always perpendicular (90°) to the line of the boom. This is true whatever position the boom is in.

An ideal preventer would be rigged so that the line of the rope is also perpendicular to the line of the boom but on the opposite side to the direction of the force it resists (and the mainsheet). This would provide a one to one ratio, meaning that the load on the preventer rope would be equal to the force acting through the boom at the point the preventer is attached. As the angle between the boom and the preventer is decreased the effect of leverage is increased. This multiplies the load pulling (tension) on the preventer line.

Angle between preventer and boom	Factor of tension relative to force
90	1
85	1
80	1.02
75	1.04
70	1.07
65	1.1
60	1.16
55	1.22
50	1.31
45	1.41
40	1.56
35	1.74
30	2
25	2.37
20	2.92
15	3.86
10	5.76
5	11.5

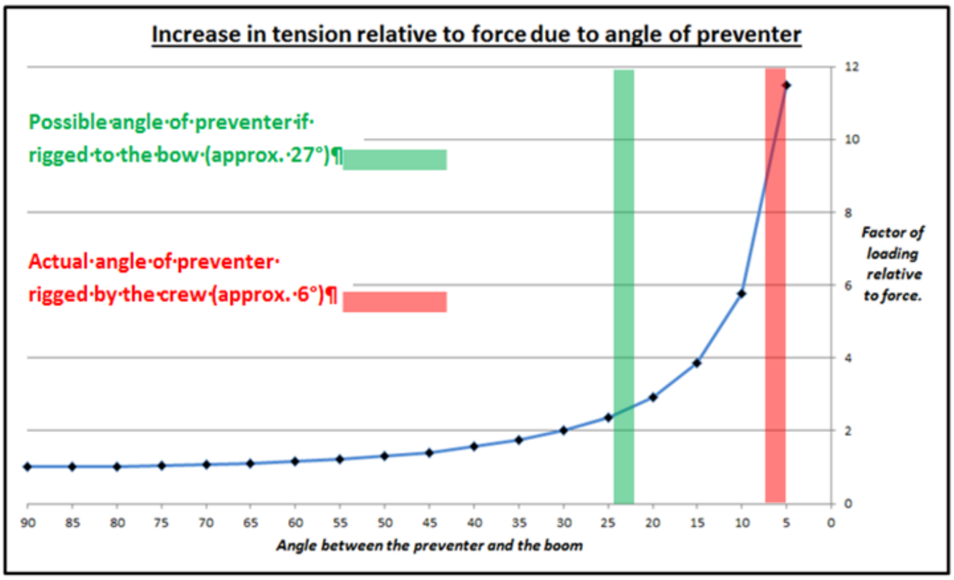


Figure 7 Graph and table indicate the relation between the angle of the preventer rigged from the boom and the resulting force

This graph illustrates how the load pulling on the preventer is inversely proportionate to the angle between the preventer and the boom. The load on the preventer line would be the force (acting through the boom where the preventer was attached), multiplied by the factor of loading relative to force. This is of minimal consequence at angles as low as 25° from the boom, where the load on the preventer would be about 2.4 times the force on the boom. However, the effect increases exponentially as the angle approaches 0°. In practice a 90° angle is virtually impossible to achieve. However, acute angles should be avoided.

The graph represents a simplified two dimensional model which does not consider that the padeye on boom was nearly 2 metres above the padeye on the rail. The third dimension would have further complicated (increased) the actual loading.

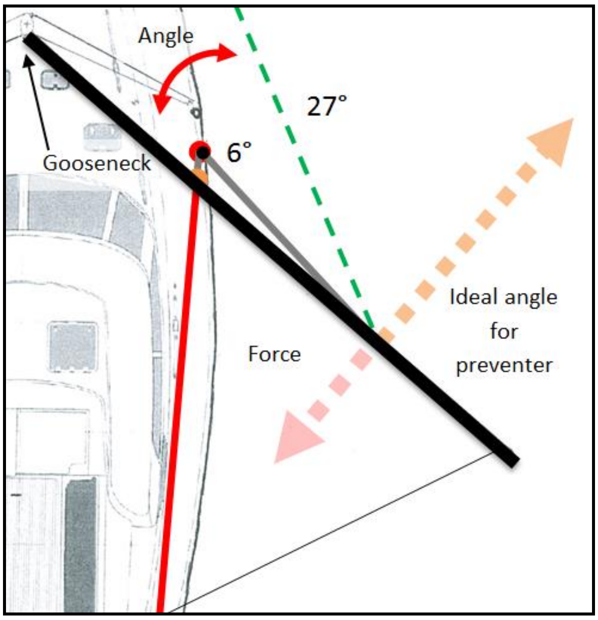
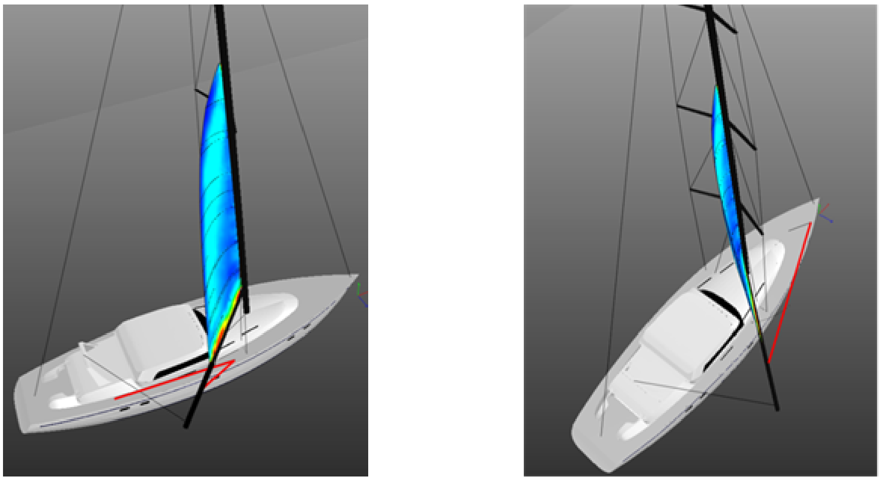


Figure 8 Impression of the preventer arrangements showing approximate angles

The diagram of ***Platino's*** preventer above shows the approximate angles of a preventer line led forward to the bow (the best case scenario) and the actual arrangement of the preventer rigged by the crew.

The scenarios described above were analysed using sail design computer software and accurate 3-D models of the actual yacht and mainsail. The calculations were made using wind speeds of 35, 40 and 45 knots with the mainsail furled to the second reef line. The loads listed indicated the tension that could be applied to the preventer line by the back winded mainsail. This was the static loading caused by the force of the wind on the sail and does not consider any dynamic movement of the boom. Though the actual loads listed are likely to be reasonably accurate, the factor of greatest significance was the difference between the two preventer arrangements.

Preventer 1 – Aft of shrouds | **Preventer 2 – Forward to bow**



Wind (Knots)	Loading on preventer line (kg)	
	Preventer 1 – Aft of shrouds	Preventer 2 – Forward to bow
35	4,600	1,100
40	6,000	1,400
45	7,000	1,700

Figure 9 Computer simulation showing calculated preventer loads based on scenarios provided by this investigation

In the simulation above, Preventer 1 represents the actual arrangement rigged by the crew, which was anchored on the padeye fixed to the toe rail aft of the shrouds. Preventer 2 represents the best case scenario of leading the line as far forward on the bow as possible.

Once connected, the extending line was tensioned on a winch to remove any stretch and effectively hold the boom in place. This meant the preventer would have carried several hundred kilograms of tension, before any additional load was introduced by the backwinded mainsail. The 558kg boom (excluding the weight of the mainsail) would have also added significant dynamic load as it began to swing back after the extending line snapped. This would have contributed considerably to the force that tore the padeye off the rail.

Component strength of the preventer rigged

The investigation established that the preventer failed at two separate points:

1. The extending line used to extend the preventer pennant to reach aft to the cockpit winch; and
2. The padeye fixed to the rail used to anchor the preventer to the toerail.

Figure 10 Starboard toerail showing padeyes

This photo shows the saddles and padeyes that were fitted to the starboard toerail during the refit. Note the after-most of the two padeyes (right) is missing from the saddle

The extending line

The line used to extend the preventer to the winch failed at a relatively low load because;

- The expected breaking load of the extending line was very low relative to the pennant line it was attached to. The line was of lower quality and expected breaking load than other lines carried onboard for sail control.
- The extending line was joined to the preventer pennant using a bowline knot, which reduced its expected breaking load considerably.

A spare line was attached to the pre-made preventer pennant to extend the line to reach the cockpit winch, where it was tensioned. Part of this line was found onboard after the accident.

The spare line used was part of the yacht's existing equipment and pre-dated the refit. The exact type and specifications of the line were not definitively ascertained and it was not load tested. The owners did not know the previous history of the line. It is likely that the line would have been weakened from its original specification, due to age and wear. The extending line was considered to have had a breaking load of no more than 4,200kg. This was based on a high quality polyester rope of similar diameter, in as new condition and not joined using knots.

The use of knots is a practical and necessary practice onboard vessels and in many other recreational and commercial activities. However, the capacity for knots to weaken the rope in which they are tied must be considered when evaluating the suitability of the rope for the application. Multiple studies have shown that tying knots in a rope can significantly reduce its strength.

As the extending line on ***Platino*** was tied with a bowline, it may have been weakened by as much as 70%. Using a relatively conservative loss in strength of 40% established a breaking load of 2,520kg. The line was likely to have broken at the bowline, and at a significantly lower load than 2,520kg.

A bowline was also tied in the preventer pennant and this too would have been weakened. However, this line was considerably stronger and the same 40% reduction in strength yields a breaking load of 9,840kg.

Snap Shackles

Snap shackles are widely used on sailing yachts but are not generally trusted for safety critical applications. They are designed to be released easily and some are specifically designed for easy release under full load. Snap shackles can release accidentally, but this usually occurs when the load is not constant such as in the case of a sail sheet that is loose, allowing the sail to flap.

Both the lines used in the preventer setup had snap shackles spliced onto their ends. The snap shackles could have been used in place of the two bowlines, and doing so may have retained a greater percentage of the line's original strength.

Despite the presence of the snap shackles, the preventer pennant and extending line on ***Platino*** were joined using two bowline knots. One was tied in the end of each of the lines with their loops tied through each other. The snap shackles were then clipped together but would not have carried any load. The snap shackles were not used to carry the load because the crew considered them to be unreliable. This practice is not uncommon.

The padeye

The padeye, used to anchor the preventer to the toerail, failed at a relatively low load because;

- The padeye was fitted for outboard sheeting of the jib and was not intended for use in anchoring a preventer.
- The padeye fitted had a safe working load lower than that recommended by the supplier of the updated sail wardrobe, which had recommended the padeyes be fitted.

The next weakest part of the preventer was the padeye on the toerail, with a breaking load of 4,080kg. The four 6mm stainless steel bolts used to secure the padeye to the saddle on the toe rail sheared through the thread, when the knots tied in the preventer line became stopped off against the snatch block.

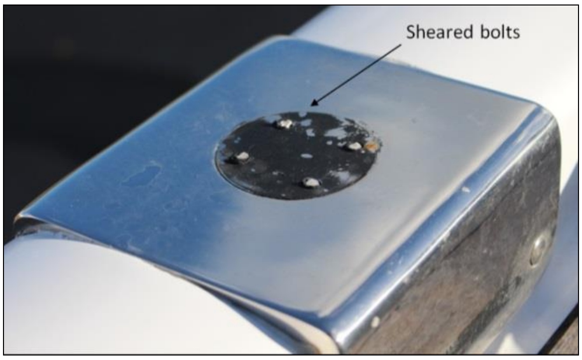


Figure 11 Starboard aft toerail saddle, sheered padeye

The 57mm padeye used to anchor the preventer was one of four fitted to the toe rails during the refit. The padeyes were placed at the recommendation of the sail supplier and were intended to be used for outboard sheeting of the jib[35]. The padeyes were not intended to be used to anchor a preventer, which was likely to involve substantially higher loads. Despite the relatively lower loads expected for outboard jib sheeting, the sail supplier recommended padeyes with a safe working load of four tons be used. Based on this, 76mm padeyes with a safe working load of 4,705kg and a breaking load of 9,430kg were selected. These would have allowed a substantial safety margin for the intended purpose. The 76mm padeyes specified have more than double the strength of the 57mm padeyes that were fitted.

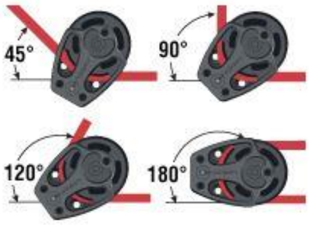
It appears the correct 76mm padeyes were ordered and supplied, but were not fitted in this position on the yacht. The appropriateness of the 57mm padeyes was questioned by the tradesman who fitted them during their installation. It appears an error in communication led to the 57mm parts being confirmed as the correct parts. With double the strength of the 57mm padeyes fitted, a 76mm padeye would have been substantially less likely to fail when the extending line snapped and the knots jammed against the snatch block.

[35] This application involved leading/deflecting the jib (headsail) sheet and would only carry a portion of the 4t maximum working load of the jib sheet.

For comparison, the 4” padeye fitted to the boom, and intended for use in the preventer arrangement, had an approximate breaking load of 10,890kg (based on the current 95mm padeye), and the snatch block used had a breaking load of 16,400kg.

Block Loading vs. Angle of Deflection

Load on a block is a combination of the load on the line passing through the block, plus a block-loading factor, which is determined by the angle by which the block turns the sheet . For example, a footblock that turns a sheet 180° will see a load equal to twice the load on the sheet. A deck organizer, which turns a halyard only 30°, will see just 52% of the load on the halyard.



Angle of deflection	Load factor	Angle of Deflection	Load factor
30°	52%	120°	173%
45°	76%	135°	185%
60°	100%	150°	193%
75°	122%	160°	197%
90°	141%	180°	200%
105°	159%		

Figure 12 Block Loading vs. Angle of Deflection[36]

If the line used to extend the preventer had not failed, the force applied to the block and the padeye on the toerail would have been nearly doubled. This is due to the mechanical advantage introduced by turning the line around the snatch block (nearly a two to one ratio). The previous illustration (Figure 6) shows the preventer line turned through approximately 130° around the snatch block attached to the padeye on the toerail. This would have resulted in 1.8 times the initial load being applied to the snatch block and padeye. This may have been sufficient force to break the 76mm padeyes if these had been fitted.

Crew knowledge and understanding

When asked about the preventer during their initial interviews, the owners both expressed no doubt in the appropriateness of the arrangement rigged. The Owner also stated that the four men onboard discussed the arrangement and “everybody was happy with the setup”. During his initial interview, the surviving crewmember stated that “we weren’t happy with the angle of the preventer on the boom but it was premade”. He was referring to the preventer pennant and went on to explain that he “wouldn’t have set it [the preventer pennant] up like that” and that it was “too short” [the pennant]. The Owner also stated that the preventer could not have been fixed to any other point because it was too short.

The crew extended the preventer pennant by attaching a second line to allow it to reach aft to be tensioned on a winch, but only after the pennant had been passed through the snatch block. The crew do not appear to have considered that the lines could have been joined before the extending line passed through the snatch block. This would have allowed the preventer to be anchored to virtually any suitable strong point on the yacht, including well forward on the bow.

The length of the pre-made preventer pennant is dictated by the length of the boom it is parked on. The pennant is intended to facilitate rigging a preventer when the outer end of the boom is inaccessible and should not dictate where the preventer is anchored on the yacht.

The surviving crew expressed surprise that the mainsheet traveller failed and the car broke free of the track. It is commonly accepted that even smaller yachts are likely to suffer component failures during uncontrolled gybes occurring at wind speeds as high as were present during the accident. ***Platino’s*** boom weighed 558kg (excluding the weight of the mainsail) and once moving at speed it, would have possessed a very large amount of kinetic energy. This would have resulted in severe shock loading as the boom’s movement was suddenly arrested by the mainsheet. Any dynamic force would have been

[36] *Source: http://www.harken.co.nz/article.aspx?id=12857*

additional to the force of the wind pushing on the sail. It would be reasonable to expect that a crash gybe occurring at high wind speeds (similar to what were present at the time of the accident) may result in the failure of other rig components on a yacht such as ***Platino***.

The owners and crew had not practiced rigging a preventer on ***Platino*** at any time prior to this voyage. Doing so might have highlighted questions regarding the length of the pennant and the location of suitable anchor points. This would have allowed the crew to gain a better understanding of the intended use of the pennant, and new anchor points to be fitted or other equipment carried if required.

Conclusions

The likely consequences of an uncontrolled gybe on a yacht such as ***Platino*** are such that it should be considered very high risk, however unlikely it may be to occur. To this end, an effective preventer (when required) is essential to minimise the possible harm. If, for any reason, an effective preventer cannot be rigged, the crew should consider stowing the mainsail and securing the boom. Other modes of sailing would have been possible such as continuing under head sail alone, motor sailing with only the head sail or even stowing all sails and using the main engine alone. This was not considered necessary by ***Platino's*** crew. Where a yacht's mainsail is unintentionally backwinded, it is likely to be in a compromised and potentially dangerous situation, even if an effective preventer has been rigged and does not fail.

The most significant cause for the failure of the preventer was the arrangement rigged, which placed unnecessarily high load on the preventer's components. The sub-optimal strength of the line used to extend the preventer, and the padeye which provided the anchor point, also contributed to the manner in which the preventer failed.

It is possible that the preventer, rigged in the way it was, would still have failed, even if stronger individual components had been used.

The importance and complexity of an effective preventer and the possible extent of the harm caused should it fail, do not appear to have been considered and/or adequately understood by the crew in this case.

Recommendations

An effective preventer is a crucial piece of safety equipment on a sailing yacht, particularly when sailing offshore where assistance is unlikely to be available in a timely manner.

Owners and skippers

Crews should rehearse rigging a preventer as part of normal competence and safety training. This should take place before the preventer is actually required in order to,

- Establish the most appropriate manner in which to rig the preventer in various situations, and consider the loads involved and limitations of various arrangements.
- Consider the suitability of the equipment carried onboard to facilitate the rigging of an effective preventer.

Crews should fully consider the risks involved in any situation and manage these appropriately. If an effective and reliable preventer cannot be rigged[37] in conditions where unintended movement of the boom is likely, or may result in serious harm, other options should be considered including the following;

- Altering course to an angle that reduces the risk to an acceptable level.
- Stowing the mainsail and proceeding under head sail and/or motor power, or hove to[38] if necessary.

[37] Depending on the circumstances and the potential harm, these options may be considered even if an effective preventer can be rigged.

[38] In sailing, heaving to (to heave to and to be **hove** to) is a way of slowing a sailboat's forward progress, as well as fixing the helm and sail positions so that the boat does not actively have to be steered.

Mainsheet traveler failure – out of control boom

The mainsheet is a rope (or tackle), which connects between the boom above and the boat below. It is used to control the position of the boom by hauling it in toward the center line of the yacht, or allowing it to swing out as required to trim the mainsail. A mainsheet traveler is a device that allows the position where the mainsheet connects to the boat to be adjusted. The traveler is typically mounted either in the cockpit area (as on ***Platino***) or on the cabin top for mid-boom sheeting.

The mainsheet may be connected to a traveler car that can be moved to port or starboard along a track fixed across the deck of the yacht. Movement of the car is generally controlled with lines on either side. To move the traveler car to port, the starboard control line is eased (allowed to lengthen) and the port control line is pulled in by hand or on a winch. Both lines should be made tight when the traveler is in the desired position.

A primary use for the traveler is to assist in keeping the boom centered when sailing close-hauled[39]. The traveler car, and hence the point from which the mainsheet pulls, can be moved to the windward side to provide a more effective angle to the boom.

The picture below shows a mainsheet traveler arrangement similar in concept to, but smaller than, the traveler installed on ***Platino***.

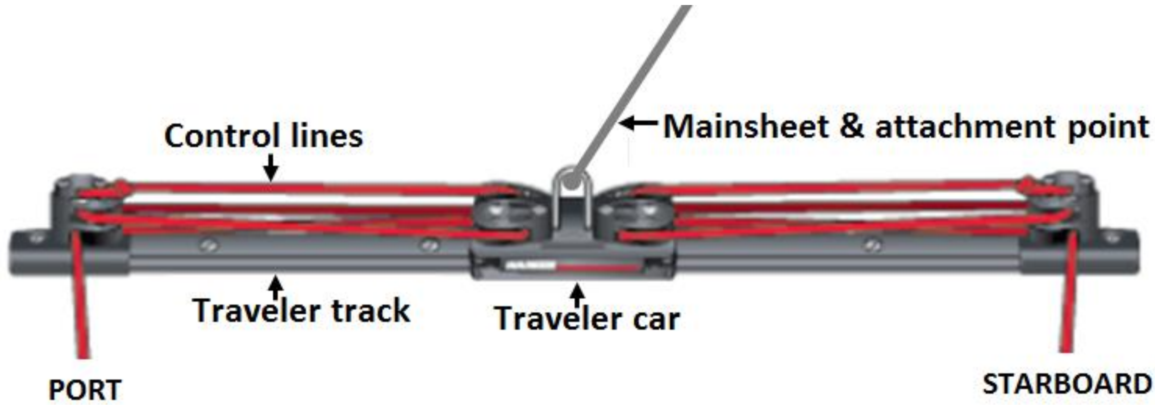


Figure 13 Impression of a mainsheet traveler arrangement showing control lines with four to one purchase

Platino's mainsheet traveler

When the owners purchased ***Platino***, the mainsheet was connected to a fixed point, with no traveler, mounted on an arch between the steering position and the cockpit. The presence of the mainsheet arch allowed crew to move between the cockpit and steering position by passing through the arch, beneath the point at which the mainsheet was fixed.

Extensive changes were made to the aft area of the yacht during the refit. This included completely removing the arch.

Following the removal of the arch, a track was mounted across (transversely) a coaming between the forward cockpit and the steering (helm) position. Two high load cars were coupled together to provide the mobile anchor point for the mainsheet. Control lines were installed with blocks providing a three to one purchase and the lines could be led to winches to be tensioned. One of the reasons for fitting a traveler to ***Platino*** (in addition to improving the upwind sheeting angle) was to allow the mainsheet to be moved to leeward[40] when sailing downwind. This would avoid the mainsheet crossing the rear

39 Sailing at an angle as close to the wind as a vessel will sail, with sails pulled in as flat as possible.

40 Leeward, on or towards the side sheltered or away from the wind; downwind

seating in the cockpit area when the boom was eased out. ***Platino's*** crew stated the mainsheet traveler was not moved from its central position during the voyage toward Fiji.

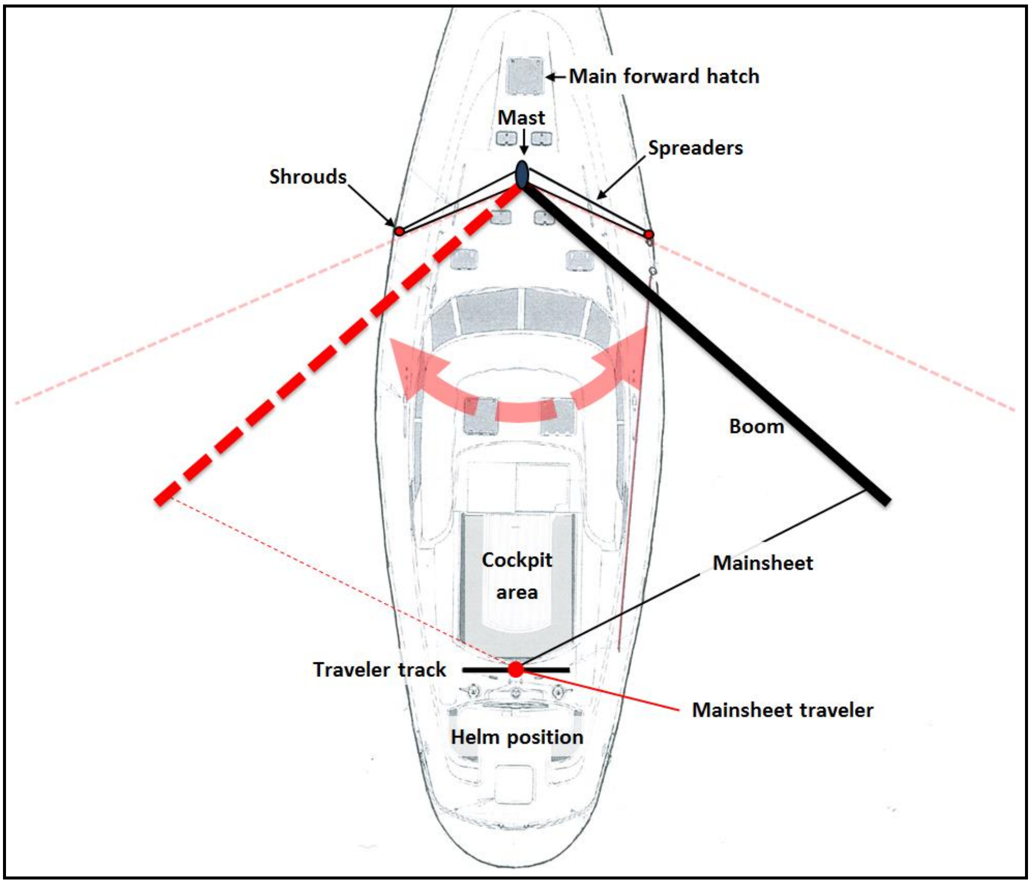


Figure 14 ***Platino*** deck plan drawing showing position of mainsheet traveler

The design for the traveler arrangement was developed in consultation with the project manager, the supplier of the components and designers, and considered:

- The maximum expected mainsheet loading information provided by the spar and rigging manufacturer.
- The type of sailing the yacht was intended to be used for[41].
- Knowledge of previous systems provided for similar applications.

The highest load a mainsheet (and traveler) is expected to be subject to is a vertical pull up from the deck when the yacht is sailing into the wind. In this situation, the boom must be held in and down, very close to the centerline of the yacht. The maximum expected vertical mainsheet load for ***Platino*** was calculated to be 4,082kgs. This figure represented the "static" loading created by the wind acting on the sail, when the yacht was being sailed within the design parameters of wind speed and sail area. The figure did not consider the "dynamic forces" and "shock loading" that may be introduced by sudden acceleration (or deceleration) of the boom and sail.

The maximum lateral load is typically calculated at 20% of the maximum vertical load. Thus, the traveler arrangement should be designed to have a safe working load (SWL) in the lateral plane (horizontally across the boat) of no less than 20% of the maximum expected vertical load.

The lateral loads acting to pull the traveler car along the track and across the boat are carried by the traveler controller/adjuster arrangement. Fore and aft forces are resisted directly by the track and are partially translated into transverse force by the car. The manufacturer of the traveler typically

[41] For example racing, cruising, coastal or ocean etc.

calculates the maximum working load of the traveler controller at 25% of the maximum vertical load to provide an increased safety margin. This resulted in the following estimated maximum working load for ***Platino's*** traveler controller.

Maximum vertical load (kgs)	X 25%	= Maximum (lateral) working load (kgs) of adjuster
4,082	X 0.25	= 1,020

(The rated breaking loads of components are typically around 200% of the rated safe working load)

The maximum safe working load of any system is limited by its weakest part(s), which in the case of ***Platino's*** mainsheet traveler adjuster were the 57mm control blocks. The control blocks were attached to either side of the coupler using shackles and were subject to the entire transverse load. The 57mm control blocks used were rated to a maximum working load of 1,134kg which was 27.8% of the maximum expected vertical load. This exceeded the manufacturer's typical requirement of 25%.

The End Controls fitted to the traveler were rated to the same maximum loads as the control blocks. However, the three to one purchase used for the control lines meant their weakest (limiting) components carried only a portion of the full load.

Mainsheet Traveler failure

The loss of heading control and failure of the preventer immediately resulted in several uncontrolled gybes, in which ***Platino's*** boom swung violently across the rear of the yacht and out to the opposite side. The motion of the boom was arrested suddenly each time it reached the end of the travel allowed by the mainsheet. This resulted in severe shock loading being applied to the mainsheet traveler. The shock load force was additional to the force of the wind acting on the sail, and is likely to have been far greater. The boom had been set in an outboard position due to the direction the yacht was heading, relative to the direction of the wind (the point of sail). This resulted in a high percentage of the force being applied to the traveler laterally, not vertically. This placed very high loads on the traveler adjuster. The Skipper was the only surviving crew member to have been on deck at the time the traveler failed. The Skipper stated that she believed the traveler failed completely the second time that the boom swung out to the port side, the third uncontrolled gybe.

Calculating the force generated by shock loading (dynamic forces) is extremely complicated and is beyond the scope of this investigation. Put simplistically the force developed depends on:

1. **The weight of the object that is in motion**. ***Platino's*** complete boom weighed 558kg and the mainsail weighed a further 120kg (678Kg total).
2. **The speed the object is moving**. Given the reported wind speeds of 30 to 48 knots it is probable that the end of the boom was moving at a speed in excess of 20 knots (10.3 metres per second) relative to the mainsheet traveler when it was stopped by the mainsheet. However, only a portion of the total weight is acting at end of the boom.
3. **How quickly the object is stopped.** The rope used for the mainsheet is designed to allow as little stretch as possible and will have decelerated and stopped the boom very quickly.

Although the shock loading that occurred has not been estimated, it was clear, due to the failure of the system, that the force exceeded what the traveler arrangement was able resist.

During the uncontrolled gybes, the mainsheet pulled the traveler car laterally to port with sufficient force to sheer the 6mm shackle pin used to connect the starboard control block to the traveler car. This allowed the car to move along the track toward the port side, most likely at high velocity.

The car then impacted on the port side End Control with sufficient force to sheer the two 10mm metric bolts which secured the End Control in its position on the track.

The traveler car and End Control then continued to move to port together and came up against the Endstop which was also held in place with one 10mm stainless steel bolt. This third M10 bolt yielded (bent) and the Endstop failed. The car was then propelled off the end of the track and released. The Endstop bolt may have also seen its full shear load but was able to bend because the end of the track broke off leaving the bolt unsupported.

The following information was provided by the manufacturer and gives an indication of the static loading that would be required to result in the damage observed to the traveler's components.

Component	Yield/Bend	Sheer	Breaking load
Control Block			2,268kg[42]
End Control bolts x 2	618kg	1,451kg	2,902kg[43]
Endstop Bolt	618kg		618kg[44]

The failure of the mainsheet traveler system was undoubtedly due most significantly to the shock loading (dynamic forces) introduced by the mass of the boom and mainsail moving at high speed and being stopped suddenly as the mainsheet became tight. The components failed in separate events as listed below. Each failure would have dissipated some of the kinetic energy introduced by the movement of the boom.

- Control Block 6mm shackle pin sheared.
- End Control M10 bolts (two of) sheared.
- End Stop M10 bolt yielded (bent).
- Control line Rope Clutch body failed.
- Control line either broke or pulled through the Footblock.

The traveler was thought by the Skipper to have failed on the second instance of the boom swinging from starboard to port. It is possible that damage to the components accumulated over multiple shock loading events.

The complete failure of ***Platino's*** mainsheet traveler arrangement left the boom able to swing freely until it hit the shrouds on either side of the mast. The mainsheet and traveler car, with other associated hardware, remained connected to the outboard end of the boom and the crew later described as acting like a wrecking ball. The out of control boom and associated hardware quickly caused serious damage to the rear of the yacht and resulted in difficulty in regaining control. It presented a very real danger to the crew which severely limited the options available to them. ***Platino's*** crew were never able to restrain the boom which eventually led to total failure of the rig. The failure of the mainsheet traveler dramatically reduced the crew's ability to regain control of the yacht.

[42] **Control Block**. The maximum working load and breaking load of this component are listed on the manufacturer's website. This component failed first and independently.

[43] **End Control bolts**. Information on the strength of these bolts was provided by the manufacturer on request and is stated to be conservative. The bolt material is described as A2, 18-8 stainless steel. The shear area of one bolt is the minor diameter of the M10 x 1.5 = 7.938mm. Calculations estimate that each bolt will yield (bend) at 618kg and shear totally at 1451kg. These bolts acted together to secure the end control and the theoretical shear load of the 2 bolts together would be 2,902 kgs.

[44] **Endstop bolt**. The Endstop bolt was not supplied by the manufacturer. Its exact characteristics are not known and it may have been of lessor quality stainless steel. The bolt was a M10 and its yield has been assumed to be similar those described above. Some energy would have been required to break the track which left the bolt unsupported and allowed it to bend. It is reasonable and conservative to assume the bolt was subject to at least the equivalent of 618kg of force. The end control and Endstop were sufficiently separated on the track to allow the end control bolts to fully sheer before the end control was impacted.

Out of control boom

Following the failure of the preventer and the mainsheet traveler, ***Platino's*** crew had no immediate means to effectively restrict the motion of the boom. This meant the boom was able to swing freely (through the arc between the shrouds) due to the wind and the motion of the yacht (rolling and pitching). The crew's attempts to subdue the boom and bring it back under control were complicated by several factors.

- The environment on deck was extremely dangerous. This limited the actions that could be taken by the crew. This was mostly due to the hardware hanging from the boom (mainsheet and traveler) and the potential for the boom to cause a catastrophic failure of the entire rig at any time.
- The crew's situational awareness was reduced due to the chaotic situation. They were not totally sure of the yacht's position, heading, speed or rate of turn.
- The crew found the steering wheel extremely difficult to turn. This limited their ability to control the heading of the yacht.
- The sea state was confused and unpredictable, leaving no obvious ideal heading to reduce the motion of the yacht.
- The Owner felt the main engine was ineffective in controlling the speed of the yacht and it was stopped soon after being started.
- The mainsail was lowered, which eliminated the possibility to control the boom using the force of the wind.
- The continued, rapid and unpredictable motion of the boom made it difficult and dangerous for the crew to attach a spare line to the boom.
- The loss of the two crewmembers significantly increased the level of pressure and stress for the surviving crew. This was not only due to the distress caused. The crew was also reduced by two members with valuable knowledge and experience.
- No procedure had been developed or practiced for dealing with a mainsheet failure.

One of the first actions taken by the Owner and the surviving crewmember, after their arrival at the helm station, was to lower the mainsail as soon as they were able. If a person is lost overboard from a sailing vessel, it is generally considered best practice to immediately start the main engine and lower the sails if required. This is done to maximize the maneuverability of the yacht and improve the crew's ability to return to the person in the water.

Had ***Platino's*** mainsail remained set (at least partially), it may have been possible to reduce the motion of the boom using the force of the wind on the sail, provided the yacht's heading could be maintained relative to the wind. This may, in turn, have reduced the damage caused by the traveler and improved the crew's chance of securing the boom using a spare line. The decision to lower ***Platino's*** mainsail, though understandable, may not have been ideal. However, it is also possible that additional uncontrolled and forceful gybes may have occurred if the mainsail had remained set and the yacht's heading could not be controlled.

The surviving crewmember stated that he did make attempts to lasso the boom when it occasionally stopped swinging but wasn't able to do so before the violent motion started again. He also stated that he wasn't sure what he would tie the line off to, in order to secure the boom, if he had been successful. Any line successfully attached to the boom would have presented serious risk of injury to the crew due to the possibility of becoming entangled with the line before the boom was secured.

Though not without danger, the foredeck area was outside of the possible swing of the boom. An approach from forward of the mast may have allowed a crew member to position a line over the boom while reducing the risk presented by the swinging boom and hardware. However, ***Platino's*** forward escape hatch was inaccessible due to the yacht's tender being secured on blocks directly over it. This meant there was no safe path to the bow area.

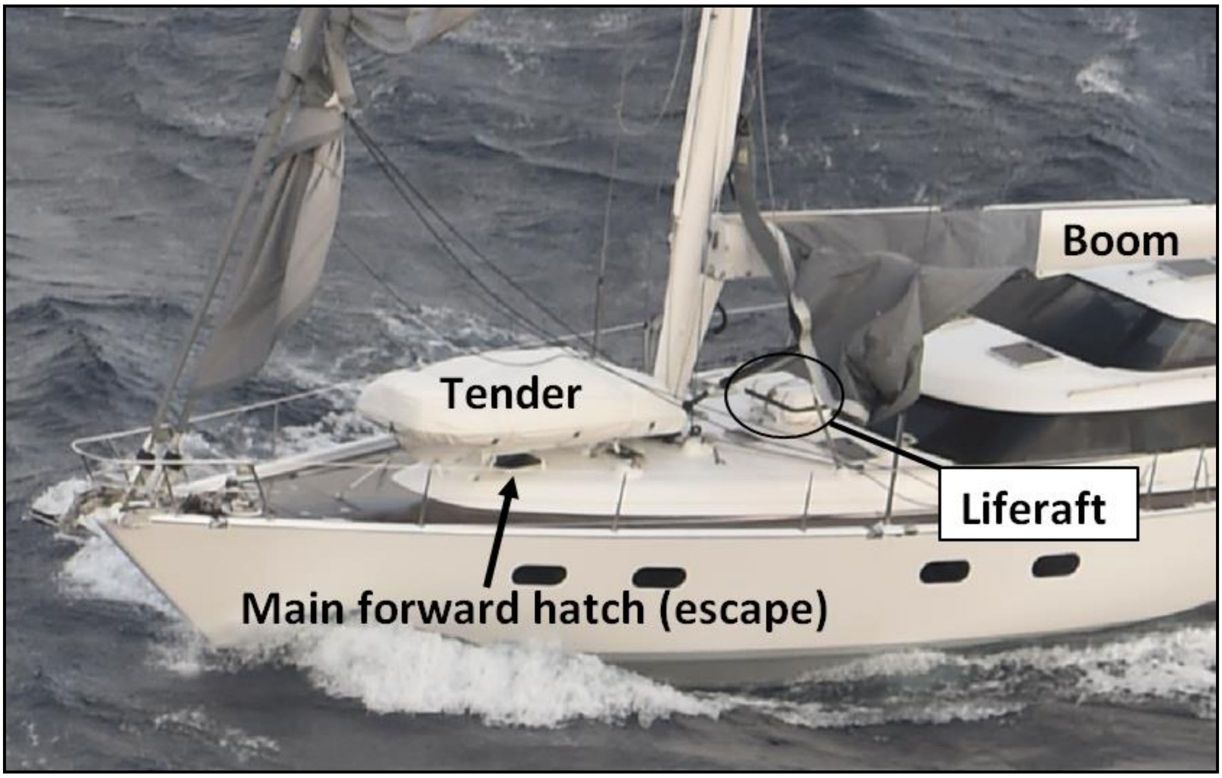


Figure 15 ***Platino*** 13 June following the initial crash gybes.

In the first few minutes that followed the initial crash gybe, ***Platino's*** jib (headsail) and sheets were flogging uncontrollably over the foredeck area. No adjustments were made to the jib and it may have rendered the foredeck inaccessible to the crew until the sail disintegrated sometime later. The boom's repeated impacts on the shrouds also had the potential to topple the mast at any time and any crewmember on the bow would have been completely exposed.

The surviving crewmember slackened the topping lift at some stage in the hope that the boom would lower sufficiently to hit the sea or the structure of the yacht and slow or stop its swing. This had very little (if any) effect on the position of the boom due to the hydraulic boom vang[45] and did not achieve the desired result. The topping lift is a line running from the cockpit area (where it is adjusted), up through the mast and back down to the end of the boom. It is traditionally used to support the boom when the mainsail is lowered. It may have been possible to release the topping lift completely and allow it to be pulled out through the mast. If successful, the line would have been left hanging from the end of the boom, which may have provided a means for the crew to secure the boom.

Conclusions

The design and installation of ***Platino's*** mainsheet traveler arrangement appears to have been satisfactory and exceeded the minimum requirements recommended. The forces involved in uncontrolled accelerations of equipment as heavy as ***Platino's*** boom are very difficult to accurately calculate, and potentially extremely large. Given the mass of ***Platino's*** boom (678kg including the mainsail) and the reported wind speeds (30 to 48 knots), it would be unreasonable to expect that the traveler arrangement would definitely hold when subjected to one or more completely uncontrolled gybes.

Platino was a very large yacht to be operated entirely by a non-professional, though experienced, crew. The boom in particular was very heavy, relative to other recreational yachts, and the likelihood of component failure occurring during an uncontrolled gybe does not appear to have been well understood by the crew.

[45] The hydraulic boom vang is a piston system on a sailboat used to exert both upward and downward force on the boom. The vang is used control the shape of the mainsail and to hold the boom up when required.

Component failure and serious harm are known potential consequences of an uncontrolled gybe occurring on a yacht of ***Platino's*** size and complexity. This is particularly true at relatively high wind speeds such as those present during the accident. Once the crash gybe(s) and traveler failure had occurred, the options available for the crew were limited.

Recommendations

All reasonably practicable steps should be taken to ensure uncontrolled gybes do not occur. This is particularly true where heavy equipment such as that installed on ***Platino*** is involved, or when wind speed is high. The consequences of any mishap are likely to be exacerbated when sailing offshore where assistance is unlikely to be available in a timely manner. It is crucial that the yacht's crew have a sufficient understanding of the likely consequences of crash gybes, should they occur.

Owners and master/skipper

Crews should fully consider the risks involved in any situation and manage these appropriately. When assessing risk of harm, care should be taken to consider;

- The likely consequences of foreseeable mishaps involving the actual equipment installed (in this case, a very heavy boom relative to more typical cruising yachts).

In conditions where unintended movement of the boom is likely or may result in serious harm, an effective preventer must be rigged to prevent uncontrolled gybes. If any doubt exists regarding the possibility of an uncontrolled gybe occurring, other options should be considered including the following;

- Altering course to an angle that reduces the risk to an acceptable level.
- Stowing the mainsail and proceeding under head sail and/or motor power, or hove to[46] if necessary.

Person overboard

The crewmember was lost overboard in the moments following the initial crash gybe(s) on June 13 2016. At that time, ***Platino*** was 305 nautical miles (565km) north-northeast of Cape Reinga. All three surviving crewmembers saw him in the water on separate occasions in the minutes that followed the accident. However, no form of flotation aid or beacon was thrown overboard at any time in an attempt to improve his ability to remain afloat, or assist in locating him during the search. The crewmember in the water was not wearing a life jacket and the remaining crewmembers were unable to regain sufficient control over ***Platino*** to immediately return to him and affect a rescue. An RNZAF aircraft was on scene within 90 minutes of the initial distress messages, but was unable to locate him. The search was officially abandoned on the morning of Wednesday 15 June and his body was never recovered.

[46] In sailing, heaving to (to heave to and to be **hove** to) is a way of slowing a sailboat's forward progress, as well as fixing the helm and sail positions so that the boat does not actively have to be steered.

Figure 16 Location of accident site relative to NZ

About person overboard/"Man overboard" (MOB)

Executing an effective rescue can be very challenging depending on the conditions. It is easily possible to lose sight of a person in the water, even if their fall overboard is witnessed, occurs in daylight and the sea is relatively calm. If the person in the water remains in sight, it may still be difficult to navigate back to them (particularly on a sailing vessel) and even to bring them back onboard once they are located. The time available to execute a rescue is finite and can be extremely limited particularly if the person is not wearing a life jacket and does not have a flotation aid available, and if the sea is rough or cold.

The importance of minimising the risk of a person being lost overboard, and maximising the chance of safely recovering a person who is, cannot be overstated. This is particularly true in higher risk situations such as when on deck alone, in heavy weather or cold sea temperatures and when proceeding off-shore. The risk of harm resulting from a person being lost overboard must be managed by the use of appropriately designed vessels, suitable equipment, safe practices and adequate training.

MOB is one of the most common emergencies to occur on any vessel and has a high likelihood of resulting in serious harm, particularly where this occurs in the open ocean. It is essential that all crew have adequate knowledge of the emergency procedures and equipment specific to the ship, in order to maximise the likelihood of their responding effectively if required. As a minimum, all adult crew members on board should be proficient in the stowage and operation of man overboard equipment and knowledge of man overboard procedures. This can only be ensured through specific and appropriate training. MOB is a key emergency procedure (along with fire, flooding and abandon ship) and best practice dictates MOB drills should be practiced on any vessel. A typical MOB procedure would include:

- Raising the alarm
- Throwing a flotation aid
- Maintain visual contact with the person in the water
- Activating the MOB function to accurately mark the position
- Mustering and instructing crew

- Starting the engine and lowering sails when appropriate
- Maneuver the vessel to the person as quickly as possible without increasing risk
- Calling for assistance if required
- Preparing equipment required to bring the casualty onboard

Lifesaving equipment carried

Platino was well equipped and generally exceeded Category 1 requirements. The common theme throughout the refit process was "no expense spared" and this extended to the safety equipment carried.

The key lifesaving equipment that was carried onboard is listed below:

- Lifejackets (inflatable)
- Recovery Module
- Rescue Sling
- Chart plotter with MOB function and AIS[47] data display
- Liferaft
- EPIRB(s)

Platino was equipped with more than sufficient lifejackets for every person, including children's sizes. The life jackets carried for each adult were high quality combined lifejackets/harnesses which met or exceeded requirements for Cat 1 certification. These lifejackets were stowed under the companionway steps which led from the cockpit to the saloon. GPS enabled AIS personal locator beacons had been supplied for each adult lifejacket.

The Recovery Module was an inflatable device that is specifically designed to aid in the safe recovery of a person who is lost overboard. The module is deployed by pulling the launch lever on the back (inboard side) of the case. Upon release, the module automatically falls outboard, detaches from the vessel entirely and inflates to provide flotation and a visual marker. The recovery module on ***Platino*** was stored in a hard case and this was mounted on the pushpit rails to the port side (left) of the main helm (steering) position. A GPS enabled AIS locator beacon had been fitted to the recovery module.

The Rescue Sling was an inflatable device that is specifically designed to aid in the safe recovery of a person lost overboard. It is deployed by pulling the pouch out of its case and throwing it to the casualty. The sling normally remains tethered to the yacht and would automatically inflate on contact with the water. The Rescue Sling was stored in a hard case and this was mounted on ***Platino's*** pushpit rails to the port side (left) of the main helm (steering) position.

Platino carried an eight person liferaft, stowed in a cradle on the mid deck just behind the mast. The liferaft is intended for a situation where the crew is forced to abandon the yacht and would not normally be used where a person has been lost overboard.

Platino was equipped with two GPS enabled 406 MHz EPIRBs. A vessel's main EPIRB may not typically be deployed in a MOB situation but could be of use.

Further information and comment - MOB

Though the wind and sea state had built considerably since the previous afternoon, the crew remained comfortable with the way the yacht was performing before the accident and were not concerned.

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[47] The Automatic Identification System (AIS) is an automated, autonomous tracking system which is extensively used in the maritime world for the exchange of navigational information between AIS-equipped terminals.

Based on the Skipper's account, it is most likely that the crewmember was knocked overboard by either the mainsheet and broken traveler, or the broken preventer, which were hanging from the swinging boom. It is possible that he was injured as he was thrown from the yacht but the investigation could not determine the nature and severity of any injuries he may have suffered. The only known fact in regard to his condition is that he was conscious and able to wave from his position in the water in the minutes that followed being lost overboard. He was lightly dressed and was not wearing a life jacket.

The Owner and the surviving crewmember then arrived on deck and made their way to the helm station area at the rear of the yacht. Once at the helm station, the two men had many tasks to perform (some complex) and the danger presented by the swinging boom created a chaotic situation, which severely limited their options. Following the Owner and surviving crewmember's arrival on deck, the Skipper went below and attempted to raise emergency communications from the saloon and companion way steps.

The Owner was the first of the crew to take the wheel after the accident. He and the surviving crewmember soon began taking short shifts at attempting to steer as the task was physically demanding. Both men reported that the wheel was extremely difficult to turn and their control was severely limited. The difficulty the two men experienced in turning the wheel was not fully established but was covered in more detail in the Autopilot failure section. The main engine was started but the Owner stated that it was later stopped "because it wasn't doing any good, I couldn't… take the boat where I wanted to take the boat because it was out of control".

Both the Owner and the surviving crewmember saw the crewmember in the water in the initial few minutes while they were on the aft deck attempting to regain control of ***Platino***. The surviving crewmember reported seeing him at "about 100 yards away" and behind the yacht. The Owner reported seeing him to the port side, in line with where he was positioned at the wheel, and about 20 metres away. Had ***Platino*** had carried on in a straight line after he was lost, the crewmember who was overboard would have been well behind the boat by the time the Owner made it to the wheel. Data gathered from ***Platino's*** navigation equipment shows that the yacht returned to the vicinity of the initial crash gybe(s) on two occasions in the first few minutes. It is impossible to determine exactly where in the yacht's track the crewmember was lost overboard, but it is likely the yacht passed close to him on at least two occasions following his fall.

GPS Track information MOB

GPS track information was recorded by ***Platino's*** master chart plotter and shows the path (track) the yacht followed during the voyage, including the area of the accident. The information has value but includes limitations, which can be misleading if not properly understood. The information consists of a series of positions (track points) where the yacht has been, which are recorded in the order the yacht travelled through them. The recorded track points do not include information on the time the yacht was at each position, the speed the yacht was moving or the actual direction the yacht was pointing (its heading).

An extract of the track data was obtained from ***Platino's*** chart plotter. Recorded data points were imported to Google Earth and the distance between data points was measured using the Google Earth Path tool and verified by secondary calculation.

Track data points recorded previous to the event below are evenly spaced and show a consistent path, generally with very little variance. The track shown below shows a dramatic change in the yachts behavior and indicates the path the yacht travelled through the scene of the accident. The first uncontrolled gybe is known to have occurred at approximately 1100 AM on 13 June 2016 and was caused by a substantial turn to starboard.

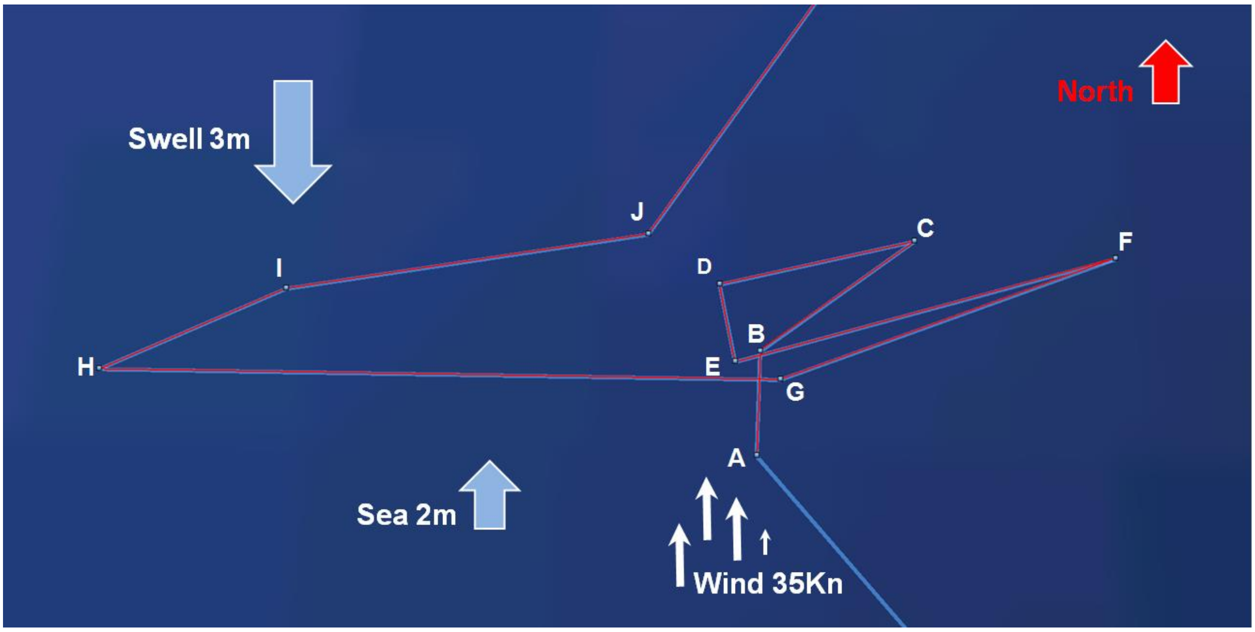

Figure 17 GPS track information from accident site, wind and sea information added.

The picture above shows 10 distinct alterations in the direction of ***Platino's*** path, which are labeled A to J. The distance between the track points is known but the time taken to travel between these can only be estimated based on assumed speed. The actual heading of the yacht is likely to be generally correlated with the path but cannot be assumed to be identical.

Platino entered at the bottom of the picture below and followed the path through the labelled data points before exiting at the top of the picture. It is impossible to definitively ascertain exactly where the crewmember was lost overboard but this did occur very early in the chain of events. At point A the yacht is thought to have been moving at approximately 9 knots based on crew statements. The distance between A and C is 120 metres and this distance would be covered in 26 seconds at 9 knots (nautical miles per hour, kn). ***Platino's*** speed can be assumed to be slowing and 26 seconds would represent the minimum time. Based on timing and the Owner's sighting of the crewmember in the water, it is most likely he was lost overboard between point B and C.

Platino returned to the vicinity of the original crash gybe(s) on two occasions (see points E and G) in the first few minutes. With a third approach to a more distant point (see point J) a few minutes later. The yacht then headed away from the scene to toward the northeast. It is likely that ***Platino*** passed within approximately 50 metres of the crewmember in the water on at least two (possibly three) occasions following his fall. This explains how the Owner was able to see the crewmember in the water alongside the boat sometime after he had been lost overboard.

Though the path travelled appears to show deliberate attempts to return to the crewmember and affect a rescue, both the Owner and the surviving crewmember maintain that the yacht was effectively out of control during these first few minutes. The factors present in the early stages of the accident created a chaotic situation and the crew's situational awareness was severely reduced. The surviving crew were not completely aware of the path that ***Platino*** followed during this time.

The path A to J is 1,043 metres. This distance would be travelled in an absolute minimum time of 3 minutes, 45 seconds, if the yacht had continued at a speed of 9 knots. However, it is very unlikely that that a speed of 9 knots would have been maintained. A more realistic average of 4.5 knots would, have resulted in a travel time of 7 minutes, 30 seconds between point A, and point J.

Training & safe practices

Two weeks prior to the departure for Fiji the crew met for a practice sail on ***Platino***. Three to four hours were spent sailing in the area between Gulf Harbour and Rangitoto Island. The main focus of this outing was to show the crew how the yacht's sail handling equipment was operated. The crew set and adjusted both of the twin headsails and the mainsail and discussed the general operation of the yacht.

The owners of the ***Platino*** informed the crew of the location of all lifesaving equipment carried prior to the accident. However the specific details of the lifesaving appliances (LSA) mounted on the pushpit rails and their use was not discussed in detail. The crew of ***Platino*** did not conduct a MOB drill or any other specific safety training at any time. No emergency procedures were developed and documented and no specific safety briefing was given.

None of the surviving crew were able to accurately describe the Recovery Module or Rescue Sling or the correct deployment and use of these items when interviewed.

No standing orders were issued and no requirements were stated for safe practices on the ship including areas such as the following,

- The circumstances in which lifejackets and harnesses must be worn and when the crew must attach these (via tethers) to the jacklines or other strong points.
- The specific expectations for maintaining an effective watch.
- The circumstances in which the skipper should be called.

It is considered unlikely that the lack of standing orders, and generally relaxed safety culture, had any bearing on the fact that the crewmember lost overboard was not wearing a lifejacket when the initial accident occurred. He was off watch and below decks at that time and the crew were not conscious of any heightened danger. However, had a more robust safety culture been in place, it is more likely that he would have donned, or at least retrieved a lifejacket before responding to the situation on deck. Had wearing lifejackets been part of the normal practice aboard, the crew would have been more practiced at retrieving and donning them before going on deck. It is also possible that they would have been stowed in a more readily available position. Best practice would be for standing orders to require all crew to don a lifejacket before responding to any emergency situation on deck.

Use of Equipment

Though lifejackets were donned by the surviving crew in the hours that followed the accident, none of the lifesaving equipment was used to assist in attempting to rescue the crewmember lost overboard.

Lifejackets

No surviving member of the crew wore a lifejacket or safety harness at any time during the voyage prior to the accident, with the possible exception of checking the fit. It appears this is also true for the deceased crewmember and the crewmember lost overboard but this cannot be confirmed. This includes periods of up to two hours where crewmembers, with the exception of the Skipper, were alone on deck at night during solo watches. In general, the crew remained within the relative safety of the cockpit area during night watch. However, leaving the cockpit to respond to any situation on deck would have exposed the crewmember to the potential to fall overboard. This included moving from the cockpit to the main helm position which was required to make adjustments to the sails, take manual control of the steering or alter the course being steered using the autopilot controller at the helm station[48]. A crewmember lost overboard during a solo watch period may not be missed for up to two hours and would have an extremely low chance of survival without an effective flotation aid. Lifejackets were donned by the surviving crew following the accident.

Best practice would require all crew to wear lifejackets and harnesses at all times while on deck. However this is not necessarily widely practiced, particularly on substantial vessels such as ***Platino***. A widely accepted minimum standard is to require crew to wear lifejackets and harnesses at any time

[48] The course could also have been adjusted using the controller in the saloon

where a risk of falling overboard exists[49], when on deck alone or if the situation onboard became dangerous for any reason. Maritime Rules, Part 91 – Navigation Safety Rules 91.2(5) requires that properly secured and appropriate personal flotation devices are worn in situations that cause danger or a risk to the safety of any person.

Lifesaving/MOB equipment

At no time during the accident, or the events that followed, was any item thrown overboard (or attempted to be thrown overboard) to provide the crewmember in the water with floatation, and assist with guiding any rescuer to him.

The Owner and the Skipper both stated that there was no opportunity, in the circumstances, to throw anything overboard to assist the crewmember in the water. This was due for the most part to the danger presented by the unrestrained boom, which continued to swing across the yacht. The swinging boom had already resulted in both the death of one crewmember and another being lost overboard, and caused serious damage to the rear of the yacht.

The Owner also stated that the Recovery Module "got smashed when the bimini came down, when the boom and the block came out and just pulled it all apart". This implied the Owner believed the Recovery Module had been damaged and could not have been used even if it had been accessible.

The surviving crewmember stated that he did consider "ejecting it" [the Recovery Module] but stated several concerns, which contributed to that fact that he did not attempt this,

- He believed the module was on a tether (i.e. would remain attached to the yacht by a rope) and the crewmember was too far away when he saw him in the water.
- He believed that, if he released the module too soon, he would have nothing to give to the crewmember in the water when they were able to bring the boat back to him - he was unsure of the best time to release it.
- He believed the risk created by the swinging boom made it too dangerous to reach the equipment.

The surviving crewmember also stated that he realised the squabs from the cockpit seating could have been thrown overboard, but he had thought of this after making his way past them to the aft deck area. By this time, he considered the danger presented by the swinging boom meant he could not get back the squabs to throw them. The surviving crewmember stated he "must have crawled back" [to the cockpit] to assist with activating the EPIRB. However, the EPIRB was activated approximately 15 minutes (possibly longer) after the accident when ***Platino*** had travelled approximately 1.3 nautical miles (2,400 metres) and was approximately 900 metres from where the crewmember was lost.

Recovery Module

The Recovery Module is designed specifically for use in a MOB situation similar to that which occurred on ***Platino***. Category One safety standards allowed the Recovery Module to be carried as a replacement for a life ring which would otherwise be required. The module is designed to be released easily and completely from the vessel, by pulling the launch lever on the back of the case. It should be deployed as soon as possible after a crew member becomes aware that a person has been lost, with the possible exception of situations where the crew is completely confident that the MOB is not in danger and will be recovered safely. The recovery module is designed for a single use and must be sent to an approved service station to be re-packed after it is deployed.

Had it been deployed, and had functioned correctly, the Recovery Module would have provided the highest likelihood of the crewmember's rescue.

The MOB/lifesaving equipment (Recovery Module, Rescue Sling and a float free EPIRB) were mounted on the pushpit rails to the port side of the aft deck and helm position. The bimini was also

[49] ***Platino's*** two cockpit layout exposed the crew to a risk of falling overboard during any move to the main helm station.

attached to the top pushpit rails above this equipment. In the early stages of the accident the mainsheet traveler car hit the bimini and tore it off. This damage occurred while the Owner and the surviving crewmember were on the aft deck beneath the bimini and attempting to bring the yacht under control.

The pushpit rails to which the lifesaving equipment was mounted were also damaged at some stage. However, this damage occurred after ***Platino*** had departed the initial scene and there is no evidence to suggest the lifesaving equipment had been damaged or was unserviceable at the time it may have been effective.

A photograph taken by a RNZAF Orion, approximately five hours after the accident, suggested that the pushpit rails and lifesaving equipment were undamaged at that time. The photograph also showed the proximity of the crewmembers at the wheel (where they were when they sighted the man in the water) to the Recovery Module and suggested it would have been accessible when required. However, at the time the photograph was taken the mainsheet was wrapped securely around the boom and was not an immediate danger to the men. This was not the case in the early stages when the module may have been effective.

At no time did any member of the crew make an attempt to deploy the Recovery Module.

Photographs taken subsequent to the salvage show the damage that occurred to the pushpit railings sometime after the photograph referred to above was taken. The MOB equipment appeared to be serviceable despite this damage.

It is more likely that the Recovery Module would have been deployed successfully if the crew had been more familiar with its design, intended use and launch procedure. The correct use of the Recovery Module should be discussed and simulated as part of a comprehensive MOB drill and general emergency preparedness training.

Rescue Sling

The Rescue Sling is attached to the yacht via a 36 metre tether line. It is possible to disconnect the tether and jettison the sling completely if no other equipment is available to assist a more distant casualty. However, the Rescue Sling is most appropriate for use when recovering a casualty that vessel has been maneuvered back to. The Recovery Module was available and ***Platino*** was never effectively brought under control and maneuvered back to the crewmember lost overboard. The sling should have been deployed only if it was accessible and the best option available. The Rescue Sling was not used.

Chartplotter MOB function

When activated, the MOB function of ***Platino's*** chart plotter(s) would have accurately marked and recorded the position of the yacht at the moment the MOB button was pressed. The system would then begin to prominently display the recorded position (MOB mark) and information regarding the distance and direction of the mark from the yacht, and the time elapsed since its activation. The relevance of the recorded position to the actual position where the person was lost would depend heavily on the how quickly the MOB function was activated and the speed of the vessel.

Platino was fitted with a navigation suite based on multifunction displays. The display mounted in the saloon was the master unit and recorded all error/alarm messages for the entire suite. The equipment's manufacturer has confirmed any activation of the MOB function would have been recorded. The data extracted from master unit does not include reference to any MOB function activations.

The Skipper initially stated that she had activated the MOB function. However she later recalled being unable to access the position information when communicating with the RNZAF Orion, which arrived within 90 minutes of communications reaching RCCNZ. The Skipper then stated she gave the position from memory. The Orion's crew began to search for the lost crewmember by flying a wagon wheel pattern with a radius of five nautical miles (Nm). The search pattern was centered 3.55 Nm away from the accident sight. The location where the crewmember was lost overboard was within the area searched but he was not sighted.

The system on ***Platino*** required the WPT/MOB button to be pressed and held for three seconds in order to activate the MOB function. The Skipper did not describe this requirement when interviewed and it is most likely that the button was not pressed for the required time.

It is more likely that the MOB function would have been activated successfully if it had been practiced prior to the accident. Activation of the MOB function should be part of a comprehensive MOB drill and general emergency preparedness training.

Considering that;

- The crew of ***Platino*** were unable to regain effective control of the yacht.
- The crewmember lost overboard had no form of flotation aid available and had been in the water for approximately 90 minutes (possibly longer) when the Orion arrived on scene.
- The search pattern flown by the Orion would have overflown the area where the crewmember was lost despite not being centered on that position

Successful and timely activation of the MOB function may not have had any bearing on the outcome of actual accident. However, if the search pattern had been centered on the accident site, the position in which the crew member was lost would have been overflown significantly more often.

8 Person Liferaft

The liferaft was secured on blocks beneath the boom and aft of the mast. Due to the danger presented by the unrestrained boom, the raft was probably inaccessible to the crew until after the rig failure of the rig. This would have resulted in a very serious situation had the crew needed to abandon the yacht at any time prior. The raft was stored in a ridged canister with no handles and weighed 46kg and moving it to the cockpit area proved difficult even after the rig had fallen.

EPIRBs

Some difficulty was experienced in activating the EPIRB. The use of the EPIRB is covered in detail in the Emergency Communications section.

Other possible actions

It is generally accepted that in a MOB situation virtually any item that will float can and should (depending on the circumstances) be thrown overboard in an attempt to provide flotation and help guide rescuers to the casualty. It is possible that other items could have been thrown overboard in an attempt to assist the crewmember lost overboard and some items have been included below for completeness. The use of novel equipment in an emergency would require presence of mind that may not be available to all people in high stress situations. Though it is prudent to discuss other options during emergency preparations, the physical use of such items is not likely to take place as part of an actual practical drill.

Squabs

Squabs will generally float for some time depending on their construction and it is widely accepted that these can be thrown overboard in a MOB situation. Squabs may directly provide flotation for the MOB, and/or help provide a visual guide for search and rescue efforts.

It is possible that squabs from the cockpit seating could have been thrown overboard in an attempt to assist the crewmember lost overboard. However, the swinging boom and associated hardware presented a definite danger, particularly in the forward cockpit area and pausing in the cockpit to unclip and throw a squab is likely to have been extremely dangerous. The cockpit table was caught by hardware hanging from the boom, broken free and propelled overboard in the first few minutes of the accident. This demonstrates that the forward cockpit was potentially an extremely dangerous area during this time.

Life jackets

It is possible that a life jacket (or life jackets) could have been inflated and thrown overboard, and/or squabs from the saloon or cockpit seating could have been thrown overboard from the relative safety of the companionway entrance.

Forward hatches

Platino was equipped with several hatches, which opened from the accommodation space to the foredeck area. It might have been possible for a crewmember to throw some form of flotation aid overboard through one of these hatches while avoiding the danger presented by the boom. However, the largest of the hatches which should have also provided a secondary means of escape was inaccessible due to the yacht's tender being secured directly over the hatch on blocks.

Conclusions

Platino was very well equipped and every member of the crew had extensive offshore sailing experience. However, the owners took very few steps to ensure the crewmembers were properly prepared for any emergency situation. Statements made by the owners indicate they placed heavy reliance on the knowledge and experience of each individual crewmember. They assumed that the crew all possessed the required expertise to effectively use the equipment onboard and respond to an emergency.

The situation onboard ***Platino*** deteriorated extremely quickly during the accident. Within only seconds the yacht, which had been sailing comfortably, was significantly damaged and effectively out of control. One crewmember had been fatally injured. Another had been lost overboard and the unrestrained boom continued to present a very real danger to the yacht and its crew. It was also possible that the mast could fall at any moment. The wind and sea conditions, which had appeared manageable, now appeared very threatening. The crew were not able to intentionally manoeuvre the yacht back to the crewmember in the water to affect a rescue.

It is very difficult to reliably predict how any person will react when experiencing a situation such as that which occurred on ***Platino***. Despite this, it appears possible that actions could have been taken which may have significantly increased the chance of the crewmember lost overboard being rescued, particularly deployment of the Rescue Module and (to a lesser extent) the jettisoning of other items, that may have provided flotation and/or helped mark his general position in the water for the search aircraft. It is widely accepted that any person is more likely to respond effectively in an emergency situation if they have received appropriate and specific training, and possess an adequate level of knowledge of the equipment available.

The surviving members of ***Platino's*** crew were not able to accurately describe the Recovery Module or the Rescue Sling, or the procedure to deploy them. No attempt was made to deploy either during the accident. The surviving crew have all stated that they believe this equipment was inaccessible during the early stages of the accident when deploying may have been of value. The MOB function of the navigation system was not successfully activated. Some difficulty was experienced in activating the EPIRB and this was only activated after the surviving crewmember was able to view the directions included on the unit. No practical drills were conducted and no specific training was undertaken onboard including any detailed discussion on the design and use of the lifesaving appliances carried.

Category 1 safety standards allow inflatable appliances such as the Rescue Module and Rescue Sling to be carried in place of life rings and these have the potential to be extremely effective, provided they are deployed. However, the procedure to use these devices is less obvious and intuitive than a traditional life ring. The devices can also be used only once (without professional servicing and re-packing) which makes actual deployment during drills extremely unlikely and may complicate the decision of exactly when they should be deployed. Inflatable lifesaving appliances may be less likely to be used in an emergency situation than traditional flotation aids, particularly where a crew has not engaged in an appropriate level of specific training.

Recommendations

Owners and skippers

The Master (skipper) and/or operator of any vessel should take all reasonably practical steps to ensure that all crew members possess a level of knowledge appropriate to the conditions is which they intend to operate, and their position and level of responsibility onboard. Information is contained in The Director's Guidelines to YNZ, contained within the Yachting NZ Yacht Safety Inspectors Manual 2009, as to the required knowledge and proficiency for the crew of a pleasure craft departing for overseas. The following should be included at minimum,

- Developing and carrying a written action plan for dealing with emergencies.
- Ensuring that at minimum all adult crewmembers are proficient in the stowage and use of all key safety equipment such as lifejackets and harness, lifesaving appliances, firefighting appliances, pumps and emergency communications equipment.
- Conducting practice drills of key emergency procedures including person overboard (MOB), fire, flooding and abandon ship. Where the use of specific equipment cannot be actually practiced during drills, the use of such equipment should be simulated and/or discussed in detail.
- Where more complicated alternatives are carried in place of traditional lifesaving appliances, extra care should be taken to ensure the crew has an adequate level of understanding of the equipment and its use.
- Care should be taken to ensure that methods of emergency escape such as hatches remain serviceable and accessible at all times.

Emergency communications

Based on crew statements, the initial accident occurred at approximately 11:00 AM. The first distress information from ***Platino*** received by RCCNZ was a notification that an EPIRB registered to the yacht had been detected at 11:15 AM. This was followed by a call from a naval architect, who had completed design work during the refit of ***Platino***. He said that he had received a distress message from ***Platino*** via mobile phone and his call was received by RCCNZ HQ at 11:24 AM.

Though distress calls were successfully transmitted from ***Platino***, there was some difficulty encountered which is described below.

Emergency Communications Equipment

In order to receive Category 1 certification, yachts travelling on international voyages must meet minimum requirements for the quantity and type of communication equipment carried. The communications equipment carried on ***Platino*** met or exceeded requirements and included the following items;

- SSB – MF/HF Radio.
- Satellite voice communication system.
- VHF Radio – Installed.
- VHF Radios – Handheld & water proof.
- EPIRBs (Emergency Position Indicating Radio Beacon)

Platino was equipped with two GPS enabled 406 MHz EPIRBs. Both were correctly registered to the yacht. When activated, the EPIRBs carried on ***Platino*** would transmit a distress signal including a unique identifier code and GPS position information. The distress signal is typically detected almost instantaneously (via satellites) and the information is immediately forwarded to the national authority where the EPIRB is registered. EPIRBs can be used to easily transmit a distress signal in any emergency situation regardless of if the ship is being abandoned or if its position is, or is not known.

A float-free EPIRB was located in an enclosure fitted to the yacht's pushpit rails. This unit was designed to be released automatically if the yacht was to sink and included a "Sea switch" which would activate the unit when immersed in water. It could also be activated manually using the Activation Switch.

A further EPIRB was carried in the yachts grab bag[50]. This EPIRB could only be manually activated using the Activation Switch.

Communications made

VHF and MF/HF Radios

Following the accident, the Skipper went to the main saloon station to call for assistance. She made attempts to raise communications on the Marine VHF and MF/HF Radios but did not receive a reply. Due to the area of operation, it was unlikely that another vessel would be within VHF range. Effective use of the MF/HF radio requires the correct frequency to be selected for the range of the intended call and the environmental conditions. This can require several frequencies to be tried and may be time consuming.

Satellite communications device

After attempting to activate one of the EPIRBs, the Skipper then moved to making phone calls via her mobile phone, which was paired to the satellite voice communications device carried.

The Skipper first attempted to call her brother's phones but was unable to reach them. She then successfully called a naval architect who had completed design work during the refit of ***Platino***. The Skipper stated she called the naval architect because "his name just happened to be there in the list so I rang him" referring to the fact that his number was saved in her phone. The first attempt to raise the alarm via the satellite voice communications device was made at 11:05:38 AM and the first successful call was made at 11:12:13 AM. The naval architect then contacted RCCNZ to relay the distress message and was transferred through to RCCNZ HQ from South comms at 11:24 AM.

The Skipper and the crew of ***Platino*** never contacted RCCNZ directly throughout their ordeal. It would have been possible for direct contact to have been made with RCCNZ immediately if the procedure been planned and the phone number had been saved in the phone(s) or made available onboard. RCCNZ made a considered decision to not call the yacht directly during the rescue. The communication in place was working effectively via the 3rd parties that the Skipper had called, and via the RNZAF Orion(s) which responded. Experience has shown that the need for direct communication must be weighed against the potential to increase the workload and stress being managed by the people involved. RCCNZ did pass on a message for the crew to contact them directly if they wished but they did not do so.

EPIRBs

An EPIRB registered to ***Platino*** was first detected at 11:15 AM on 13 June 2016 (23:15 12/06/16 UTC). The EPIRB that was activated was the manual unit, which was stored in the yacht's grab bag.

The Skipper had retrieved the EPIRB from the grab bag but found she was unable to activate it. The surviving crewmember stated he "must have crawled back and picked it up" to assist, after hearing the Skipper repeatedly say "I can't set it [the EPIRB] off". The surviving crewmember discovered that the EPIRB worked differently to the one he had on his own boat and he was not familiar with the procedure required to activate it. The EPIRB was activated only after he was able to read the instructions on the unit's casing.

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[50] A grab bag is a pre-prepared bag containing essential items which should be taken in the event of abandoning ship.

The EPIRB was activated nine minutes after the initial attempt to raise the alarm via the satellite communications device and three minutes after the successful call to the naval architect. It should have been possible to activate the EPIRB within a few seconds of retrieving it from the grab bag.

Activation of the EPIRB should be discussed and simulated as part of a comprehensive abandon ship or general emergency drill. It is more likely that the EPIRB would have been activated with less difficulty if its activation had been practiced prior to the accident.

The float free EPIRB, fitted to the pushpit rails, was not activated during the accident and was still in place when ***Platino*** was salvaged. It is possible that this EPIRB could have been manually removed from its enclosure and activated to raise the alarm. This EPIRB could also have been thrown overboard in an attempt to mark the position of the crewmember lost overboard. The EPIRB's “Sea Switch” would have activated the unit on contact with the water removing the need for it to be manually activated. However releasing the EPIRB from its enclosure would have required a crew member to remove the R-clip on the outboard side of the enclosure and pull the cover off to access the beacon. This action would have been more difficult than launching the Rescue Module and exposed a crewmember to a greater level of danger.

Manual activation of the EPIRBs carried on ***Platino*** is identical and achieved as follows.

1. Remove the EPIRB from its mount or enclosure
2. Break off the anti-tamper tab by pulling it upwards
3. Push the switch catch in and move the switch fully to the left “ON” position

This information was included on the EPIRB casing.

Conclusion

Distress communications were successfully transmitted from ***Platino*** following the accident. However, difficulties were encountered with activating the EPIRB, and in making a call by satellite phone. The difficulties experienced delayed the receipt of distress information from the yacht by RCCNZ. Detailed information could have been delivered directly to RCCNZ via voice call at least nineteen minutes earlier, if RCCNZ had been called initially. The EPIRB could have been activated at least ten minutes earlier than it was, and possibly up to fifteen minutes earlier based on the accident occurring at 11:00 AM.

It is more likely that distress information would have been transmitted via the EPIRB and satellite communications system without difficulty or delay, if the procedure had been practiced prior to the accident. Activation of the EPIRB should be discussed and simulated as part of a comprehensive abandon ship or general emergency drill. An actual test call could be made to RCCNZ during a drill (simulating use of the satellite communications device) and this could be carried out using normal mobile phone coverage prior to moving offshore. At a minimum the skipper and all adult crewmembers should be proficient in the emergency use of the communications equipment including the EPIRB(s).

Recommendations

Owners and master/skipper

The Master (skipper) and/or operator of any vessel should take all reasonably practicable steps to ensure that all crew members possess a level of knowledge appropriate to the conditions is which they intend to operate, and their position and level of responsibility onboard. For a vessel conducting an offshore voyage, this should involve:

- Developing and carrying a written action plan for dealing with emergencies.
- Ensuring that at minimum all adult crewmembers are proficient in the stowage and use of all key safety equipment such as lifejackets and harness, lifesaving appliances, firefighting appliances, pumps and emergency communications equipment.

- Conducting practice drills of key emergency procedures including person overboard (MOB), fire, flooding and abandon ship. Where the use of specific equipment cannot be actually practiced during drills, the use of such equipment should be simulated and/or discussed in detail.

Where a telephone is intended for use, as a form of emergency communication,

- Telephone numbers for appropriate points of contact such as RCCNZ should be established. These numbers should be shown prominently within written emergency plans, readily available onboard and where possible stored on any telephone that may be used to make a distress call.

Rig collapse

Platino's rig was built when the yacht was built in 1997. The original rig was retained and thoroughly inspected (including being x-rayed) during the refit.

Given the circumstances of the accident, and the accumulation of damage to the rigging caused by the unrestrained boom, the eventual failure of the rig was inevitable. Due to this, the investigation and this report did not include an in-depth examination of this failure. No conclusion has been drawn as to whether the rig was properly designed, built or maintained over its life. However, no evidence was found to suggest otherwise.

Other considerations

Alcohol use

Findings

Statements from the crew interviewed confirmed that alcohol was consumed by ***Platino's*** crew each evening of the voyage. Up to three drinks each were consumed between 5 PM and the end of dinner, including beer, rum and coke and wine. Crew statements also indicate that no alcohol was consumed within sixteen hours of the initial crash gybe, and no crewmember was thought to be intoxicated during the voyage.

Command and control

As stated throughout this report, the culture onboard ***Platino*** with regard to command and control, and safety, was relaxed and casual. The Skipper completed a Marine 1st Aid course, and both the Skipper and the Owner completed an Advanced Sea Survival course while preparing to sail ***Platino*** offshore. The crew met for a practice sail prior to the departure to Fiji, and all crewmembers were made aware of the type and location of the lifesaving appliances. However the key equipment mounted on the pushpit rails, and its use was not discussed in detail.

- No emergency drills, or any other safety training specific to the yacht and its equipment was carried out with the crew at any time.
- No emergency procedures were developed and documented.
- No specific safety briefing was given.
- No standing orders were issued and no requirements were stated for safe practices on the yacht including areas such as the following,
    - When lifejackets and harnesses must be worn,
    - Maintaining an effective watch.
    - The circumstances in which the skipper should be called.
- No log book was kept.

- No written watch roster was provided.

The owners relied on the knowledge and experience of each individual crewmember. It was assumed that they all possessed the required expertise to effectively use the equipment onboard and respond to an emergency.

The Skipper had extensive ocean sailing experience and had trained to achieve several qualifications including Boat Master, Coastal Yacht Master, Ocean Navigation, Radar and Radio courses. However, the Skipper did not necessarily directly command the actual sailing of the yacht or oversee all functions onboard. For example she did not take part in rigging the preventer, which had not been rigged at any time prior to the voyage to Fiji. She was not able to confidently describe configuration of the preventer that was rigged.

In general, decisions onboard were made by discussions involving all crew. The hierarchy of control, where no one person was clearly in command may have affected the quality of the decisions being made.

Recommendations

All skippers should utilize the knowledge, experience and ability of their crew. All crewmembers should take personal responsibility for safety and are obliged to raise any concerns that they may have. However, the overall responsibility for the safe operation of the yacht and the protection of its crew and the environment lies solely with the skipper.

Owners and skippers

Care should be taken to ensure the Master (skipper) of any vessel:

1. Understands the level of responsibility associated with that position.
2. Personally possess a level of knowledge suitable to the position and are capable of exercising effective command over the yacht and its crew.
3. Has sufficient oversight over all relevant functions onboard to ensure the responsibility is met.

Appendix 1 – Overview of crew qualifications and experience

This section provides a brief overview of the experience held by ***Platino's*** crew members. It is by no means complete and only serves to demonstrate that the yacht was adequately crewed for the intended voyage.

The skipper (co-owner)

The skipper was an experienced seafarer who indicated that her sailing experience spanned 30 years. She estimated she had sailed sixty to seventy thousand nautical miles including an 8 year period spent living aboard a yacht while sailing around the world. The skipper had obtained Boat Master and Coastal Yacht Master certificates and had completed ocean navigation, marine radio and radar operator's courses. She completed sea survival and marine 1st Aid courses while preparing to sail ***Platino*** offshore.

The owner

The owner was an experienced seafarer who stated his sailing experience spanned more than 45 years. His experience included crewing on yachts during races and delivery voyages in the inshore, coastal and offshore arenas. The owner had no formal sailing qualifications but was an experienced marine electrician.

The surviving crewmember

The surviving crewmember was an experienced seafarer who stated he became very involved sailing after an earlier focus on rowing. He owned his own boat and had gained extensive experience sailing as crew on yachts of up to one hundred feet in length. His extensive experience included crewing during races and delivery voyages in the inshore, coastal and offshore arenas. The surviving crewmember had no formal sailing qualifications.

The crewmember fatally injured on deck

The crewmember fatally injured on deck was an experienced seafarer who had been involved with boats and the sea since a young age. He was also an experienced boat builder who served an apprenticeship beginning at the age of sixteen. He was heavily involved in the New Zealand yacht racing circuits on both a local and national level. He built and raced his own yacht and sailed as skipper, watch captain, navigator and crew on many others. He competed in shorthanded and fully crewed races in the inshore, coastal and offshore arenas. He held a Boat Master certificate.

The crewmember lost overboard

The crewmember lost overboard was an experienced seafarer who had been involved with boats and the sea since a young age. He was also an experienced engineer and had owned and operated a small engineering business for 32 years. His boating experience included owning his own boats and being crew for yacht deliveries between various international ports. He sailed regularly for many years on yachts competing in the Auckland Club racing circuit, and numerous times on prestigious yacht races including the Coastal Classic, Sydney to Mooloolaba, Sydney Hobart and the Kenwood Cup. He held a Boat Masters Certificate.

Appendix 2 – Overview of recommendations

Certification for pleasure craft departing on international ocean voyages

Recommendations

Maritime NZ and Yachting New Zealand

The version of this report sent out to interested persons for comment in June 2017 included a draft recommendation that Maritime NZ and Yachting New Zealand conduct a review to examine the effectiveness of the current certification system, and its associated procedures. In July 2017, the Director of Maritime NZ commissioned a review of the process by which recreational craft are evaluated prior to departing New Zealand on international voyages. At the time of this version of the report being released, that review was not complete.

YNZ introduces changes to the *Safety Regulations of Sailing*.

Since the time of the ***Platino*** accident, YNZ has made changes to Changes to Safety Regulations of Sailing with the learnings of the ***Platino*** accident in mind. These changes are listed below;

1. All vessels must have the required ratio of crew with an Advanced Sea Survival qualification[51] (SR APPENDIX 6). This requirement had previously been applied only to racing yachts. However the requirement is now being applied to cruising yachts which may be lightly crewed but are undertaking a long voyage.

2. All vessels seeking a category 1 safety certificate are to have a written manual available to all crew.

3. Yacht Inspectors who have not attended the last conference or have not completed an inspection in the 12 months immediately prior is to be accompanied by another Inspector.

Autopilot Failure

If an autopilot is used to control a vessel in situations where failure of the system may result in harm, precautions should be taken to safeguard against that risk. The extent of the precautions implemented should be appropriate to the severity and likelihood of the possible harm, i.e. the risk. If it is not possible to implement appropriate precautions, either the situation should be modified to reduce the risk (e.g. stow the mainsail) or the autopilot should not be used.

It is recommended that:

Owners and skippers

- Ensure the skipper (and crew, where appropriate) are familiar with the correct use and required maintenance of the autopilot system prior to departure.
- Visually inspect the autopilot drive unit (and any other safety critical system) immediately prior to departure, then at reasonable intervals throughout the voyage. This may, for example, be once in every twenty four hour period.
- Consider steering manually during periods of heightened risk that cannot be avoided by other means.
- Position the person on watch so as to facilitate immediately taking control if the autopilot is used during periods of heightened risk. This could mean a crewmember is placed at the wheel, though not actively steering.

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[51] ***Platino*** met this requirement with the Skipper and Owner having undertaken the Advanced Sea Survival Training within 5 years of the voyage.

Owners and service providers

- Fully consider and assess the design of the installation of the autopilot drive (and any other safety critical system) prior to installing or modifying the equipment.

- Consider fitting a low level alarm to the hydraulic fluid header tank for the autopilot drive unit (or any other safety critical system) to provide advanced warning of any potential leak.

Preventer Failure

An effective preventer is a crucial piece of safety equipment on a sailing yacht, particularly when sailing offshore where assistance is unlikely to be available in a timely manner.

Owners and skippers

Crews should rehearse rigging a preventer as part of normal competence and safety training. This should take place before the preventer is actually required in order to,

- Establish the most appropriate manner in which to rig the preventer in various situations, and consider the loads involved and limitations of various arrangements.
- Consider the suitability of the equipment carried onboard to facilitate the rigging of an effective preventer.

Crews should fully consider the risks involved in any situation and manage these appropriately. If an effective and reliable preventer cannot be rigged in conditions where unintended movement of the boom is likely, or may result in serious harm, other options should be considered including the following;

- Altering course to an angle that reduces the risk to an acceptable level.

- Stowing the mainsail and proceeding under head sail and/or motor power, or hove to if necessary.

Mainsheet traveler failure – out of control boom

All reasonably practical steps should be taken to ensure uncontrolled gybes do not occur involving heavy equipment such as that installed on ***Platino***. This is particularly true where wind speed is high or when sailing offshore where assistance is unlikely to be available in a timely manner. It is crucial that the yacht's crew have a sufficient understanding of the likely consequences of crash gybes, should they occur.

Owners and master/skipper

Crews should fully consider the risks involved in any situation and manage these appropriately. When assessing risk of harm, care should be taken to consider;

- The likely consequences of foreseeable mishaps involving the actual equipment installed (in this case, a very heavy boom relative to more typical cruising yachts).

In conditions where unintended movement of the boom is likely or may result in serious harm, an effective preventer must be rigged to prevent uncontrolled gybes. If any doubt exists regarding the possibility of an uncontrolled gybe occurring, other options should be considered including the following;

- Altering course to an angle that reduces the risk to an acceptable level.

- Stowing the mainsail and proceeding under head sail and/or motor power, or hove to if necessary.

Person overboard

Owners and skippers

The Master (skipper) and/or operator of any vessel should take all reasonable practical steps to ensure that all crew members possess a level of knowledge appropriate to the conditions is which they intend to operate, and their position and level of responsibility onboard. Information is contained in The Director's Guidelines to YNZ, contained within the Yachting NZ Yacht Safety Inspectors Manual 2009, as to the required knowledge and proficiency for the crew of a pleasure craft departing for overseas. The following should be included at minimum,

- Developing and carrying a written action plan for dealing with emergencies.
- Ensuring that at minimum all adult crewmembers are proficient in the stowage and use of all key safety equipment such as lifejackets and harness, lifesaving appliances, firefighting appliances, pumps and emergency communications equipment.
- Conducting practice drills of key emergency procedures including person overboard (MOB), fire, flooding and abandon ship. Where the use of specific equipment cannot be actually practiced during drills, the use of such equipment should be simulated and/or discussed in detail.
- Where more complicated alternatives are carried in place of traditional lifesaving appliances, extra care should be taken to ensure the crew has an adequate level of understanding of the equipment and its use.
- Care should be taken to ensure that methods of emergency escape such as hatches remain serviceable at all times

Emergency communications

Owners and master/skipper

The Master (skipper) and/or operator of any vessel should take all reasonably practicable steps to ensure that all crew members possess a level of knowledge appropriate to the conditions is which they intend to operate, and their position and level of responsibility onboard. For a vessel conducting an offshore voyage, this should involve:

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- Conducting practice drills of key emergency procedures including person overboard (MOB), fire, flooding and abandon ship. Where the use of specific equipment cannot be actually practiced during drills, the use of such equipment should be simulated and/or discussed in detail.

Where a telephone is intended for use, as a form of emergency communication,

- Telephone numbers for appropriate points of contact such as RCCNZ should be established. These numbers should be shown prominently within written emergency plans, readily available onboard and where possible stored on any telephone that may be used to make a distress call.

Command and control

All skippers should utilize the knowledge, experience and ability of their crew. All crewmembers should take personal responsibility for safety and are obliged to raise any concerns that they may have.

However, the overall responsibility for the safe operation of the yacht and the protection of its crew and the environment lies solely with the skipper.

Owners and skippers

Care should be taken to ensure the Master (skipper) of any vessel:

- Understands the level of responsibility associated with that position.
- Personally possess a level of knowledge suitable to the position and are capable of exercising effective command over the yacht and its crew.
- Has sufficient oversight over all relevant functions onboard to ensure the responsibility is met.