Report

The loss of the sailing vessel, *Essence* 22 July 2021

Nō te rere moana Aotearoa
MARITIME NEWZEALAND

Contents

Glossary

TERM	DEFINITION
Amidships	In the middle of a ship, either longitudinally or laterally
Anemometer	A device used for measuring wind speed and direction
Bare Poles	Sailing with no sails set
Beam	The width of a ship at it widest part
Beaufort Wind Scale	A wind scale invented by Admiral Sir Francis Beaufort in 1805 to help judge wind and sea strength
Bimini	A lightweight cover, usually made of fabric stretched on a metal frame which is readily removable, for the cockpit or deck of a speedboat or sailboat
Broach	To accidentally slew around in spite of the helmsman so that the wind is brought abeam when running before a heavy sea
Broad reach	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
Cabin	Raised accommodation area above the deck
Danbuoy	A flagged floating marker pole used by mariners to mark the position of a casualty in the water
Deep reef	Reefing is the means of reducing the area of a sail, usually by folding or rolling one edge of the canvas on itself. The converse operation, removing the reef, is called “shaking it out”. Reefing improves the performance of sailing vessels in strong winds, and is the primary safety precaution in rough water. A *deep reef* results in a substantial reduction in the sail area
Drogue	A device dragged from the stern to slow progress through the water and to keep a vessel from broaching
EPIRB	An emergency position-indicating radio beacon (EPIRB) that transmits a signal via satellite to a ground station. Used for distress signalling. An EPIRB is registered to a vessel
Founder	To fill with water and sink
GFS	Global Forecast System
Grab bag	A pre-prepared bag containing survival equipment in the event a vessel sinks
UTC	Universal Time Co-ordinated
Heave to	To lay a sailing ship on the wind with her helm a-lee and her sails shortened and trimmed so that, as she comes back into the wind, she will fall off again on the same track and thus make no headway. A sailing vessel will normally heave to in heavy seas where and when strong wind makes normal sailing impossible
Helm	A tiller or steering wheel. A helm station is the area from which a vessel is steered
HPA	Hectopascal Pressure Unit. Hectopascal is 100x multiple of the pascal, which is the International System of Units for pressure
Jack line	A rope or wire strung from the bow to the stern to which a safety harness can be clipped
Knockdown	The action of a small vessel that is rolled to the degree her mast(s) and sail are in the water by wave action and/or violent squall
Knot	The nautical measure of speed. A vessel travelling at one knot is averaging one nautical mile (or 1852 metres) in one hour
Laying a-hull	Dropping sails and fixing the helm to a set position, allowing a vessel to drift in the direction of the wind in a beam sea
Lee shore	A lee shore is one that is to the lee side of a vessel, meaning the wind is blowing towards it
Leg	A run or distance made on a single tack by a sailing vessel
Lloyds Register Quality Assurance (LRQS)	LRQA provides certification services, such as assessing standards, including international standards and industry-specific standards
Nautical mile	A unit of distance used at sea that is equal to 1852 metres

NZDF	New Zealand Defence Force
NZDT	New Zealand Daylight Time
Off the wind	Away from the direction from which the wind is blowing
Pitch poling	To capsize stern over bow
PLB	Personal Locator Beacon. A PLB is registered to a person. It is used in an emergency to alert the search and rescue services
Reach	A course sailed across the wind. If the wind is 90° it is a broad reach. Reaching (verb) is sailing with the wind coming from the side
Run or running	To sail before the wind
Quarter	The areas on either side of a vessel between amidships and the transom. Usually described as the port quarter or starboard quarter
Painter line	A painter is a line that is attached to the bow of a dinghy (or liferaft), or other small boat
Rebate	A recess or groove cut into the edge of machinable material
Sea room	Sea room means enough room on an ocean, a lake, or an estuary so the yacht won't blow ashore during a storm
Significant wave height	The average height of the highest one-third of the waves (trough to crest). This figure is used by scientists, but doesn't identify larger waves that can cause great damage. The maximum wave height can be up to two times (or more) of the significant wave height
EC	European Commission. The part of the European Union which is responsible for suggesting laws, making decisions, supporting the union's agreements, and general organisation
MetService	New Zealand Meteorological Service
VHF radio	A radio that transmits on electromagnetic waves from 30 to 300 megahertz, commonly used in the maritime sector
Wave period	The time in seconds between the arrivals on consecutive crests passing a stationary point

Foreword

Under the Maritime Transport Act 1994 (MTA), Maritime NZ and its Director, have a number of statutory functions and powers that apply to maritime safety and investigations.

Pursuant to section 431, the statutory functions of Maritime NZ (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, as well as 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 approach 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 ***Essence*** investigation, if shared with other seafarers, have the potential to contribute to improving standards of safety in the maritime sector. This report has been produced for that purpose.

Since this accident and following recommendations by an external consultant, Maritime NZ in collaboration with Yachting New Zealand (Yachting NZ), has amended the Safety Regulations of Sailing 2017–2020 (the Regulations) relating to the requirements for storm coverings over windows for vessels sailing from New Zealand to overseas ports that were in force when ***Essence*** was inspected by Yachting NZ.

The Yachting NZ manual containing the Director's guidelines to Yachting NZ inspectors has also been updated to make it easier for Yachting NZ and inspectors to interpret and apply the Regulations.

This report focusses on findings pertinent to the loss of ***Essence*** and highlights the amendments and updates to the Regulations and the Director's guidelines.

It also aims to inform seafarers and the maritime community in general of the circumstances surrounding the loss of ***Essence***.

The Transport Accident Investigation Commission did not investigate the ***Essence*** accident, however, New Zealand Search and Rescue (NZSAR) conducted independent enquiries and have promulgated a report on the response by rescue services:

https://nzsar.govt.nz/assets/Downloadable-Files/Review-report-Operation-ESSENCE-Final-1.pdf

Summary

On 14 October 2019 the sailing yacht ***Essence*** foundered in heavy seas off Northland's east coast. The crew abandoned the vessel into the sea and were rescued from the sea by helicopter. The skipper did not survive.

The investigation has identified a number of issues relating to the operation of ***Essence*** and has made a number of findings and recommendations for yachts undertaking international voyages. Included are recommendations relating to the inspection regime in place for yachts departing for ports outside of New Zealand.

Factual Information

Essence Particulars

Essence was a 47-foot Ocean series Bavaria Yacht designed and manufactured in Germany. She was registered in Part B of the New Zealand register that provided the vessel with nationality for travelling offshore.

The original owners ordered ***Essence*** in 1999, following which she was shipped out to New Zealand and commissioned. The current co-owners were on board when she foundered.

Photograph 1: *Essence*

Design & build	Bavaria 47 Ocean
Registration	NZ591 Part B registered New Zealand pleasure ship
Home port	Tauranga
Length overall	14.68 metres
Beam	4.45 metres
Draft	2.0 metres
Displacement	11.900 kg

The manual for owners and skippers advises that ***Essence*** was made from a GRP (glass-reinforced plastic) construction with the hull and deck solely made in hand laid-up polyester works. The deck and hull are described as being of "sandwich construction" with the hull strengthened by securely laminated main bulkheads made of plywood. Below the water line, the hull is described as being of "massive laminate construction".

The manual further advises that the Bavaria Ocean 47 has an EC (known also as a CE) type examination certificate (authorisation of products for the marine industry from the European Commission in the European Union (UE)), as well as a serial certificate of Lloyd's Register Quality assurance GmbH-Yacht Services in form of a type examination, a manufacturer's approval and a series building supervision.

To be EC-certified, a vessel must meet the essential safety and environmental requirements set out in Annex I of the Recreational Craft Directive.

Directive 94/25/EC 'Recreational Craft' (as amended by Directive 2003/44/EC) applies to vessels built before 18 January 2016, such as ***Essence***. To be EC-certified, a vessel must meet the essential safety and environmental requirements set out in Annex I of the Recreational Craft Directive. Among other matters, this includes structure, openings in the hull, deck and superstructure, flooding and liferaft stowage.

Bavaria yachts are one of the most common European production vessels and can be found in most parts of the world where cruising yachts frequent. The vessel manual states that all Bavaria sailing yachts belong to a category of design A and are:

> *"designed for extended voyages where conditions may exceed wind force 8 (Beaufort Wind Scale) and significant waves of four metres and above".*

Diagram 1: Beaufort Wind Scale

Beaufort Force	Description	Sea Conditions	Wind speed knots	Wave height meters	Wave height feet
0	Calm	The sea is like a mirror.	<1	0	0
1	Light air	Ripples without foam crests.	1-3	0.1	0.3
2	Light breeze	Small wavelets. Crests glassy but do not break	4-6	0.2-0.3	0.6-1
3	Gentle breeze	Large wavelets. Crests begin to break. A few whitecaps.	7-10	0.6-1	2-3
4	Moderate breeze	Small waves becoming longer. Frequent whitecaps	11-16	1.0-1.5	3-5
5	Fresh breeze	Moderate waves with long form. Many whitecaps. Little spray.	17-21	2.0-2.5	7-8
6	Strong breeze	Large waves begin to form. Extensive whitecaps. Some spray.	22-27	3.0-4.0	10-13
7	Near gale	Sea heaps up and white foam blows in streaks in the direction of the wind.	28-33	4-5.5	13-18
8	Gale	Moderately high waves of greater length; edges of the crests begin to break into spindrift. Streaks of foam.	34-40	5.5-7.5	18-25
9	Strong gale	Higher waves. Crests begin to tumble. Dense streaks of foam. Spray may affect visibility.	41-47	7.0-10	23-33
10	Storm	Very high waves with long toppling crests. The sea all white as foam is blown off in dense bands. Spray affects visibility.	48-55	9-12.5	30-41
11	Violent storm	Giant waves limit visibility. The edges of the wave crests are blown into froth. The sea is covered with blowing spray.	56-63	11.5-16	38-53
12	Hurricane	Seas tumultuous. Air filled with foam. The ocean is totally white with driving spray. Visibility seriously reduced.	64+	14+	Over 46

Narrative of Events

Events leading to the accident

This section provides a narrative of the voyage from Denarau, Fiji, and includes the key events which took place between the yacht's departure from Denarau and the rescue of the crew off Northland on 14 October 2019.

Essence cleared Fiji Customs in Denarau on 7 October 2019 and departed for New Zealand on the morning of 8 October 2019. During the voyage good sailing conditions were encountered, however, by 10 October weather models for Northland's east coast predicted deteriorating conditions. This was confirmed in communications with Gulf Harbour Radio, a NZ licenced coast radio station that provides weather analysis and forecasts for yachts cruising the South Pacific. Conditions deteriorated further as ***Essence*** closed on the east coast on the final leg to Tauranga.

Late on 12 October 2019, a decision was made to head in to Opua in the Bay of Islands due to the forecast.

On 13 October 2019, the crew prepared for heavy weather. All hatches were checked and loose gear was secured. Storm sails were prepared along with a storm drogue. Storm coverings, however, were not secured over windows.

Early in the morning of 14 October 2019, with a gale warning in force and with heavy easterly seas building, conditions had deteriorated to the point where the skipper put up a deep reef in the mainsail and rigged a storm jib.

By 0400 hours, the conditions became more severe. ***Essence*** was broad reaching before increasingly steep waves and strengthening winds on the port quarter and surfing down waves in winds of 40 to 45 knots. When large seas approached, it was necessary to steer directly down waves to avoid broaching.

The skipper and crewman at the helm were double tethered to the cockpit floor and by jack lines to their harnesses and periodically taking turns on the wheel.

As conditions worsened, crew described a series of semi-knockdowns during which waves broke onto the cockpit and destroyed solar panels on the starboard side.

At approximately 0945 hours, the first knockdown occurred, calculated at 77°.

At approximately 1050 hours, a second knockdown occurred, calculated at 80°.

At 1116 hours, in position 34° 42S 174 26, ***Essence*** commenced making calls on channel 16 VHF to Kaitaia Maritime Radio, however, effective communications were not achieved.

At 1135 hours, in position 34° 44 S 174.26 E, effective communications were achieved. The knockdowns and worsening conditions were reported and a course of 204°T was given. A one-hour radio schedule was arranged with the next call scheduled for 13.00 hours.

Crew below stated that the anemometer was capable of indicating a maximum of 60 knots, and remained fixed at 60 knots prior to the final knockdown. This suggests the wind speed was a minimum of 60 knots at that time.

The foundering

At approximately 1225 hours, the final knockdown occurred. The crewman on deck stated that he believes ***Essence*** fell from the top of a breaking wave down the face into its trough. He described being held under water for a considerable period by tremendous forces and eventually being pulled clear by the skipper. On righting, considerable damage was observed to the bimini and the steering station. While the rig and sails were intact, substantial water ingress was evident below deck so it was determined that the vessel was in danger of sinking and a distress message needed to be sent.

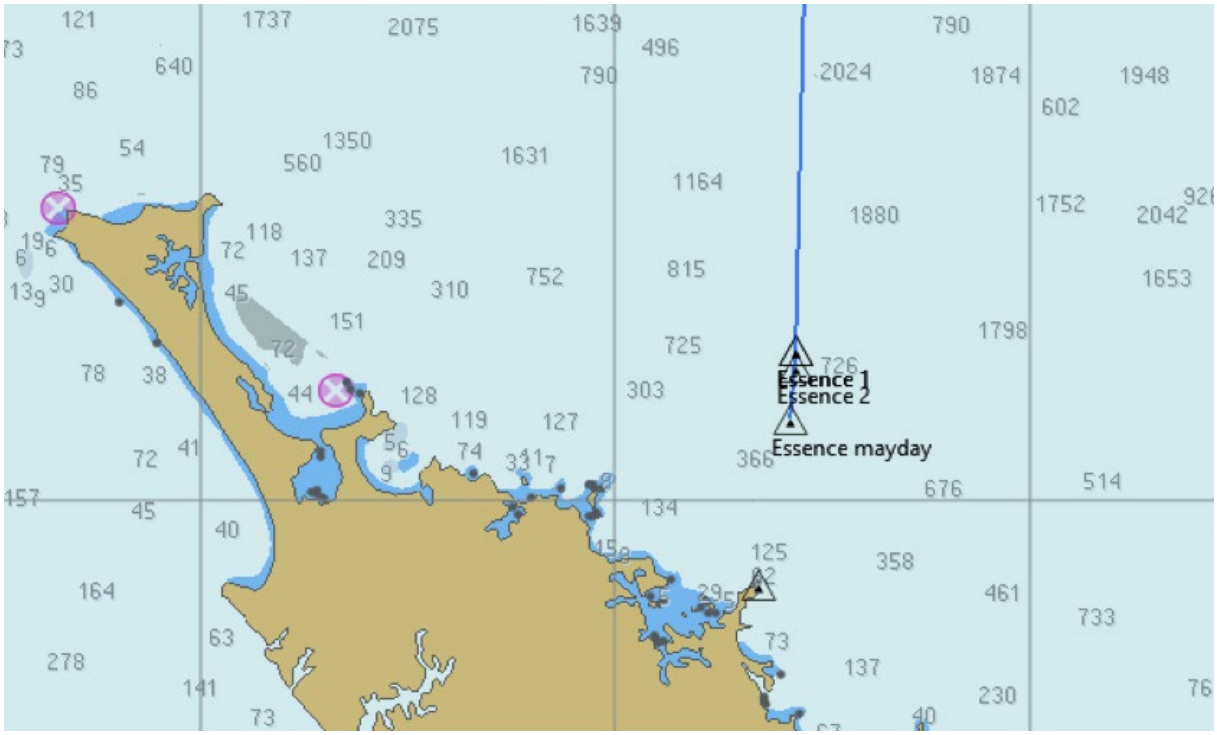
During the knockdown, crew below described hearing a booming noise, seeing the starboard windows explode outwards followed by an inundation of water, and being in knee and thigh-deep water. A heavy table, stairway and other furniture had broken loose and the EPIRB was missing from its bracket and could not be located. One of the crew below deck described being submerged in water for what felt like a considerable period, during which he activated his inflatable lifejacket.

On assessing the situation, the crew determined that fitting the storm coverings at this point was not an option as they needed a drill to fit them and that was not possible under the circumstances.

At 1229 hours, a Mayday was issued on VHF Channel 16 to Maritime Radio from a position of 34° 50.3156S, 174° 25.208 E advising that the vessel was full of water and likely to sink. One of the crew went forward to find his personal PLB which he then activated. He observed that the forward hatch that had earlier been closed was now open, and closed it. A decision was then made to abandon ship to the liferaft, however, the liferaft had been washed off the aft deck.

The crew then assembled in the cockpit area with a grab bag containing emergency equipment, and discussed their predicament. The hand-operated bilge pump at the helm was operated in an attempt to remove water from the cabin, but it proved ineffectual. After approximately 15 to 20 minutes ***Essence*** began to settle and sank bow first as the crew disembarked into the sea through the port aft rails, with a danbuoy and the grab bag containing a waterproof handheld VHF radio.

Diagram 2: Approximate track of *Essence*



The rescue

At approximately 1441 hours, after approximately two hours in the water, the crew were sighted by a NZDF P3 Orion that had earlier spotted an inflated liferaft adrift, presumed to have been from ***Essence***. Intermittent beacon signals were transmitted from the crewman's PLB, most likely due to being periodically submerged in waves. Unreadable transmissions from the handheld VHF were being transmitted by the skipper.

At approximately 1453 hours, a liferaft was deployed from the Orion. After some difficulty the crew were able to haul themselves to the raft along an attached line and two were able to board. The owners, however, were unable to board due to entanglement in what is likely to have been the danbuoy line and the line attached to the raft, despite the efforts of the two crew to haul them in to the raft.

Photograph 2: Liferaft dropped by NZDF Orion with crew on board and in the sea
(Picture: New Zealand Defence Force)

At approximately 1521 hours, ***Westpac Rescue 1*** arrived on the scene and, in challenging conditions, a rescue diver was able to carry out four lifts of the crew from the liferaft and surrounding seas. The skipper was first to be lifted but was deceased when pulled into ***Westpac Rescue 1***.

Photograph 3: Rescue of crew from the liferaft
(Picture: New Zealand Defence Force)

Crew

The four crew on ***Essence*** were experienced sailors. The owners had sailed extensively offshore in ***Essence*** between 2000 and 2007 and had completed a circumnavigation.

The skipper/co-owner held an Ocean Yacht master qualification. The other three crew were also experienced seafarers, one having sailed his own vessel in heavy seas on offshore and coastal voyages.

As part of Yachting NZ's departure from New Zealand requirements, two crew were required to undergo an Advanced Sea Survival course run by Coastguard Boating Education.

Meteorological

Meteorological Service Forecasting

Whilst the Metrological Service (MET) forecast was for gale force conditions, storm to violent storm conditions were encountered by ***Essence***. All MET service forecasts are issued with a disclaimer that while all reasonable endeavours to ensure accuracy are made, there are no guarantees.

Crew stated that four different weather models, along with information from Gulf Harbour Radio and advice from a marine weather consultant, were considered to determine the most appropriate date for departure from Fiji. A whole of journey service, which provides continual weather updates and routing advice to optimise a passage, was not, however, provided by the consultant.

Based on information received, a decision was made to depart Fiji on the morning of 8 October. The crew were aware that a low pressure system was likely to cause bad weather on the east coast of New Zealand, but considered the maximum 40 to 45 knots forecast and associated seas would be manageable for ***Essence***. Weather models for Northland received during the voyage from 10 October onwards indicated deteriorating conditions, with the system that had previously been predicted as tracking down the west coast of New Zealand, intensifying and tracking south east towards North Cape.

The marine forecast issued by MET for New Zealand Coastal waters area, Brett, at 0439 hours NZDT on the morning of 14 October was for a gale warning:

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BRETT
*GALE WARNING IN FORCE*
Easterly 15 knots. Rising to easterly 30 knots early this morning,and
to 40 knots this afternoon. Turning northwest 35 knots late this
evening. Sea becoming very rough. Easterly swell rising to 4 metres.
Poor visibility in rain with possible thunderstorms.
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Wind recordings from Okahu Island, west of Cape Brett in the outer Bay of Islands, between 0900 to 1400 hours gave wind speeds of up to 48 knots with gusts of up to 60 knots:

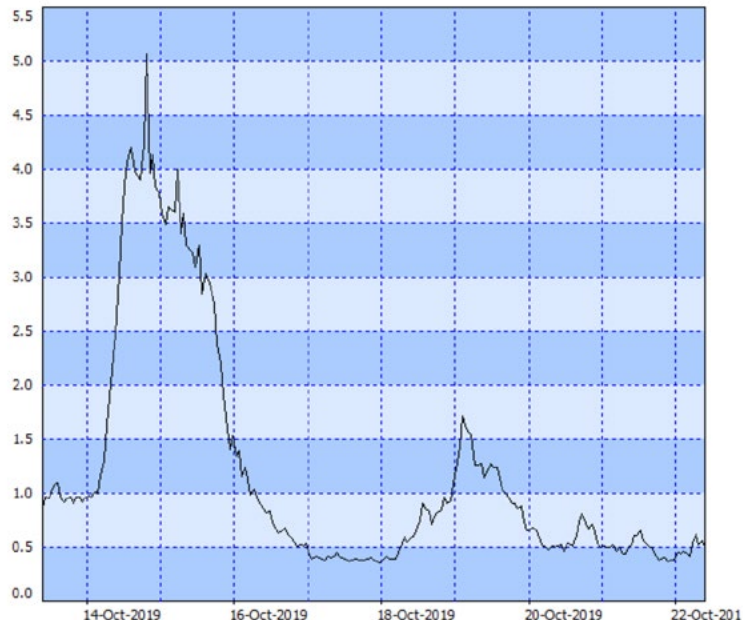
2019-Oct-14 09:00	110	39	50	
2019-Oct-14 10:00	100	43	53	
2019-Oct-14 11:00	100	46	59	
2019-Oct-14 12:00	100	48	60	
2019-Oct-14 13:00	100	45	59	
2019-Oct-14 14:00	110	40	58	

Wave buoy data

The Northland Regional Council wave data buoy, located off the Purerua Peninsula, north of Tikitiki Rock at the northern entrance to the Bay of Islands, provided wave height and wave frequency data for 14 October 2019. It should be noted that the buoy is located in shallower water and may not accurately reflect the sea state at the position ***Essence*** suffered the final knockdown. The three graphs below establish significant increases in wave height and reduction in wave period just prior to midday when ***Essence*** suffered the final knockdown.

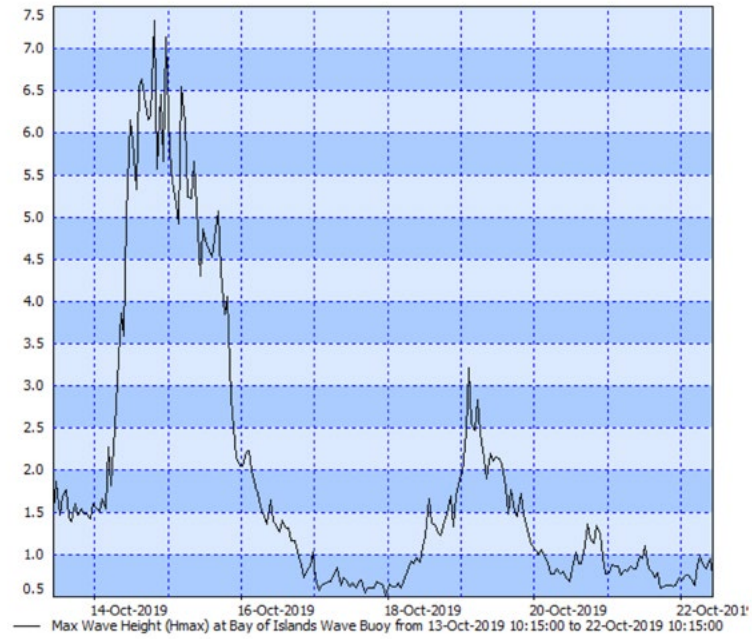
The significant wave height depicted in diagram three is the average of the highest one-third (33%) of waves, from trough to crest, that occurred in a given period and provides evidence of wave heights of just over five metres:

Diagram 3: Significant wave height data



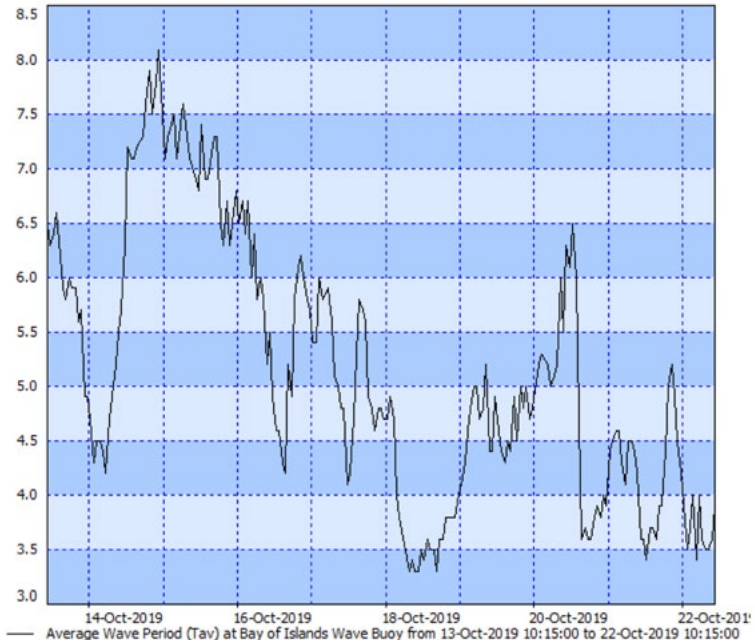
The maximum wave height depicted in diagram four represents the average wave height, from trough to crest, of the highest one-third of the waves and provides evidence of wave heights of over seven metres:

Diagram 4: Maximum wave height data



The average wave period depicted in diagram five represents the distance between two waves passing through a stationary point, measured in seconds:

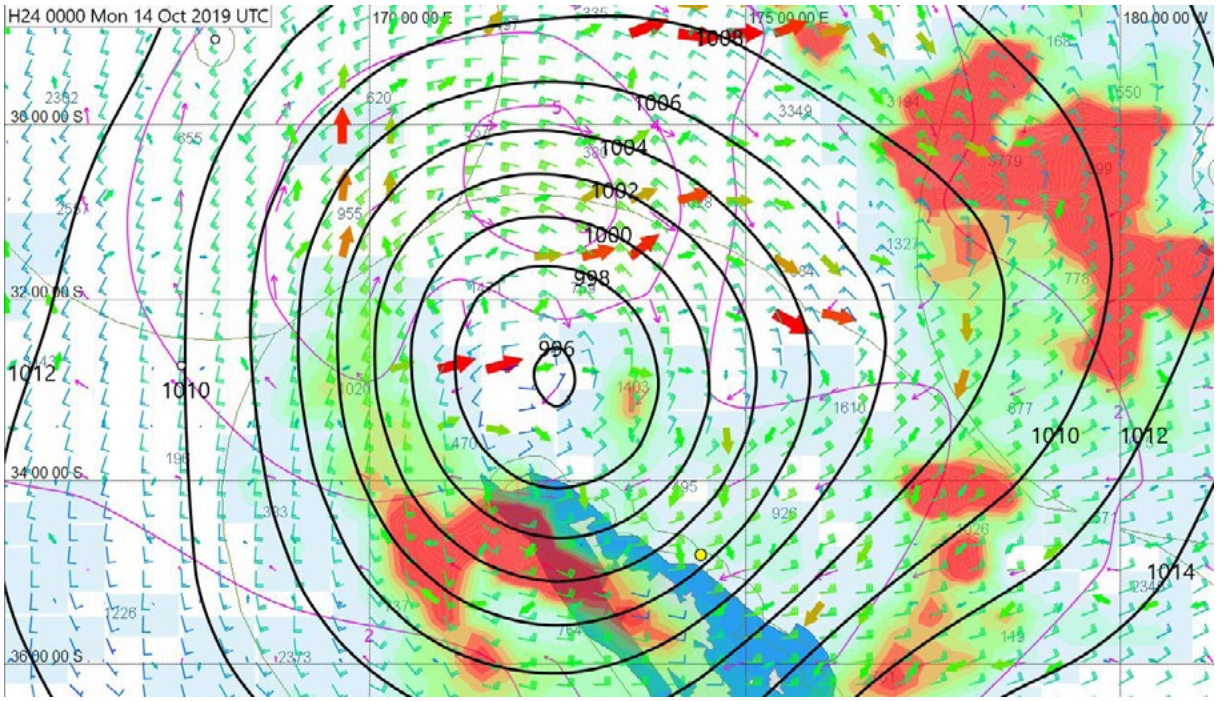
Diagram 5: Average wave period



The wave rider diagrams are evidence of wave heights in excess of seven metres, with wave periods of eight seconds at the peak of the storm. These readings equate to steep breaking seas as described by surviving crew and witnessed by rescuers. Close distance waves of this size can be generated when they reach shallower waters within New Zealand's continental shelf and create dangerous seas for smaller vessels like ***Essence***. On arrival at the scene, the crew of the Orion assessed the seas to be six to seven metres in height.

At midday on 14 October 2019, a projection chart depicted a deep low pressure system of 996hPa, centred north of North Cape with strong easterly conditions in the Bay of Islands/Cape Brett area:

Diagram 6: Projection chart
(courtesy Bob McDavitt)



Composed using **https://www.expeditionmarine.com/software** showing the 24 hour prognosis for 0000UTC Monday 14 Oct 2019 =1pm Monday NZDT based on the GFS model

- Green arrows give the wind speed and direction, each barb is worth 10 knots and half a barb is 5 knots
- Magenta/purple colour shows the swells with arrows for direction and lines for height in significant metres
- Red, yellow, green arrows show the speed and direction of the surface current, with larger currents being larger arrows with red for strongest
- Black lines give the isobars
- Coloured shading shows the modeled rainfall, with red for heaviest

The search and rescue forecast for RCCNZ issued by the MetService at 1306 hours on 14 October 2019 was as follows:

> *An intense low, preceded by gale easterlies, approaches the upper North Island from the north today, affecting the North Island until late Wednesday when it moves away to the east. A brief ridge crosses the country on Thursday, then strong north-westerlies develop ahead of another low which crosses the South Island on Friday.*

At 1200 hours on 14 October 2019, a current of approximately 0.8 knots was setting to the south-south east that would have created steeper seas.

Legislation and Regulations

Certification for pleasure craft departing on international ocean voyages

Section 21 of the MTA requires skippers of pleasure craft departing from any port in New Zealand for any place 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:

21 Pleasure craft departing for overseas

(1) *No skipper of a pleasure craft shall permit that pleasure craft to depart from any port in New Zealand for any place outside New Zealand unless—*

(a) *the Director has been notified in writing of the proposed voyage and the full name of the person who is in command of the pleasure craft; and*

(b) *the Director is satisfied that the pleasure craft and its safety equipment are adequate for the voyage; and*

(c) *the Director is satisfied that the pleasure craft is adequately crewed for the voyage; and*

(d) *the pleasure craft and the skipper comply with any relevant maritime rules.*

(2) *No pleasure craft shall be entitled to a certificate of clearance to depart from any port in New Zealand under the* ***Customs and Excise Act 2018*** *unless subsection (1) has been satisfied*

The regulatory requirements for New Zealand flagged pleasure yachts departing New Zealand for overseas travel are contained in Part III of the Regulations published by Yachting NZ. It is against these Regulations that Yachting NZ inspectors assess pleasure yachts destined for places outside New Zealand.

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."

Yachting NZ 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. Criteria includes minimum standards for the yacht's design, condition, equipment and crewing. Yachting NZ safety inspectors carry out inspections to Cat 1 standards under delegated authority from the Director of Maritime NZ.

To assist them, inspectors also refer to the Yacht Inspectors' Manual. In the case of ***Essence***, the manual in force at the time was the 2009 manual, which has been superseded by the 2021 manual. The 2021 manual contains changes described in the 'Action Taken' section of this report. Both manuals incorporate the Regulations and the Director's guidelines to Yachting NZ for the exercise of delegated powers under section 21 of the MTA.

The Cat 1 inspection involves a sampling process and not every requirement or recommendation of the standard is necessarily examined in detail. The 2009 manual 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 is understood to have occurred on ***Essence***.

The 2009 manual allowed inspectors to have regard to previous offshore experience undertaken by the vessel and by the skipper or crew in determining the adequacy of the vessel and permitted the Regulations to be varied or waved in exceptional specified circumstances. On this point the manual advised:

"The following situations may constitute an "exceptional case" where the inspector may vary or waive compliance with the provisions of the relevant regulation:

- *the requirements of the regulation have been substantially complied with and the yacht inspector considers that further compliance is unnecessary; or*
- *alternative action taken or provision made by the yacht owner in respect of the matter to which the regulation relates, is as effective, or more effective, than actual compliance with the regulation; or*
- *the prescribed requirements of the regulation are clearly unreasonable or inappropriate in the particular case; or*
- *events have occurred that make the prescribed requirements of the Regulations unnecessary or inappropriate in the particular case."*

The 2021 manual emphasises the discretionary nature of the delegated power and points out that there is no express guide as to what is required for the inspector to be "satisfied" that the vessel and crew are "adequate" for the proposed voyage.

In relation to vessel windows, the 2009 manual advised:

"More and more boats are being fitted with large reinforced windows. While the window material itself has considerable strength, the method of fastening often relies on no more than sealant. If flexing of the area occurs in a seaway, the failure of the seal could lead to loss of the entire window. This practice needs careful evaluation in each case and the assurance from the owner that car windscreens are fastened with just sealant is not sufficient for providing an inspection certificate for vessels heading offshore.

Where a method of retaining such windows is required, fastening may be in the form of a metal plate at each corner of the window, through-bolted and crossing the corner of the glass. In all cases, a certificate from both builder and designer stating that the window structure and fastening is adequate for the vessel to make ocean voyages is acceptable."

Analysis

Heavy weather sailing

Essence foundered in the south east quadrant of the low pressure system. Most authorities on low pressure system avoidance recommend avoiding quadrants where more dangerous seas can be generated. In the southern hemisphere, mariners should avoid the south east quadrant of intense low pressure systems as more severe conditions are usually generated in this sector. A passage plan should avoid dangerous quadrants where possible and, if encountered, a determination should be made if it is necessary to sail on a heading towards a safer quadrant. Also, if there is a possibility of encountering dangerous seas whilst closing on a lee shore, consideration should always be given to standing out to sea and heaving to with adequate sea room to allow a low pressure system to pass before heading towards a shore. An important factor to consider when closing on a lee shore in heavy seas is that more dangerous seas can be encountered due to the shelving coastline.

Strategies that can be used by yachtsmen to survive dangerous seas include:

- deploy a drogue astern to slow down the vessel in steep following seas to avoid pitch poling or broaching
- deploy a parachute from the bow to keep a vessel head (bow) to the seas
- laying a-hull
- heave to under reduced sail with a staysail or jib sheeted to windward and the helm lashed over to maintain a heading of approximately 30° off the wind
- sailing away from the dangerous quadrant of low pressure system at an angle of approximately 60 degrees, and taking measures to stall or check the vessel to prevent it sailing down waves in an uncontrolled manner that will cause a broach (often with a drogue)
- running under reduced sail or bare poles as attempted by ***Essence***. This can be an effective method of avoiding dangerous seas, however, it requires considerable skill and concentration on the part of the helmsperson to avoid knockdowns. In this situation, fatigue can be a major factor if an individual remains on the helm for extended periods.

Running from heavy breaking seas carries the danger of broaching or pitch poling. During a broach, a vessel is unable to maintain a course directly down the face of a steep wave and finds itself side-on to a breaking or steep wave. This can cause a vessel to drop sideways from the top of a wave down its face to the bottom of the trough in front of it. In such cases, a vessel can land heavily on its side and, in extreme cases, can be rolled 360°. This is what seafarers describe as a knockdown. It can be an extremely violent motion that can cause serious damage to a vessel and severe injury to those on board.

When a vessel pitch poles, it capsizes stern over bow with equally serious consequences.

Tactics to be used in heavy weather sailing depend very much on the handling characteristics of the vessel and the skill set and fitness of the crew. Dependant on hull and rig configuration, some vessels will heave to or run safely, others will not. Ultimately, the decision lies with the skipper who, if sufficiently experienced, is likely to be the best judge of what tactics are best for his or her vessel. ***Essence's*** crew stated a decision was made to not heave to or deploy the drogue. One crew member considered these two options were more dangerous than running.

The information provided by survivors is consistent with ***Essence*** suffering a knockdown. This resulted in the starboard cabin windows being blown out, causing a large volume of water ingress within seconds and rendering the vessel unseaworthy with virtually no hope of recovery.

A number of publications provide guidance on heavy weather sailing. The following are generally recognised as authoritative:

- Hal Roth – *Handling Storms at Sea: The 5 Secrets of Heavy Weather Sailing*
- Adlard Coles – *Heavy Weather Sailing.*

Window/hatch failure

The cabin windows on ***Essence*** were approximately double the size specified under the Regulations as requiring storm coverings, however, as storm coverings were understood to have been on board, ***Essence*** was compliant in this respect.

Photograph 4: Cabin windows in excess of 1852cm² in a Bavaria Oceans 47 sister ship

Photograph 5: Plywood storm coverings in position, but not secured over windows, on a Bavaria Oceans 47 sister ship

The crew stated that the impact of the vessel falling into the trough caused the windows to blow out. This may also have caused the forward hatch to open. The impact of landing in the trough is likely to have caused the hull, cabin and deck to flex due to hydraulic forces. This is also likely to have caused pressure within the cabin which, combined with the flexing, may have caused the windows to blow out. It is noted that prior to the final knockdown, a crewman observed the cabin flexing due to wave pressure.

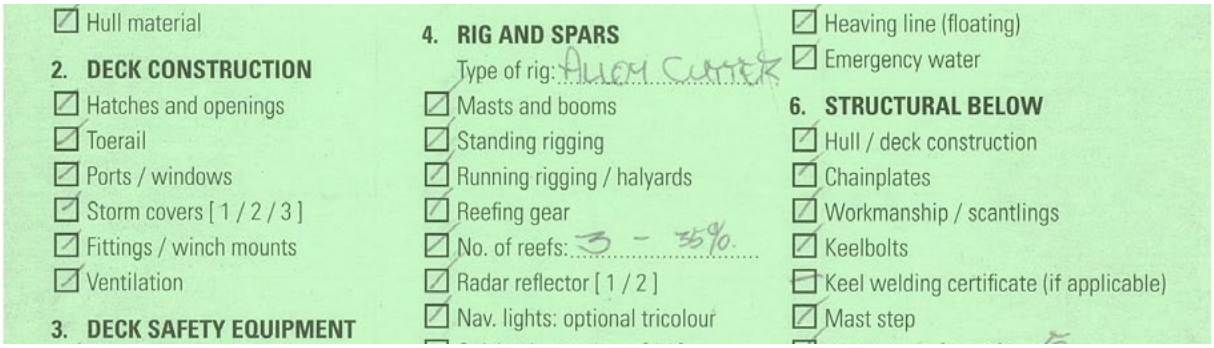
There is an increasing trend to have larger windows, in particular among production vessels that are touted as being suitable for ocean voyages. The larger the area of window, the greater the risk of failure, particularly for many production vessels that are subject to flexing in extreme conditions.

There is a commonly held view that windows will always break inwards due to external wave pressure and this can often be the case, however, many relatively modern production vessels, such as ***Essence***, are constructed from materials that are more susceptible to flexing under pressure. This, when combined with the larger windows that are commonly found in modern sailing vessels, makes the rebated substrate area around the windows more susceptible to failure.

Storm coverings

Storm coverings are intended to prevent windows from being compromised, both by heavy seas and loose items on the deck, such as flogging blocks and eyes.

The inspection certified ***Essence*** to Cat 1 standard. The checklist for ***Essence*** had no unsatisfactory findings. Section 2 of the report, Deck Construction, received a tick for "Storm covers":

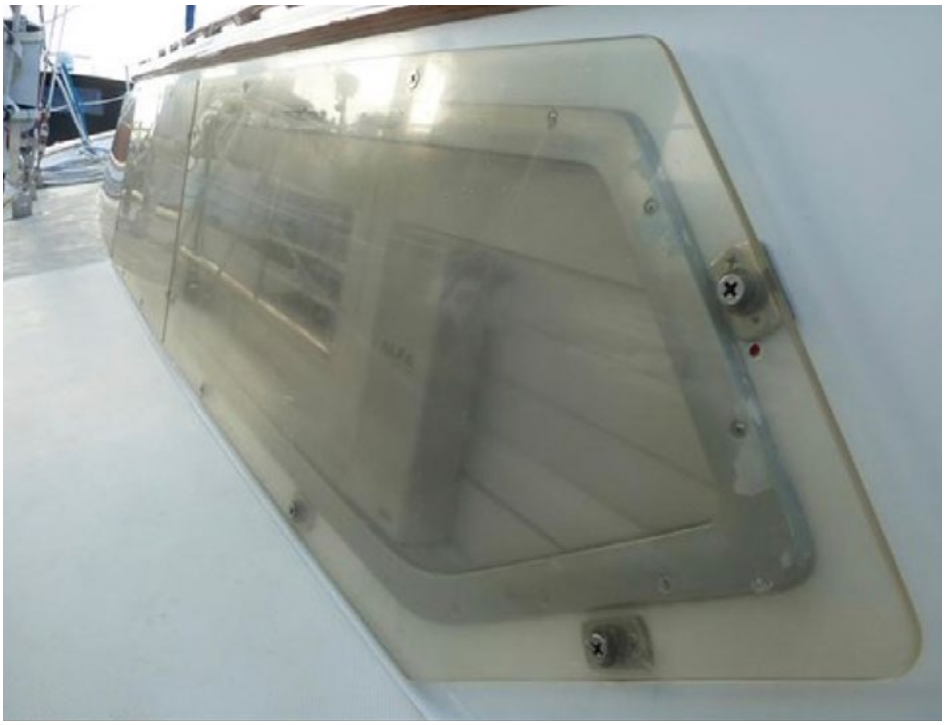


The Regulations in force when ***Essence*** was inspected required that storm coverings for windows of more than 1852cm^2 be on board, however, they did not require storm fittings to be inspected whilst fitted or that they be secured during voyages.

Under the amended Regulations, storm coverings must now be fitted over windows of for all windows more than 1852cm^2 in area. The amendment thus avoids the need for crew to fit storm coverings at sea, which can be a difficult and dangerous undertaking, particularly in heavy seas.

Where warranted, consideration should be given to installing storm coverings for windows under 1852cm^2. Whilst not required under the Regulations, window strength, rebating and other relevant factors should be considered in determining if such action is prudent for the safety of the vessel in question.

Photograph 6: Example of a storm covering with securing arrangements



Abandon ship procedures

Regulation 21.0 requires abandon ship procedures to be in place. The Yacht Inspectors' Manual requires that crew are proficient in abandon ship procedures:

> *"All boats on ocean voyages should have a written action plan for emergencies such as abandon ship."*

The inspector stated that abandon ship procedures were discussed during the inspection and that a laminated procedures document was to be posted on a bulkhead. The crew, however, state that no written procedures were posted. The co-owner commented that the skipper briefed the crew on abandon ship procedures at the commencement of the voyage and ran through the procedures immediately prior to abandoning ship.

Procedures posted in a prominent position serve to reinforce the steps to take in an emergency and should ensure the crew are aware of their respective roles.

Liferaft

Liferafts should be robustly secured to decks and placed in a position where they are less subject to hydraulic forces generated by wave action.

It is likely that ***Essence***'s liferaft was washed from the deck by wave action and/or the hydrostatic release unit being activated due to pressure generated during the final knockdown. In both scenarios, the liferaft would have inflated out of its container and, due to the tension of the painter line acting on a weak link, the painter line would have broken, allowing the liferaft to drift free of ***Essence***. When sighted by the Orion P3 crew, it appeared fully inflated. Regardless of the mechanism involved, this highlights the vulnerability of safety equipment stowed on an exposed deck during heavy seas. The Regulations require liferafts to be carried on the working deck or in a special stowage area that only contains liferaft(s) and opens immediately to the working deck. Specified provision for vessels built after July 1983 enable liferafts to be stored under the working deck.

Hypothermia

Mariners who anticipate being on deck in exposed conditions should ensure they wear multiple layers of wool or thermal clothing under wet weather gear. Extended periods exposed to the elements with inadequate protection will contribute to the onset of fatigue and hypothermia.

Following an abandon ship, immersion in cold seas can rapidly lead to hypothermia, which is often a factor that can lead to drowning.

In October 2019, the sea surface water temperature for the Paihia/Opua in the Bay of Islands averaged 16.3°C (Courtesy of National Oceanic and Atmospheric Administration data). A sea surface temperature of 17°C was provided by MetService.

At this temperature the onset of hypothermia can be rapid. Time spent on deck exposed to the elements prior to immersion in the water can be an additional factor.

Maritime NZ has published information on how to survive in cold water on its website:
https://www.maritimenz.govt.nz/recreational/safety/lifejackets/survive-in-cold-water.asp

A publication on hypothermia by Gordon G. Giesbrecht and James A. Wilkerson, Hypothermia Frostbite and Cold Injuries, 2nd Edition, Mountaineer Books, provides useful insight into cold water immersion:

> *"Severe hypothermia is defined as a core temperature below 82° F (28° (C), at which stage death is imminent. Acid base abnormalities develop, and without rewarming the cold heart eventually goes into ventricular fibrillation followed by a full cardiac arrest."*

In colder climates, many vessels carry immersion suits that can greatly extend survival time in cold water. Multiple layers of clothing can be worn underneath them, and they keep the wearer dry. Many suits provide buoyancy exceeding that of most lifejackets. Whilst not common on board recreational vessels in New Zealand waters, and arguably not warranted for vessels operating in tropical waters, they should nevertheless be considered as additional safety equipment for vessels carrying out coastal and ocean passages.

Conclusions

Essence's course took her into a dangerous sector of a severe low pressure system.

Heavy seas generated by storm force conditions caused ***Essence*** to suffer a severe knockdown, resulting in cabin windows being compromised followed by a sudden ingress of water of sufficient volume to render her unseaworthy with no hope of recovery.

The cabin windows and forward hatch were not protected by storm coverings and, due to their size, were vulnerable to forces generated from the knockdown. Had storm coverings been in place, it is likely ***Essence*** would not have foundered.

Regulations in force at the time did not require that storm coverings be fitted. This is now a requirement under the amended Regulations as detailed below.

Amendments to the Regulations and the Yacht Inspectors' Manual will provide greater clarity to Yachting NZ inspectors to assist in preventing a similar accident from happening in the future.

Action Taken

Acting on consultant recommendations, Maritime NZ has completed a review of the section 21 MTA delegation to Yachting NZ by working collaboratively with Yachting NZ to provide more clarity and transparency of the roles and responsibilities of Maritime NZ and Yachting NZ in relation to the process of gaining a Cat 1 certificate.

The following amendments to the Regulations and the Yacht Inspectors' Manual relating to vessels sailing on international voyages from New Zealand have been made/approved by the Director:

Regulation 13.11 has been amended and now requires storm coverings to be fitted for all windows of more than 1853 cm^2.

The revised manual comments on the hazards associated with vessels having large reinforced windows:

> *"More and more vessels are being fitted with large reinforced windows if flexing occurs in a seaway the failure of the sealant could lead to the loss of the entire window. This practice needs careful evaluation in each case before providing an inspection certificate for vessels heading offshore."*

In addition, the manual provides enhanced guidance on a number of points relevant to the loss of ***Essence***, not only in relation to storm coverings but also for liferaft stowage, drogues and sea anchors:

14.10. Deck and Windows (Refer SRS section 13.11)

f. Windows with an area near or over 1852cm² must have shutters fitted or knees that reduce the size of the window. Relying on an international classification agency to determine whether a vessel is suitable for the voyage intended must not be relied upon especially as the vessel gets older.

14.11. Deck Safety Equipment

c. *Liferafts: (Refer SRS Section 17.11)*

i. While it is best to have a liferaft stowed on deck or in the cockpit, it must be securely fastened with substantial through-bolted fittings. The painter must be secured to a substantial through-bolted fitting. There have been numerous occasions when liferafts have been swept away either through a fitting failure or because a hydrostatic release has operated during a knockdown or roll.

ii. The stowage of the raft should take into account not only foundering, but an uncontrollable fire as well. A liferaft must be able to be at the rail within 15 seconds of the decision being made to deploy.

d. *Drogues and Sea Anchors (Refer Safety Regulations of Sailing17.31 (K)*

i. The skipper must be able to demonstrate knowledge of how their vessel performs with a drogue and have actually practiced with it.

ii. A vessel must have a method of steering that does not include the rudder, and a drogue provides one option.

iii. Sea anchors have proven to be problematic for conventional yachts, however, if one is carried it must have been deployed as practice and at the time of the Inspection the sea anchor is rigged ready for deployment.

The revised manual will also be reviewed every four years to ensure consistency with Yachting NZ practice and regulations, and to reflect current industry best practice.

Recommendations

Maritime NZ

It is recommended that Maritime NZ continues to work closely with Yachting NZ to ensure that amendments to the Regulations and the Yacht Inspectors' Manual are applied consistently.

It is also recommended that regular reviews take place as specified, or earlier if required, to ensure the Regulations and the Yacht Inspector's Manual meet best practice industry standards to ensure the safety of vessels and crew undergoing international voyages from New Zealand.

Owners and skippers

Careful consideration should be given to the suitability for ocean voyaging of vessels that may be susceptible to excessive flexing to withstand heavy seas and what is required to mitigate the risk associated with large windows on such vessels.

Manufacturers and international classification agency determinations in relation to the suitability of a vessel for offshore voyages should not be relied on, particularly for older vessels.

Low pressure systems do, on occasion, generate conditions well in excess of what is forecast. A prudent mariner should always take this into consideration when planning a passage.

Abandon ship procedures with allocated duties for crew should be posted in a prominent position.

Consideration should be given to whether storm coverings should be installed over all large windows for vessels intending to voyage in offshore and international waters.

The positioning and securing of liferafts on deck should be carefully considered to minimize the possibility of them being washed overboard or activated by heavy seas. To address this, the cradle holding liferafts require fittings to be as strong as possible with substantial backing plates.

All crew should be familiar with the operation of equipment on board that may be deployed during heavy weather. The deployment and recovery of drogues and other equipment should be explained by the skipper and, if practicable, be included in ship drills.

It is recommended an EPIRB be carried in the grab bag.

Update to Storm Cover regulations

As stated earlier in this report, Maritime NZ and Yachting NZ have worked in collaboration to update regulations relating to storm coverings.

Here is an excerpt from the new Yachting New Zealand (YNZ) Safety Regulations of Sailing 2021–2024, available on the YNZ website:

- *13.11 (K)* ***Change from****: Storm coverings are required for all windows more than 1852 cm^2 (2sqft) in area*
- ***Change to****: Storm coverings shall be fitted for all windows more than 1858 cm^2 in area*

Note: This means that storm coverings must now be fitted as opposed to just being on board.

Comment

Whilst the Maritime NZ investigation has revealed a number of issues in relation to the operation of ***Essence***, the key finding for the loss of ***Essence*** was the failure to have storm coverings secured in heavy seas.

It is important, however, that this be viewed in terms of the overall high standards maintained by the owners, both in terms of maintenance and equipment on board which, in some cases, surpassed Cat 1 requirements.

No aspersions are levelled at the skipper. He was a highly experienced blue water yachtsman who, in the face of testing conditions, adopted a commonly-used strategy of running before heavy seas. It is clear from the evidence of the survivors that he was instrumental in contributing to the survival of his crew throughout the ordeal.

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