

MCIB

Marine Casualty Investigation Board
Bord Imscrúdú Taisní Muirí



**REPORT OF THE INVESTIGATION
INTO AN EXPLOSION AND FIRE
ON BOARD THE BOAT
'PEGASUS'
OFF ORANMORE STRAND,
CO GALWAY,
ON
9th APRIL 2016**

**REPORT NO. MCIB/256
(No.7 OF 2016)**

The Marine Casualty Investigation Board (MCIB) examines and investigates all types of marine casualties to, or on board, Irish registered vessels worldwide and other vessels in Irish territorial waters and inland waterways.

The MCIB objective in investigating a marine casualty is to determine its circumstances and its causes with a view to making recommendations for the avoidance of similar marine casualties in the future, thereby improving the safety of life at sea.

The MCIB is a non-prosecutorial body. We do not enforce laws or carry out prosecutions. It is not the purpose of an investigation carried out by the MCIB to apportion blame or fault.

The legislative framework for the operation of the MCIB, the reporting and investigating of marine casualties and the powers of MCIB investigators is set out in The Merchant Shipping (Investigation of Marine Casualties) Act, 2000.

In carrying out its functions the MCIB complies with the provisions of the International Maritime Organisation's Casualty Investigation Code and EU Directive 2009/18/EC governing the investigation of accidents in the maritime transport sector.



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The Marine Casualty Investigation Board was established on the 25th March, 2003 under the Merchant Shipping (Investigation of Marine Casualties) Act, 2000.

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1. SUMMARY

On the afternoon of Saturday the 9th April 2016, the owner and another man boarded the yacht 'Pegasus' to check the mooring chain and bridle. The vessel was lying on her own swinging mooring in Oranmore Bay to the south of Galway Bay Sailing Club.

After a period working on the boat's mooring, both men returned to 'Pegasus' for lunch. The owner went below into the cabin to light the gas cooker to put the kettle on and asked his friend to turn the gas on at the cylinder in the cockpit locker.

The owner struck a match whilst standing in front of the cooker, which was followed immediately by a large explosion and fireball.

Both men managed to get off the boat and into the dinghy. The explosion had been witnessed by those ashore and several dinghies made their way to the scene.

Both men were taken from their dinghy into the dinghies of witnesses and brought ashore. An ambulance had been called and both men were taken to Galway University Hospital.

The boat sank within minutes of the explosion.

Both men were wearing Personal Flotation Devices (PFDs) at all times during the incident.

All times quoted are local times (IST).

2. FACTUAL INFORMATION

2.1 Vessel Description

Name of vessel:	<i>'Pegasus'</i> .
Class of vessel:	Virtue 25.
Date of manufacture:	Early 1960's.
LOA:	7.7 metres (m) (25.4').
LWL:	6.6 m (21.6').
Beam:	2.2 m (7.2').
Draft:	1.4 m (4.5').
Displacement:	4.35 tonnes (t).
Construction:	Carvel built mahogany hull planking on oak frames. Marine ply deck sheeted in epoxy. Long keel. Transom hung rudder (see Appendix 7.1 Photograph No. 1).
Engine:	Yanmar 2GM 18 hp with fixed three blade bronze propeller.

2.2 Conditions at time of Incident

Wind:	Westerly force 3 to 4.
Weather:	Sunny with occasional showers.
Visibility:	Good.
Air Temperature:	6°C to 7°C (see Appendix 7.2 Met Éireann Weather Report).

2.3 Persons Involved

The owner of the vessel and his friend.

Both were wearing Personal Flotation Devices (PFDs).

2.4 Marine Casualty Information

Date & Time: 9th April 2016, approximately 13.00 hrs.

Type of Casualty: Serious Marine Casualty (total loss of vessel).

Location of Incident: Oranmore Bay, Co. Galway.

Fatalities: None.

Environmental Impact: None.

2.5 The vessel was bought by the current owner in 1992 and initially restored professionally in Askeaton, Co. Limerick. A new three burner gas cooker complete with grill was purchased and installed by the owner shortly before the incident (see Appendix 7.1 Photograph No. 2). The installation had been tested but not used.

2.6 With the exception of the ambulance, none of the Emergency Services were involved in this incident.

3. NARRATIVE

- 3.1 During the winter season, the owner had purchased and installed a new three burner gas cooker complete with grill. The unit was a Plastimo Neptune 3000 model designed specifically for the leisure market. The installation was completed using a length of synthetic flexible gas hose to BS 3212/2 1991, inside diameter 9.2mm connected directly to the gas cylinder regulator at one end and the cooker hose tail, outside diameter 8 mm, at the other. The original gas cylinder and regulator were used. The only gas isolation valve was that fitted to the regulator on the cylinder. No gas alarm was installed.
- 3.2 At approximately 13.00 hrs on Saturday the 9th April 2016, the owner and another man (a friend of the owner) boarded the yacht 'Pegasus' to check the mooring chain and bridle. The vessel was lying on her own swinging mooring in Oranmore Bay to the south of Galway Bay Sailing Club.
- 3.3 After checking the chain from the dinghy, the two men returned to the 'Pegasus' for lunch. On boarding the boat, the owner switched on the batteries and opened the engine fuel cock and cooling water valve. He then started the engine to charge the batteries.
- 3.4 The owner went below into the cabin to put the kettle on the new gas cooker for tea. He called out to his friend in the cockpit to open the gas valve on the gas cylinder regulator in a cockpit locker. The gas valve remained open for approximately ten minutes before the owner managed to find a box of matches as the electric sparking device did not have any batteries fitted and thus was not functioning.
- 3.5 Upon striking a match, there was a large explosion followed immediately by a ball of blue flame. The owner, his hands burnt by the fireball, was thrown away from the cooker towards the bow of the boat and debris was thrown into the air.
- 3.6 Although the owner was temporarily deafened by the explosion, he heard his friend call to him from the cockpit to stop the engine. The friend managed to close the gas valve in the cockpit despite having been hit by falling debris and being cut on his head.
- 3.7 The owner regained his feet in the cabin and struggled to remove a fire extinguisher from its bracket. However, as his hands were severely burnt, he failed to do so but found a rag and managed to douse the flames with it. The boat was now listing to starboard.
- 3.8 The deck had been blown off the boat, the bulkheads in the cabin had been dislodged and the bow split open by the force of the explosion.

- 3.9 Apart from the owner's burnt hands and his friend's cut head, both men were relatively uninjured and managed to get out of the boat and into the dinghy tied alongside. They released the dinghy and made for the shore.
- 3.10 Meanwhile, a number of people ashore witnessed the incident and two or three launched their own dinghies in an effort to offer assistance. Both men were transferred into the boats of these assistants and taken ashore in the vicinity of Galway Bay Sailing Club where they were taken by ambulance to hospital.
- 3.11 Shortly after the men had abandoned the boat, the '*Pegasus*' sank quickly.
- 3.12 The wreckage of the '*Pegasus*' was raised a week after the incident and brought ashore (see Appendix 7.1 Photograph No. 3).

4. ANALYSIS

- 4.1 The gas cylinder in use at the time of the incident was a Campingaz type cylinder with a screw on regulator mounted on top. The regulator was equipped with an isolating valve. The cylinder and regulator could not be found following the incident. The owner had installed the new cooker in gimbals on the starboard side of the cabin in the galley area. The flexible hose was routed from the cockpit into the cabin and emerged outboard from the cooker. The hose was then fitted to the copper hose tail on the cooker and secured with a hose clamp (see Appendix 7.1 Photograph No. 4). No secondary isolating valve was fitted nor was a gas alarm.
- 4.2 The flexible hose used for the gas installation was of an approved type however, the internal diameter was too large for the outside diameter of the cooker hose tail. The result of this was that, despite being clamped in place by the hose clamp, the hose was likely to have been loose and its shape distorted. The initial inspection of the gas installation following recovery of the vessel showed that the hose had become disconnected from the cooker hose tail. The end of the hose and the hose clamp were found to be distorted and also blackened and scorched (see Appendix 7.1 Photograph No. 5).
- 4.3 It was noted that there was a ball of blue flame. The nature of this would suggest that it is most likely caused by the ignition of gas which had collected in the bilges of the vessel as a result of the hose becoming loose at the connection to the cooker. As the valve was open at the cylinder this would have released gas for the period of the ten minutes that it was open.

5. CONCLUSIONS

- 5.1 As the explosion caused severe and extensive damage to the vessel, it is not possible to be certain of the layout of the gas cylinder, regulator and hose prior to the explosion, however; as the gas hose was detached from the cooker hose tail and blackened and scorched on inspection, it is most likely that it had become loose or partially detached before the incident took place. Thus, when the gas valve was turned on in the cockpit, it is most likely that gas was flowing freely into the grill area of the cooker and, as this gas is denser than air, overflowing onto the floor and then into the bilges. When the owner struck the match, the gas on the floor and in the bilge exploded and the gas flowing from the hose ignited forming a blue ball of flame.
- 5.2 If a gas alarm had been installed, it would have sounded as soon as the gas started flowing from the hose and given adequate warning of a gas leak. This would have alerted the owner and could have prevented the events which followed.

6. SAFETY RECOMMENDATIONS

- 6.1 It is recommended that the Minister for Transport, Tourism and Sport draws attention to Marine Notice No 1 of 2002 - Use of liquefied petroleum gas (LPG) installations and systems on merchant vessels, fishing vessels, pleasure craft and other marine craft.
- 6.2 It is recommended that the Minister for Transport, Tourism and Sport should provide updated guidance on the fitting and usage of LPG installations in the Code of Practice for the Safe Operation of Recreational Craft. This is included as Action No. 16 in the Maritime Safety Strategy of the Department of Transport, Tourism and Sport.

7. APPENDICES

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7.1 Photographs.

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7.2 Met Éireann Weather Report.

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Appendix 7.1 Photographs.



Photograph No.1 - 'Pegasus' before the explosion.

Appendix 7.1 Photographs.



Photograph No.2 - Cooker as installed in galley.



Photograph No.3 --- following salvage.

Appendix 7.1 Photographs.



Photograph No.4 - Gas hose refitted to cooker hose tail.



Photograph No.5 - Gas hose cooker end as found, charred and distorted.

Appendix 7.2 Met Éireann weather report.

Our Ref. WS3018/2_16248
Your Ref. MCIB/12/256

Estimate of weather conditions in the sea area around 53°14.97N 008°58.09W off Oranmore Strand/Renville, Co Galway, on the 9th April 2016, between 6 hours and 18 hours.

General Meteorological Situation: A large and complex area of low pressure covered the eastern Atlantic and extended over Ireland and the UK. Associated trough lines moved slowly eastwards across the area bringing showers. The almost uniform pressure field resulted in light or moderate winds.

Details:

06:00 – 12:00 hours:

Wind: Light (Force 2 or 3) occasionally moderate (Force 4) near showers from a southwesterly or westerly direction. (gusts of 12 to 17 knots were recorded at nearby stations)

Weather: Mist patches during the early morning, clearing quickly to sunny spells with passing showers.

Visibility: Moderate at first in mist, otherwise good.

Temperature: Air temperatures increased from 3 degrees to 6 degrees Celsius. Sea temperature was 8 or 9 degrees Celsius.

Sea State*: Slight from a west-southwesterly direction.

12:00 – 18:00 hours:

Wind: Light or moderate (Force 3 or 4) from a westerly veering northwesterly direction (gusts of 15 to 18 knots were recorded at nearby stations). Winds decreased light (Force 3 or less) by late-afternoon and became variable by the end of the period.

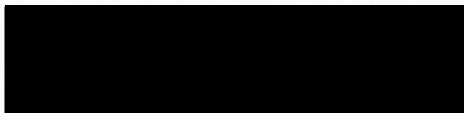
Weather: Sunny spells with occasional passing showers.

Visibility: Good.


Temperature: Air temperatures were 6 or 7 degrees Celsius. Sea temperature was 8 or 9 degrees Celsius.

Sea State*: Slight from a west-southwesterly direction.

*Sea State: the nearest weather buoy M1 was out of service. The sea state estimate in this report is derived from computer generated wave data.



Appendix 7.2 Met Éireann weather report.



**Marine Weather Services
Sea Area Map**

Beaufort Scale of Wind

Force	Description	Speed [*] knots	km/hr	Sea state	Wave height ^{**} in metres
0	Calm	<1	<1	Sea like mirror	0.1 (0.1)
1	Light air	1-3	1-5	Ripples	0.2 (0.3)
2	Light breeze	4-6	6-11	Small wavelets	0.6 (1)
3	Gentle breeze	7-10	12-19	Large wavelets, crests begin to break	1 (1.5)
4	Moderate breeze	11-16	20-28	Small waves becoming longer, frequent white horses	2 (2.5)
5	Fresh breeze	17-21	29-38	Moderate waves, many white horses, chance of spray	3 (4)
6	Strong breeze	22-27	39-49	Large waves, white foam crests, probably some spray	4 (5.5)
7	Near gale	28-33	50-61	Sea begins to up, streaks of white foam	5.5 (7.5)
8	Gale	34-40	62-74	Moderately high waves of greater length	7 (10)
9	Strong gale	41-47	75-88	High waves, dense streaks of foam, spray may reduce visibility	9 (12.5)
10	Storm	48-55	89-102	Very high waves, long overhanging crests, visibility affected	11.5 (16)
11	Violent storm	56-63	103-117	Exceptionally high waves, long white foam patches cover sea	14 (-)
12	Hurricane	64+	118+	Air filled with foam and spray, sea completely white	14 (-)

*Speed - mean speed at a standard height of 10 metres.
**Wave height is only intended as a guide to what may be expected in the open sea.
†Bracketed figures indicate the probable maximum wave height.

Wave Heights / State of Sea

The wave height is the vertical distance between the crest and the preceding or following trough. The table below gives a description of the wave system associated with a range of Significant Wave Heights. The Significant Wave Height is defined as the average height of the highest one-third of the waves. (It is very close to the value of wave height given when making visual observations of wave height.)

Sea State (Descriptive)	Significant Wave Height (in meters)
Calm	0 - 0.1
Smooth (Wavelets)	0.1 - 0.5
Slight	0.5 - 1.25
Moderate	1.25 - 2.5
Rough	2.5 - 4
Very rough	4 - 6
High	6 - 9
Very high	9 - 14
Phenomenal	Over 14

Individual waves in the wave train will have heights in excess of the significant height. The highest wave of all will have a height about twice the significant height

Descriptions of visibility mean the following:

Visibility (Descriptive)	Visibility in nautical miles (kilometres)
Good	More than 5 NM (> 9 km)
Moderate	2 - 5 NM (4 - 9 km)
Poor	0.5 - 2 NM (1 - 4 km)
Fog	Less than 0.5 NM (< 1km)

NATURAL JUSTICE - CORRESPONDENCE RECEIVED

Section 36 of the Merchant Shipping (Investigation of Marine Casualties) Act, 2000 requires that:

- “36 (1) Before publishing a report, the Board shall send a draft of the report or sections of the draft report to any person who, in its opinion, is likely to be adversely affected by the publishing of the report or sections or, if that person be deceased, then such person as appears to the Board best to represent that person’s interest.
- (2) A person to whom the Board sends a draft in accordance with subsection (1) may, within a period of 28 days commencing on the date on which the draft is sent to the person, or such further period not exceeding 28 days, as the Board in its absolute discretion thinks fit, submit to the Board in writing his or her observations on the draft.
- (3) A person to whom a draft has been sent in accordance with subsection (1) may apply to the Board for an extension, in accordance with subsection (2), of the period in which to submit his or her observations on the draft.
- (4) Observations submitted to the Board in accordance with subsection (2) shall be included in an appendix to the published report, unless the person submitting the observations requests in writing that the observations be not published.
- (5) Where observations are submitted to the Board in accordance with subsection (2), the Board may, at its discretion -
- (a) alter the draft before publication or decide not to do so, or
 - (b) include in the published report such comments on the observations as it thinks fit.”

The Board reviews and considers all observations received whether published or not published in the final report. When the Board considers an observation requires amendments to the report that is stated beside the relevant observation. When the Board is satisfied that the report has adequately addressed the issue in the observation, then the observation is ‘Noted’ without comment or amendment. The Board may make further amendments or observations in light of the responses from the Natural Justice process.

‘Noted’ does not mean that the Board either agrees or disagrees with the observation.

8. NATURAL JUSTICE - CORRESPONDENCE RECEIVED

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8.1 Correspondence from Owner of vessel and MCIB response 20

Note: The name and contact details of the individual respondent has been obscured for privacy reasons.

CORRESPONDENCE 8.1

Correspondence 8.1 Owner of vessel and MCIB response.

From: [REDACTED]
Sent: 13 September 2016 12:40
To: Marine Casualty Investigation Board
Subject: [REDACTED]

Dear [REDACTED]

please note minor corrections to report 17 August, Pegasus.

Kind regards
[REDACTED]

2 Factual information

2.5 Please delete The owner..... up to 2014 . In addition to the existing please state

In 2014, part two of the restoration of Pegasus.
The reconditioned Yanmar 2GM engine was fitted professionally
16 frames were replaced on the hull.
The hull was completely refastened using 4" silicon bronze screws.
The hull was raked out and recaulked professionally
All chainplates were removed and refitted with Stainless steel bolts.
All galvanised bolts below the waterline were replaced.
Exterior of Cabin was professionally sealed with fibreglass to reinforce and prevent leaks.

Narrative

3.6
Slight bit of confusion here...
My friend shouted to me to turn of the engine and put out the fire.
He having first closed the gas valve in order to prevent a secondary explosion.

5. Conclusion

The boat was launched 5 April. The stove had been used prior to this date whilst the boat was on the hard prior to launching. I find it difficult to understand how it can be concluded that the gas hose became detached from the cooker hose tail *before* the accident as stated.

MCIB RESPONSE:
The MCIB notes this observation, however it is not connected with the main cause of the incident.

MCIB RESPONSE:
The MCIB notes this observation and has amended the report at 3.6.

MCIB RESPONSE:
The MCIB notes this observation. Paragraph 4.3 has been added and paragraph 5.1 has been amended to show that the gas hose was loose or partially detached from the cooker hose.



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