Report on the investigation of

the capsize of the sailing dinghy

Mollyanna

With two fatalities off Puffin Island, North Wales

2 July 2005

Marine Accident Investigation Branch
Carlton House
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Extract from

The Merchant Shipping

(Accident Reporting and Investigation)

Regulations 2005 – Regulation 5:

"The sole objective of the investigation of an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 2005 shall be the prevention of future accidents through the ascertainment of its causes and circumstances. It shall not be the purpose of an investigation to determine liability nor, except so far as is necessary to achieve its objective, to apportion blame."

NOTE

This report is not written with litigation in mind and, pursuant to Regulation 13(9) of the Merchant Shipping (Accident Reporting and Investigation) Regulations 2005, shall be inadmissible in any judicial proceedings whose purpose, or one of whose purposes is to attribute or apportion liability or blame.

CONTENTS

GLOSSARY OF ABBREVIATIONS AND ACRONYMS

ADCO	-	Administrative Co-operation
BMF	-	British Marine Federation
BS	-	British Standard
BSI	-	British Standards Institution
CPR	-	Cardiopulmonary Resuscitation
DIS	-	Draft International Standard
DTI	-	Department for Trade and Industry
EC	-	European Commission
EEA	-	European Economic Area
EEC	-	European Economic Community
ESO	-	European Standards Organisation
EU	-	European Union
FDIS	-	Final Draft International Standard
GRP	-	Glass re-enforced plastic
Hp	-	horse power
ICOMIA	-	International Council of Marine Industry Associations
IMCI	-	International Marine Certification Institute
ISO	-	International Standards Organisation
kg	-	kilograms
kW	-	kilowatts
RIB	-	Rigid Inflatable Boat
RAF	-	Royal Air Force
RCD	-	Recreational Craft Directive

RNLI	-	Royal National Lifeboat Institution
RSG	-	Recreational Craft Sectoral Group
RYA	-	Royal Yachting Association
SI	-	Statutory Instrument
UK	-	United Kingdom
UTC	-	Universal co-ordinated time
VHF	-	Very high frequency

SYNOPSIS

At about 1430 on 2 July 2005, the sailing dinghy *Mollyanna* capsized 7 cables off Puffin Island, North Wales. Onboard were its owner, his son, and his two grandsons. After capsizing, the owner's son tried to right the dinghy, which had inverted. Despite the wind strength of force 5 to 6 and a wave height of about 1.5m, he twice successfully rotated the boat upright, but it quickly capsized, inverting again on both occasions. The dinghy's owner died about 10 minutes after the initial capsize. His son and two grandchildren were able to hold onto the up-turned hull, and at 1558, were seen by a passing charter fishing boat. The crew of the dinghy were recovered on board the fishing vessel. Both children were taken to hospital by helicopter, but the youngest child was pronounced dead on arrival. The deceased owner and his son were taken to Beaumaris by an RNLI lifeboat, and the charter fishing vessel respectively. The dinghy, which could not be righted by RNLI personnel, was towed to Beaumaris and beached.

The investigation highlighted a number of causal and contributory factors, including:

- The dinghy could not be righted following capsize; it did not meet the stability and buoyancy requirements of EN ISO 12217-3 with respect to boat design category C.
- Calculations undertaken in 2001 regarding the dinghy's stability and buoyancy contained errors, and were possibly incomplete.
- A Statement of Conformity with the essential requirements of the RCD was issued by a notified body on the basis of the results of the calculations made in 2001, despite no evidence of calculation being produced in respect of the required flotation tests.
- Problems with the boat, such as its difficulty to right following capsize and water ingress into the flotation spaces between the dinghy's deck and outer hull when swamped, were not identified during the stability and buoyancy tests conducted on the boat in 2001.
- The crew were not aware that deteriorating weather conditions had been forecast.
- The crew were inexperienced dinghy sailors.
- The clothing worn by the crew would have afforded little protection.
- The owner's lifejacket was not securely fastened.
- A number of departures from the requirements of the RCD by the manufacture were evident, including the failure to provide an owner's manual.
- The departures from the RCD were not recognised by the importer of the boat, or the dealer who sold the boat.

In November 2005, the MAIB sent letters to MG Boats (supplier), DarekCo, and Poliglass (manufacturers), to advise the companies that the BEZ 2 dinghy did not meet the stability and buoyancy requirements for boat design category C, and to strongly recommend that customers who have already purchased a BEZ 2 were advised of the category limitations which should correctly apply to the dinghy. The Maritime and Coastguard Agency, The Royal Yachting Association, and the British Marine Federation have undertaken to implement measures to encourage boat users to undergo appropriate sailing courses, and to help boat users understand the technical information provided with each craft.

Recommendations have been made to the Department for Trade and Industry, the British Standards Institution, and the British Marine Federation with the aim of improving: the effectiveness of the stability and buoyancy test required by craft similar to the BEZ 2; the quality of the information provided regarding the limitations of a craft, and; the education of the recreational craft industry worldwide with respect to the requirements of the RCD.

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *MOLLYANNA* AND ACCIDENT

Vessel details

Registered owner	:	Private
Type	:	Sailing Dinghy
Built	:	2005, Augustow, Poland
Construction	:	GRP
Length overall	:	4.17m
Weight	:	250kg
Engine power	:	1.7kW
Other relevant info	:	Outboard motor

Accident details

Time and date	:	1430 (UTC+1) on 2 July 2005
Location of incident	:	53º19’5N, 004ºW. 7 cables north east of Puffin Island, North Wales
Persons on board	:	4
Injuries/fatalities	:	2 fatalities
Damage	:	Hull and rigging severely damaged during recovery

1.2 NARRATIVE

1.2.1 The capsize

At about 1200 on 2 July 2005, the sailing dinghy *Mollyanna* set off from Conwy, North Wales for a day trip to Red Wharf Bay, Anglesey **(Figure 1)**. Onboard were her owner, his son, and his two grandsons. The dinghy departed from a position close to the marina in Conwy, where it had been launched from a road trailer. After the motor was started, the centre plate lowered, and the mainsail hoisted, the dinghy then motor-sailed down the main channel into Conwy Bay.

When adjacent to Penmaenmawr Point, *Mollyanna's* course was adjusted to the north west toward the north side of Puffin Island **(Figure 1)**. Initially, there was insufficient wind to sail, but as soon as it was noticed that the wind, which was from the south west, had increased, the engine was stopped. The dinghy continued her passage with only her mainsail set. *Mollyanna* was on a port beam reach, with all of her crew sitting on the port side of the cockpit. The owner's son was the furthest aft, holding the tiller and controlling the mainsheet.

As *Mollyanna* approached Puffin Island, the wind increased considerably and the sea became choppy. Spray came into the boat, and the younger of the grandchildren moved to the shelter of the cabin. The drop boards to the cabin access were then replaced, and secured by a single clasp **(Figure 2)**. The boat appeared to be sailing on an even keel, but the owner's son found it increasingly difficult to keep the mainsheet in hand, and took a turn around a mooring cleat adjacent to where he was sitting **(Figure 2)**.

At about 1430, the owner's son received a telephone call from his wife. He told her that he would be arriving in Red Wharf Bay in about 30 minutes time, and that he was unable to talk further because he required both hands to control the dinghy. Soon after, when *Mollyanna* was between 300m and 400m off Puffin Island, a sudden gust of wind caused her to turn quickly to port. The movement could not be controlled by the use of the rudder, and as the dinghy turned, water entered the cockpit area. The dinghy capsized to port and quickly inverted.

All of the crew successfully cleared the upturned hull, with the child in the cabin either escaping through the dinghy's forward hatch **(Figure 3)**, or the access, which had been secured by drop boards. The owner's son climbed onto the upturned hull and fully extended the centre plate, which had almost completely dropped back to its stowed position. He then hung from the centre plate and pulled the boat upright. Almost immediately, the boat rolled over on top of him, and again inverted. The owner's son repeated the procedure. During the second attempt, the boat remained upright for about 15 seconds before capsizing and inverting yet again. During the short period the dinghy was upright, the owner's son saw that the cockpit was full of water, and that the drop doors to the cabin were missing. He also confirmed that the mainsail sheet was no longer secured to the mooring cleat.

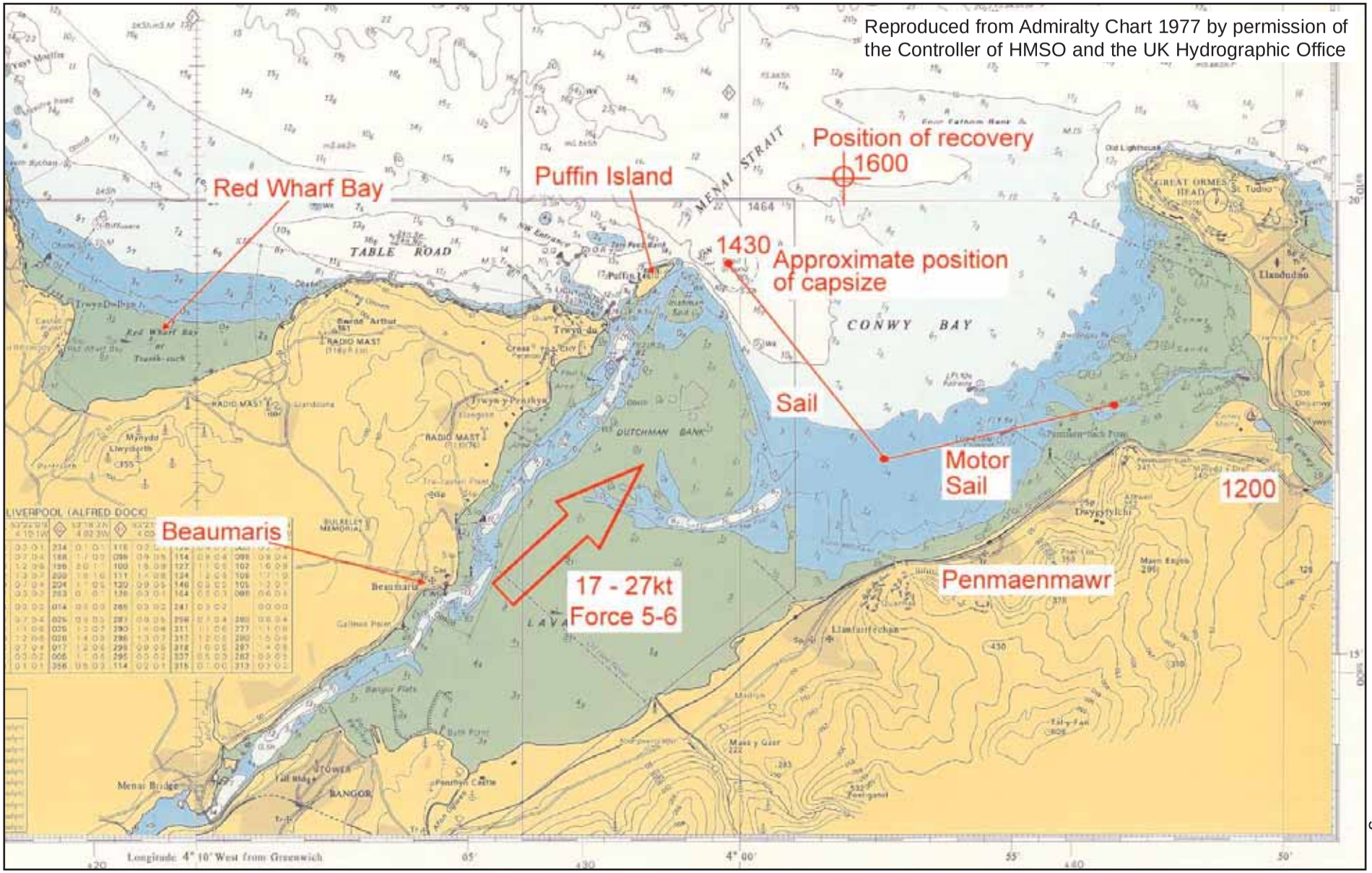
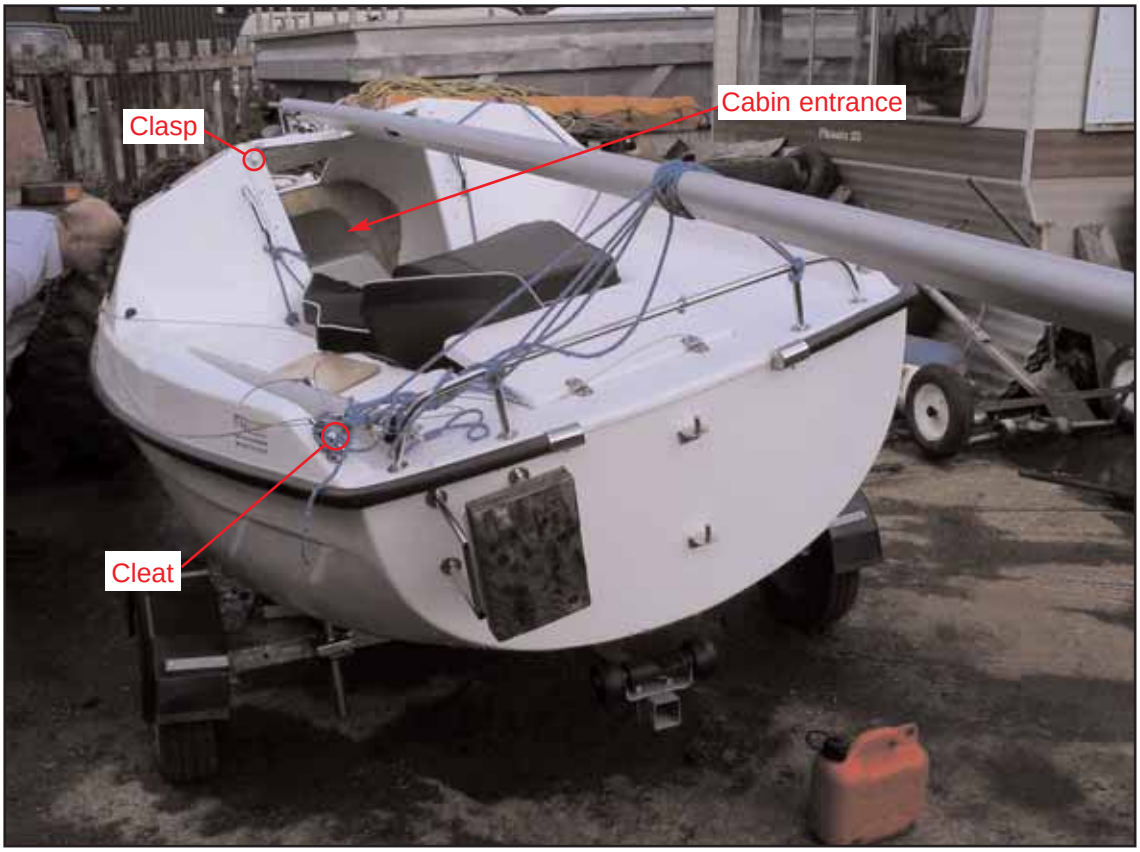


Figure 1

Extract of chart BA1977

Figure 2



Mollyanna after recovery

Figure 3

Forward hatch

By now, the owner was struggling to breathe. His son realised that his father's lifejacket wasn't inflated, and pulled him to the upturned hull. He then located and pulled the toggle on his father's lifejacket, which fully inflated. However, the lifejacket did not appear to be fitted properly, and the owner continued to struggle for breath. He died about 10 minutes after the initial capsize.

1.2.2 The rescue

The owner's son managed to pull his youngest child on the middle of the upturned hull, but had to continually support him to prevent him from falling off. His eldest child was able to keep himself clear of the water without assistance. About 30 minutes after the capsize, a boat was seen passing about 200m away. The owner's son climbed to the middle of the hull and waved, but he was not seen. About 1 hour later, at 1558, the owner's son saw a second boat, and waved frantically. He was seen by a fisherman on the aft deck of the charter fishing vessel *Starida II* **(Figure 4)**, which was returning to Beaumaris **(Figure 1)** from Llandudno Bay.

The skipper of *Starida II* turned towards *Mollyanna*, which was between 500m and 1000m off his starboard quarter in position 53° 20.29N, 003°58W **(Figure 1)**. He then called the coastguard on VHF radio channel 16 and requested assistance. As soon as *Starida II* was alongside the upturned hull, the youngest child was pulled on board, and CPR was commenced. The eldest child and his father were then recovered. At 1609 the skipper of *Starida II* advised the coastguard that a helicopter was required to take the younger child to hospital. He also contacted the skipper of *Sarah Jane II*, another charter fishing vessel in the vicinity.

Figure 4

Starida II

As soon as the skipper of *Starida II* was made aware that the owner of the dinghy was still in the water but was dead, a search was commenced. The owner of *Mollyanna* was found several minutes later lying face down in the water about 0.5nm from the dinghy.

At 1626, a qualified first-aid person was transferred from *Sarah Jane II* to *Starida II*. Shortly after, both the Beaumaris inshore lifeboat and an RAF rescue helicopter arrived at the scene, and the youngest child was winched on board the helicopter. He arrived at Bangor Hospital at 1646, but was pronounced dead on arrival. The helicopter returned to *Starida II*, and transferred the eldest child to hospital. The owner's son and the body of the owner were then taken to Beaumaris; the owner in the inshore lifeboat, and his son in *Starida II*. Postmortems indicated that the owner died from hypothermia and drowning, and his grandson from hypothermia.

1.2.3 Dinghy recovery

Sarah Jane II took the inverted *Mollyanna* in tow at 1632, and headed towards Beaumaris. During the tow, the dinghy continually 'porpoised' nose down, even at very slow speed, and the assistance of the inshore lifeboat was requested. The lifeboat arrived at about 1710, and two crewmen entered the water to try and right the dinghy. They were able to turn the hull on to its side, but were unable to get the sail clear of the water. The sail was cut free and sank, and the crewmen made several further attempts to right the dinghy by applying their weight to the centre plate. However, they were unable to bring *Mollyanna* beyond about 45°. As the dinghy could not be righted, she was towed back to Beaumaris inverted, and was badly damaged when she was beached. When the dinghy was removed from the sea, it was evident that water had entered the space between its inner mouldings and hull.

1.3 ENVIRONMENTAL CONDITIONS

The Inshore Waters Forecast for St Davids Head to Colwyn Bay, issued by the Meteorological Office at 0600 on Saturday 2 July, included:

Wind: southwest 3 or 4 backing south 5 to 7 for a time.

Sea State: slight to moderate becoming moderate to rough.

At the time of the rescue, the wind was reported as force 6 from the south west, and the height of the sea as 1.5m. The owner and his son had not been aware of the Inshore Weather Forecast, but had watched the local weather forecast on the television during the evening of 1 July. They were not aware of any severe weather forecast for the area.

From 1250 until 1450, the predicted tidal stream in the position of tidal diamond 'H', shown on **Figure 1,** was north west up to a maximum of 0.6kn. From 1450, the predicted direction changed to south east with a rate of 0.2kn at 1525. It was neap tides plus 25% of the difference between neap and spring tides, and the sea water temperature was about 16°C.

1.4 THE OWNER AND CREW

The owner of *Mollyanna* was 64 years old. He had previously owned a 5m motor cabin cruiser, which he had frequently used along the Welsh coast between 1971 and 2003. The owner had no previous sailing experience before purchasing *Mollyanna*, in which he had sailed on about seven occasions on the North Wales coast, in varying conditions. It is not known if the owner understood the information shown on the boat's builder's plate with regard to design category.

The owner was diagnosed with an irregular heartbeat in 2004, for which he was taking, and responding to, medication. He was not able to consume alcohol because of this medication, and slept well during the night before the accident. The owner weighed 84kg, and was not a strong swimmer.

The owner's son was 38 years old, weighed 115kg, and was a confident swimmer. He had accompanied his father in *Mollyanna* on the majority of occasions he had sailed in her, and had about 40 hours of experience in the dinghy. The owner's son also had about 20 hours experience of dinghy sailing on lakes in other boats during his youth. Both he and his father considered that should *Mollyanna* capsize, she could be righted providing the forward hatch **(Figure 3)** and drop boards at the entrance to the cabin **(Figure 2)** were secured. Consequently, this practice was followed. The owner's son was aware that the recommended maximum load was three persons plus baggage, but as two of the persons on board were children, he did not think the boat was over-loaded. He was also aware that the BEZ 2 was suitable for use in inshore waters, but did not know the definition of "Category C" noted on the builder's plate affixed to the boat. The owner's son had consumed about four units of alcohol during the evening of 1 July, and had slept well overnight. He had not consumed any alcohol before the accident on 2 July.

The grandchildren were 8 and 11 years of age, and weighed 31kg and 38kg respectively. Both were confident swimmers, but neither had any previous sailing experience.

1.5 EQUIPMENT AND CLOTHING

All of the crew in the boat were wearing 'T' shirts, shorts, and training shoes. The owner was also wearing a thin, zip-up style golfing jacket and a lifejacket **(Figure 5)**. The lifejacket was manufactured in 1994, but it is not known where or when it had been purchased, and there was no record of servicing. The owner's son and his grandchildren were all wearing buoyancy aids.

Equipment carried in the boat included an anchor, weighing about 15kg, and a hand-held orange smoke signal, the expiry date of which was December 2004. The outboard engine, which was sited on a plinth on the port side of the aft transom, was 2.3hp and weighed 12.7kg. No bailers were carried.

1.6 THE PURCHASE OF *MOLLYANNA*

The owner of *Mollyanna* bought the dinghy at the Birmingham Boat Show in February 2005, with the intention of sailing her in the waters near his holiday home in Spain. The dinghy was on display on the MG Boats Ltd stand, but was purchased from a representative of Parley Boats Ltd, who was manning the stand, along with representatives of MG Boats, and other dealers, selling boats the company imported. As well as the dinghy, the owner also purchased a trailer and the outboard engine. The dinghy was supplied with three sails and an owner's manual. The owner's manual, provided by MG Boats, not the manufacturer, contained general information regarding boating safety, environmental considerations, and maintenance. It did not contain any information specific to the boat itself. No other equipment or written guidance was provided, but the owner was offered free practical instruction in the use of his dinghy in Poole. The owner did not respond to this offer.

The builder's plate affixed to *Mollyanna* **(Figure 6)** showed:

- the recommended maximum number of persons was three,
- the maximum recommended load was 250kg,
- the sail area was 7/9 [sic],
- the maximum recommended power rating of the outboard engine was 11kW, and
- the dinghy was intended for use in waters in Category C waters.
- It also showed the CE marking along with the notified body number of Germanischer Lloyd (0098), and the name of the manufacturer, Poliglass.

The hull identification number of the boat (PL –PGSB2002A505) was fixed on the outboard side of the stern transom.

1.7 THE BEZ 2

1.7.1 Background

The BEZ 2 sailing dinghy was initially manufactured in Poland by Foto Pam from 1980 until about 1995 when the company ceased trading. In 2001, the production of the dinghy was resumed by Poliglass P.H.U.P. located in Augustow, Poland. However, the dinghies were marketed by DarekCo P.H.U.P, a boat manufacturer also located in Augustow, which took on the responsibilities of the manufacturer with regard to its compliance with the European trading regulations as detailed in Directive 94/25/EC (Recreational Craft Directive) with a view to exporting the dinghies to the EEA.

The BEZ 2s produced by Poliglass and marketed by DarekCo, were first sold within Poland, but between April and November 2003, seven were imported into the UK by MG Boats Ltd based in Norfolk, England. Following a disagreement

Figure 5

Owner's lifejacket

Figure 6

Builder's plate

between MG Boats and DarekCo during the winter of 2003, MG Boats arranged for the BEZ 2 to be supplied directly from Poliglass. Since 2001, between 26 and 33 BEZ 2 dinghies were exported from Poland to the UK, and were sold to the public via the importer's dealership network. A further 20 were sold in Poland, and 1 in Germany. Neither DarekCo, nor Poliglass, nor MG Boats were aware of any stability problems associated with the BEZ 2.

1.7.2 Description

The boat is made from GRP; the hull is made from a single mould, but its inner mouldings including the deck and superstructure comprise several modules, which are attached separately to the hull **(Figures 7 and 8)**. The void spaces between the inner-mouldings and the hull, which are not airtight, contain polystyrene, which is cut to fit. The cockpit is self-draining, but the cabin has no drain, or any pumping arrangements. The dinghy is fitted with a pivoted metal centre plate, which can be raised and lowered using a rope pennant in the cockpit. The centre plate can be secured in its raised, but not in its lowered position. The rudder is detachable and is fitted with an "up- line" for raising in shallow water, but is not fitted with a "down-line" to ensure it stays in the down position when in use. Jamming cleats are provided for the jib and genoa sail sheets, but not for the mainsheet. The boat is supplied with three sails: a mainsail, a jib and a genoa. The main sail area is 5.41m^2, the jib 2.86m^2, and the genoa 4.4m^2. It is estimated that the boat makes about 4 knots headway under full sail.

1.7.3 Testing and certification

In June 2001, DarekCo arranged for a prototype BEZ 2, produced by Poliglass, to be tested to ensure the dinghy complied with the stability and buoyancy requirements of the RCD. A dinghy was taken from Poland to Berlin, and was tested for stability and freeboard, and buoyancy and flotation by a consultant. The tests were conducted using the wind stiffness test in accordance with a draft version of ISO 12217-3, which later became the applicable harmonised standard in May 2002[1].

The test results **(Annex A)** were forwarded to IMCI, a notified body within the EU (No 0609). Based on information provided by the manufacturer regarding the buoyancy fitted, the consultant had calculated that an additional 245 litres of buoyancy was required to meet the standard. No allowance was made for the fitting of an outboard engine, and no record of the calculation was kept. From the results of the wind stiffness test, the consultant calculated that a constant wind speed of 11.21m/s was required to heel the boat to deck edge immersion. As this exceeded 11m/s, the boat was considered to conform to the stability and buoyancy requirements for Category C, providing the additional flotation was added.

[1] While this standard was only at the draft stage, it had been agreed by the Notified Bodies within the RSG (Recreational Craft Sectoral Group) that the draft version could be used, as there was no alternative option at that time.

Figure 7

BEZ 2 - modular construction

Figure 8

BEZ 2 - superstructure

IMCI checked the wind stiffness calculation and noted that the resultant wind speed, using the inputs provided by the consultant, was less than 11m/s. However, the notified body was aware that the draft version of ISO 12217-3 still allowed the boat to be placed in Category C, providing the sail area could be reduced by reefing, and that appropriate advice was contained in the owner's manual. Accordingly, it contacted DarekCo by telephone and arranged for an appropriated section to be included in the owner's manual. No calculations made by IMCI, following the receipt of the consultant's test report, were retained.

The owner's manual was revised by DarekCo to include (translated from German):

Safety Notice

Should you fix additional fittings to the deck or internal bulkheads, please ensure that they are carefully sealed, as the areas below are buoyancy bodies. When wind speed exceeds Beaufort Force 4, the area of the sail must be reduced by approximately 25% to comply with the requirements of design category C. ***Warning, danger of capsizing!***

On receipt of this amendment, IMCI issued a 'Statement of Conformity' **(Annex B)** dated 26 September 2001, which certified that when used in design Category C waters, the BEZ 2 met the essential safety requirements of section 3.2 for stability and section 3.3 for freeboard and buoyancy and flotation of the EC Directive 94/25 for recreational craft. The certificate was valid for the 2001 and 2002 models only[2]. A copy of the test results was also forwarded to, and acknowledged by, DarekCo.

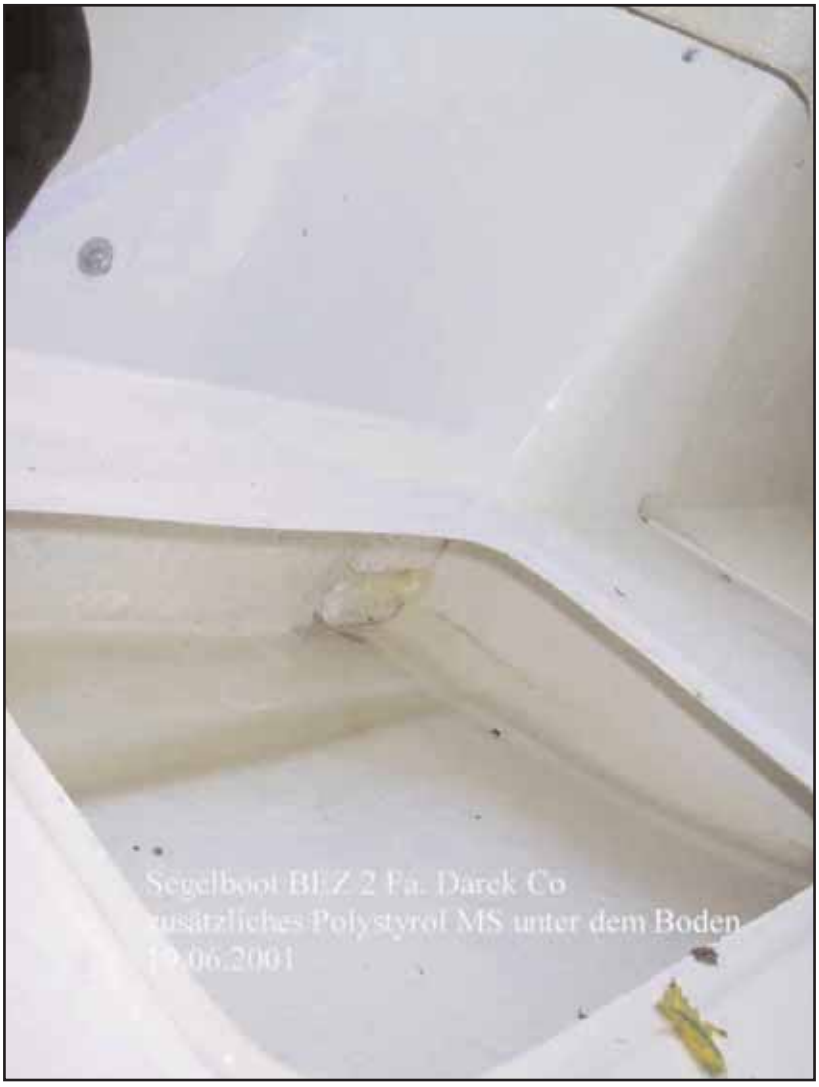
It is not known if, or how, the requirement for the additional flotation required by the test results was passed to Poliglass, but following the tests in June 2001, additional polystyrene was fitted between the boat's deck and outer hull, notably in two storage areas with removable covers on either side of the cabin deck **(Figure 9)** as indicated at **Annex A**. These areas were sealed after 2001.

In September 2003, DarekCo was aware that the Statement of Conformity issued by IMCI required renewal. It was also aware that because ISO 12217-3 had been harmonised with the RCD in 2002, the use of a notified body was no longer required. Accordingly, DarekCo approached the consultant who had tested the boat in June 2001 to certify the dinghy still complied with the RCD essential requirements for stability and freeboard, and buoyancy and flotation. On receipt of written confirmation from DarekCo that no modifications had been made to the BEZ 2, the consultant issued a certificate of conformity. The maximum engine power rating on this certificate was 3.6kW.

[2] The model year is a twelve month period, during which a particular craft model is intended to be sold. However, it remains effective as long as no major modifications have been made to the original design such that it could be considered to be new model.

DarekCo forwarded a copy of this certificate to MG Boats, which passed a copy to Poliglass as soon as it ceased trading with DarekCo. Reference to this certificate was noted on the declarations of conformity provided by Poliglass with its BEZ dinghies. A copy of the declaration of conformity for *Mollyanna*, which was provided by MG Boats and was not signed, is at **Annex C**.

Figure 9



Under-deck storage

1.8 OWNER'S MANUAL

When DarekCo commissioned the testing of the BEZ 2 in 2001, it also commissioned the consultant who conducted the tests to write an owner's manual. This was produced in German, and was later translated into Polish. The manual contained information regarding capsize and recovery, which was based on the consultant's knowledge of sailing, not practical experience gained in the BEZ 2, or on guidance provided by either DarekCo or Poliglass. The manual also stated that the maximum engine power of the BEZ 2 was 11kW, which was the power rating proposed by DarekCo to the consultant following its receipt of the certificate issued by IMCI.

It is possible that DarekCo supplied copies of the owner's manual for the BEZ 2 in German and Polish with some of the BEZ 2s exported to the UK, but the manuals were never translated into English. A translation of this manual, which was provided to the MAIB by DarekCo in August 2005, and contains a copy of the certificate of conformity provided by the consultant, is at **Annex D**.

Poliglass did not provide an owner's manual with any of the BEZ 2s it produced. It considered that it was not required to do so until January 2006, due to Poland's transition into the EEC. The company considered that, until then, the responsibility for the provision of an owner's manual rested with MG Boats.

1.9 POLIGLASS P.H.U.P.

Poliglass was set up in 1989. The company initially manufactured rowing boats, but progressed to manufacturing motor boats of varying sizes. The BEZ 2 is the only sailing boat the company manufactures. Poliglass employs thirteen full time staff, plus an additional nine on a seasonal basis. Most of the boats produced by the company are exported within the EEA. The company was aware of the RCD requirement to maintain a technical construction file for each model of boat manufactured. Since 2004, Poliglass used Germanischer Lloyd to compile these files, and also to conduct the appropriate stability and freeboard, and buoyancy and flotation tests on all of its boats, except the BEZ 2. The company stated that the maximum recommended engine rating for the dinghy was 3.6kW in accordance with its declaration of conformity, and that the 11kW rating shown on the builder's plate of *Mollyanna* was due to a mistake by the manufacturers of the plate. The figure of 2-3 noted in the manufacturer's declaration of conformity **(Annex C)**, with regard to the maximum number persons, was also acknowledged by Poliglass to have been an oversight.

Shortly after Poliglass started manufacturing the BEZ 2 in 2001, the company's owner intentionally capsized and recovered the prototype on which the stability and buoyancy tests were conducted. In his experience, it was important for one person to swim to the end of the mast following capsize to prevent the dinghy from inverting. A second person was then required to grab the centre plate, which he found always remained protruding from the hull. When sufficient weight was applied to the centre plate to prevent the mast from sinking, the dinghy could be brought upright by both of the crew applying their weight to the centre plate.

1.10 INTERNATIONAL MARINE CERTIFICATION INSTITUTE (IMCI)

IMCI was started in 1996, and until 2003 its accreditation as a notified body had been via the Belgian Ministry of Transport. Its accreditation since June 2003 has been via Belcert, an organisation within the Belgian Ministry of Finance. IMCI is required to comply with EN ISO 45011 to maintain its accreditation.

IMCI employs about 40 CE inspectors worldwide, and currently certifies over 5100 craft. Verbal feedback from its last audit, conducted by Belcert in September 2005, indicated that no major problems with its procedures were

evident. The company's procedure for the checking of the results of tests conducted in accordance with the conformity assessment module Aa of the RCD, is that only the calculations submitted by the manufacturers are checked. The inputs to the calculations are not. However, the degree of trust afforded to individual manufacturers is dependent on the body's knowledge of them, and how trustworthy their work has been. In 2001, IMCI had previously worked with the consultant contracted by DarekCo, and his work was found to be reliable. The consultant became a CE inspector for IMCI in December 2003.

1.11 EN ISO 12217-3

1.11.1 Background

Prior to its harmonisation with the Recreational Craft Directive in May 2002, the standard underwent a number of draft stages. The latest version of the draft standard in June 2001 was ISO/FDIS 12217-3, which became available to Notified Bodies in February 2001, but was not publicly available until January 2002. A number of earlier draft versions (DIS) had been publicly available since 2000. It is not known which version of the DIS or FDIS the consultant based his tests on the BEZ 2.

1.11.2 Testing options

For the BEZ 2, the draft standard (DIS and FDIS) allowed conformity with the stability and buoyancy requirements of the RCD to be demonstrated by the successful completion of any one of the following three tests:

- a wind stiffness test, the purpose of which was to demonstrate that:

  when a sailing boat is heeled to a steady wind speed appropriate to the design category, the boat does not start flooding or exceed 45º heel;

- a knockdown recovery test, the purpose of which was to demonstrate that:

  a boat can return to the upright unaided after being knocked down; and a

- capsize recovery test, the purpose of which was to demonstrate that:

  a boat can be returned to the upright after a capsize by the actions of the crew using their body action/or righting devices purposely designed and fitted to the boat, that it will subsequently float, and to verify that the recommended minimum crew weight mass is sufficient for the recovery method used.

Important differences between the ISO/DIS 12217-3 and ISO/FDIS 12217-3 relevant to wind stiffness test include:

- ISO/FDIS 12217-3 required a boat intended for use in Category C waters to pass a level flotation test to demonstrate that it has adequate swamped buoyancy and stability. ISO/DIS 12217-3 only required a basic flotation test to be conducted.

- ISO/FDIS 12217-3 contained calculation worksheets for use with the required tests.
- ISO/FDIS 12217-3 allowed a boat which could not satisfy the requirements of the wind stiffness test with full sail, to be categorised C or D, provided the requirements were met with the sail reefed provided:
  - the reefed sail area is not less than two thirds of the actual profile projected area of the standard sail plan,
  - the wind force at which reefing becomes necessary is clearly stated in the owner's manual, and
  - warning symbols are displayed at the main control position **(Figure 10)**.

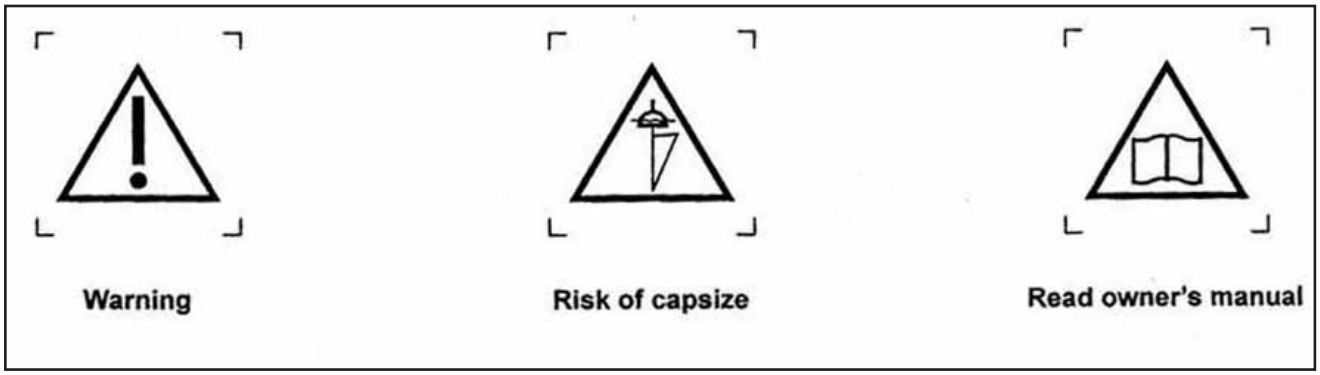
1.11.3 Information to be provided

EN ISO 12217-3 (2002), requires specific stability information relating to the relevant tests conducted to be provided where appropriate. Examples include:

- Whether a boat is only intended to be sailed with the centreboards or drop-keels in the lowered position (where the stability has only been assessed in this condition)
- The highlighting of openings which are marked "WATERTIGHT ENCLOSURE – KEEP SHUT WHEN UNDERWAY", and reminding owners that care should be taken to observe this warning.
- When a boat has passed the capsize-recovery test, information regarding the minimum crew mass to recover the boat, the recommended technique, and the likelihood of capsize.
- For boats passing the wind stiffness test, the likelihood of a boat being swamped or capsized if excessive sail is carried, and the wind speed on the Beaufort Scale at which the sail should be reefed.

No specific information regarding the tests conducted, or tests not conducted which might be relevant to the limitations of the boat, are required to be provided.

Figure 10



Warning signs

1.12 POST ACCIDENT TESTS

1.12.1 The BEZ 2

On 4 October 2005, a new 2005 model BEZ 2 was tested by the RYA, an EU notified body for the testing of recreational craft. The tests were in accordance with the requirements of BS EN ISO 12217-3 (2002), of which the requirements for the wind stiffness and flotation tests were the same as FDIS ISO 12217-3. It was also tested against the requirements of DIS 12217-3.

The tests conducted by the RYA on the BEZ 2 included the wind stiffness test, the knockdown-recovery test, the capsize recovery test, and the level and basic flotation tests. A summary of the results is shown at **Figure 11**, and the full test report is at **Annex E**. Photographs taken during the tests are at **Annex F**.

During the capsize recovery test, the dinghy inverted as soon as it was intentionally capsized, and the steel centre plate dropped back into the hull. The recovery of the centre plate to allow its use in righting the dinghy was only possible by using a pennant, which had been attached before the test began. Once the centre plate was extended from the hull, the crew had great difficulty in getting the boat upright. Once upright, it was evident that the cabin and cockpit had filled with water.

Figure 11

Summary of Results Against BS EN ISO 12217-3

Test	Test Design Category	Floatation Test	Final Design Category
Wind Stiffness Test	Category C (Only In Reefed Condition)	Basic - D	**D**
Knockdown Recovery Test	Fail	Basic - D	**Fail**
Capsize Recovery Test	Fail		**Fail**

Summary of Results Against ISO/DIS 12217-3

Test	Test Design Category	Floatation Test	Final Design Category
Wind Stiffness Test	D	Basic - C	**D**
Knockdown Recovery Test	Fail	Basic - C	**Fail**
Capsize Recovery Test	Fail		**Fail**

Summary of RYA tests

On completion of the capsize-recovery test, the water from the BEZ 2 could only be bailed when supported by craft on either side to prevent further capsize. When the boat was taken out of the water following the tests, it was evident that a large amount of water had entered the space between the inner mouldings and the hull. This substantially increased the weight of the boat, making it difficult to support on its trailer without damaging either the dinghy or the trailer. When the boat was tilted forward, the trapped water was seen to escape from the hull void space into the cabin via the seam joining the inner mouldings to the hull **(Figure 12)**. When the dinghy was tilted aft, water escaped into the aft storage locker in a similar manner. In order to release all of the trapped water to safely transport the dinghy, it was necessary to drill a hole through an internal bulkhead into the void space. The hole was later secured with a watertight drainage plug.

Figure 12

Water passing through deck seam

1.12.2 Lifejacket

The lifejacket worn by the owner of *Mollyanna* was examined and tested by QinetiQ[3] on behalf of the MAIB. The examination and tests indicated that the lifejacket was not damaged, was airtight, and operated correctly when manually inflated. When fitted correctly, the lifejacket supported a flotation manikin representing an unconscious body, in a stable position with the head clear of the

[3] Qinetiq – Independent research company utilised by MAIB to conduct tests on safety equipment in the furtherance of accident investigation.

water. When the lifejacket was fitted with the waist belt loose, it tended to ride up the torso and allow the body to slip through, with the result that the manikin floated in the water with the mouth just submerged.

1.13 RECREATIONAL CRAFT DIRECTIVE

1.13.1 General

In 1998 Directive 94/25/EC (Recreational Craft Directive) was introduced by the European Commission to ensure a uniform level of safety in the design and manufacture of recreational craft throughout the European Economic Area. This established the free movement of recreational craft within the single market, and was implemented in the UK by the Recreational Craft Regulations 1996 S.I. 1996/1353. The RCD applies to all craft (with some exemptions) placed on the market or put into service and intended to be used for sporting and recreational purposes with a hull length of between 2.5 and 24 metres.

The Directive does not contain any retrospective provisions and, as such, existing boats in use in the EEA lie outside the Directive. As a trade directive, it bears on the first point of sale (or hire), and Member states are unable to elaborate on its rules in the conditions they themselves impose on new craft first being placed on to their waters. At the national level the Department of Trade and Industry (DTI) has responsibility for the Recreational Craft Regulations within the UK, with enforcement being the responsibility of local authority trading standards departments.

1.13.2 Essential requirements

Annex I of the Directive lays out essential safety, health, environmental protection, and consumer protection requirements that must be met by recreational craft. These requirements include:

- Boat design categories

There are 4 design categories within the Directive. These are: A – 'Ocean', B – 'Offshore', C – 'Inshore', and 'D' Sheltered waters. Design category C – 'Inshore' is defined as:

Designed for voyages in coastal waters, large bays, estuaries, lakes and rivers where conditions up to, and including, wind force 6 and significant wave heights up to, and including, 2m may be experienced[4]*.*

Design category D – 'Sheltered Waters' is defined as:

Designed for voyages on small lakes, rivers, and canals where conditions up to, and including, wind force 4 and significant wave heights up to, and including, 0.5m may be experienced.

[4] The significant wave height is the mean height of the highest one-third of the waves, which approximately corresponds to the wave height estimated by an experienced observer. Some waves will be double this height.

- Builder's Plate

Each craft is required to have a plate affixed showing:

- The manufacturer's name,
- A CE marking,
- The boat design category,
- The manufacturer's maximum recommended load, and
- The number of persons recommended by the manufacturer for which the boat was designed when underway[5].

It is also acceptable for manufacturers to add the maximum rated engine power to the plate, provided the information is consistent with the information contained in the owner's manual.

- Owner's manual

Each craft must be provided with an owner's manual. The owner's manual is provided as guidance to the owner of the boat, most particularly on safety issues, and should be written in the language applicable to the EEA State in which the craft is to be sold. The manual should cover risks applicable to the type of boat. Information not relevant to the boat model must be deleted to avoid confusion.

- Stability and freeboard

The RCD requires that:

(The) craft shall have sufficient stability and freeboard considering its design category..and the manufacturer's maximum recommended load..

- Buoyancy and flotation

The RCD requires that:

(The) craft shall be constructed to ensure that it has buoyancy characteristics appropriate to its design category….and the manufacturer's maximum recommended load.

Boats of less than six metres in length that are susceptible to swamping when used in their design category shall be provided with appropriate means of flotation in the swamped condition.

[5] Maximum recommended number of people (with an assumed mass of 75Kg each) based on the seating or space requirements of ISO 14946, and/or design category.

- *Manufacturer's maximum recommended load*

The RCD states:

The manufacturer's maximum recommended load (fuel, water, provisions, miscellaneous and people (in kilograms) for which the boat was designed, …shall be determined according to the design category, stability and freeboard, and buoyancy and flotation.

In addition to the essential requirements of the Directive, administrative requirements include that manufacturers compile a file of technical information. In the case of complete craft or hulls, this file is to include test reports or calculations demonstrating that the craft has adequate stability in the anticipated sea conditions.

1.13.3 Conformity with the essential requirements

The essential requirements of the RCD must be met before a manufacturer can place its boat on the market in the EEA. This can be achieved through the application of harmonised standards, which gives a presumption of conformity with the Directive's essential requirements. In broad terms, harmonised standards are European standards, which are adopted by European Standards Organisations (ESOs), prepared in accordance with the general guidelines agreed between the European Commission and ESOs, and follow a mandate issued by the commission. Appendix 3 of the RCD lists the standards harmonised under the Directive. With regard to the essential requirements noted in paragraph 1.12.2, the harmonised standards applicable to *Mollyanna* with respect to stability and freeboard, and buoyancy and flotation, owner's manual, and manufacturer's maximum recommended load are:

- EN ISO 12217-3:2002: Small craft – Stability and buoyancy assessment and categorisation – Part 3: Boats of hull length less than 6m (ISO 12217-3:2002)
- EN ISO 10240:1995: Small craft – Owner's manual (ISO 10240:1995)
- EN ISO 14946:2001: Small craft – Maximum load capacity (ISO 14946:2001)

However, the application of harmonised standards is voluntary, and is not the only method available to demonstrate conformity. If a harmonised standard is not followed, a manufacturer is obliged to prove that his product conforms to the essential requirements of the Directive by alternative means.

1.13.4 Methods of assessment of conformity with the essential requirements

The method of assessment of a boat's conformity with the essential requirements of the RCD is dependent on its design category and length. In the case of the BEZ 2, assessment was possible in either Module A (internal production control) or Aa (internal production control plus tests), depending on whether the harmonised standards for stability and buoyancy were complied with.

When module A is used, it is the responsibility of a manufacturer to provide a 'Declaration of Conformity' for each separate craft, which should include:

- name and address of the manufacturer or his authorised representative established in the EC.
- Description of the recreational craft or of the component.
- References to the relevant harmonised standards used, or references to the specifications in relation to which conformity is declared.
- Where appropriate, reference to the EC type examination certificate issued by a notified body.
- Where appropriate the name and address of the notified body.
- Identification of the person empowered to sign on behalf of the manufacturer or his authorised representative established within the EC.

A recommended format for the declaration of conformity is at **Annex G**. When module Aa is used, which is normally when the harmonised standards for stability and buoyancy are not used to demonstrate compliance, the control of all tests are the responsibility of a notified body, which issues an examination report. A list of notified bodies and their identification numbers, which can be appointed to carry out the tasks pertaining to the conformity assessment procedures, is published by the European Commission.

1.14 A CAPSIZE OFF LANGSTONE

On the afternoon of 2 July 2005, another BEZ 2 also capsized and could not be righted. The capsize occurred in the approaches to Langstone Harbour near Chichester, England. The wind was force 4 to 5, and the height of the waves was about 0.5m. After leaving the lee of the shore, the dinghy was sailing with the wind between 40 and 50 degrees on her starboard bow. The owner (weight approximately 105kg) sat on the starboard side towards the front of the cockpit controlling both the main and the jib sheets. The owner's wife (weight approximately 100kg) sat on the port side of the cockpit, towards the stern, controlling the tiller.

Suddenly, a gust of wind blew the dinghy until it was almost lying on its port side. The owner's wife fell backwards, but managed to remain holding on to the tiller. She was prevented from falling completely overboard by the main sheet. Meanwhile, the owner fell under the boom into the water. The boat stopped in the water on its port side, and when the owner went to check that the jib sheet was not cleated before attempting recovery, the dinghy rolled towards him and inverted.

On inverting, the centre board retracted to its stowed position, making it impossible to attempt to right the boat. A nearby fishing vessel recovered the owner and his wife, who were not wearing lifejackets or buoyancy aids. The BEZ 2 was then towed by a RIB into more sheltered waters where a line was attached to one of the dinghy's shrouds. The dinghy was then pulled upright. Initially, the dinghy appeared to be stable, but when a crewman from the RIB climbed on board, it again capsized and inverted. The up-turned hull was then observed to be lower in the water than previously. The dinghy was towed gently into shoaling water where it was righted, and pumped out.

When the boat was recovered ashore, a large amount of water was drained from the space between the inner mouldings and the hull via a through hull fitting housing a depth sounder. The owner considered that the water probably entered the space through this fitting, when the dinghy capsized and the cabin was filled with water, because the fitting might not have been tightened sufficiently on its inboard side.

SECTION 2 - ANALYSIS

2.1 AIM

The purpose of the analysis is to determine the contributory causes and circumstances of the accident as a basis for making recommendations to prevent similar accidents occurring in the future.

2.2 FATIGUE

Both the owner and his son were well rested prior to the sailing trip, and there is no indication that fatigue influenced their decision-making or actions.

2.3 CREW EXPERIENCE

The crew of *Mollyanna* were very inexperienced dinghy sailors. The owner had no previous sailing experience before acquiring the dinghy, and his son's experience was very limited and lacked currency. The manufacturer produced no written guidance, and the owner had not taken up a familiarisation course offered by the boat's vendor. Therefore, the owner's knowledge of the characteristics of the BEZ 2 was gained only from what had been passed by salesmen at the Birmingham Boat Show, and his practical experience. This had been limited to about seven previous trips in varying conditions, but probably none as testing as the conditions encountered on 2 July.

During the period from when *Mollyanna* sailed from Conwy at about 1200 until her crew were taken on board *Starida II* at about 1600, the weather and sea conditions had deteriorated considerably. This is evident from there being insufficient wind to sail the dinghy when passing Penmaenmawr Point, and the reported conditions of a force 6 south west wind and a 1.5m wave height at the time of the rescue. It is also supported by the 1.5nm drift experienced by the upturned hull after capsize **(Figure 1)**. However, although the worsening conditions might have been exacerbated by a funnelling effect through the Menai Strait, the Meteorological Office had forecast the strong southerly winds. Had the owner of *Mollyanna* or his son been aware of the inshore forecast, rather than the general forecast on the television, the planned excursion might not have been attempted.

2.4 THE CAPSIZE

When *Mollyanna* capsized, the dinghy was on a beam reach with the mainsail carried on the starboard side. All of the crew were positioned on the port side, and although the dinghy was kept on an even keel, the owner's son had found it increasingly difficult to keep *Mollyanna* on a straight course as the wind strength increased. This was probably because with just the mainsail set, the wind would have tended to act on the stern of the dinghy, causing her bow to seek the wind. To counter this tendency, increasing amounts of starboard helm would have been required. However, as the sea-state had also increased, and the rudder could not be secured in the down position, the rudder would probably have been prone to lifting, and its effectiveness reduced.

In gusty conditions, control of a dinghy is usually maintained by the adjustment of the mainsail. By easing the main sheet, the wind is ‘spilled’, and the induced heeling and turning moments are reduced. This was not possible on this occasion because the owner’s son required both hands to control the tiller. He had therefore secured the mainsheet to a mooring cleat. Consequently, when the strong gust of wind was experienced, and the tendency for the dinghy to turn into the wind could not be checked by the use of the rudder alone, the mainsheet could not be immediately eased or released.

Once the dinghy turned into the wind, the heeling effect of the wind would have been lost, and with all of the crew positioned on the port side, it was not surprising that the dinghy capsized. Additionally, as the dinghy turned into the wind, she would have also turned into the sea. It is possible that she stalled and was pushed down the wave stern first. This might have caused water to enter the cockpit, causing further instability.

Although the risk of capsize was increased by the loading of the dinghy, it is difficult to determine to what degree. The recommended maximum number of persons for the BEZ 2 was three, with a maximum recommended load of 250kg. The owner and his son were aware of the recommended number of persons, and had made the decision that the occupancy of the boat could be safely increased to four because two of the crew were children. The total weight of the crew was 268kg. This, together with the anchor (15kg) and outboard engine (12.7kg), and sundry items would have given a total onboard weight of about 300kg.

Notwithstanding a dinghy’s categorisation, it is recognised that most, if not all, dinghies are prone to capsize in any conditions, depending on the skill and experience of their crew. In this case, it is almost certain the inexperience of the crew contributed to the capsize of *Mollyanna*. The risk of capsize would probably have been significantly reduced had the jib and a reefed mainsail been set instead of a full mainsail, and the main sheet kept in hand. Such actions, which a more experienced crew might have taken, would have probably made the boat more balanced and easier to control, and enabled the wind to be spilled more quickly in the gusty conditions.

2.5 EVENTS AFTER THE CAPSIZE

Mollyanna’s crew were in the water for over 1 hour following the dinghy’s capsize. During this time, the owner died through a combination of hypothermia and drowning, and his grandson became hypothermic to the extent that he could not be resuscitated. It is likely that several factors contributed to their deaths.

First, the dinghy could not be maintained in an upright condition after being righted. Had this been possible, the owner and his grandson would potentially have been able to get clear of the water. Also, the chances of the dinghy being

seen by the first boat to pass in close proximity, would have been considerably increased, particularly as the flares in the cabin of the boat would have been accessible and could have been used to attract attention.

An inexperienced crew is more likely to encounter difficulty in righting a capsized dinghy than an experienced and practised crew. However, on this occasion, inexperience was not a factor. The owner's son successfully managed to right the boat on two occasions in extremely difficult conditions, but the boat lacked sufficient stability, when swamped, to remain upright. The efforts of the owner's son were commendable given the difficulty encountered in righting the BEZ 2 during the RYA tests, and by the RNLI crewmen on the afternoon of the accident.

Second, the clothing worn by the crew would have provided very little insulation from the cold sea-water. Although at 16°C, the water was relatively warm, it would soon have had a debilitating effect on the crew, particularly in the strong wind. The wearing of wet suits or even splash tops would have considerably increased the chances of survival.

Finally, the owner of *Mollyanna* encountered difficulties with his lifejacket. As the tests conducted by QinetiQ indicated that the lifejacket provided proper support when inflated, it is evident that the owner had not tightened its waist belt sufficiently. This allowed the jacket to ride up his body, causing it to be more of a hindrance than assistance, particularly as the owner was not a strong swimmer and the sea had become choppy. It is not known to what extent the owner's heart condition or medication affected his chances of survival.

2.6 CONFORMITY ASSESSMENT

2.6.1 Categorisation

At the time of the accident, the dinghy was in coastal waters, and although the wind was probably close to the Category C maximum wind force 6 at the time of the capsize, and during the attempts to right the boat, it did not exceed it. Also, the sea conditions experienced with wave heights of 1.5m were smaller than the 2m significant wave height, which is the maximum used in the standard and RCD. The dinghy was therefore operating within the definition of Category C waters, as was the BEZ 2 which capsized and could not be righted, off Langstone.

2.6.2 RYA tests

It is evident from the tests conducted by the RYA on 4 October 2005, the BEZ 2 did not meet the stability and buoyancy requirements of EN ISO 12217-3 (2002) with respect to Category C **(Figure 11 and Annex E)**. It also did not meet the requirements of ISO/DIS 12217-3. The dinghy failed both the capsize recovery, and knockdown recovery tests, and could only meet the requirements for

category ‘D’ in the wind stiffness test. Therefore, the declaration made by Poliglass **(Annex C)** that *Mollyanna* conformed to the stability and buoyancy requirements of ISO 12217-3 for a craft in Category C waters, was incorrect.

2.6.3 Testing

The results of the RYA tests cast serious doubt on the accuracy of the test results recorded in 2001 **(Annex A)**. Scrutiny of the wind stiffness test calculation and accompanying diagram at item 7.6 of the test results shows that 51° rather than 39° was used for ØT. When the correct value for ØT is used with the other stated values, the resultant wind speed is 9.7m/s **(Annex H)**. This value is similar to the wind speed value obtained during the tests in 2005, and below the 11m/s required for craft in design category C. A similar calculation for another dinghy, the Ixylon dinghy, undertaken by the same consultant in 1998 was found to contain the same error.

The consultant cannot recall whether the tests were conducted using ISO/DIS 12217-3, which required only a basic flotation test to be completed when using the wind stiffness test option, or ISO/FDIS 12217-3, which also required a level flotation test to be conducted, and contained worksheets for use with the basic and level flotation tests. The test report indicated the additional flotation required to conform to the standard, but did not include any calculations to show how the requirement for this additional flotation was derived. The calculation required for the level flotation test would have been difficult, and would have probably required a degree of computer modelling, as well as detailed information regarding the thicknesses of the materials used in the boat’s construction. It is probably a calculation the consultant would have remembered completing. Therefore, in view of the BEZ 2’s failure of the practical level flotation test in October 2005, and its lack of stability in the swamped condition evident in *Mollyanna* and the BEZ 2 off Langstone, it is possible that either the calculation for the level flotation test was not undertaken, or was incorrect.

2.6.4 Certification

Although IMCI was not involved in the certification of the BEZ 2s manufactured after 2002, and the MAIB is not aware of any accidents involving BEZ 2s manufactured up to 2002, the inaccuracy and potential incompleteness of the tests conducted in 2001 **(Annex A)** calls into question the validity of the Statement of Conformity **(Annex B)** issued by IMCI in 2001. The validity of the Certificate of Conformity **(within Annex D)** issued by the consultant in 2003 is also questionable. IMCI noted that the wind stiffness calculation was incorrect, and issued its ‘Statement of Conformity’ only after DarekCo had included advice on reefing in its owner’s manual for the BEZ 2, in accordance with ISO/FDIS 12217-3. However, although ISO/FDIS 12217-3 also required that a level flotation test be conducted, the notified body did not question the consultant’s report in this respect. This was surprising considering it had detected error in the wind stiffness calculation, the test report did not specify the draft standard used, and did not include any of the flotation test calculation worksheets

contained in ISO/FDIS 12217-3. It is not known if IMCI advised DarekCo to place warning signs **(Figure 10)** in the cockpit of the BEZ 2, as required by ISO/FDIS 12217-3, but none were affixed.

The basis of the declaration of conformity made by Poliglass was the Certificate of Conformity **(within Annex D)** issued to DarekCo in September 2003. This was provided by the consultant on the assumption that the additional flotation noted in the 2001 test report had been fitted, and that no other significant modifications had been made to the dinghy. The consultant had not been made aware of his error in the wind stiffness calculation, or of the reefing clause included in the owner's manual. He also made no reference to EN ISO 12217-3, (2002), despite not recalling which version of the draft standard he had used in 2001. Although the requirements of the standard had potentially been amended, this was in accordance with industry practice, which assumes that once a vessel conforms to the relevant applicable safety standards, it retains conformity, regardless of subsequent changes to the standards. This approach is understandable in order to prevent the repeated testing of craft with proven safety records when the standards are changed, but the inclusion of only the current standards used on a declaration of conformity **(Annex G)** is therefore potentially misleading. Reference to the dates or versions of the standards used would provide a more accurate means of determining the specific elements of a standard to which a boat conforms.

2.7 DINGHY CONSTRUCTION

The instability of the BEZ 2 in a swamped condition evident during the tests conducted in October 2005, and also following the capsize of both *Mollyanna*, and the dinghy off Langstone on 2 July 2005, was due to a lack of buoyancy. This was probably because the dinghy was either fitted with insufficient flotation, or because of the ingress of water into the spaces between the inner mouldings and the hull. The requirement for the fitting of additional flotation noted on the consultant's test report in 2001 was acknowledged by DarekCo, but a copy of the report was not forwarded to Poliglass, the boat's constructor. Therefore, although additional flotation was added after 2001, it is not certain whether the requirements of the test report were fully implemented.

The danger of water ingress into the spaces between the inner mouldings and hull was noted in the owner's manual **(Annex D)**, which advised that care was to be taken when securing fittings to the deck and inner bulkhead because of the adjacent buoyancy spaces. However, the buoyancy spaces contained polystyrene and were not airtight; they were also not watertight **(Figure 12)**. Consequently, as soon as the boat capsized, and water entered the cabin and cockpit area, it was able to penetrate into the buoyancy spaces and fill the areas not containing polystyrene. This caused a reduction in the dinghy's buoyancy, which was evident from the reduction in hull visible above the waterline while inverted during the tests in October 2005. Water trapped in the buoyancy spaces not only has a detrimental effect on the dinghy's stability, it also increases the risk of damage to the boat when stored or transported on a trailer.

Furthermore, after being righted as part of the capsize-recovery test in October 2005, although the BEZ 2 successfully completed a practical basic flotation test, its stability, buoyancy, and freeboard were adversely affected by water in its cabin and cockpit. As the cabin is not fitted with any means of drainage or pumping arrangements, the potentially large volume of water trapped in this area can only be hand-bailed. Even though the BEZ 2 conformed to EN ISO 12217-3 with respect to design category D, in view of the boat's propensity to invert, and for its centre plate to retract following capsize, the ingress of water into its buoyancy spaces, and the lack of drainage or pumping arrangements in its cabin, its use in sheltered waters where assistance is not readily at hand is questionable.

2.8 VALIDITY OF THE WIND STIFFNESS TEST

The wind stiffness test was used in preference to the capsize-recovery test to demonstrate the BEZ 2 conformed to the stability and buoyancy requirements of the RCD in 2001. The test was used to show that the dinghy did not heel and start to flood when subjected to a steady wind speed appropriate for its use in 'inshore waters'. However, the test did not eliminate the risk of capsize. Indeed, craft of the size and displacement of the BEZ 2 are expected to capsize through a variety of factors. Equally, the crew of such craft also expect to be able to right following capsize, as demonstrated by the views in this respect of *Mollyanna*'s owner and his son. For such craft, the provision of information regarding a boat's behaviour during capsize, righting, or when swamped is invaluable. This information was not available from the wind stiffness test, but would have been had the capsize-recovery test been used. The construction deficiencies noted in paragraph 2.7 would also have been apparent.

2.9 UNDERSTANDING AND APPLICATION OF THE RCD

Several departures from the requirements of the RCD were evident during this investigation.

First, although DarekCo advised IMCI that its owner's manual had been amended to include a section on the reduction of sail area in winds above force 4, this section was not included in the manual provided to the MAIB in 2005, which did include the Certificate of Conformity issued in 2003.

Second, when Poliglass supplied the BEZ 2 directly to MG Boats, it assumed the responsibilities of the manufacturer. Consequently, the testing and certification arranged by DarekCo via IMCI in 2001, and the re-validation of the craft's conformity with the relevant standards by the independent consultant in 2003, were no longer valid. On assuming the responsibilities of the manufacturer, Poliglass was obliged to make its own arrangements to ensure the BEZ 2 complied with the essential requirements of the RCD before exporting any of the craft into the EEA, particularly as it did not hold any details of the stability and buoyancy tests conducted in 2001.

Third, Poliglass was unaware of the requirement to provide an owner's manual with each of the craft it built. It considered that this was only required from 2006.

Fourth, the information on the builder's plate affixed to *Mollyanna* was misleading. It indicated that Germanischer Lloyd had been involved in the production of the boat, when it had not. This was possibly due to the fact that Poliglass used Germanischer Lloyd in the conformity assessment of its other boats.

Fifth, the maximum power rating noted on the certificate of conformity, issued in 2003 by the consultant, was 3.6kW; the maximum rating on the builder's plate was 11kW. Poliglass considered this to be an error, although 11kW was the rating used when the boats were sold via DarekCo.

Finally, the declaration of conformity shows that the maximum number of persons shown was 2.3 [sic]. It also listed as 'CE Classification' the local number of the certificate of conformity issued by the consultant in 2003.

These departures from the RCD, and its associated harmonised standards, indicate a lack of attention to detail. More importantly, they also indicate the manufacturer's lack of appreciation of the Directive's importance, and a lack of understanding of its requirements.

2.10 INFORMATION REQUIRED BY EN ISO 12217-3

Successful completion of either the wind stiffness test, or the capsize recovery test, or the knockdown-recovery test as detailed in EN ISO 12217-3, does not imply that a boat would have passed the other tests, had they been undertaken. During the RYA tests, the BEZ 2 successfully passed the wind stiffness test for Category D, but failed the knockdown-recovery test for the same category **(Figure 11)**.

The standard requires information derived from the test completed to be included in the owner's manual. The requirement for warning signs **(Figure 10)** is similar, despite the expectation that most small dinghies are prone to capsize. Furthermore, the standard does not require attention to be drawn to the information that is available from failed tests, or tests that have not been attempted. Such information could be extremely useful in helping boat dealers to provide accurate product information, and in assisting boat owners to determine the limitations of their craft.

2.11 ENFORCEMENT OF THE RCD REQUIREMENTS

All of the BEZ 2s sold in the UK since 2003, were marketed as boats which met the stability and buoyancy requirements of design category C, which they did not. They were also supplied without owner's manuals. Furthermore, the boats provided directly to MG Boats by Poliglass were supplied with erroneous

information on their builder’s plates and declarations of conformity. None of these deficiencies were detected, even though they were marketed in high profile arenas such as the Birmingham Boat Show.

It is almost impossible for the market surveillance of any boat to be able to assess conformity with the RCD with respect to stability and buoyancy. These aspects inevitably rely on the quality assurance procedures adopted by the manufacturers, and where used, the notified bodies. In the case of the BEZ 2, where a mistake in the assessment of a boat’s conformity was made, this mistake would have been almost impossible to determine via market surveillance alone. However, better knowledge of the information required to be provided by the RCD would have assisted the importer and dealer to quickly establish that the BEZ 2 was not supplied with an owner’s manual in accordance with EN ISO 10240. The inconsistencies on the builder’s plate and declaration of conformity might also have been detected.

SECTION 3 - CONCLUSIONS

3.1 SAFETY ISSUES

The following safety issues have been determined from the foregoing analysis. They are not listed in any particular order of priority.

1. There is no indication that the actions or decision-making of the crew were influenced by fatigue. [2.2]

2. The owner and his son were inexperienced dinghy sailors. [2.3]

3. The owner and his son were not aware of the deteriorating conditions predicted by the Meteorological Office in its Inshore Weather Forecast. [2.3]

4. When a strong gust of wind was experienced, the owner's son was unable to prevent the dinghy from turning towards the wind by use of the rudder, and he was also unable to 'spill the wind' from the mainsail because the main sheet had been secured to a cleat. [2.4]

5. Despite the determined efforts of the owner's son to right the capsized dinghy, it could not be kept upright. Its crew had to remain in the water, and were unable to access the flares carried in the cabin to raise an alarm. [2.5]

6. The clothing worn by the crew would have provided very little insulation from the cold sea water. [2.5]

7. The waist belt on *Mollyanna*'s owner's lifejacket was not tightened sufficiently. Consequently, the jacket rode up his body when inflated, and was more of a hindrance than assistance. [2.5]

8. The BEZ 2 dinghy did not meet the stability and buoyancy requirements of EN ISO 12217-3 (2002) with respect to use in Category C (Inshore) waters, and the declaration of conformity provided by the manufacturer in this respect was incorrect. [2.6.2]

9. The wind stiffness calculation made in 2001 was incorrect. [2.6.3]

10. It is possible that either the calculation for the level flotation test was not undertaken, or was incorrect. [2.6.3]

11. The notified body did not question the consultant's calculations regarding the required flotation tests, despite having detected errors in the wind stiffness calculation, the test report not specifying which version of the draft standard was used, and the flotation test calculation worksheets contained in ISO/FDIS 12217-3 were not forwarded. [2.6.4]

12. The inclusion of only the relevant standards used on a declaration of conformity is potentially misleading. Reference to the dates or versions of the standards used would provide a more accurate means of determining the specific elements of a standard to which a boat conforms. [2.6.4]

13. The instability of the BEZ 2 in a swamped condition was due to a lack of buoyancy, which was probably due to the dinghy either being fitted with insufficient flotation, or because of the ingress of water into the spaces between its inner mouldings and its hull. [2.7]

14. In view of the boat's propensity to invert, and for its centre plate to retract following capsize, the ingress of water into its buoyancy spaces, and the lack of drainage or pumping arrangements in its cabin, its use in sheltered waters where assistance is not readily at hand is questionable. [2.7]

15. It would have been more appropriate for the stability and buoyancy of the BEZ 2 to have been assessed using the capsize-recovery test, rather than the wind stiffness test. [2.8]

16. The number of departures from the RCD and its associated harmonised standards, indicates the manufacturer's lack of appreciation of the RCD's importance, and a lack of understanding of its requirements. [2.9]

17. Information from failed or uncompleted tests contained in owners' manuals could be extremely useful in assisting boat owners to determine the limitations of their craft. [2.10]

18. Better knowledge of the information required to be provided by the RCD would have assisted the importer and dealer to quickly establish that the BEZ 2 was not supplied with an owner's manual in accordance with EN ISO 10240. The inconsistencies on the builder's plate and declaration of conformity might also have been detected. [2.11]

SECTION 4 - ACTION TAKEN

On 23 November 2005, the MAIB sent letters to MG Boats, DarekCo, and Poliglass, to advise the companies of the tests conducted by the RYA on 4 October 2005, and to strongly recommend that customers who have already purchased a BEZ 2 are advised of the category limitations which should correctly apply to the dinghy. Action taken by other bodies includes:

The DTI has:

- Informed the Polish Authorities of the results of the stability tests on the BEZ 2 undertaken in October 2005. The department requested that necessary actions were taken to ensure that the manufacturer(s) advise any customers who had purchased a BEZ 2, of the category limitations which should apply to the dinghy. It also requested that future BEZ 2 dinghies are annotated with the correct design category and meet the essential requirements of the RCD.

The Polish Office for Competition and Consumer Protection has:

- Determined that DarekCo and Poliglass have informed their customers in the UK, Poland and Germany through whom the BEZ 2s were distributed, of the applicable design category limitations for this dinghy. It has also received an advice from Poliglass, that the dinghy will no longer be manufactured by the company.

The RYA and BMF have:

- Undertaken to co-operate to introduce measures to assist boat users to understand the technical information given in documents provided in accordance with the RCD.
- Undertaken to investigate the viability of vouchers being issued to purchasers of boats by dealers and/or manufactures, which can be exchanged for training courses operated by the RYA.

BMF has:

- Assisted MG Boats in notifying all UK dealerships, through which MG Boats sold the BEZ 2 dinghy, of the MAIB recommendation to inform customers who have purchased a BEZ 2 of the correct category limitations which should correctly apply to the dinghy. The dealerships were also informed of the requirement of Trading Standards for the BEZ 2 to be withdrawn from the market until modifications to relevant documentation, including the owners' manual, Declaration of Conformity and builder's plate had been completed. The dealerships were requested to advise the BMF in writing of the actions they had taken. A copy of this letter is at **Annex I**.
- Undertaken to introduce a verification scheme to assist UK manufacturers in complying with the essential requirements of the Recreational Craft Directive.
- Continued its ongoing training and education initiatives to industry and trading standards officers with regard to the RCD.

The MCA has:

- Undertaken to co-ordinate a review of current educational material available to boat users with the RYA, BMF, and RNLI with a view to assisting boat owners to understand the information provided in owners' manuals, builder's plates, and declarations of conformity.

SECTION 5 - RECOMMENDATIONS

The Department for Trade and Industry is recommended to:

2006/146 Promulgate advice to the ADCO Group, at the earliest opportunity, that the importance of indicating the revision dates of the harmonised standards used on Declarations of Conformity is highlighted in its 'Instructions on how to complete a Declaration of Conformity'.

The British Standards Institution is recommended to:

2006/147 Propose to the International Standards Organisation that the requirements of the wind stiffness test in EN ISO 12217-2 and EN ISO 12217-3 be reviewed, particularly regarding onboard signage and the information to be included in owners' manuals, with a view to providing users with a more comprehensive knowledge of a craft's limitations, and of the appropriate precautions to be taken. In this review, consideration should be given to limiting the application of this test to boats of greater than a defined minimum displacement or length.

The British Marine Federation is recommended to:

2006/148 Commend to ICOMIA its conformity assessment verification scheme with UK manufacturers, with a view to using the scheme as a model for best practice to be used by other national industry bodies.

Marine Accident Investigation Branch
March 2006