Report on the investigation of the

swamping and foundering of a

4.6m grp open sports boat

with the loss of three lives

on Loch Ryan

south-west Scotland

12 July 2003

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Extract from

The Merchant Shipping

(Accident Reporting and Investigation)

Regulations 1999

The fundamental purpose of investigating an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 1999 is to determine its circumstances and the causes with the aim of improving the safety of life at sea and the avoidance of accidents in the future. It is not the purpose to apportion liability, nor, except so far as is necessary to achieve the fundamental purpose, to apportion blame.

NOTE

This report is not written with liability in mind and is not intended to be used in court for the purpose of litigation. It endeavours to identify and analyse the relevant safety issues pertaining to the specific accident, and to make recommendations aimed at preventing similar accidents in the future.

CONTENTS

GLOSSARY OF ABBREVIATIONS, ACRONYMS AND TERMS

ADAS	-	Action Data System
ALB	-	All weather lifeboat
BMF	-	British Marine Industries Federation
Cable	-	Unit of distance measurement, 1 cable = 1/10 nautical mile = 184m
Clo	-	Unit of clothing insulation
Freeboard	-	Vertical distance from waterline to top of the boat's watertight hull
GPS	-	Global positioning system
GRP	-	Glass reinforced plastic
gt	-	Gross ton – a unit of volume used to measure the size of a vessel
Gunwale	-	Upper weathertight edge of a boat's side
hp	-	Horsepower – a measurement of power equivalent to 0.746kW
HSC	-	High speed craft
ICCS	-	Integrated Coastguard Communication System
ICS	-	International Chamber of Shipping
ILB	-	Inshore lifeboat
IMO	-	International Maritime Organization
IMS	-	Incident Management System
Knot	-	One nautical mile per hour
kW	-	Kilowatt – measurement unit of power
"Mayday"	-	International radio-telephone signal indicating distress
MCA	-	Maritime and Coastguard Agency
MF	-	Medium frequency
MIN	-	Marine Information Notice
MRCC	-	Marine Rescue Co-ordination Centre

MRSC	-	Maritime Rescue Sub-Centre
N	-	newton. Unit of force which, acting on a mass of 1kg produces an acceleration of 1 metre per sec^2
Nm	-	nautical mile
OSC	-	On-scene co-ordinator
OOW	-	Officer of the Watch
“Pan Pan**”**	-	International radio-telephone signal indicating urgency
Port	-	Left hand side of vessel looking forward
RAPP	-	Risk assessment passage plan
RNLI	-	Royal National Lifeboat Institution
RLSS	-	Royal Life Saving Society
RYA	-	Royal Yachting Association
SAR	-	Search and rescue
SARIS	-	Search and Rescue Information System
SBBNF	-	Ship and Boat Builders’ National Federation
SEACheck	-	Safety Equipment Advisory Check (a free service offered by the RNLI)
Squat	-	Change in trim and bodily lowering of a vessel when moving in shallow water
Starboard	-	Right hand side of vessel looking forward
STCW	-	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended in 1995
Transom	-	The flat stern of a boat
UTC	-	Universal Co-ordinated Time
V	-	volt
VHF	-	Very High Frequency
>	-	greater than
<	-	less than

Terms

Depth Froude number (Fn_h)

A relationship between vessel speed and depth of water, which can be calculated by using the formula $Fn_h = Vs / \sqrt{(g \times h)}$, where Vs is the vessel speed through the water in m/s, g is the acceleration due to gravity ($9.81 m/s^2$), and h is the depth of water in m.

Critical speed range

The RAPP for the two HSC which operate through Loch Ryan shows the critical speed range as being between a depth Froude number of 0.85 and 1.10.

Wash waves

As a vessel proceeds, the motion of the hull(s) and the thrust of the propulsion system disturb the water. The disturbed water is known as wash or wake. The wash from a vessel includes wash waves which can be propagated from both the bow and the stern of a vessel, and which then travel away from the path of the vessel at a speed calculated using the formula $V \times \cos ø$, where V is the velocity of the vessel in m/sec and ø is the angle of propagation.

SYNOPSIS

At about 1640 on 12 July 2003, a 4.6m long GRP boat was swamped while underway on Loch Ryan, Scotland. On board were four members of one family (two boys, their father and their grandfather) and a friend of the grandfather. They had been returning to the slipway at Lady Bay, where they had launched the boat, after a successful day's fishing. The swamped boat continued to take on water until it sank, leaving all five people in the water. The weather, which had been good earlier in the day, had deteriorated slightly and there was a fresh wind from the south-south-west which was causing a choppy sea.

The boat's bow later rose to the surface and provided support for two of the party, but the others, the father and his two sons, drifted away. Although conventional and high speed ferries, fishing boats and yachts operate through the loch, no one saw their plight until, after about 4 hours spent in the cold water clinging to the bow, the grandfather and family friend were finally seen by a passing yacht and recovered.

One and a half hours later, during extensive search and rescue efforts, the father and younger boy were located 2 cables north of where the grandfather and friend had been found. They were airlifted to hospital but, despite resuscitation efforts, were later pronounced dead. The body of the older boy was discovered nearly 6 weeks later.

Examination of the boat and her engine revealed that the hull had been substantially modified from the original design. The modifications had resulted in a reduction in her integral buoyancy. The 48kW(65hp) outboard engine had been modified and poorly maintained. There had been insufficient lifejackets and safety equipment on the boat. She was heavily loaded at the time of the accident.

The radar recordings taken from the Voyage Data Recorders (VDRs) belonging to five ferries which were operating through Loch Ryan, were analysed and were effective in determining the probable time of swamping and the involvement of vessels in the area: a conventional ferry had passed the boat at a speed of about 17 knots at a distance of about 3 cables. The boat rode the waves from the ferry without causing undue concern although some spray and water was taken on board. She was then steered further out into the loch and her speed was increased. The boat was heading into choppy seas. About 4 minutes later, with little warning, a wave broke on board the boat over her starboard quarter. This shorted the battery and stopped the bilge pump and engine. The weight of water decreased the already low freeboard. More waves came on board and the vessel sank. There was no time to make a distress call or retrieve the flares that had been carried. There had been just enough time to retrieve two lifejackets from their plastic bags and hurriedly put them on the boys. The MAIB cannot determine with certainty the source of the wave(s) that led to the demise of the boat. The boat was very vulnerable to swamping especially from waves, wind generated or wash, approaching her stern.

An error, early in the SAR operation, meant that search and rescue units were directed to an incorrect datum, resulting in a delay in finding the father and son.

Recommendations have been addressed to the Loch Ryan Advisory Management Forum to improve safety in the local area, and to national sea safety groups to review the issues raised, and to consider the best ways to promulgate sea safety awareness to casual boat users.

Recommendations have also been addressed to the Maritime and Coastguard Agency (MCA) with respect to coastguard operations room procedures and, in conjunction with the RNLI, search and rescue (SAR) communications practice.

Further recommendations have been made to the MCA and operators of roll-on/roll-off passenger ferries to and from UK ports with respect to critical wash from vessels operating within the critical speed range.

Photograph 1

View of the GRP boat

SECTION 1 - FACTUAL INFORMATION

All times are UTC +1 unless stated otherwise

1.1 PARTICULARS OF THE BOAT AND ACCIDENT

Vessel details (Photograph 1)

Registered owner	:	Shaun Ridley
Type	:	Glastron Aqualift II
Built	:	Approx early 1970s
Manufacturer	:	Glastron (UK) Burntwood Staffs
Construction	:	GRP and wood
Length overall	:	4.6m
Engine power and/or type	:	Johnson outboard 48kW (65hp) c1973
Service speed	:	20 knots
Other relevant info	:	Auxiliary 4kW (5hp) outboard on board

Accident details

Time and date	:	Approximately 1640 12 July 2003
Location of accident	:	About 55° 01.1'N 005° 04.2'W. Loch Ryan.
Location of initial rescue	:	55° 00.9'N 005° 04.07'W. Loch Ryan.
Persons on board	:	Five
Injuries/fatalities	:	Three fatalities: one adult and two children. Cause of death given as immersion. Two persons suffered the effects of hypothermia.
Damage	:	Boat swamped and partially submerged.

1.2 BACKROUND

1.2.1 Loch Ryan - description

Loch Ryan **(see Figure 1)** forms the northern part of the Rhinns of Galloway on the west coast of Scotland. The west side of the loch, bordering the North Channel of the Irish Sea, is comparatively low lying, the east side is steep sided and high.

The loch is entered at the northern end between Milleur Point on the west, and Finnarts Point, 1.5 miles to the east. The loch extends slightly over 8 miles in a southerly direction, and varies in width between 2.5 miles and slightly under 1 mile.

There are various public access points on both sides, including several boat slipways. On the west side of the loch is a small craft anchorage.

The section of the loch seabed close to Stranraer has been dredged so that both conventional and high-speed craft (HSC) can operate out of Stranraer into Loch Ryan. A further small area just north of Cairn Point has also been dredged. The loch is deep enough for ferries to operate over most of its length, and out to sea.

1.2.2 Ferry operations

The first regular ferry service between Loch Ryan and Northern Ireland started in 1861 and it is, therefore, one of the oldest established routes across the Irish Sea.

At present, P&O (Irish Sea) Ferries Ltd and Stena Line Ltd operate from Cairnryan and Stranraer respectively. P&O and Stena Line each operate one high-speed ferry and two conventional ferries on the route. The high-speed ferries were high-speed craft (HSC) within the meaning of The Merchant Shipping (High Speed Craft) Regulations 1996. There are in excess of 6000 ferry departures (both conventional and high speed) from Loch Ryan every year.

1.3 NARRATIVE - ACCIDENT

All times are UTC +1.

On Friday 11 July 2003, Shaun Ridley, his two sons Steven and Michael, and his father, brought their recently purchased, second-hand, 4.6m long moulded GRP boat to Loch Ryan for a weekend of fishing **(Photograph 2)**. Accompanying them from Manchester was a family friend.

The family friend had been requested to accompany them on the fishing trip because of his previous boating experience, and to provide boat-handling advice to Shaun Ridley.

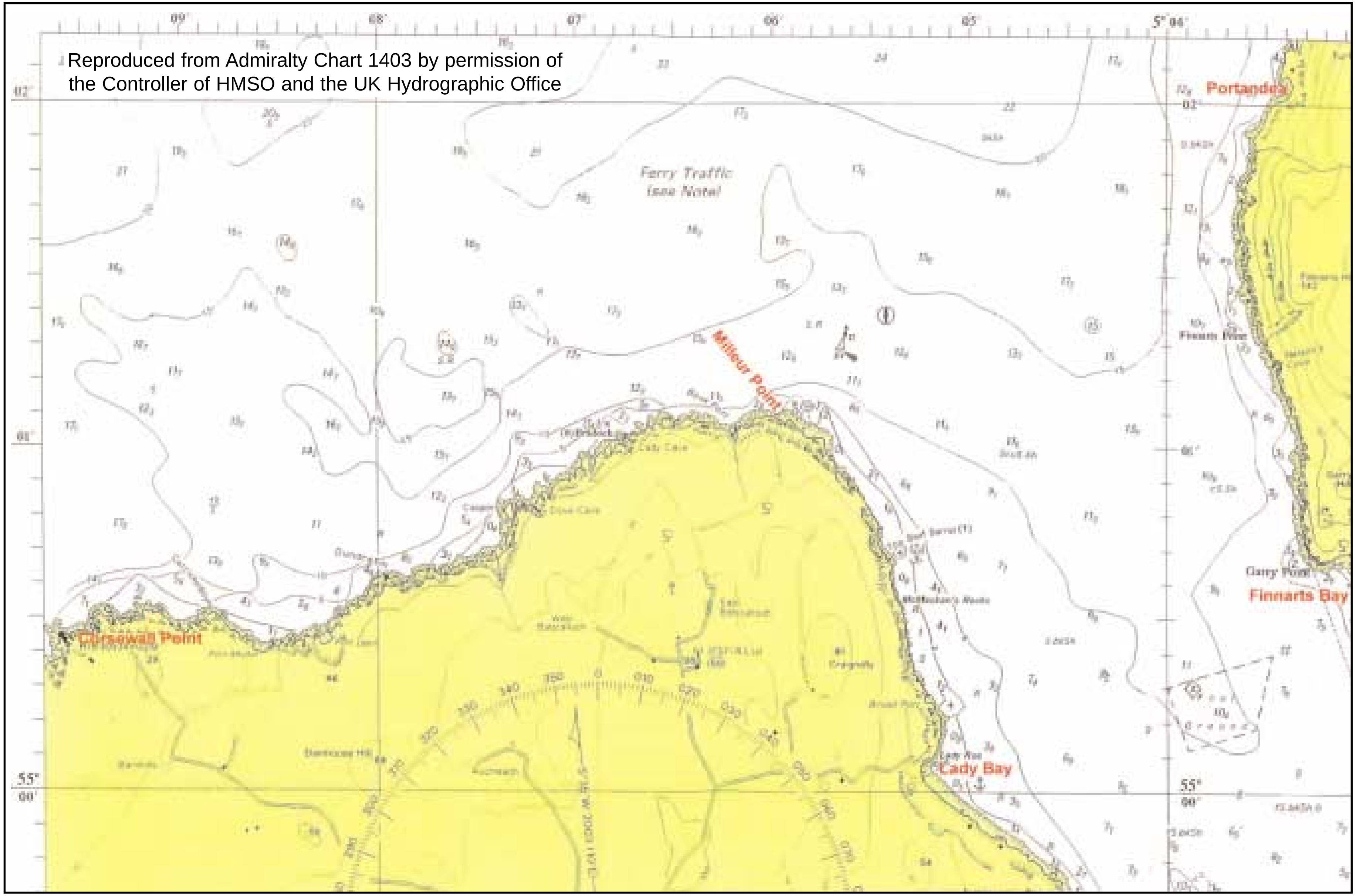


Figure 1

Loch Ryan entrance chartlet

Photograph 2

View of the GRP boat

That evening, they stayed in the family caravan near the Isle of Whithorn, to the south east of Loch Ryan, and, on the following day, after breakfasting in Stranraer, they took the boat to Lady Bay on the west side of the loch.

They launched the boat shortly after 1000, with the five of them on board and the friend operating the boat from the steering position on the starboard side. The boat was fitted with a Johnson 48kW (65hp) outboard engine. Three automatic inflatable lifejackets and some flares were carried on board the boat. The lifejackets were stored in their plastic covers.

A slight southerly breeze was blowing at the time, with a calm sea and clear sunny sky.

Initially they travelled north, hugging the west coast up to the entrance of the loch at Milleur buoy, where they started rod fishing. After a while, they moved outside and to the west of the loch entrance, along the north coast of the Rhinns of Galloway. They eventually stopped about half a mile from Corsewall Point lighthouse, and fished there for perhaps half an hour. They used a fish plotter to locate shoals of fish, stopping when fish were found.

By late morning or early afternoon, they decided to try other fishing areas on the advice of the friend. They motored east across the loch entrance to the east shoreline.

During the afternoon, they continued to rod fish along the east shoreline. While fishing, they allowed the boat to drift slowly north with the tide for periods of about half an hour, before starting the engine and returning to the start position. It took several attempts to start the engine on one occasion.

At 1450, Shaun Ridley received a telephone call on his mobile phone from his wife. During the 44-second conversation, he told her that they were having a good time, although Steven was feeling ill. He said the weather was good, and that they had caught a lot of fish. He also mentioned they were close to the shore.

As the day progressed, the weather conditions changed and the wind increased from the south-south-west. The sea conditions became choppy with some white tops, and the boat began taking spray over the bow, which collected in the bottom of it.

At some stage, Steven Ridley, who, at 15, was the older of the two boys, started to become seasick and he lay down in the forward end of the boat. Partly because of this, and because the wind was picking up and they had caught a good catch of about 25kg of fish, they decided that the fishing trip should end. They started to make their way down the loch from the area north of Finnarts Point in a south-south-westerly direction, using slow speed to reduce the amount of spray coming over the bow.

Visibility was still good, and the family friend could see, what he believed to be, a high-speed ferry coming up the loch from Stranraer ferry terminal. The time was about 1630. Aware of the speed and wash effects of ferries, he held back from crossing the loch and continued to motor at slow speed down the loch until the ferry had passed.

The ferry passed them at a distance of nearly 3 cables at 1637. The friend saw the wash from the ferry but, although it seemed large, it did not concern him unduly as they had been riding out wash from numerous passing ferries, both conventional and high speed, during the day without any difficulty.

At about 1638, the friend brought the bow of the boat to head into the wash waves, which they rode without undue difficulty, although spray, and probably some water came on board.

The boat was then turned further out into the loch towards Lady Bay, and the speed was increased. The bilge pump was started.

At about 1642, the grandfather noticed a wave approaching the boat’s starboard quarter. The friend had no time to take any action before the wave broke on board, causing the bilge pump to stop. The engine stopped at about this time as well.

The grandfather and the father probably made an attempt to bail using fish boxes at this time.

At about 1644, as the boat began to sink by the stern, two lifejackets were removed from their protective plastic bags and hurriedly put on the boys. Shaun Ridley also tried, in vain, to make a telephone call. The boat sank quickly, and the five found themselves in the water.

Shaun Ridley, who was wearing a thermal buoyancy jacket, stayed close to the boys, whose lifejackets had inflated. The three of them began to drift away in a north-easterly direction from the grandfather and the friend, under the influence of the wind. It is estimated they had drifted about 20m when the bow of the boat bobbed up near the grandfather and friend. It remained protruding about 1m out of the water.

The inbound high-speed ferry *Superstar Express* passed them just before 1646, but no one on board saw their plight.

The grandfather and friend were not wearing lifejackets, and only had light clothing. Using a buoyant throwing line which was floating near them, they made themselves fast to a loose part of the rubbing strip on the boat's bow.

The grandfather and friend clung to the bow of the boat for about 4 hours, drifting in and out of consciousness, their extremities numbed by the cold water. While the survivors were in the water, on seven occasions ferries passed them at a distance of between 400 and 800m, but the crew and passengers on board the ferries did not see them. The grandfather and friend also saw other smaller vessels in the loch, including a blue and white fishing boat which passed down the western shore. They could see the fishermen on deck gutting fish, but the fishermen did not see them.

Eventually a yacht, *Catalina,* entered the loch from the north, and saw, first the bow of the boat, and then the casualties in the water. *Catalina*'s crew recovered the casualties and alerted the coastguard at 2038. Search and rescue (SAR) operations started immediately.

Three RNLI lifeboats, auxiliary coastguard teams, and a Royal Navy rescue helicopter were involved in the search, along with a number of ferries (see Narrative of the SAR Operation). At 2149, the deck officers on *European Mariner* noticed two lifejackets in the water as their ferry entered the loch en route for Cairnryan.

Portpatrick lifeboat was guided to the scene, where the lifeboatmen recovered Shaun and Michael Ridley from the water, along with the two inflated lifejackets. Shaun Ridley had been found floating on his back, with an arm through each of the inflated lifejackets. Michael had been face-down and only partly in his lifejacket. There was no sign of Steven Ridley. The two casualties were transferred to the rescue helicopter and airlifted to hospital but, despite attempts to resuscitate them, they were pronounced dead.

The search for Steven Ridley continued in vain throughout the night and the following day. Further land and sea searches were carried out during the following weeks. These, too, were unsuccessful.

On 21 August 2003, a shore fisherman found the body of Steven Ridley at Port Logan, south of Portpatrick, 21 miles south of Loch Ryan. He was not wearing a lifejacket.

1.4 WEATHER AND TIDAL EFFECTS

During the morning, the sea was calm, and it was bright and sunny with a light southerly wind. Later in the afternoon, the wind altered to south-south-west and increased to force 4, and the sea conditions became choppy with some white tops. The sea temperature was 10°C.

High water at Stranraer occurred at 1120 and low water at 1710. The tidal height at Stranraer during the day varied between a maximum of 2.9m, to a minimum of 0.5m above chart datum. Tidal streams generally set across the entrance to the loch. The stream in the loch entrance is complex, but generally of low velocity.

1.5 FERRY WASH

1.5.1 History

Wash generation, in respect of HSC operations, is a complex subject which is still the subject of much research. The main parameter is Depth Froude Number (Fn_h), which is a relationship between vessel speed and depth of water. The critical speed for wash generation occurs at $Fn_h = 1$. To avoid creating the most hazardous wash, an HSC must be operated outside the critical speed range, which is usually defined as between Fn_h 0.85 and Fn_h 1.1.

High speed craft have to transcend the critical speed range when slowing for a port arrival or when speeding up on departure. When operating within the critical speed range, the vessel creates waves of maximum energy which can be especially hazardous to small craft and people on or near the shoreline. To limit the time spent within the critical speed range, particularly close to the coastline, an HSC should transcend this range as quickly as possible, and in an area where the critical wash waves produced will disperse without causing damage or danger. Operating at speeds above the critical range (super critical), and below the range (sub critical), creates wash waves of considerably lower energy, but which can still produce a significant effect on an adjacent shoreline. Some conventional vessels can develop sufficient speed in shallow water to move into the critical speed range and produce critical speed wash similar to that of an HSC.

A fundamental difference between wash produced by a vessel travelling at high speed, and that produced at much slower speed, is the presence of powerful waves of long wavelength produced at high speed. Conventional vessels, or HSC travelling at sub critical speeds, generally produce waves of shorter wavelength, slower speed, lower amplitude but steeper form. The energy in these waves generally disperses quickly as the waves move away from the point of propagation. HSC, and some conventional vessels travelling at fast speeds in the critical range, produce waves of long wavelength of medium height but which contain a large amount of energy. These waves, unlike those produced at slow speed, can travel many miles retaining the energy within the wave. When the high speed wave comes into shallow water, or impacts on a rocky shore, the energy is dispersed suddenly, either by the wave changing to a steep breaking form as it travels on to a shelving shoreline, or by crashing against a rocky one. Waves produced by craft travelling at high speed, although containing large amounts of energy, are not generally considered to be a danger to vessels and boats in deep water away from the immediate shoreline.

Between 1997 and 1998, the MCA commissioned a project, Research Project 420: *Investigation of High Speed Craft (HSC) on Routes near to Land or enclosed Estuaries* (MIN 48). The researchers were tasked to investigate the wash produced by high-speed ferries operating in Belfast Lough, because of public concern arising from the size of wash waves reaching and impacting on the shoreline.

As a result of that research, the route/speed profiles of HSC when they operate in and around Belfast Lough were reviewed to minimise the impact of wash on other users.

Among other things, the project found that operating at a Froude number (Fn_h) as low as 0.9, for a sustained period of time, could generate breaking wash waves, and that this could be achieved by fast conventional ferries.

Further research was recommended and, between September 1999 and April 2001, the MCA commissioned The Queen's University of Belfast to carry out the work. This resulted in Research Project 457: *A Physical Study of Fast ferry Wash Characteristics in Shallow Water* (MIN 118).

One of the conclusions this project reached was that all craft capable of exceeding a depth Froude number of 0.85, (that is fast conventional craft and HSC), entered the critical range and hence produced critical wash waves. Specifically, Research Project 457 states:

> *The effect of the wash of high-speed craft on other moving vessels is dependent on size, displacement and hull form. Consequently the risk to each vessel must be assessed individually. Vessels operating in the transcritical range should not overtake small vessels.*

Since 20 January 2000, the MCA has required the compilation of a Risk Assessment Passage Plan (RAPP) for all HSC ferry routes to and from UK ports. This goes beyond the requirements of the internationally agreed IMO HSC Code. The MCA took action because HSC wash was proving hazardous in certain areas. The RAPP contains an analysis of wash, and specifies the speed profile and track of the HSC to minimise the effects. No such passage plan is required for conventional ferries.

A report on wash analysis for a conventional ferry was written in 2001 on behalf of one of the ferry companies that operates on the Loch Ryan route. The analysis was carried out at the Port of Dublin to satisfy Dublin Port Authority on the potential risks from wash produced by conventional vessels capable of operating at high speed in shallow water and thus generating a Depth Froude Number (Fn_h) greater than 0.85.

As a result of the analysis, the speeds recommended for the inbound and outbound passage plans within the Dublin Bay Pilotage limits, no longer produce an Fn_h in excess of 0.85.

1.5.2 Controls in Loch Ryan

Conventional ferries have operated in Loch Ryan on routes between the UK mainland and Northern Ireland for many years. HSC have been operating between Loch Ryan and Belfast Lough since 1992. Since then, faster, more powerful ferries, both conventional and HSC, have been introduced to allow larger numbers of passengers and vehicles to be carried, with reduced journey times.

Pilotage is not compulsory, and there is no formal port control in Loch Ryan, apart from Stranraer harbour itself. Stena Line and P&O (Irish Sea) Ltd set up the Loch Ryan Navigation Committee to self-regulate the navigation of ferries operating in Loch Ryan and Larne, Northern Ireland.

As a result of the Belfast Lough project, HSC operators were required to produce an impact assessment, as evidence that they had taken into account the wave-making potential of their vessels, and had identified areas at risk. Both Stena Line and P&O (Irish Sea) Ltd have, as a result, produced an in-depth assessment, in conjunction with Queen’s University Belfast and independent consulting engineers, for Loch Ryan. A separate investigation was also made into the coastal processes in Loch Ryan, which included the impact that HSC had on the coast and seabed.

As a result of the assessments, controls were instigated to take account of wash produced by the two HSC when entering or leaving Loch Ryan. These controls included:

- Altering the vessel's speed and/or course when passing Milleur buoy if small boats were in the vicinity of Milleur point.
- Reducing speed earlier, or delaying the transit through the critical range, if small boats were in shallow areas either side of the ferry course in the loch.
- In consultation with Dumfries and Galloway council, wash wave warning signs were displayed at all publicly accessible points along the loch coastline to seaward of Cairn Point.
- The two ferry companies initiating a VHF Channel 14 reporting system, to enable ferries to be forewarned of other loch users, and other loch users who have access to a VHF radio to be warned of imminent ferry traffic.

In Loch Ryan, the critical speed zone is deemed to have a depth Froude number (Fn_h) between 0.85 and 1.1. As explained above, operation within this range can produce the most dangerous wash waves. The two high-speed ferries (HSC) generally transit the northern part of the loch at high speed and, because the water depth ranges between 8m and 20m in this area, they are, therefore, operating at super-critical (Fn_h >1.1) speeds. It is during their deceleration phase inbound, or acceleration phase outbound, that the vessels' speed transits the critical range, and a potentially hazardous wash is created. These phases generally occur just to the north of Cairn Point, and are passed quickly.

In the area where the accident occurred, a conventional ferry (or HSC) would have to be making a speed of between 17.2 and 22.2 knots through the water to operate within the critical speed zone.

On the day of the accident, the outbound conventional ferry was making just under 17 knots through the water, and the inbound fast ferry was making about 33 knots. Neither was operating in the critical speed range.

<u>Warnings printed on the chart of the area</u>

Admiralty chart 1403 *Scotland - West Coast Loch Ryan*, which covers the Loch Ryan area, has a ferry traffic notice. It states:

> *Due to the high concentration of ferry traffic, including high speed craft, within the area of Loch Ryan, it is recommended that vessels maintain a listening watch on VHF in order to receive prior warning of ferry movement. See Admiralty List of Radio Signals for further details. Some*

high speed ferries may generate large waves, which can have a serious impact on small craft and their moorings close to the shoreline and on shallow off-lying banks. For further details see Annual Notice to Mariners No. 23.

When the Ridley family and their friend left Lady Bay, they did not have a VHF radio or a hydrographic chart of the area. There is no requirement for owners of small, non-commercial boats to have this equipment. However, their friend had local knowledge and was aware of the operation of ferries through the loch. During the day of the accident, many ferries passed them without incident.

1.6 THE TRACK OF THE BOAT THROUGH THE DAY

1.6.1 Evidence gained from Voyage Data Recorders

Voyage Data Recorders (VDRs) became mandatory equipment on certain classes of vessel in July 2002. Their primary purpose is to record evidence for the use of accident investigators. VDRs must be fitted to all passenger ships, and other ships of over 3000gt, constructed on or after 1 July 2002. Each VDR records certain key information, including the conversation on the bridge and radar picture.

Both ferry companies which operate in Loch Ryan were requested to provide VDR discs from relevant ferries to assist the MAIB investigation.

Five VDR discs were downloaded, four of which covered the time period of interest between 1000 and 2200 on 12 July 2003. The radar information, in particular, has proved invaluable in piecing together the movements of the boat, both before and after the accident. A ‘track’ of the probable movements of the boat, through the day, could be built up through ‘snapshots’ of the four radar recordings analysed **(see Figures 2, 3 and 4)**.

A further contact detected by analysis of the radar recordings was of an HSC operating between Belfast and Troon, which was heading in a north-easterly direction at about 35 knots. She was about 7 miles north-west of Corsewall Point at 1618 **(see Figure 5)**.

Other VDR data has enabled the exact course and speed profile for relevant ferries and other craft to be analysed.

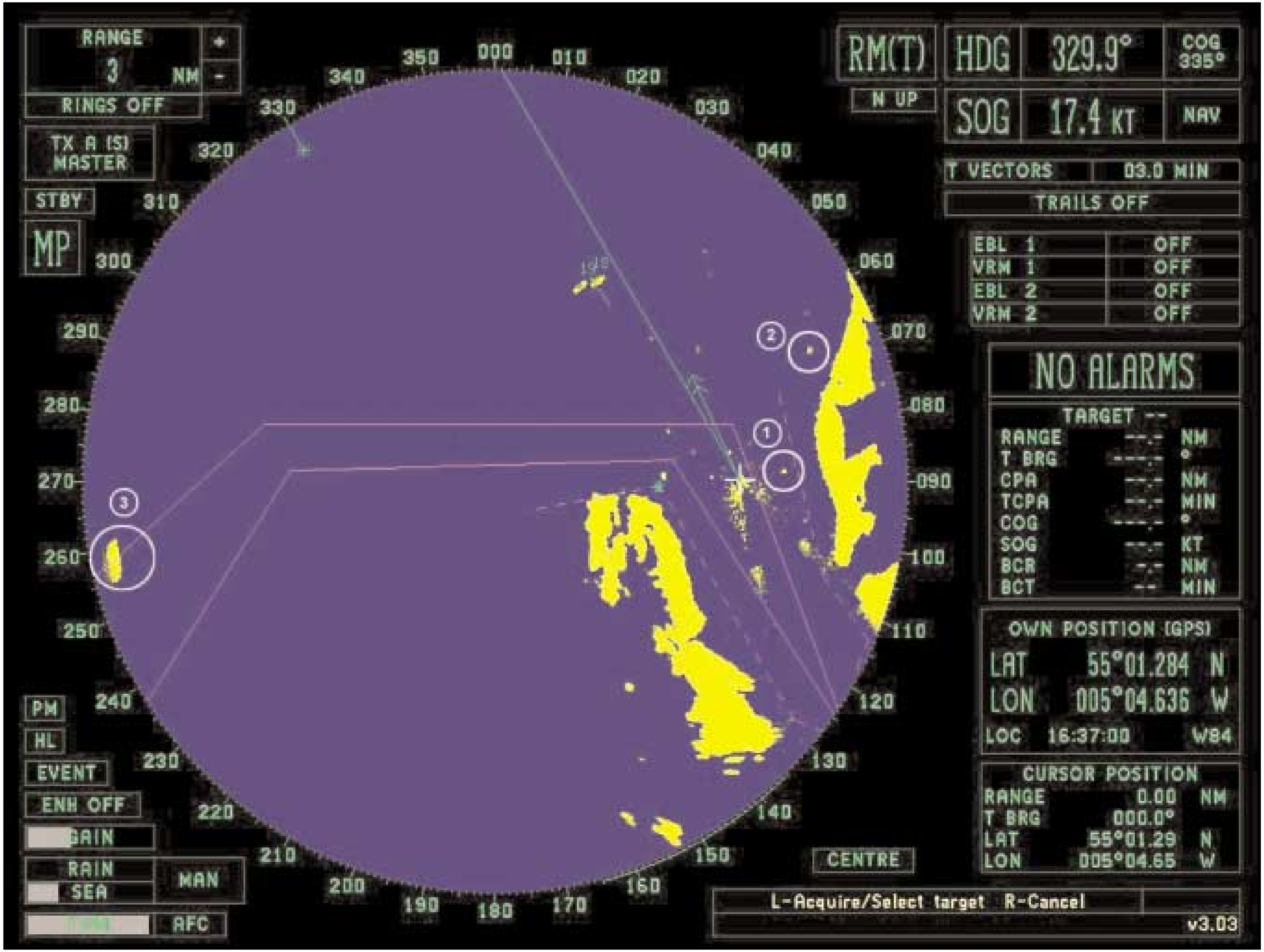


Figure 2

Radar display from the conventional ferry *Stena Caledonia* departing Loch Ryan at 1637 with a contact believed to be the boat (1), a contact believed to be the fishing boat that passed at 1641 (2), and contact (3) SSE inbound

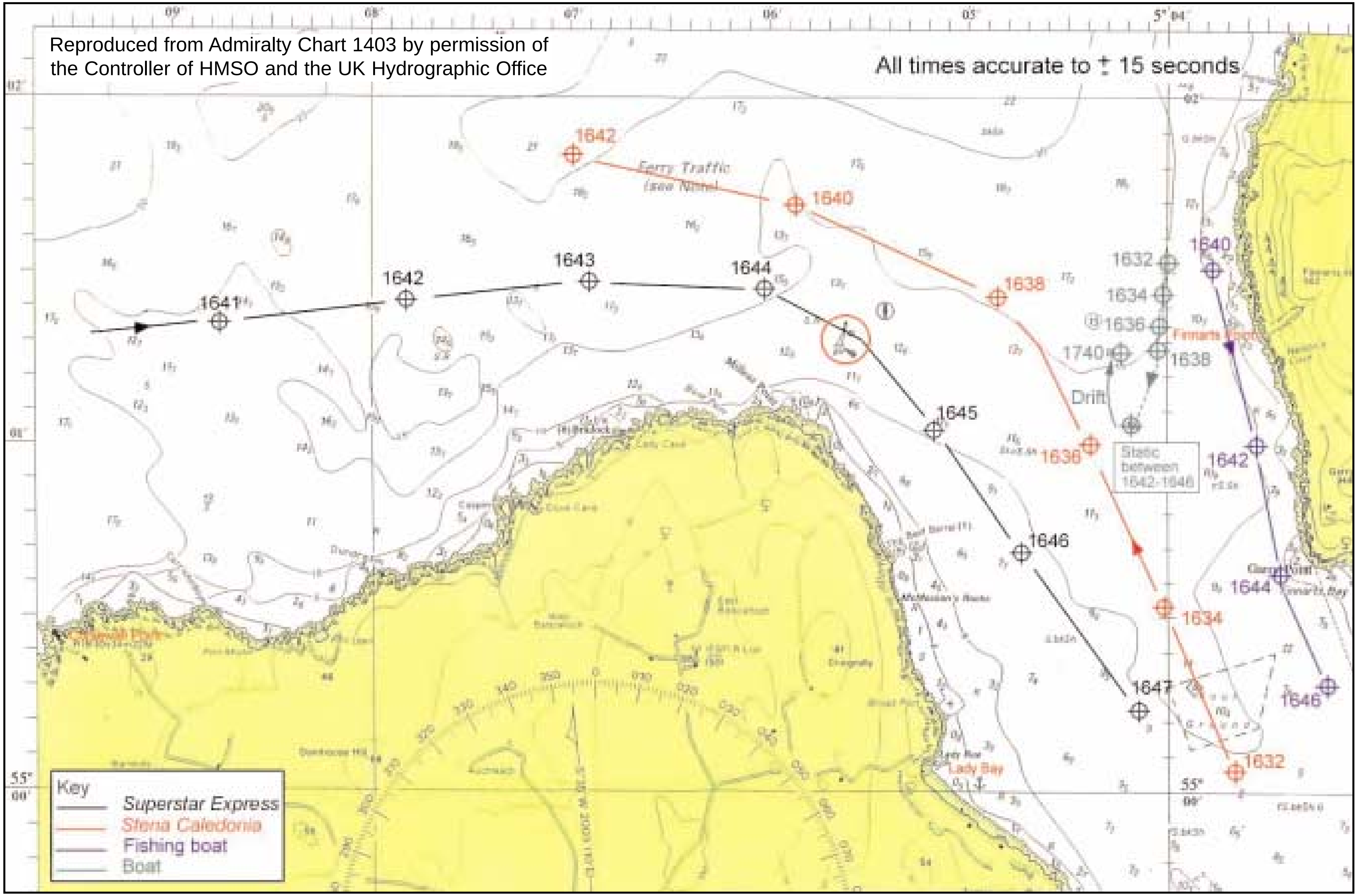


Figure 3

Chartlet of entrance to Loch Ryan showing probable track of the boat between 1632 and 1646, and tracks of *Stena Caledonia*, *Superstar Express* and a fishing vessel

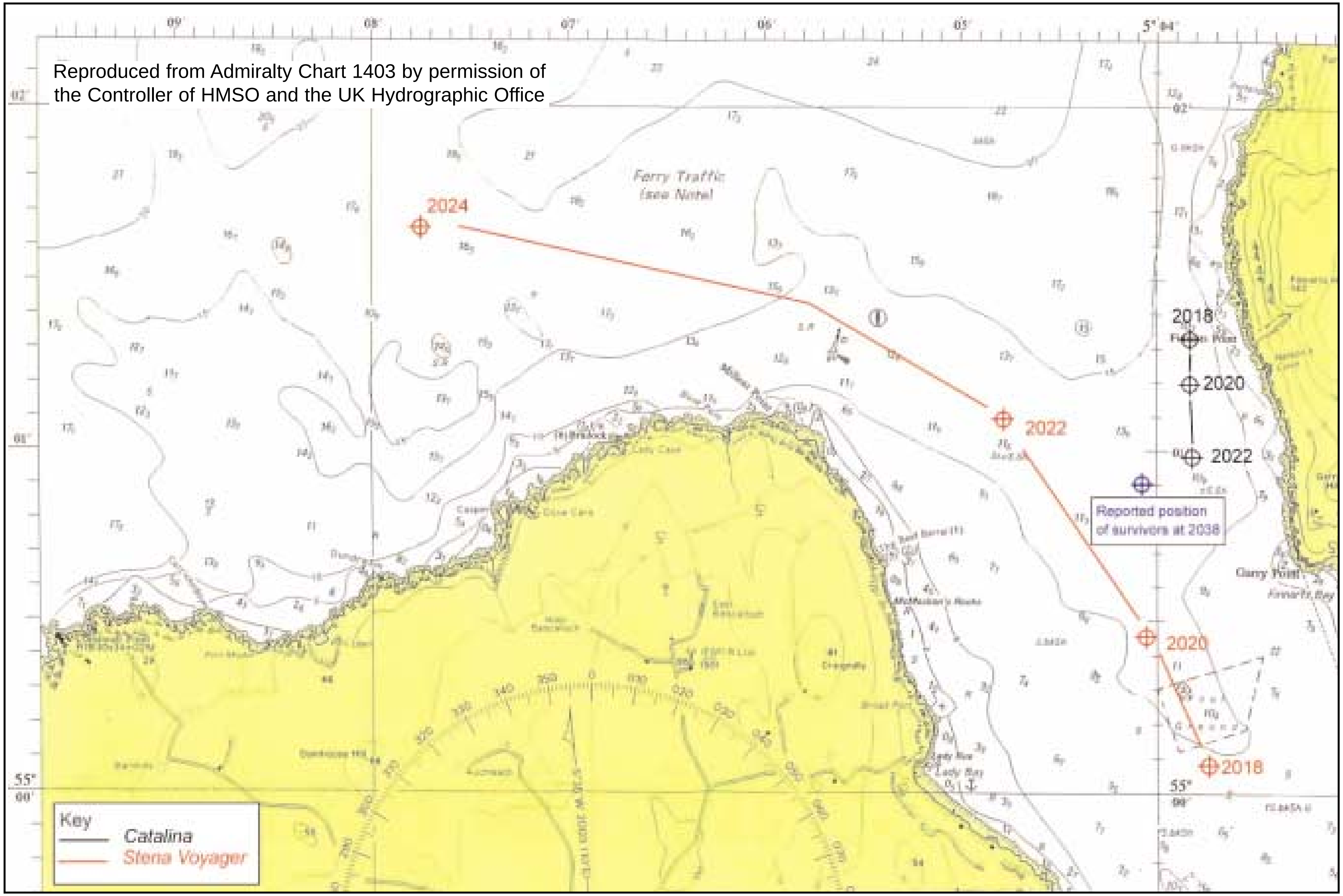


Figure 4

Chartlet of entrance to Loch Ryan showing track of yacht *Catalina* between 2018 and 2022, shortly before the survivors are rescued, and the track of *Stena Voyager*

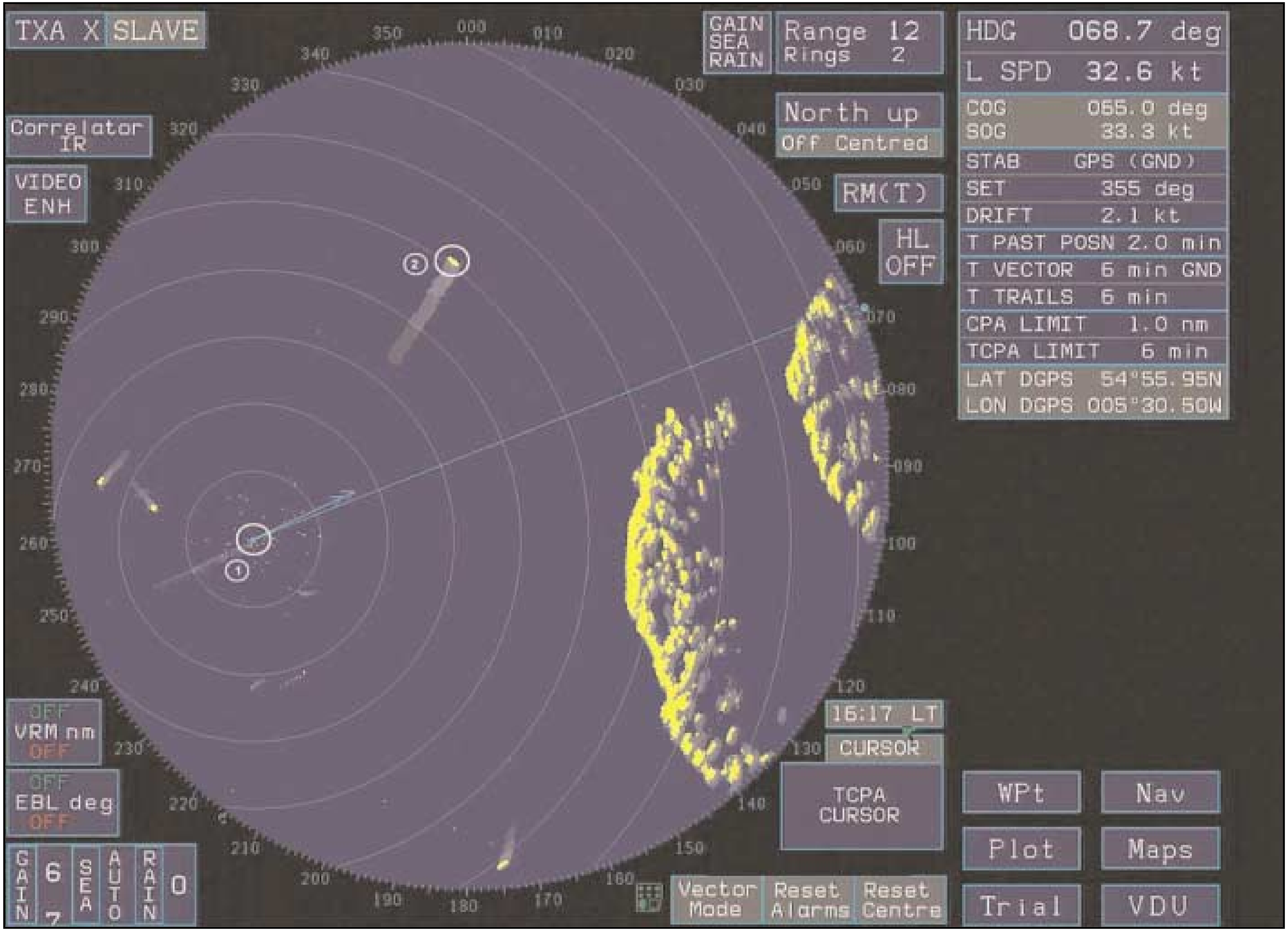


Figure 5

Radar display from the HSC *Superstar Express* (1) en route to Loch Ryan at 1617 and track of *Seacat Rapide* (2)

1.6.2 Evidence gained from visual sightings of the boat

At about 1130 on 12 July, the conventional ferry *European Highlander* had left Cairnryan and was heading north out of the loch. When the ferry was about 1½ miles from Milleur buoy, the officers on the bridge saw a stationary blue and white small boat in the vicinity of the buoy, roughly on the intended track of the ferry. A discussion started on how small the boat was in comparison to the buoy, and also about how low in the water she appeared. When the ferry reached within 1 mile of the buoy, the boat sped off in a north-easterly direction toward Portandea on the east coast. Its bow was out of the water, and its speed was estimated at 15 knots. The recording of the vessel's radar has a contact whose position and movement reflects that described by the bridge officers. *European Highlander* passed Milleur buoy at 1145.

Some fishermen also saw this small boat, as they fished near Milleur buoy late that morning. Five people were seen to be on the boat. Later that day, the same fishermen returned along the west side of the loch to Wig Bay, from where they had launched. They reached the end of The Spit as *Superstar Express* berthed at Cairnryan about 1655.

Probably the last sighting of the boat afloat was by the crew of another fishing vessel which passed her south-bound on the east coast of the loch at about 1641.

Apart from those sightings already mentioned, at the times stated, no other ferry crews operating that day have any recollection of seeing the boat on Loch Ryan.

Stranraer police published a poster, requesting anyone who had seen the boat on Loch Ryan to assist them in investigating the accident **(Figure 6)**. The response has been taken into account in the MAIB investigation.

1.7 THE EQUIPPING AND OPERATION OF THE BOAT

Although Shaun Ridley was a keen fisherman, and had been on sea fishing expeditions before, they had been on commercially-operated day fishing boats. He, therefore, had limited boat-handling experience. He was aware that he did not have the experience to take a boat into open water and, therefore, he had asked his father's friend to come with them to Scotland.

The friend had operated small boats for many years although, due to illness, had not been on board one during the 5 years before the accident. From his experience of the sea conditions on the south-west coast of Scotland, he advised Shaun Ridley against launching the boat from the Isle of Whithorn, which had been the original plan, because of the strong currents encountered there. He recommended Loch Ryan as a safer place to try the boat for the first time.

Witness Appeal

Boating Incident

Loch Ryan, Stranraer

On Saturday 12 July 2003 a tragic incident occurred in Loch Ryan, Stranraer which resulted in the death of a man and his son aged 12 years. Another son, aged 15 is missing, presumed dead. They were fishing in this boat with two other men who survived.

Were you in a vessel on Loch Ryan between 9am – 9pm on Saturday 12 July 2003? If so please contact Stranraer police.

Were you a passenger on any of the ferries that sailed to or from Stranraer, between 9am – 9pm on Saturday 12 July 2003? Did you see the boat in the water during your journey? Did you see anything else that you feel may be relevant? If so, please contact Stranraer police station.

Anyone who has any information is asked to contact police at Stranraer on 01776 702112 or any police officer.
Calls can be made anonymously to Crimestoppers on freephone 0800 555 111

Scotland CRIMESTOPPERS 0800 555 111 Uniting against crime

SAFER SCOTLAND

safeguard

Police poster

The friend inspected the boat before leaving Manchester. He suggested that additional buoyancy needed to be added, along with a ‘cuddy’ to provide protection for those on board and to prevent spray from coming over the bow and entering the boat. However, neither of these modifications were made before the trip.

1.7.1 Safety equipment

The safety equipment on board the boat comprised three self-inflating lifejackets of 150N buoyancy each, a pack of three flares and two buoyant heaving lines. In addition, there was an auxiliary outboard engine of 4kW (5hp). Shaun Ridley wore a thermal buoyancy jacket and carried a mobile telephone.

The lifejackets, which were new, had been borrowed from another family friend who, in turn, had borrowed them from his place of work. The family friend had instructed Shaun Ridley in the lifejacket donning procedure before he travelled to Loch Ryan; however they were full-size adult lifejackets and had not been adjusted to fit the boys. Additionally the family friend had asked that they be kept clean.

1.7.2 Other boat equipment

There was adequate fuel on board for their day trip, comprising 22 litre and 27 litre fuel tanks for the main outboard, and an 18 litre fuel tank for the auxiliary outboard. The boat had an electronic fish plotter. Its 12V battery was located aft under the aft seat, along with the 12V battery for starting the outboard engine.

The bilge pump was sited aft in the same area as the batteries. The auxiliary engine was stored on the deck between the steering console and forward stowage/seating area, although it was intended to be mounted on a home-made wooden bracket aft of the port windscreen. An anchor was also carried. **(Photograph 3)**.

1.8 SAFETY AWARENESS

Although the level of safety equipment provided on a privately-owned boat is left to the owner’s decision, there is plenty of free guidance available from such sources as the MCA, Royal Yachting Association (RYA) and the Royal National Lifeboat Institution (RNLI).

The RNLI will also provide free, friendly and confidential sea safety advice (SEA Check service) and is available countrywide through a system of co-ordinators and volunteers **(Figure 7)**. Although the RNLI cannot provide advice on vessel seaworthiness, it can provide guidance on effective lifesaving apparatus (LSA), and other equipment that would prove useful in different sea conditions, as well as distress and emergency procedures. A variety of leaflets are also available. This service is advertised on boating websites, at marinas, sailing meetings and

Photograph 3

Boat equipment

yacht clubs. In an attempt to reach people, such as sea anglers, who might not view boating as a hobby in itself, the RNLI visits slipways, to hand out safety leaflets, and talk to boat owners about safety awareness. Piloted on the south-coast of England, this is a growing scheme, and is proving successful.

The MCA, in conjunction with other marine safety and leisure organisations, has produced a *Safety Afloat* booklet, in which guidance is offered to various leisure craft users.

Relevant advice includes:

- *Learn how to operate your boat – take a recognised training course;*
- *Tell someone on shore where you are going and when you will be back;*
- *Check the weather forecast, tides and local conditions;*
- *Establish your boat's capabilities and limitations – and your own;*
- *Wear wetsuits, drysuits or take waterproofs – it is always colder at sea than ashore.*

Figure 7

SEA CHECK
Safety Equipment Advisory Check

Safety Equipment Advisory Check – 73002

Lifeboats
Royal National Lifeboat Institution

(Please use BLOCK CAPITALS)

Title	Surname	Initials
Address:		
	Post Code:	
Tel:	Mobile:	
Email:	Fax:	

Vessel Name: Length: ft m

Home Port/Where Kept:

Sailing Yacht ☐ Motor Cruiser ☐ Sports Boat ☐ Sea Angling ☐

Dive Boat ☐ RIB ☐ PWC ☐ Other ....

☐ 1st Check ☐ Re-check ☐ Annual Check ☐ Yacht and Boat Safety Scheme

"I certify that this vessel is operated solely as a pleasure craft. I request and authorise this SEA Check to be conducted. I understand that this SEA Check is by way of an additional service to me. It in no way replaces or is a substitute for appropriate manufacturer warranties and proper and regular maintenance checks by qualified experts or for any government legislation which may apply to myself or my vessel and for which I acknowledge I am responsible for complying with. I further understand and agree that completion of this SEA Check indicates only that essential equipment was on board my vessel and that the Royal National Lifeboat Institution its employees, officers, servants and agents ("The RNLI") does not warrant the condition of the equipment and that the RNLI assumes no responsibility whatsoever with respect to either any services given or any opinions expressed in connection with this SEA Check. I understand that my boat and equipment details will remain totally confidential within the RNLI but that information gathered through the SEA Check service will be used to assist future accident prevention programmes."

Signed ....

Date ....

Your details will be used by the RNLI and passed to RNLI trading companies only. We never give your information to any other organisations. If you do not want to receive information about RNLI membership, the RNLI gift catalogue, lottery, special appeals or approved third party promotions please tick here. ☐ DPA

Shaded boxes denote equipment not considered necessary for category of use.
✓ = Equipment present. X = Not carried.
N/A = Not Applicable.

Essential Equipment
Anchor with warp / chain / strong point
Radar reflector
Appropriate navigation lights, shapes, sound signals etc
Lifebuoy or similar
Man overboard recovery equipment
Life raft
Life raft / inflatable dinghy
Emergency steering
'Kill Cord' (PWCs RIB etc.)
Compass
Alternative means of propulsion or starting
Engine tool kit and spares
Lifejacket / buoyancy aid - per person
Lifejacket 150 N - per person
Safety harness / means of attachment
Bailer
Bucket and hand/electric pump
Charts, navigation publications & nav instruments
VHF
Torch
Pyrotechnics - in date
Fire blanket - for cooking appliances
Fire extinguisher(s)
Temporary hull repair kit
Clock/watch
First aid kit

Recommended Equipment
Fair lead for anchor line
Mooring warp + fenders
Heaving line / rescue quoit
Boarding ladder
Dan buoy marker
Radio receiver
VHF
Navtex
HF/SATCOM + EPIRB
Handheld VHF
Emergency aerial
Barometer
Echo sounder
Electronic positioning nav aid
Hand bearing compass
Log
Binoculars
First aid kit
Personal protective / warm clothing
Emergency grab bag
Emergency water
Emergency repair material

COMMENTS

SEA Check Area	Duration of Check: hr min	Gold ☐ Silver ☐ Standard ☐ No Award ☐	SEA Check Adviser Signature: Print name:	ID No.

SEA Check is supported by the following organisations: British Marine Industries Federation, Maritime & Coastguard Agency, Royal Life Saving Society UK and Royal Yachting Association.

Supported entirely by voluntary contributions Registered Charity No. 209603

SEA Check service

Advice, specifically for sea anglers includes:

- *Boats less than 3.66m (12 feet) in length are considered unsuitable for sea angling. It is recommended that a boat of 3.66m to 4.27m (12 to 14 feet) overall length is suitable for two people, and 0.6m (2ft) of length should be added for each extra person;*

- *Keep to the schedule (time and location) given to your shore agent before setting out.*

1.9 THE DESIGN AND CONSTRUCTION OF THE BOAT

The boat, a Glastron Aqua Lift II, was of American design. The manufacturer, Glastron Boats, was founded in 1956 in Austin, Texas. Since then, it has been associated with progressively-styled performance-orientated runabouts. The company was the first large-scale manufacturer of GRP boats. The Aqua Lift II hull was developed in the early 1960s. Glastron refers to the hull form as being of the "deep-vee" type. However, in the UK, the hull shape is usually known as a "cathedral" or "twin tunnel" type.

Other manufacturers built Glastron boats under licence, and this boat was built by Glastron (UK) Ltd at Burntwood, Staffordshire, probably in the early 1970s. The design dates back to the late 1960s and is of the "bowrider" style, which had seating ahead of the cockpit. The builder's identification stamp on the hull stated that the boat construction conformed to the Ship & Boat Builders' National Federation (SBBNF) Code of standards, and was capable of carrying the equivalent of six people with an outboard motor up to 100 horsepower, and was based on the buoyancy of the vessel **(Photograph 4)**. The Code recommended that boats were able to remain afloat and upright after swamping. The SBBNF has, over the years, evolved into the British Marine Industries Federation (BMF).

The construction utilised vertical wood planks, positioned fore and aft along the inside of the bottom of the hull, which were then "glassed over", to form longitudinal stiffeners. The deck consisted of sheet plywood laid on top of the longitudinal stiffeners. This deck was also "glassed over" to create a watertight void between the deck and the hull which gave the boat inbuilt buoyancy to reduce the possibility of her sinking if she was swamped.

There was some solid foam buoyancy in the bow and in the port and starboard quarters. Foam could have been injected into the void as an optional extra available to the original purchaser. However the option was not taken on this boat.

Photograph 4

The builders’ identification stamp

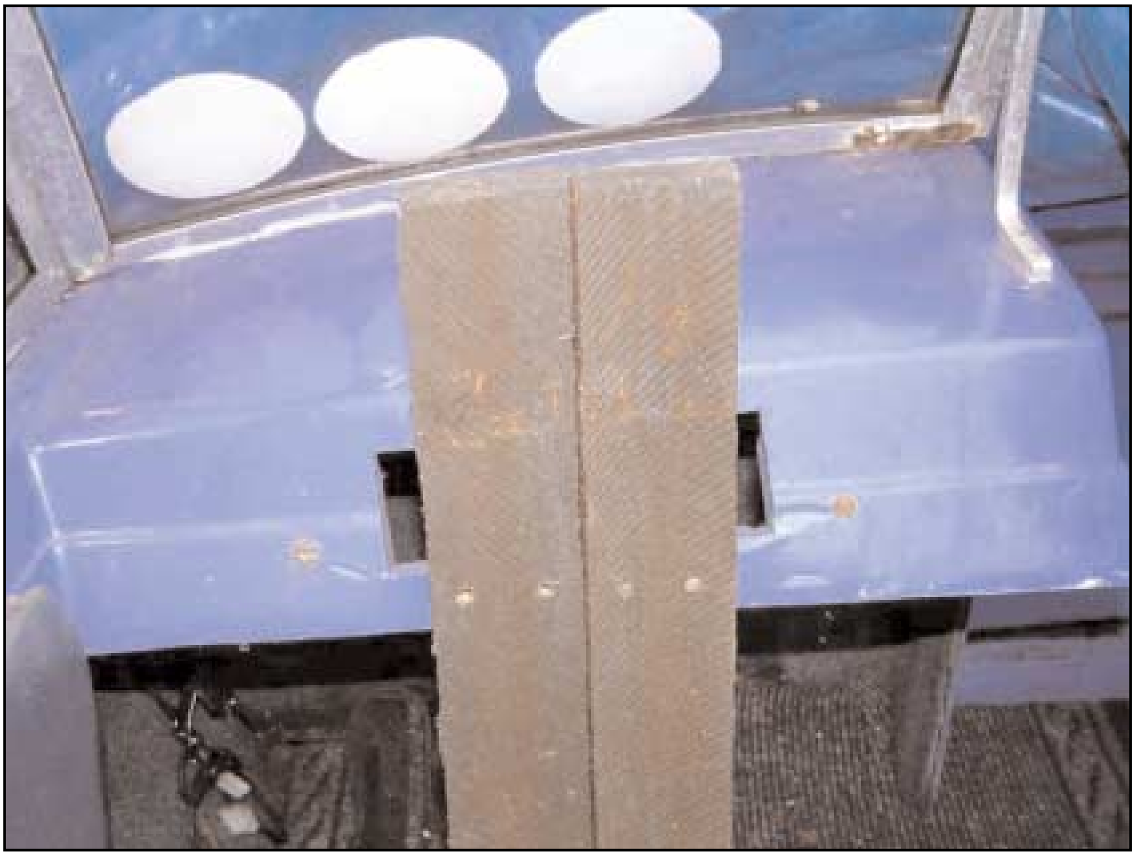
1.9.1 Modifications made to the boat

Shaun Ridley had bought the boat about 4 weeks before the accident. The previous owner had owned the boat for about 15 months, with the intention of using it on inland waters and at sea for fishing and water skiing, but work commitments had prevented this. He had carried out several modifications during his ownership. For example:

- The original pressure fuel pump was replaced with a diaphragm pump, for safety reasons. This made the steering-console-mounted fuel pump switch redundant.
- The hull was painted blue with white sides and a black stripe added.
- The original deck had become flexible, so a large section of it was cut out, and a sheet of plywood was laid over the opening. The new plywood was screwed to the stiffeners in the hull.
- A seat at the stern was built to house the engine battery.
- A wooden bracket was fitted to stow the auxiliary outboard engine **(Photographs 5 & 6)**.
- The bilge pump had new electrical connectors fitted.

Photograph 5

Photograph 6



Wood bracket fitted to stow the auxiliary outboard

The boat was sold to Shaun Ridley, along with the main and auxiliary engines and a trailer.

The previous owner but one had purchased the boat in about 1985 and used it for water skiing. It had been laid-up on several occasions during his ownership. Modifications were carried out during his ownership, including renewing the electrical wiring, fitting fuel and bilge pump pull switches and electrical connectors, to allow electrical fittings to be removed easily. This owner also had repairs carried out to the main outboard engine.

The deck originally drained into a bilge well that could be emptied through a plug in the transom when the boat was out of the water. Prior to Shaun Ridley's ownership, a hole in the forward end of the bilge well recess had been made, to drain the void. An opening was subsequently cut in the top of the void at the aft end, and a bilge pump was fitted into the void space **(Photograph 7)**. As a result of these modifications, the boat lost the integral buoyancy that the void had originally provided.

Photograph 7

1.10 RECREATIONAL CRAFT REGULATIONS

The Ship & Boat Builders' National Federation (SBBNF), now the British Marine Industries Federation (BMF) represented the interests of the boating industry. The SBBNF Code gave guidance to boat builders on construction methods. In terms of small boat construction, it provided provisional standards for GRP construction. If a boat builder followed this guidance, they were allowed to affix the SBBNF identity plate to the boat.

Until June 1996, when the Recreational Craft Directive (RCD) 1996 was implemented, there were no regulations governing the construction of recreational craft.

Within the RCD, recreational craft are defined as:

> *'Recreational craft' shall mean any boat of any type, regardless of the means of propulsion, from 2.5 to 24m hull length, measured according to the appropriate harmonised standards intended for sports and leisure purposes. The fact that the same boat could be used for charter or for recreational boat training shall not prevent it being covered by this Directive when it is placed on the market for recreational purposes.*

Boats of the type involved in this accident (ie less than 6m in length which are susceptible to swamping) are now required to have robust integral buoyancy, such that they will not sink when swamped.

1.11 LOOKOUT

During the time the survivors were in the water, ferries, which operate regularly through the loch, passed them seven times. Neither the crew nor passengers saw the boat's bow, or the two survivors clinging to it. Although it is not known when the boys became separated from their lifejackets, the lifejackets would, nevertheless, have been inflated, afloat and visible, albeit with some difficulty, in the prevailing conditions on the loch. Some of the conventional ferries, which operate through Loch Ryan, operated with dedicated seamen lookouts, while the others had either the officer of the watch (OOW) or master performing this function.

The requirements of a proper lookout to be carried are detailed in the International Regulations for Preventing Collisions at Sea, namely in Rule 5:

> *every vessel shall at all times maintain a proper lookout by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision*.

Further detail as to what is required with regard to a lookout can be found in Merchant Shipping Notice 1767 (M), namely *Hours of Work, Safe Manning and Watchkeeping Revised Provisions from 7 September 2002*. This states that the principles applying to the keeping of a safe watch are given in Chapter A-VIII of the STCW Code, and must be followed to comply with the regulations.

The STCW Code, or International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended in 1995, states:

> *A proper lookout shall be maintained at all times in compliance with rule 5 of the International Regulations for Preventing Collisions at Sea, 1972,* (as above), *and shall serve the purpose of: … detecting ships or aircraft in distress, shipwrecked persons, wrecks, debris, and other hazards to safe navigation. The lookout must be able to give full attention to the keeping of a proper lookout and no other duties shall be undertaken or assigned which could interfere with that task.*

The aforementioned is also clearly stated in the International Chamber of Shipping (ICS) Bridge Procedures Guide in Chapter 3.2 Watchkeeping.

Figure 8 - *Superstar Express* inbound at 1643 shows a contact, assessed to be that of the boat.

Figure 9 - *Superstar Express* outbound at 1740 also shows a contact in the same position, assessed to be the bow of the boat and the two survivors.

Figure 10 - *European Highlander* inbound at 1805 has a contact approximately one cable from the previous contact, again assessed to be the bow of the boat.

Figure 11 - *Stena Voyager* outbound at 2018 shows the yacht *Catalina* heading in the direction of the bow of the boat.

1.12 NARRATIVE - SEARCH AND RESCUE (SAR) (see Figure 12)

All times UTC +1

After the yacht *Catalina* found the two survivors, her skipper broadcast a “Pan Pan” message to Clyde Coastguard at 2038. Clyde Coastguard did not clearly receive the “Pan Pan” because of broadcast interference from aerials in the north of its area.

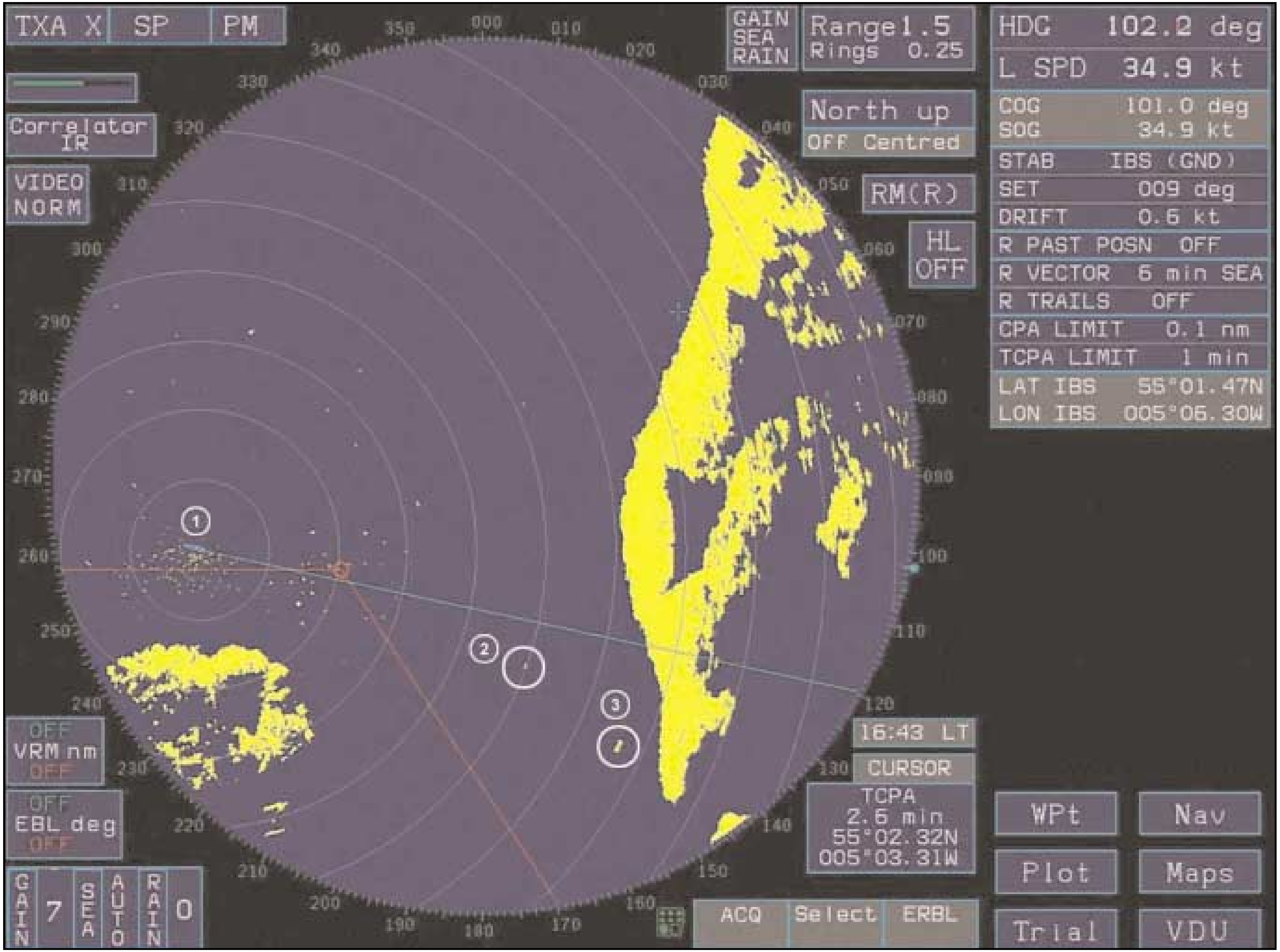


Figure 8

Superstar Express inbound at 1643 (1), contact (2) believed to be the boat, and contact (3) believed to be the fishing boat

Figure 9

Superstar Express outbound at 1740 (1), and contact (2) believed to be the boat

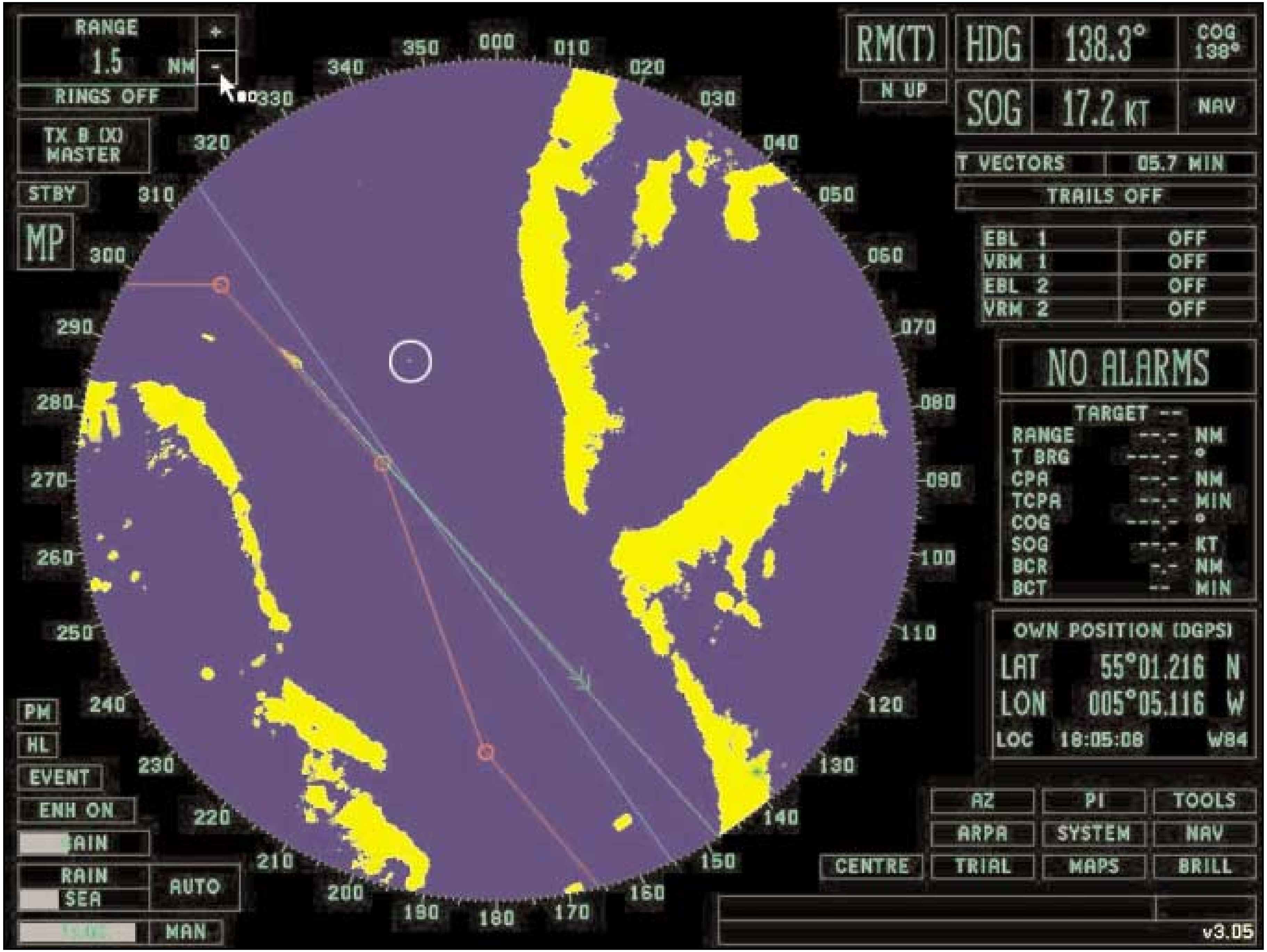


Figure 10
European Highlander inbound at 1805 - contact circled

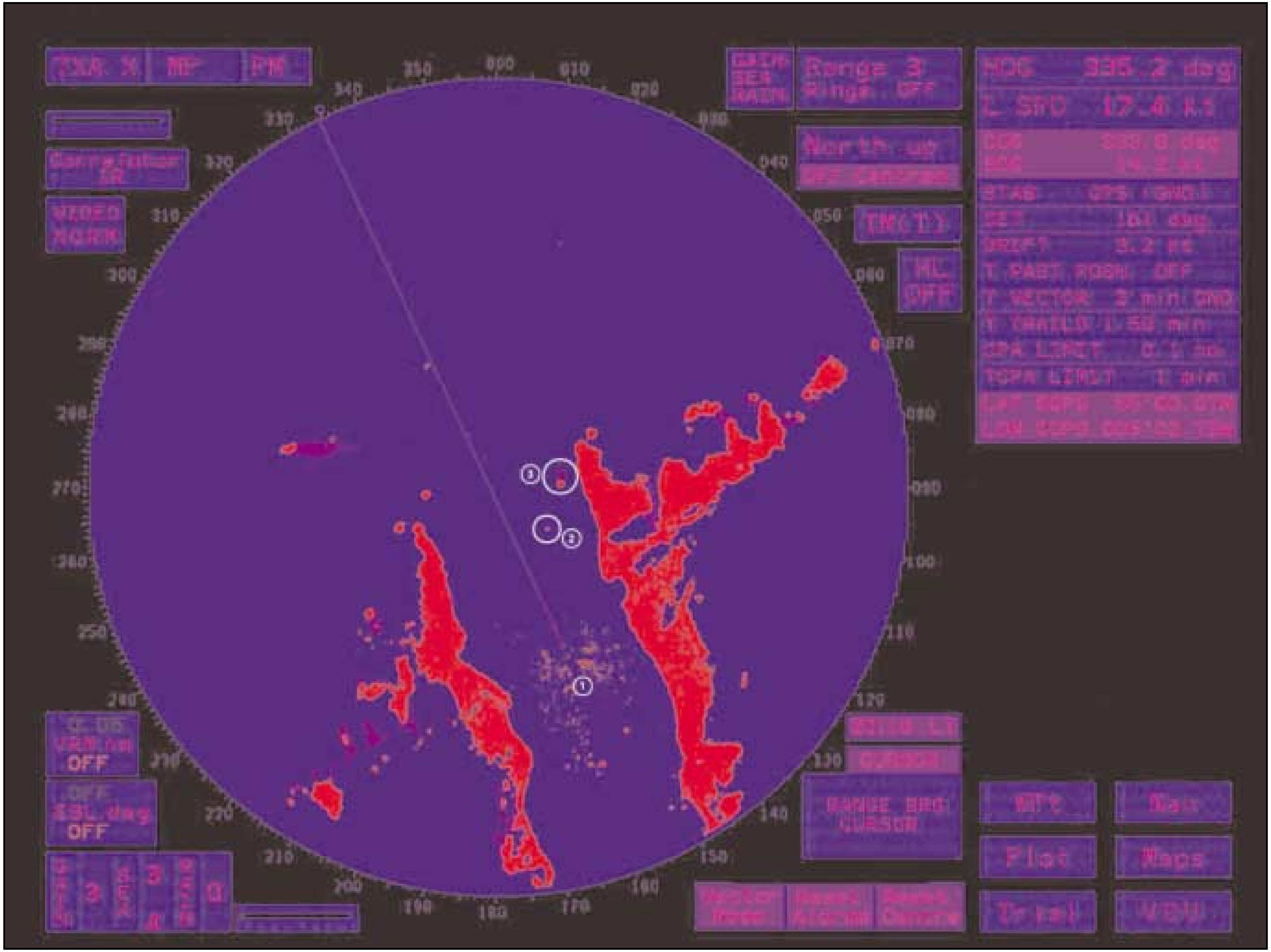
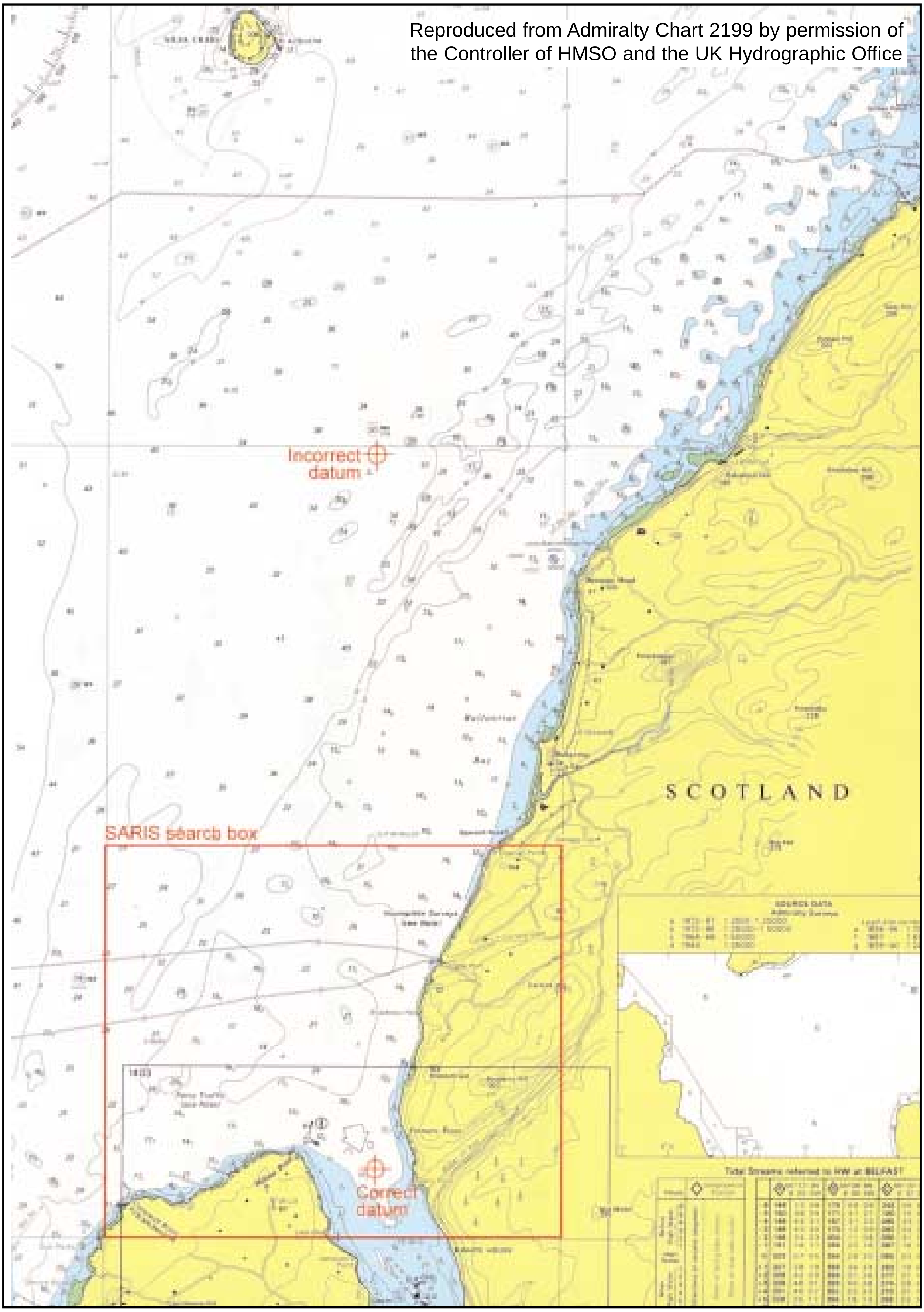


Figure 11

Stena Voyager outbound at 2018 (1), contact (2) believed to be the boat, and contact (3) believed to be the yacht *Catalina*

Figure 12



Charlet of mouth of Loch Ryan and Ailsa Craig
showing SARIS search box and datum positions

As there was no immediate response from Clyde Coastguard, the yacht skipper re-broadcast the “Pan Pan” to Belfast Coastguard, which immediately responded. The skipper informed the coastguard officers that two survivors of a boating accident had been found at the entrance to Loch Ryan. He supplied the latitude and longitude co-ordinates from the yacht’s GPS, and he also said that three other people were missing. Belfast Coastguard officers repeated the details, and entered them into their computer system correctly **(see Figure 12)**.

Clyde Coastguard officers were, at the same time, listening to the call from the yacht, and the details were typed into their computer system. They also began contacting SAR units. However, a typing error had been made in the latitude, which indicated the location of the two survivors was 9 miles north of the true location.

As the accident had occurred within Clyde Coastguard’s area of operations, a telephone conversation ensued between Belfast and Clyde. In this conversation, the two watch managers agreed that Clyde would co-ordinate the SAR operation. Partly because Clyde Coastguard was operating on minimum manning, and its staff were fully occupied in contacting and tasking SAR units, Belfast was requested to upgrade the emergency to a “Mayday” and to broadcast a “Mayday Relay” message on behalf of Clyde Coastguard.

A Royal Navy rescue helicopter based at Prestwick, Portpatrick all-weather lifeboat (ALB), Stranraer inshore lifeboat (ILB), and an auxiliary coastguard shore search unit, were tasked by Clyde Coastguard within the first few minutes after receiving the broadcast from the yacht. Within half an hour, Girvan lifeboat, further shore search teams, and three ferries were also called to assist in the search for Shaun Ridley and his sons.

The Incident Management System (IMS) computer system used by the coastguard, through software called BOSS, allows coastguard stations to access each other’s incident information. Belfast used the mistyped information from Clyde Coastguard’s computer for the “Mayday Relay” alert. No one at either station realised the error. The “Mayday Relay” was broadcast at 2055.

When Clyde had initially tasked the rescue helicopter, the incident area given was Loch Ryan. At 2049, once the helicopter was en route and passing Bennane Head, about 7.5 miles north of the mouth of Loch Ryan, Clyde Coastguard gave them a situation update which included the incorrect latitude position. The helicopter crew, believing the original location supplied to be incorrect, turned the helicopter west to the latest position they had been given. At about 2057, the helicopter was ‘on scene’, but at the incorrect position **(see Figure 12)**.

At 2103, an update from the yacht indicated that the two survivors had last seen the three missing persons drifting toward Ailsa Craig, a rocky island about 14 miles north of the mouth of Loch Ryan, and that they had launched from the area of Lady Bay and Corsewall Point.

In the meantime, Stranraer ILB had launched from Lady Bay at 2043, and was making its way up the west side of the loch with the intention of reaching Corsewall Point. At about 2109, a coastguard shore patrol requested the ILB to investigate a floating object about 1 mile north-west of Finnarts Bay. At 2111, the ILB had discovered the bow of Shaun Ridley's boat, and confirmed that no casualties were found with it.

As the ILB did not have a portable GPS, they asked Clyde Coastguard if the rescue helicopter could fly over to provide an accurate datum for further searches. Because of the volume of radio traffic from the SAR units, this request was not answered, and the ILB was unable to communicate further with Clyde Coastguard until 2120. The ILB then asked Clyde Coastguard if the boat should be towed out of the shipping lane, or left as a datum. With Clyde Coastguard's permission, once a triangulated position of the boat had been taken, the ILB towed the boat to Finnarts Bay. At this stage of the SAR operation, no other search and rescue units (SRUs) were operating within the loch.

At 2115, the ferry *European Mariner*, which was en route from Larne to Cairnryan, and had been tasked to help with the search, was released by Clyde Coastguard. At this time she was 30 minutes from Loch Ryan.

Meanwhile, the crew of the rescue helicopter had swept through from the incorrect position down to Corsewall Point. As the wind was southerly, and the tidal set had been in the same direction over the preceding few hours, they decided, with Clyde Coastguard's agreement, to search north from Corsewall Point up to Ailsa Craig, using their onboard computer to determine a drift plot for the missing persons. By 2120, they had done this, searched the southern shoreline of Ailsa Craig, and had begun a creeping line ahead search pattern back in the direction of Corsewall Point, covering 3 miles either side of the axis.

During this time, Portpatrick and Girvan ALBs were travelling towards Loch Ryan, and auxiliary coastguard teams were working their way progressively along the east and west shorelines of the loch and around towards Corsewall Point.

Portpatrick ALB arrived near Milleur buoy at 2145, and was given the job of on-scene SAR co-ordinator (OSC) by Clyde Coastguard. Clyde Coastguard informed Portpatrick ALB of the required search box to enable them to organise the SAR units available. The search box had been derived from the coastguard's Search and Rescue Information System (SARIS) computer programme; it was 5 miles square, and covered the area around the entrance to the loch and was based on the position given by the yacht *Catalina* **(see Figure 12)**.

At 2149, *European Mariner*, which was en route to Cairn Ryan and no longer part of the search, passed Milleur buoy at the entrance to the loch. The bridge officers were looking carefully for signs of the missing people, and saw lifejackets about half a mile away on their port side. They contacted Clyde Coastguard, who directed Portpatrick ALB and the rescue helicopter to the area.

At 2158, Shaun and Michael Ridley were recovered from the water, and, shortly after, transferred to the helicopter and flown to a waiting ambulance.

The search for Steven Ridley continued as far as possible through the night and during the following day. His body was discovered about 21 miles to the south of Loch Ryan about 6 weeks later.

1.13 THE DEPLOYMENT OF SEARCH AND RESCUE UNITS (SRUs)

The following is the chronology of the SRUs tasked, starting from the "Pan Pan" call at 2038:

2039: R177 rescue helicopter called

2041: Portpatrick all weather lifeboat (ALB) called

2041: Stranraer inshore lifeboat called

2043: Stranraer shore response team called

2049: R177 given incorrect co-ordinates by Clyde Coastguard

2101: Girvan all weather lifeboat called

2101: *European Highlander* conventional ferry called

2103: Update from *Catalina*: three missing persons last seen drifting towards Ailsa Craig, boat launched from Corsewall Point/Lady Bay

2107: *Stena Caledonia* conventional ferry called

2107: *European Mariner* conventional ferry called

2109: Portpatrick shore response team called

2125: Drummore shore response team called

2129: Ballantrae shore response team called

2130: *Superstar Express* HSC ferry called

2140: Girvan shore response team called

Further SRUs were tasked to continue the search for the missing boy after the first two casualties had been located.

<u>The following is the chronology of SRUs arriving on-scene and operations carried out:</u>

2057: R177 rescue helicopter at the incorrect datum position

2109: Stranraer ILB finds bow of boat

2111: Stranraer ILB confirms boat's identity, requests R177 to provide datum

2111: R177 arrives at Corsewall Point

2120: Stranraer ILB requests guidance on what to do with the boat

2120: R177 searches Ailsa Craig and commences sweep south

2124: Stranraer ILB told to tow boat to Finnarts Bay

2139: Shore search team find Ridley's car at Lady Bay

2145: Portpatrick ALB arrives at Milleur buoy, receives search grid and designated on-scene co-ordinator

2149: *European Mariner* passes Milleur buoy en route to Cairnryan terminal, bridge officers see lifejackets in water

2158: Portpatrick ALB picks up two casualties

2200: R177 takes casualties to hospital.

SRUs continue search for missing boy.

1.14 HM COASTGUARD'S ROLE IN SAR

In 1998, the Marine Safety Agency and the Coastguard Agency amalgamated to become the Maritime and Coastguard Agency (MCA).

The MCA exists to promote high standards of safety at sea, to minimise loss of life among seafarers and coastal users, to protect the environment by minimising pollution from ships and to respond to maritime emergencies 24 hours a day. This means the MCA must maintain an adequate civil maritime search and rescue co-ordination service through HM Coastguard. This clear definition of the role of HM Coastguard within the MCA has enabled the MCA to focus on introducing the best available technology, which means that the UK Coastguard is a world model for search and rescue co-ordination.

HM Coastguard no longer thinks only of rescue. Despite handling thousands of incidents every year, improved efficiency has freed officers to take part in safety campaigns. Each year, these target the most common causes of accidents at sea.

The coastguard co-ordination centres are fitted with an integrated coastguard communication system (ICCS) which replaced analogue control equipment with digital technology, though HM coastguard continues to monitor the distress frequencies of VHF Channel 16 and VHF DSC Channel 70. The ICCS, along with the IMS, enables MRCCs and MRSCs to share the workload during major incidents, or to release staff for other duties.

In 1999, the coastguard replaced British Telecom in providing maritime safety information. Four-hourly meteorological and navigational warnings are broadcast using VHF and MF, with coverage extending 150 miles. The coastguard also links vessels at sea with medical authorities, so that advice can be received directly from a doctor.

1.14.1 Coastguard operations room manning

Belfast MRSC

On the evening of 12 July 2003, the watch manning level at Belfast MRSC did not meet the minimum requirement of three, as defined by coastguard guidelines. The three members of staff on duty were all probationary and acting above their substantive ranks in the positions they held during the watch, including one who was still classed as a trainee.

A risk assessment was carried out, which looked at the hazards of operating below minimum manning during the watch. No explanation of the under-manning, or limited experience of those on watch, was given **(Annex 2)**.

The coastguard had employed the watch officer (acting as watch manager, and responsible for SAR co-ordination during the watch) since 1995, and he had deputised effectively over many years. The watch assistant (acting as watch officer) had been employed for four years and his performance was at the level required of the watch officer grade.

The watch trainee (acting as watch assistant), an experienced ex-auxiliary operations room assistant with over ten years service in that capacity, was tasked with keeping a listening watch on VHF Channel 16.

Clyde MRCC

Although Clyde MRCC did meet the minimum manning on the evening watch of 12 July 2003, it failed to meet the recommended requirement of five staff, as defined by coastguard guidelines. A risk assessment was carried out to evaluate the hazards and associated risk of operating below recommended manning. The reduction in manning was explained by reason of annual leave and sick leave, but concluded that the experience and competence of those on watch was adequate to cover the probability, or scale of, any incidents likely to arise during the watch **(Annex 2)**.

The coastguard had employed the watch manager since 1988. Because of his previous experience in the Merchant Navy and offshore industry, he was employed initially as a watch officer, before progressing through the ranks to become watch manager in 1997.

The watch officer had joined the coastguard in 2001, after ten years in Fisheries Research, progressing to watch officer in 2003.

The two watch assistants had been with the coastguard between 2 and 3 years each.

Description of Manning Level Risk Assessment

Risk assessments are carried out by the coastguard station watch manager when manning levels do not meet recommended levels. The level and experience of the watch manning is considered against the predicted level of incident activity, based on the coastguard's experience, the weather forecast and any local factors.

Recommended manning can be defined as the manning level which is capable of supporting the normal level of incident activity with a margin for safety.

Minimum manning can be defined as the manning level which is capable of supporting the normal level of incident activity without the margin of safety.

Description of the Incident Management System (IMS)

The IMS system is a computerised event logging system, which relies on data/events being inputted manually by coastguard officers. Each input is automatically time-stamped. Coastguard stations are able to access the incident logs of other coastguard stations, to appraise themselves of the current state of an incident. The system is secure in that data entered cannot be subsequently altered, although certain additional information can be added after the event.

Description of the Search and Rescue Information System (SARIS)

The SARIS computer system predicts probable drift patterns of people, or vessels at sea, to enable SAR resources to be directed as quickly as possible to the most likely area for recovery of those in need of rescue. SARIS uses criteria such as the time of year, the tides, known positions and weather. Because of complex tidal streams which can occur near the coast, it is not as reliable for coastal predictions as it is for open sea. Local knowledge can be used to assist the SARIS prediction for coastal conditions.

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 ANALYSIS OF THE MOVEMENT OF THE BOAT BETWEEN 1630 AND 2038

At about 1630, *Stena Caledonia* was outbound from Stranraer, and about 1½ miles from the loch entrance, when two small craft were noticed visually on the eastern side at the mouth of the loch, ie on the vessel's starboard bow. The two craft were later confirmed as an inbound fishing boat close in to the shore off Portandea, and a small boat with a blue and white hull, which was slightly closer to the ferry off Finnarts Point. Analysis of the ferry VDR radar recording has shown that the small boat was heading in a southerly direction, about 2 to 3 cables off the eastern shore of the loch, and proceeding at a speed of about 2.5 knots. The fishing boat was closer inshore, and also inbound into the loch at a speed of about 10 knots (see Section 1.6). After the accident, *Stena Caledonia*'s watch officer identified the small boat as that belonging to Shaun Ridley.

At 1637, the ferry passed the small boat at a speed of about 17 knots, at a distance of 2 to 3 cables, altered course to port around Milleur buoy and proceeded out of the loch. At about 1638, the radar targets of the small boat and the fishing boat were lost in the radar shadow sector behind the vessel **(see Figure 2, Section 1.6)**.

Between about 1640 and about 1644, the small boat was seen by those on the fishing boat which was overtaking them down the eastern side of the loch. Those on the fishing boat noticed nothing untoward during this time, although they noted that the boat was taking spray over the bow, and they were concerned that such a small boat was out in those conditions.

The HSC *Superstar Express* passed inbound into the loch, passing Milleur buoy at between 1644 and 1645. Subsequent analysis of her VDR radar recording **(see Figure 8, Section 1.12)** shows two targets. One of those targets is that of the inbound fishing boat which moved progressively down the coastline, while the other, less prominent target, which was first detected at 1642, remained virtually stationary in a position midway across the loch and south-west of Finnarts Point. *Superstar Express* continued into the loch at a speed of 38 knots. At about 1645 it passed the target at a distance of about 4 cables, but no one on the bridge reports sighting a boat or persons visually in the water in that position. The target was lost to *Superstar Express*'s radar just before 1647 as the ferry moved away from the boat's position.

At 1740, an hour later, *Superstar Express* transited the loch outbound after disembarking and embarking her passengers at Cairnryan port, and subsequent analysis of the VDR radar recording shows a weak target in a position about 3 cables north-north-east of the last known radar contact of the small boat. Taking into consideration the tide at the time, one would expect the small boat to have drifted to approximately this position **(see Figure 9, Section 1.12)**.

At 1805, *European Highlander* entered the loch inbound to Cairnryan terminal. There is a static contact on her radar recording approximately 1 cable south of the 1740 target position mentioned above. Taking into account the change in tidal flow (low water occurred at 1710), it is assessed that this again is the boat's bow and the two survivors **(see Figure 10, Section 1.12)**.

Between 2018 and 2022, the radar recording from the outbound *Stena Voyager* shows the yacht *Catalina* inbound en route to Stranraer. It also has a faint target which correlates with the bow of the boat as assessed by analysis of other VDRs. The yacht initially passed and then returns to this target, which demonstrates unequivocally that it was the bow of the boat with the two survivors. The geographical location is that given to the coastguard by the yacht at 2038 **(see Figure 11, Section 1.12)**.

With the exception of the actual time of the accident and the identity of the vessels involved, the above sequence of events determined by analysis of the VDR recordings from three vessels, visual sightings from the bridge team on *Stena Caledonia*, and from the fishing vessel which overtook the boat at 1641, is also confirmed by the survivors. The survivors believed the accident occurred at about 1500, some 1½ hours earlier than the above scenario and had involved wash from an HSC.

Other evidence supporting the MAIB's reconstruction comes from the survivors who stated they saw another fishing boat, travelling south off the western coast of the loch. The fishing boat they saw is believed to have reached the Spit buoy as the *Superstar Express* berthed at Cairnryan at 1655 **(see Section 1.6)**. The radar on the outbound *Stena Caledonia* picked up several contacts on the west coastline around 1633, any of which might have been this fishing boat.

Finally, the survivors mention seeing a yacht entering, and then leaving, the west side of the loch, a short while after they had capsized. At 1700, the *Superstar Express* VDR recording shows a contact which entered the west side of the loch near Milleur buoy for a short period before departing.

On many occasions in the past, the MAIB has found that a person's memory is fallible, especially when that person has been subjected to a very stressful situation. In particular, witnesses can rarely provide an accurate chronology of events, and time periods are difficult to judge. The MAIB considers that, on the balance of the evidence, the small boat referred to above is the boat to which this report refers, and that the events that finally sank her unfolded between 1639 and 1644.

2.3 SAFE BOAT OPERATION

Although the family friend of the Ridleys had previous boat-handling experience, the MAIB considers it is unreasonable for three adults and two children to take a small boat, of unknown history, out on the open sea with minimal safety equipment and limited overall experience.

Modifications to the boat, including adding additional buoyancy and a 'cuddy', were discussed before the family set out, but it appears that these were not considered important enough to delay the fishing trip.

Other relevant issues were:

- No checks were carried out on the boat beforehand to ensure its survivability if swamped;
- They had inadequate safety equipment on board and the equipment that was supplied was either not used (flares), or was used ineffectively (lifejackets);
- Their proposed operational area and route were not discussed with anyone ashore, and no one knew what time they were expected back. This is contrary to good practice;
- They were wearing inadequate clothing, taking into account possibly changing weather conditions or abandonment of the boat.

<u>Comparison of this boat's equipment with that included on the RNLI SEACheck form</u>

Because of the sea areas visited by the Ridleys, it is considered reasonable to include the equipment level headings: 'Inshore use', 'Sheltered use' and 'Small leisure craft'.

<u>Essential equipment</u>

<u>SEA Check</u>	<u>Equipment on board the boat at the time of the accident</u>
Anchor with warp	Yes
Radar reflector	No
Appropriate navigation lights etc	No
Lifebuoy or similar	No
Life raft/inflatable dinghy	No

Emergency steering	Yes
Compass	No
Alternative means of propulsion	Yes
Engine tool kit and spares	Yes/No
Lifejacket/buoyancy aid for each person	No
Safety harness	No
Bailer	Yes
Bucket and hand/electric pump	Yes
Navigation instruments	No
VHF	No
Torch	No
Pyrotechnics – in date	Yes
Fire extinguisher	No
Temporary hull repair kit	No
Watch	Yes
First-aid kit	N/A

<u>Recommended equipment (not included in essential list)</u>

Heaving line/rescue quoit	Yes
Radio receiver	No
Barometer	No
Binoculars	No
Personal protective/warm clothing	Partial compliance

<u>Equipment which might have made a difference</u>

A VHF radio might have enabled the Ridleys to call for assistance as soon as they found themselves in a dangerous situation.

A waterproof torch might have increased their visibility and improved the likelihood of being rescued at an earlier stage.

Properly fitting lifejackets being worn by all persons on board would have reduced the risk.

Personal protective/warm clothing would have increased their ability to withstand the cold water and, therefore, increased their survival chances.

A radar reflector would have made the boat more visible, and might have alerted *Superstar Express* to their presence as she entered the loch at 1645.

2.4 BOAT CONSTRUCTION AND CAPABILITIES

This boat had a low freeboard, but originally a large volume of sealed buoyancy was incorporated. As well as the void, there was a small amount of solid foam buoyancy in the bow and in the port and starboard quarters. The concept with this type of construction is to compensate the low freeboard with the integral buoyancy. The low freeboard makes a boat of this type susceptible to swamping, but with a large volume of protected buoyancy, the boat should not sink even when swamped.

The open design of the boat allowed the sea spray, which it had encountered in the choppy conditions prior to the accident, to enter the boat and run down into the bottom. This made conditions in the boat wet for those on board, and consequently its speed had to be limited to keep the occupants relatively dry.

However, problems often arise with boats like this when they get older and are subject to the bumps and knocks normally experienced in use. Damage, even slight, can cause water ingress into the void. Such ingress can be very small at first, but with prolonged immersion it can build up. At some stage in the life of this boat, water penetrated the void and it started to fill with water. A previous owner might have first realised this when water could be heard sloshing inside the boat when it was being moved on its trailer. No drain was fitted so, at some time, a hole was cut into the aft end of the void to drain the water into the bilge well. Probably, at some later stage, an opening was cut in the top of the void at the aft end, to remove the water, and a bilge pump was fitted into this opening to drain water from the void.

Once the void started to fill with water, and especially after an opening had been cut into it, the void no longer constituted sealed buoyancy and the boat could not withstand swamping without sinking.

The MAIB has investigated accidents involving similar boats. Although the design concept is reasonably safe, once the void is compromised, these boats become hazardous. If flooding of the void occurs, it is well disguised because the void cannot easily be inspected. The resulting loss of freeboard would also be gradual so that it, too, could go unnoticed. A reduction in freeboard increases the risk of swamping if, for example, large waves are encountered.

The small amount of solid foam was insufficient to prevent this boat sinking when it was swamped. However, when all the loose items dropped out, it did provide enough buoyancy to enable the bow of the boat to return to the surface.

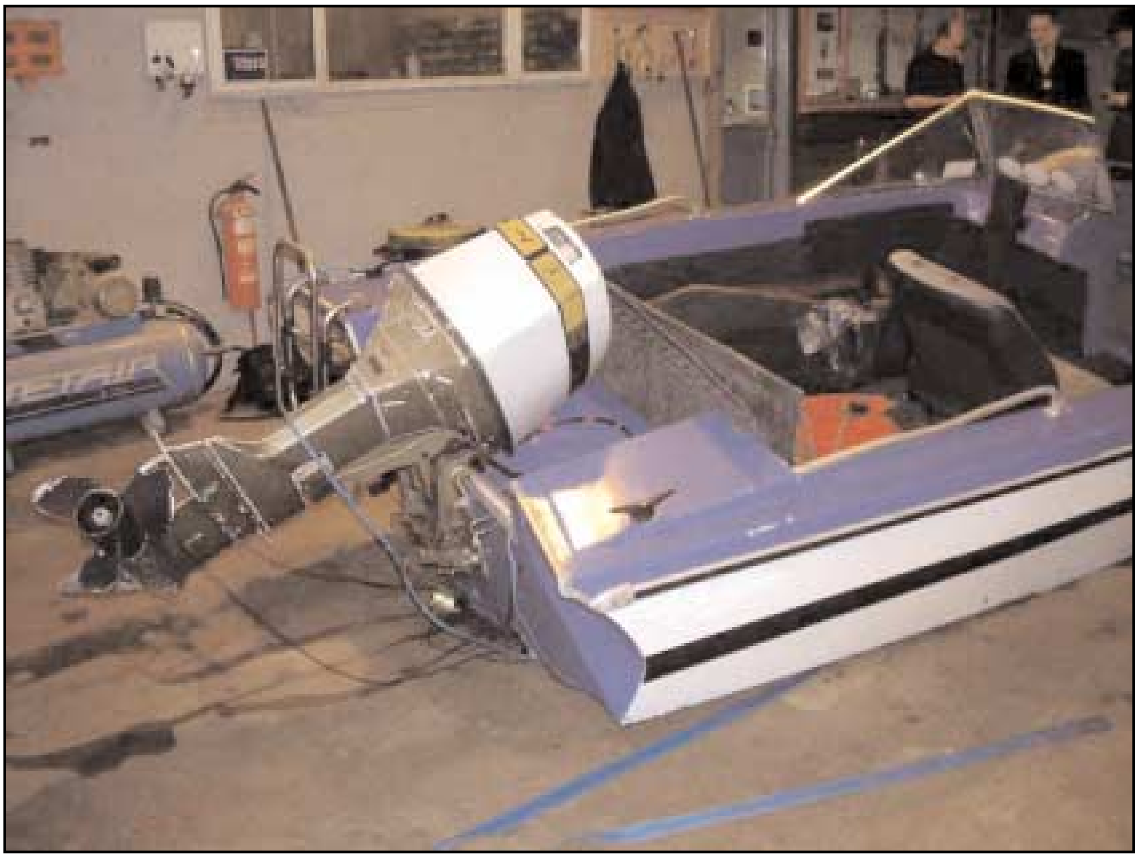
The deck of this boat was constructed of thin, non-marine plywood, which was glassed over. The underside of the plywood was exposed to the inside of the void. The water which got into the void at some stage subsequently penetrated the plywood deck. The deck then started to become rotten and lost its rigidity. Because the deck had become flexible, the previous owner cut out a large portion and replaced it with a thicker sheet of plywood. This measure made the deck more secure, but further compromised the watertight integrity of the void.

According to the Safety Afloat Voluntary Code of Best Practice for Leisure Craft Users, this boat, by virtue of her length, would be considered borderline for going to sea with five people and their equipment on board.

2.5 THE CONDITION OF THE ENGINE (Photograph 8)

The survivors of the accident stated that the engine stopped soon after the boat was swamped, but before it sank.

Photograph 8



Outboard engine

An outboard engine specialist inspected the main outboard after the accident. The 1973 model, Johnson 48kW (65hp) two-stroke engine was fully dismantled to expose the crankshaft, con rods and the three pistons. If the engine had drawn water in through the carburettors while it was running, con rod damage would be expected, because of hydraulic lock in the cylinders. The specialist found no damage of that kind, and he concluded that the engine was not running when it was submerged.

The only significant damage found was a failed bottom-end-bearing stud from one of the piston con rods. The sheared section of the failed stud was corroded across part of the face of the failure, and the remaining surface was shiny. There was no evident damage to the cylinder head or piston crown, which would be expected if a bottom end bolt had sheared while the engine was running. This would, therefore, indicate that the stud probably sheared off when the engine was stripped down, taking into account the partial failure of the stud at some time in the past.

The specialist also noted that there were non-standard electrical connections on the wiring harness which, unlike the original fittings, were not waterproof. The engine had its own generator to provide an electrical supply for the ignition system, once it had been started from the battery. The specialist also noted that the engine connection terminals for the battery starting cables had short circuited and failed. He concluded that this must have happened before the battery became submerged.

One of the cylinders also showed signs of poor combustion. Darker carbon deposits could be seen on the cylinder head and spark plug, compared to the light brown colour on the other two cylinder heads. The spark plug anode gap on this cylinder was also smaller than the other two spark plugs.

2.5.1 Further consideration of the cause of the failure

The engine, once started by the 12-volt battery, would not require any further external electrical supply to enable it to continue running, as it had a self-generating power supply for the ignition. Although the electrical system was not examined in detail, unless water had managed to affect the ignition system, possibly through the modified non-waterproof cabling, then it is unlikely to have stopped by other electrical means. Because the engine had been submerged, it was not possible to investigate whether any water ingress into the electrical system had occurred beforehand to cause the engine to stop.

The specialist concluded that the battery cable connections at the engine failed first because of short circuit when they were submerged or splashed with water. This would indicate that, although there was floodwater in the battery compartment under the after seat, it had not covered the battery when the engine submerged. This is very unlikely, so it is considered probable that a wave coming into the boat splashed the connections and caused the short circuit.

The poor combustion, indicated from the stripdown of the outboard engine, might have been the cause of the failure to re-start the engine during the afternoon **(see Section 1.3)**. The poor combustion was probably owing to the spark plug gap being too small, preventing a large enough spark being produced to promote good combustion. This might have caused a poor tickover, as the other two cylinders would have been producing the bulk of the rotational power.

2.5.2 Conclusions

The engine stopped soon after the boat was swamped probably because of:

- water ingress affecting the ignition system; or
- the engine revolutions being allowed to drop below a sustainable level, taking into account the poor combustion in one of the cylinders.

2.6 POST-ACCIDENT TRIALS WITH THE BOAT

2.6.1 Loading trials

With the assistance of the Stranraer inshore lifeboat crew, the MAIB re-created the estimated loading condition of the boat at the time of the accident. This loading trial was conducted on 14 July 2003, in calm water conditions, to accurately assess the freeboard.

The two boys, Michael and Steven Ridley, had been seated forward. Their father, Shaun Ridley, was seated in the middle of the boat to port, and their grandfather was seated aft. The family friend was seated at the helm. The weights of the crew, and all the loose items on board at the time of the accident, were established or estimated.

For the trial, the boat was put afloat and volunteer lifeboatmen were embarked until the loading condition, in terms of weight and distribution, was similar to that just before the accident. The freeboard at the starboard side at mid length was measured as 425mm, and at the transom it was about 215mm **(Photograph 9).** After the first wave was taken on board, apparently Shaun Ridley moved aft to assist his father to try to bail out the boat; his weight would have further reduced the freeboard at the transom. His weight would also have trimmed the boat so that the floodwater would have run aft, adding to the trim and reducing the freeboard still further. The amount of water from the first wash wave taken on board is not known, so an accurate trial to determine the freeboard could not be conducted. However, a trial was conducted to simulate Shaun Ridley moving aft, and it was found that the freeboard at the transom would have reduced to about 130mm. The weight of the floodwater reduced the freeboard further, making the boat particularly vulnerable at the aft end.

Photograph 9

Loading trials - loading condition similar to that just prior to the accident
Note: other crew not visible from photograph angle

Photograph 10

Loading trials - lifeboatmen moved to the starboard side of the boat to assess stability

All the lifeboatmen were moved to the starboard side of the boat to assess stability **(Photograph 10)**. This resulted in an angle of list of about 14°, with a freeboard at the starboard side at mid length of 210mm, and at the starboard side of the transom of only 85mm. Although not a requirement for privately owned small boats, the stability standard in the MCA Code of Practice for Workboats can be used as a guide. This Code states, for vessels under 15 metres in length, that when the people and cargo are shifted to one side, the angle of list should not be more than 7°, and the freeboard should not be less than 250mm. This boat would have failed both of these requirements.

2.6.2 Swamping trial

On 26 August 2003, a trial was conducted with the assistance of the Stranraer inshore lifeboat crew and the local fire brigade. Lifeboatmen and firemen boarded the boat until it was loaded to a similar condition, in terms of weight and distribution, to that just before the accident. A hose was then taken off the fire engine and the boat was filled. This water quickly ran down into the void, confirming that the deck was not watertight. The amount of water being fed into the boat was measured. The trial was stopped when the void was full and water started to gather on deck. It was found that 300 litres had been pumped on board by this time.

The trial was continued until the freeboard at the transom was minimal and the boat was on the verge of sinking. It was found that 581 litres had been pumped on board by that time.

2.6.3 Sea trial

On 27 August 2003, a sea trial was conducted. The outboard motor, which was fitted to the boat at the time of the accident, had been stripped down for inspection and, therefore, was not available. An outboard of a similar power and weight was hired from a local marina and this was fitted before the trial.

The MAIB, once again, was assisted by the local RNLI station. The boat was launched and then loaded to a similar condition, in terms of weight and distribution, to that just before the accident. One of the lifeboatmen who had a lot of experience in handling small boats on Loch Ryan took the helm, and other lifeboatmen were used to match the loading condition. The wind was blowing at force 2 to 3.

A variety of manoeuvres were undertaken to assess how the boat handled. These manoeuvres included straight runs, using the full range of available power, standing starts, turns to port and starboard including tight turns, and crash stops. While the trial was in progress, the vehicle/passenger ferries, which operate between Scotland and Ireland, were sailing up and down the loch, and the opportunity was taken to see how the boat handled when ferry wash was encountered.

Before the trial, the boat was drained to ensure that there was no water on board. After the trial, she was recovered from the water and, when she was on her trailer, the drain plug was removed and 40 litres of water were measured as having been taken on board during the trial. The sea trial had lasted 2½ hours. The duration of the trip before the accident was about 6½ hours so, on the same basis, it is calculated that about 100 litres of water would have been taken on board through ingress. This additional weight, roughly equivalent to the weight of a large adult, would have further reduced the freeboard, if the water had not been pumped out using the bilge pump. This water would also tend to run to the after part of the boat, where the freeboard was already low, particularly when engine power was applied.

2.6.4 Trial conclusions

When dry, the boat appeared to be safe in these ambient conditions, using only moderate engine power, as was reported to be the case on the day of the accident. Even when high power was used, and when the boat was handled quite roughly, for instance during tight turns and crash stops, there was no concern for safety among the crew. The only exception to this was how the boat behaved when wash was encountered. In one instance, the boat was steered, under low power, bow-first into the wash of a ferry; the vessel had passed about a quarter of a mile away. The boat pitched quite violently in this wash, and a wave was taken over the bow. No test was undertaken with the side or stern facing into the wash, but it is concluded that the low freeboard made this boat vulnerable to swamping if wash or weather generated waves approached it from these directions. If water had collected in the void space during the day of the accident, unbeknown to the crew, the boat would have been even heavier in the water and even more susceptible to swamping.

2.7 BOAT INSPECTION

MAIB inspectors carried out an inspection of the boat while it was out of the water. She was given a detailed visual examination, and any damage discovered was photographed. The damage noted was minor, and was probably caused by the bumps and knocks received during the normal life of the boat; however several of these areas of damage could have been the source of minor leaks. The damage which was considered to be most significant, was a repair patch on the starboard side of the hull where the rollers on the right-hand side of the trailer supported the boat. The repair consisted of a piece of plywood, about 100mm square, glued to the hull and then coated with resin. The patch was in poor condition, with fracture lines in the resin at the periphery. It is not known when, or by whom, this patch was fitted, however, it was not painted blue to match the rest of the hull.

On 28 August 2003, the cockpit fittings were dismantled. The seats were taken out and the large sheet of plywood fitted by the previous owner was unscrewed and removed. The hull structure was then clearly visible **(Photograph 11)**. To check the results of the previous trial, the void was filled with water **(Photograph 12)**. It was found that the capacity was about 300 litres, which confirmed the previous result **(see Section 2.6.2)**.

Photograph 11

Hull structure

Photograph 12

Void filled with water

A test was also carried out on the bilge pump. A 12-volt car battery, which was in good condition, was used as the power supply. Initially, when the pump was connected to the battery, it could be heard clicking, but the impeller did not rotate. However, once the impeller had been freed, by nudging it with a small screwdriver, the pump started to operate. It was then tested twice; 8 litres were pumped in 20 and 23 seconds respectively, which is an average rate of 1339 litres per hour. The bilge pump was rated at 400 US gallons per hour (1514 litres per hour) **(Photographs 13 & 14)**.

The electrical wiring, between the bilge pump and the steering console switch, and between the battery and the steering console switch, was tested and found to be working as it should.

2.7.1 Safety issues arising from the construction and maintenance of the boat

- The boat had a non-watertight void compartment as a result of poor workmanship and materials, and a lack of thought being used when modifications were made to the boat.
- A poor, non-watertight repair had been made to the hull.
- The battery compartment was prone to flooding, which put the operation of the bilge pump at risk when it was most needed.

2.8 THE PROBABLE ACCIDENT SCENARIO

Some of the available evidence is conflicting, so it is impossible to state the cause and circumstances of the accident with certainty. However, the VDR evidence in particular is compelling, and the MAIB believes that it is possible to accurately reconstruct the final minutes before the boat sank.

<u>To do this, the following evidence is gained from VDRs and can be considered as fact:</u>

The boat motored at about 2.5 knots down the east coast of the loch until its radar target was lost in *Stena Caledonia*'s radar blind arc at about 1638.

Those on the bridge of *Stena Caledonia* saw the boat as they approached and passed her.

The boat was detected on *Superstar Express*'s radar at 1642, by which time it was stopped in the water further out into the loch to the south-south-west of her 1638 position **(see Figure 3)**. The target remained stationary, or nearly stationary, until it was lost to *Superstar Express*'s radar just before 1647. Within this time, the radar echo was lost briefly at about 1644 as *Superstar Express* turned around Milleur Buoy into the loch.

Photograph 13

Bilge pump

Photograph 14

Bilge pump

Stena Caledonia passed the boat at a distance of about 3 cables at 1637. [The boat would have experienced the wash from the ferry at about 1638.]

Superstar Express passed the boat at a distance of about 4.5 cables at about 16h45m30s. [Her wash would have reached the boat at about 16h46m30s.]

Seacat Rapide passed 7 miles off Corsewall Point about 25 minutes before the accident.

<u>The following is evidence gained from the survivors:</u>

The Ridley family were heading back to their launching point at Lady Bay when they saw a ferry coming out of Stranraer. They held back to let the ferry pass before crossing the loch.

The ferry passed, and the family friend, who was at the controls, saw the wash approaching - it did not give him cause for concern as they had been riding out wash all day.

They rode the first waves without incident and then headed out into the loch.

The grandfather drew the family friend's attention to the fact that there was water around his feet, and consequently, the bilge pump was switched on.

A little time later, which could have been seconds or minutes, the grandfather, who was sitting at the stern on the starboard side, drew the family friend's attention, with some alarm, to a wave that was approaching.

A wave came on board over the starboard quarter. The battery shorted out and they lost the use of the bilge pump.

The engine also stopped at about this time.

At some stage there was an attempt to bail water out using empty fish boxes. To do this, a second adult moved to the after end of the boat, which would have reduced even further the freeboard at the stern.

Realising the danger of the situation, the father had time to take two lifejackets from plastic covers and hurriedly put them on the boys. The father also tried to make a 999 call on his mobile telephone, but did not have time to make a connection.

One, or perhaps several more waves came on board, and the boat went down quickly.

When the boat went down, the outgoing ferry was just leaving the loch.

After the boat sank the next ferry that came past was inbound.

Other relevant evidence

The boat was seen by the skipper of the fishing vessel, which went down the east side of the loch about 3.5 cables away, passing the Ridley's boat just before 1642. The boat was noted to be moving, because spray was seen coming over its bow. Nothing untoward appeared to have happened to the boat at that time, but the skipper was concerned that such a small boat should be out in the loch in those conditions. The skipper noticed waves hitting Milleur buoy across the other side of the loch entrance. The fisherman has given quite detailed descriptions from memory of the relative positions of his own boat, *Superstar Express* and the Ridley's boat, which, if taken as fact, indicates that the boat was still afloat at about 1645. However, the evidence was given some days after the event and the MAIB believes that, on balance, the boat had probably sunk by about 1644.

The weather had picked up considerably just before the accident.

The boat had an incipient leak through the hull.

A considerable amount of water, up to 300 litres, can accumulate in the boat, under the floor, without it being immediately obvious to its occupants. A shift of weight aft would cause the water to run aft and exacerbate the problem of low freeboard. The freeboard at the transom the boat would have been only 230mm with it dry internally. The freeboard would have been reduced further when spray and/or wash waves were taken on board.

Sea trials with the boat indicated that she was particularly vulnerable to swamping by waves approaching from astern. During sea trials, some ferry wash came on board the boat over the bow.

Probable accident scenario

Bearing the above evidence in mind, it is considered that the most probable accident scenario is as follows:

The boat was held back to wait for *Stena Caledonia* to pass. As the ferry passed, the family friend headed the boat into the approaching wash waves, which they rode successfully. The boat took some spray and possibly some water over the bow. The water accumulated under the floor.

After riding the wash, at about 1638, the boat headed out into the loch and speeded up. As she did so, she trimmed by the stern and the water moved aft. It came above the floor, and the grandfather commented on this to the family friend. The bilge pump was switched on. The boat was punching into choppy seas and taking spray over the bow. The freeboard aft was low and the boat was vulnerable.

At some time between about 1639 and 1642, but probably just before 1642, the grandfather looked over his shoulder and saw a wave approaching the starboard quarter. He drew the family friend's attention to it. The friend had no time to do anything about it, and it came on board over the starboard quarter. This shorted the battery, stopped the bilge pump and, probably, stopped the engine.

After the first wave came on board, Shaun Ridley might have moved aft to help the grandfather to bail the water out using fish boxes.

The boat was now helpless. They recognised that the situation was dangerous. At the friend's prompting, Shaun Ridley retrieved two of the lifejackets from plastic bags and hurriedly put them on the boys. He also tried to make a mobile telephone call, but had insufficient time.

Another wave, or more waves came on board the boat. There was not enough time to retrieve the flares before the boat sank underneath them, probably at about 1644.

<u>The source of the wave(s) that came over the starboard quarter of the boat.</u>

The MAIB does not know the source of the wave(s) that impacted on the boat at, or about, 1642.

The survivors strongly believe that the wave(s) had originated from the ferry (*Stena Caledonia*), which had very recently passed them. However, the ferry had passed out of the loch by the time the waves reached the boat and, considering the position of the accident, obtained from VDR radar recordings, and the apparent direction of the wash waves, this theory is not supported by the evidence.

The MAIB believes the wave(s) could not have come from either *Stena Caledonia* or, for that matter, *Superstar Express,* which had yet to enter the loch around Milleur buoy.

The MAIB considers the boat to have been in a vulnerable condition just prior to the impact of the wave(s). Even fairly small waves from astern could have caused disastrous flooding. The wind had freshened and the seas were choppy. The condition became much worse once the first wave had come on board.

The survivors are strongly of the opinion that one or more sizeable waves caused the boat to be swamped. Their evidence indicates that the waves approached the boat from the starboard quarter. Bearing this and the VDR evidence in mind, the MAIB believes that the first wave probably reached the boat at, or before, 1642 and that it came from a direction of about north-west.

Seacat Rapide, the Belfast to Troon fast ferry, passed 7 miles from Corsewall Point, about 25 minutes before the accident. The MAIB has consulted experts for an opinion on whether wash waves from this vessel could have been significant in the position of the accident. The Branch was told that they would not have been. However, during an investigation into another incident the Branch asked, through advertisements in local papers, for members of the public to come forward with their experiences of wash from ferries in the Loch Ryan area. One response, from a reliable witness, included the information that over many years of observing the effects of wash in the area, he had noted, among other things, that the wash from the Belfast to Troon ferry could have a noticeable and significant effect on the shoreline. He noted further that wave(s) could be seen approaching the loch as a line on the water. He estimated that the waves reached the shoreline about 25 minutes after the ferry passed.

Wash propagation from high-speed ferries is not yet completely understood. Despite the experts' view, the MAIB believes that the observer's evidence is compelling and the coincidence in the timing, and in the fact that waves from *Seacat Rapide* would approach the loch from roughly the right direction, should not be ignored. The Branch believes, therefore, that there is a possibility that the waves originated from this source.

The waves may not have been dangerous to a well-found boat or to any boat that was anticipating them and was prepared. However, the waves that caused the final demise of the Ridley's boat were not anticipated, and they approached from its most vulnerable direction.

2.9 FERRY OPERATION

2.9.1 Wash

The Ridley's boat was possibly affected by wash waves from two different vessels, first *Stena Caledonia* and then *Seacat Rapide*.

Those on board *Seacat Rapide* could not see the Ridley family, and the Ridley family would not have been aware of *Seacat Rapide*. The ferry was steering a north-easterly course and making a speed of 35 knots in 70 to 80m depth of water; she passed no closer than some 9 - 10 miles from the accident site. She was not operating within the critical speed range, but would have been producing quite powerful high-speed sub critical waves. The operation would have been within the parameters set out in the vessel's RAPP.

Conventional ferries operating in Loch Ryan have not previously been thought to be the source of hazardous wash. Vessel speeds have not been restricted for this reason.

In the area where the accident occurred, where the water depth is about 11m, a vessel making 17.2 knots through the water is on the margin of the critical speed zone. In this case, *Stena Caledonia* was making slightly less speed. Even so, she would have been producing large sub critical wash waves such as those described by the survivors.

A RAPP for conventional vessels operating within Loch Ryan, based on Depth Froude Number, such as that initiated within the Dublin Bay pilotage area, would probably not have required *Stena Caledonia* to proceed at a slower speed as it passed the Ridley's boat. However, the greater knowledge and understanding of wash emanating from conventional vessels, gained by having a RAPP, might have given the bridge officers a greater awareness of the effects of wash from their vessel on a small craft.

The MAIB investigation has discovered an apparent lack of awareness among the conventional ferry crews about the hazards of wash effects. In the vicinity of small boats, there appears to be a lack of concern unless a collision or close quarters situation is imminent. Interest in the boat appears to diminish once she is past the beam of the ferry. Both high speed and conventional ferries can produce significant wash which can endanger vulnerable craft after the vessel has passed. There appears to be an assumption, on the part of the ferry crews, that small boat users will see the ferry, keep clear, be aware of the wash produced and take the appropriate action.

At about 1630 on 12 July 2003, the bridge officers on *Stena Caledonia* did not consider Shaun Ridley's boat to be close enough to their track to warrant an alteration in speed or heading; they were correct in this. However, bridge teams bear a responsibility to other mariners to ensure that other craft are not put at risk by the effects of their wash and a careful watch should be kept on any boat which might be at risk, until the time of risk is over.

2.9.2 Lookout

This accident raises the question as to whether an efficient lookout was being kept by the bridge teams on the three ferries that passed, in total, 7 times, and other craft which passed the survivors and the partially submerged boat. They passed at distances between 400 and 800 metres, yet didn't see them. National and international regulations clearly state what constitutes a proper lookout, and what a lookout should be looking out for. This includes*: … detecting ships or aircraft in distress, shipwrecked persons, wrecks, debris, and other hazards to safe navigation*. Furthermore, the regulations are clear that a lookout should be kept by sight and hearing as well as any other means available. Of particular significance in this case is the fact that the partially submerged boat was a contact on a properly adjusted radar. The MAIB noted during the investigation that at least two of the ferries had radars that were either set on an inappropriate scale or were not properly adjusted.

The rules are clear that a lookout should not be distracted from his task by having other duties. For this reason, some of the ferries operating in Loch Ryan have a designated seaman as a lookout, in addition to the bridge watch officer. Other ferries operate in the entrance to Loch Ryan with the bridge officer or the master performing the role. The latter arrangement would be deemed to be compliant with the rules if the officer can devote his time solely to the task of lookout. However, it is doubtful that, with all the other requirements associated with either setting out on passage, or on arrival, the bridge officer or master can adequately perform the role in the confines of the entrance to Loch Ryan.

Notwithstanding the fact that a designated lookout is not always posted on some conventional ferries, the MAIB has been assured that all three of the vessels which passed the survivors in the water a total of seven times, had dedicated lookouts posted.

It would appear from this accident that, especially on fast craft where a designated lookout is posted, there is a tendency to concentrate on only what is directly ahead of the vessel, and that which poses a threat to her. This is contrary to the STCW rules as quoted above and, arguably, is contrary to the practice of good seamanship.

Although some shortfalls in the lookout arrangements on the ferries have been identified, in the conditions which prevailed that evening, it would not have been easy to detect either the upright bow of the boat, or the people in the water. The blue and white colouring of the boat's hull made it even more difficult to see by eye. As can be seen from **Figures 8, 9, 10 and 11**, the MAIB, with the benefit of hindsight, has been able detect the echo of the boat's bow on the radar screens of several of the ferries using VDR recordings. It should be noted, however, that it was a poor radar target which gave only a weak echo which was not easily detected among the spurious echoes and sea clutter returns that litter radar screens in choppy sea conditions.

2.10 SEARCH AND RESCUE

2.10.1 Coastguard performance overview

Consideration of the VDR data confirms that the position *Catalina* gave to the coastguard was correct, and analysis of recordings taken from the coastguard operations room indicates that the transmission was correctly and effectively sent by the yacht's skipper. The co-ordinates were also correctly repeated back by the Channel 16 operator at Belfast Coastguard. The position sent and received was 55° 00.9'N 005° 04 .07'W.

However, Clyde Coastguard co-ordinated the SAR effort, and its Channel 16 operator incorrectly typed the position into the IMS system as 55° **009.9'**N 005° 04 .07'W . Despite individual coastguard officers also noting down the position as it was transmitted over the Channel 16 loudspeaker system, and a general perception that the incident had occurred in the entrance to Loch Ryan, the 9 miles discrepancy was not highlighted, nor the watch manager informed. The incorrect position was later transmitted to all potential rescue craft in the "Mayday Relay" signal.

Crucially, the incorrect datum position was given to the rescue helicopter and this led directly to the helicopter initially searching in the wrong area. The initial response was also adversely affected by the first surface craft that arrived on scene, the Stranraer ILB, being tasked to tow the partially submerged boat to the shore instead of starting a search of the immediate area. Stranraer ILB arrived on scene at 2109 (31 minutes after the "Pan Pan" call), and initially took bearings to determine the boat's position. A member of its crew was then put in the water to ascertain whether any casualties might still be in the boat. They then spent about 30 minutes towing the boat to the shore in Finnarts Bay.

The survivors' correct position was used by Clyde Coastguard's watch officer in the SARIS computer system to gain the co-ordinates of a search box. The search area information was available at 2145 as other SRUs closed in on the area and just before the lifejackets were seen by those on the bridge of *European Mariner.* The box encompassed both the survivors' position and where Shaun and Michael Ridley were eventually found.

Shaun and Michael Ridley were found about 2 cables (about 370m) north of the position of the two survivors. They were recovered to the rescue helicopter at 2158, 80 minutes after the initial call was received by the coastguard. Had the helicopter travelled directly to the correct datum position, it would have been overhead at about 2111. It was still daylight and the coloured lifejackets would have assisted the helicopter crew to locate them. It is therefore possible, in a best case scenario, that Shaun and Michael Ridley could have been recovered about 47 minutes earlier had the correct position been given.

The discrepancy in the positions was first noticed by the MAIB during the course of its investigation. As a result, considerable time elapsed between the incident and the Belfast and Clyde Coastguard teams being interviewed by MAIB inspectors. This fact inevitably made it difficult for the coastguard officers to recall details. This was exacerbated by the fact that they had been unaware that there had been problems with the deployment of resources. Nevertheless, the MAIB received the full co-operation of the MCA in the investigation, and a good indication of the course of the SAR operation was obtained.

2.10.2 The principal errors in the SAR response

1. The co-ordinates of the yacht *Catalina* were incorrectly entered in the log:

The Clyde Coastguard watch assistant dealing with VHF channel 16 monitored the yacht's "Pan Pan" call to Belfast Coastguard and made a typing error in omitting the decimal point in the minutes of latitude. His attempt to correct the error resulted in an anomalous entry (*009 .9*). Typographical errors are to be expected in the normal course of events, particularly when complex messages are being précised in real time. The watch assistant's failure to make an unambiguous correction might have been, in part, because of inexperience and also because the normal practice in coastguard operations necessarily accepts that the log is an approximate record of events. The pace of events in an incident is such that abbreviations (some of them personal), brief summaries of complex exchanges (eg *sit rep passed*), and omissions are common. The watch assistant appears to have accepted the partial correction of his error because, at the time, he did not appreciate that, subsequently, it might be misinterpreted.

2. The incorrect co-ordinates were included in the "Mayday Relay" signal:

   The Belfast watch assistant (acting as watch officer) who composed the "Mayday Relay" signal probably used the co-ordinates entered into the Clyde log. The "Mayday" form occupies much of the computer screen, so it was probably easier to refer to the Clyde log on an adjacent screen, perhaps by asking the probationary watch assistant at the adjacent station, rather than to scroll through his own log viewed through a window of only a few lines depth.

3. The co-ordinates in the "Mayday" signal were not checked:

   The Belfast watch officer (acting as watch manager) approved the signal without checking the details of the co-ordinates. He might have assumed that the watch assistant had agreed the contents with Clyde Coastguard. More likely, it is probably not universal practice to check the accuracy of all the details in such a signal because of the pace of events in the early stages of an incident. The Belfast watch officer might also have been influenced by the fact that (at 19:45UTC) he had discussed the details of the situation with Clyde Coastguard when offering to broadcast the "Mayday Relay". However, as far as can be determined from the log, co-ordinates were not included in this discussion.

4. Incorrect co-ordinates were passed to the RN SAR helicopter tasked to assist:

   This probably happened at 19:49 UTC when the Clyde watch manager passed a situation report to the helicopter. He probably derived the co-ordinates from the watch assistant's entry in the log. There was an opportunity here for the error to be corrected. Firstly, the watch manager, himself, had made a note of the correct co-ordinates. (A watch officer had also correctly recorded and plotted the datum). In principle, the difference could have been detected. Secondly, the co-ordinates as recorded were anomalous; the minutes entry contained too many digits. The anomaly could easily be interpreted as an extra leading zero, and this is what seems to have happened. But it might also have prompted the watch manager to check his own note, those of others, or to query the entry with the watch assistant. However, the procedures used in managing an incident do not seem to provide a robust defence against transmission of simple typing errors. In part this is probably because of the workload involved in the early stages of an incident, and because the watch manager relied on his own mental model of the situation, supplemented by reference to the log.

It appears that the helicopter crew received the correct co-ordinates first (possibly from the watch assistant who passed the initial call for assistance) and then the incorrect ones. This was another opportunity for checking that was missed, probably because the crewman who took the first call was off the radio donning his immersion suit when the second came through. Errors of this type are not rare, and the helicopter crew assumed the second datum was a correction of an error. All subsequent conversations between the coastguard and the helicopter crew were interpretable by the aircrew by reference to the incorrect datum without apparent logical consistency. However, it is conceivable that at least one member of the coastguard team might have spotted the discrepancy between a creeping line search near Ailsa Craig and the location of the rescue of the two survivors, had the two pieces of information been presented together in an accessible, visible form.

5. The inshore lifeboat was inappropriately used:

   After the inshore lifeboat had found the swamped boat, it was tasked with towing it from the scene. Although there were several good reasons for removing the boat (including preservation of evidence and removal of a hazard to shipping), priority should have been given to searching for survivors. At about the same time, the helicopter had searched the southern side of Ailsa Craig and was beginning a search from Ailsa Craig to Corsewall Point. The watch manager may not have been aware of this and, possibly, believed the helicopter to be closer to the critical area than it was. This would, arguably, have reduced the need for the inshore lifeboat to search. The alternative, that he expected the airborne search to sweep quickly towards the critical area, seems unlikely given his experience. The actions of the ILB were affected to some extent at this time by the fact that VHF Channel 0, as used by the SAR resources, was very busy and it was difficult to find a slot to pass messages to the coastguard operators.

   The information from a survivor that the remaining casualties were last seen drifting towards Ailsa Craig may have helped to confuse matters, particularly by making deployment of the helicopter near Ailsa Craig (14 miles north of the entrance to Loch Ryan) seem sensible. It is difficult to evaluate the impact of this piece of information. In principle, its effect should not have been significant. Even without co-ordinates, the fact that the survivors were picked up in the entrance to Loch Ryan and, later, that their boat was found there, should have focussed attention in the correct area (at least, after drift calculations had been made). Other incidental bits of information also had the potential to cause confusion: the mention of Lady Bay as the launching place and of Corsewall Point as a place visited by the casualty vessel. These appear to have had little effect, but add emphasis to the need for a clear analysis of the situation, understood by all members of the coastguard team and, perhaps to a lesser degree, by the assets it co-ordinates.

2.10.3 Coastguard manning

The Belfast Coastguard team was undermanned (below minimum level) and Clyde Coastguard team was manned at below the recommended level. The three people on duty in Belfast were all acting above their substantive ranks. Under-resourcing possibly contributed to high workload which, in turn, contributed to the errors made. Most important, several opportunities to detect the initial recording error and its knock-on effects were not taken. A better deployment of the resources available might have supported a more robust defence against errors. For example, one officer could maintain an up-to-date situation display. In addition to key pieces of information, such as locations and the number and details of casualties, a plot of the casualty position and deployment of assets would relieve the watch manager of the need to maintain a mental model of the situation. Having to maintain a mental model increases the risk that his recollection of details and his ability to make decisions may be compromised. The situation map which is properly sited in full view of the whole team would be ideal, and this would allow other members of the team to check and query details if they did not agree with their recollections or with the log.

Probably the most labour intensive time in an SAR operation is within the first hour, as information is coming in and resources are being tasked. This is also a crucial time for any casualties in the water. The coastguard response, assisted by the RN SAR aircraft and RNLI teams, was swift. Resources were being tasked even as the "Pan Pan" call was being received **(see Section 1.13)**. However, had the SAR helicopter been given the correct datum during the subsequent situation report (SITREP), or if it had queried the incorrect datum, and, if the Stranraer ILB had not been allowed to divert to the task of wreck removal, then the early stages of the search and rescue would have been more effective. The manning levels at coastguard stations and the quality of the staff deployed should be sufficient to operate effectively from the moment the emergency call is received.

2.11 SURVIVAL TIMES

From all the combined research on cold water accidents, it is clear that sudden immersion in cold water, ie below 15°C, can be very dangerous because of cold shock. A person's swimming ability is also severely hampered in cold water.

The two survivors stated that the water felt painful as soon as they fell in. They also lost feeling in their limbs within a short space of time and, as a result, lost their grip on the boat several times. They also lapsed into temporary unconsciousness while they waited to be rescued.

The MAIB has sought advice from a recognised expert in cold water immersion survival times. Professor Mike Tipton's report is included at **Annex 1**.

The report by Professor Tipton concludes that the maximum predicted survival time of Shaun Ridley, based on his height, mass, body fat, clothing and the water temperature was in the region of 3.7 to 4.1 hours.

The report also concludes that the two boys would not have survived as long as their father because of their higher body surface area to mass ratio, and because both wore ill-fitting lifejackets, which would not have supported them properly in the water.

The probable time at which the boat eventually sank is about 1644 and, therefore, the maximum predicted survival time for Shaun Ridley would have been 1644 + 4.1 hours = 2050, (12 minutes after the "Pan Pan" call to the coastguard and 19 minutes before the first SRU reached the partially submerged boat).

Had the yacht *Catalina* carried out a search in the vicinity of the two survivors at 2038, she might have located Shaun and Michael Ridley. However, it is not unknown for rescued individuals to relapse and subsequently die after cold water retrieval. Therefore, getting the two survivors to medical support was the best method of ensuring that at least two people survived the accident. It is also not known how long it might have taken for *Catalina* to locate Shaun and Michael Ridley who were, in the event, about 360m from the partially submerged boat. The MAIB considers that *Catalina*'s actions were correct in the circumstances.

The first SRU at the correct datum point was the Stranraer inshore lifeboat, which had reached the partially submerged boat at 2109. The crew looked in the immediate vicinity of the boat, but did not conduct a search of the wider area. They were given permission to tow the boat ashore at 2124. Had they conducted an expanding box search it is possible that the casualties would have been located, but this would have taken some time.

If the Royal Navy helicopter R177 had not been diverted to the incorrect datum position while it was en route to Loch Ryan, it would have been over the area of the partially submerged boat at about 2111. It is likely that the lifejackets held by Shaun Ridley would have been seen from the helicopter, had it been directed to the correct datum, and that Shaun and Michael Ridley would have been recovered soon afterwards. However, it should be noted that the earliest time they could have been recovered by R177 is more than 20 minutes after the longest predicted survival time given by Professor Tipton.

In conclusion, the MAIB believes that, in all probability, the errors which occurred in tasking SRUs made no difference to the tragic final outcome of the SAR mission.

SECTION 3 - CONCLUSIONS

3.1 SAFETY ISSUES

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

- The Ridley family members and their friend's decision to take a previously untried boat into the open sea for a fishing trip was ill-considered. The family friend had advised, among other things, that additional buoyancy was needed. That modification should have been made before the trip was undertaken. [2.3]
- The owner of the boat was probably unaware that the modifications which had been made to the boat had reduced her design capability. Previous modifications to the boat effectively removed much of its integral buoyancy, leaving it with a hidden non-watertight void. The dangers associated with incipient flooding in the void, combined with heavy loading and low freeboard, were not fully appreciated by those on board. Furthermore, they were probably unaware that the boat would not be able to remain afloat if swamped. [2.4]
- The safety equipment carried on the boat was insufficient for the number of people and the type of trip envisaged. [2.3]
- The clothing worn by those on board the boat was inadequate for the envisaged trip. [2.3]
- Properly fitting lifejackets were not worn by all persons on board. [2.3]
- The trip was not planned properly, and nobody ashore was told where those on the boat were intending to go, or what time they intended to return. [2.3]
- The boat possibly encountered waves produced by a fast ferry that had passed over 7 miles away about 25 minutes previously. [2.9]
- The boat was caught out by a wave from an unexpected direction, which hit it at its most vulnerable point. Unexpected events do occur at sea, waves are sometimes unpredictable in both direction and height, and seagoing boats must be constructed, equipped and handled to cope with such events. [2.9]
- There is a general lack of awareness that fast conventional vessels, as well as HSC, can, and do, operate within the critical speed range for wash production. Such vessels have the potential to produce wash waves that are dangerous to small craft and people on, or near, the shoreline. A requirement for these vessels to produce a RAPP with respect to wash production would heighten the knowledge, understanding and awareness of wash and its associated hazards. [2.9.1]

- The MAIB considers that there were shortfalls in the efficiency of the lookout being kept by the bridge teams on the ferries and other craft which passed the survivors and the partially submerged boat without seeing them. The MAIB believes a more co-ordinated approach, involving the OOW, the use of radar, and a dedicated lookout might enable a more effective lookout to be maintained. [2.9.2]

- The search and rescue operation co-ordinated by the coastguard (MCA) was not fully effective in the first hour after receipt of the urgency signal ("Pan Pan"). A single error was compounded by the lack of checks and balances in the command and control structure. Furthermore, the direct involvement of the Clyde watch manager in the handling of the SRUs, reduced his capability to stand back, analyse and fully co-ordinate the response to the accident. [2.10]

SECTION 4 - ACTION TAKEN

- **The Royal National Lifeboat Institution** had already begun to extend the scope of its free SEACheck service, by attending slipways known to be used by non club-affiliated boat owning individuals who might not be aware of the SEACheck initiative. It is expected that this scheme will eventually cover the full UK coast.

- **The Maritime and Coastguard Agency** had already begun development of an SAR Mission Co-ordination Certification course for those coastguard officers holding the position of watch manager.

- **Stena Line Ltd** had instituted a trial radar training programme before the incident, for the seamen lookouts on *Stena Voyager*.

- **P&O Irish Sea** has issued additional detailed training and operating instructions to masters, officers and lookouts regarding the conduct and operation of a proper lookout, especially in regard to the requirement to watch for signs of distress.

SECTION 5 - RECOMMENDATIONS

The Loch Ryan Advisory Management Forum is recommended to:

2004/156 Consider more appropriate signs at public access points, stressing the need for boat owners to be aware of the dangers associated with the frequent ferry operations within the loch. The signs should also stress the dangers of taking a boat on to the water without adequate lifesaving equipment, and the need to ensure that the boat is suitable, bearing in mind that sea conditions can change.

The free SEACheck service offered by the RNLI could also be advertised.

The Safety on the Sea Group (MCA, RNLI, BMF, RYA, RLSS) is recommended to:

2004/157 Consider how best to communicate to casual boat users the lessons to be learned from this accident. In particular that:

- Owners of small boats should be aware that modifications and maintenance carried out by themselves, or previous owners, might have compromised the safe design of the boat and its ability to operate as originally specified.
- All users of small craft should be reminded of the dangers that can arise from the wash of passing vessels.
- Properly fitting lifejackets should be carried for all persons on board. In deciding whether to wear lifejackets and warm clothing, it should be remembered that no harm comes from wearing them in even the most benign of conditions, and they may save lives if an unexpected event occurs.
- Owners of small boats should be reminded that a small boat is not easily visible from the bridge of a ship, and wearing high visibility clothing will make them more easily seen.
- Manufacturers and designers of small boats should be reminded that boats made, or coated with, highly visible materials will be much more easily seen by other vessels.
- In considering the above, the Safety on the Sea Group should bear in mind that appropriate signs at slipways and other access points might serve to remind boat owners of some of the above lessons.

The Maritime and Coastguard Agency is recommended to:

2004/158 Review the organisation and training of coastguard officers working in the coastguard control centre operations rooms, to ensure that the watch manager can, and does, maintain a clear overview of the total SAR response to an accident. In particular, operational guidance should ensure that any risk assessment carried out to operate at less than the prescribed minimum manning is done so with this clear requirement in mind.

2004/163 Ensure that Competent Harbour Authorities are aware of the potential for fast conventional vessels to create critical speed wash similar to that produced by high speed craft, and for relevant authorities to consider appropriate actions under the Port Marine Safety Code, to ensure that dangerous wash is not generated in the areas under their jurisdiction.

The Maritime and Coastguard Agency and **the Royal National Lifeboat Institution** jointly are recommended to:

2004/159 Revisit and reinforce the communications protocols and discipline required during an SAR operation.

2004/160 Reinforce the need to optimise the use of search and rescue units (SRUs) on search and rescue operations before committing them to other tasks.

All operators of ferries to and from UK ports are recommended to:

2004/161 Review their operational guidelines with respect to how their vessels can keep the most effective bridge lookout, particularly with respect to detecting signs of distress/casualties.

Operators of roll-on/roll-off passenger ferries to and from UK ports are recommended to:

2004/162 Consider whether any of the conventional ferries under their management have the potential for operation within the critical speed range (Fn_h 0.85 to 1.1) with respect to wash generation. For any ferries in this category a Risk Assessment Passage Plan (RAPP) should be produced, and her deck officers should be made fully conversant with critical speed wash production and the associated inherent dangers.

Marine Accident Investigation Branch
April 2004

ANNEX 1

Professor Mike Tipton’s report on the Loch Ryan boat accident 12 July 2003

REPORT ON THE LOCH RYAN BOAT ACCIDENT 12 JULY 2003 (PDG0411930703)

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MAIB REF: 1/10/236

REFERENCES REVIEWED
Map of scene of incident (Loch Ryan)
Incident Accident Report
MAIB Summary of Incident Report
Autopsy Report: Sean Ridley
Autopsy Report: Michael Ridley

DATE OF THIS REPORT: 31 October 2003

INTRODUCTION
Following an initial telephone conversation and a subsequent meeting on the 24th October 2003, the MAIB asked me to comment on the likely survival times of the individuals involved in the Loch Ryan boating accident of the 12th July 2003. My qualifications to make such comments are contained within my brief curriculum vitae, which is attached.

With regard to the objective of estimating survival time, the most significant data extracted from the references reviewed and the conversations held with the MAIB were:

Water temperature: 10°C
Sea State during accident: Choppy Sea
Wind Force during accident: SSW 3
Time of immersion: 1640
Time of recovery (survivors): approximately 2030
Immersion time (survivors): approximately 3h 50min
Time of recovery (deceased): 2155
Immersion time (deceased): 5h 15min

<u>Survivors</u>
Age: 58years and 61years.
Body mass: 89.1kg and 92.3kg
Build: "Medium" and "Heavy"
Clothing worn: "Lightweight"
Circumstance when found: Lashed to hull of boat
Condition on rescue: Very cold but coherent

Deceased
a. Father (Sean Ridley)
Thin caucasian male.
Age: 37 years
Body mass: 68kg
Height: 5feet 10inches
Clothing worn: Blue jeans – black belt; black socks; grey T-shirt; black waterprooof leggings; green flotation jacket (Albatros "Gilfin" Floating thermosuit, Size XL – "This thermosuit is not a lifejacket but a buoyancy aid. It will support a person up to 100kg. Also protects temporarily against supercooling").
Circumstance when found: Each arm through a lifejacket and he was quite clear of the water in a reclined position.
Left lung: 1440g expanded.
Right lung: 1450g expanded.
Stomach: lumen contained around 200mL of slightly mucoid watery fluid.
Left kidney: 180g, congested.
Right kidney: 170g, congested.
Commentary of the pathologist: Death due to immersion. Likely mode of death was hypothermia and the slim body build may have caused him to be more prone to the effects of cold as the two people who survived were heavier for their height.

b. Son (Michael Ridley)
Thin caucasian male.
Age: 12 years.
Body mass: 38kg.
Height: 5feet 1inch.
Clothing: Blue/white Nike training shoes; blue jeans; white T-shirt; blue/white boxer shorts; blue jumper; yellow lifejacket (Discussions with MAIB revealed that the lifejacket was donned in a hurry and was probably not being worn correctly).
Circumstance when found: Fully submerged, face down, head between father's legs, mostly out of lifejacket. Lifejacket fully inflated.
Left lung: 600g expanded.
Right lung: 690g expanded.
Commentary of the pathologist: Death due to immersion. Likely mode of death was hypothermia and the slim body build may have made the deceased more prone to suffer from the effects of cold as the two people who survived were heavier for their height.

c. Son (Steven Ridley)
Reported to have been seasick prior to the accident.
Age: 15years.
Clothing: Green boxer shorts; blue Umbro training trousers; grey socks; Adidas trainers; navy fleece with red collar; yellow life jacket.
Body found 3-4 weeks later.

COMMENTS
Survival time in cold water can range from minutes to many hours depending on circumstances. A significant proportion of individuals die from drowning or cardiac related problems during the first minutes of immersion as a result of "cold shock", caused by sudden cooling of the skin. With continued cooling superficial muscles and nerves are cooled and their function deteriorates. The resulting impairment of such things as grip strength, manual dexterity and swimming ability can result in problems, chief amongst which is incapacitation and drowning as victims become unable to keep their airway clear of the water. A properly donned and functioning lifejacket is an essential piece of lifesaving equipment at this time. The deep body tissues of the body cool next and hypothermia ensues at a body temperature of 35°C (2°C below normal). At a body temperature of between 30-33° victims become unconscious and are likely to drown if their airway is not supported clear of the water by an effective and properly donned lifejacket.

The two main sources of the information used to estimate "survival times" in cold water are reviews of actual emergencies and laboratory experimentation supplemented by mathematical manipulation and extrapolation. From these sources, the times one would expect 50% of individuals to survive in water at 10°C are presented in Table 1. The times resulting in "likely death" are presented in Table 2.

Water Temp	Molnar	Hayward	Golden	Tikuisis
10°C (50°F)	2.2	2.9	2	3.6

Table 1. 50% Survival times (hours) for lightly clad males, from various authors.

Water Temperature	Molnar	Nunnely & Wissler	Allan	Lee & Lee
10°C (50°F)	4	2.6	2.5	3

Table 2. Immersion time (hours) resulting in "likely death" from various authors. Lightly clad males.

It is worth noting that these estimations are predicated on the assumption that death on immersion is the result of hypothermia. Thus, no consideration is given to cold shock and the problems related to it. The times presented in Tables 1 & 2 approximate those taken from the SAR tables (3.5hours). In addition, using a mathematical model (DCIEM Survival Time Model v1.0, Tikuisis et al, 1988) to predict the survival time of Sean Ridley, on the basis of his height, mass, the water temperature, and assuming Mr Ridley was 10-13% body fat ("thin") and was wearing 0.1Clo of external insulation (0.06Clo = naked; 0.3Clo = full immersion dry suit). The resulting predicted survival time was 3.7 to 4.1hours, that is, similar to the times given above.

With regard to the accident in question, none of the times presented above approaches the 5hours 15minutes immersion time of the deceased.

It is important to note that the estimation of survival time is not a precise science; considerable variation exists between individuals. The sources of this variation include: body composition and size, clothing, protective equipment, sea state, having to perform exercise, age, motion illness. In the accident under investigation most of these factors appear to have operated to the disadvantage of the deceased, and to the relative advantage of those who survived.

Body fat provides insulation against deep body cooling and protection against hypothermia, the two survivors were fatter than those who died. Children generally have less body fat than adults and higher surface area to mass ratios – they cool more quickly in cold water as a consequence. Exercising in cold water accelerates the rate of fall of deep body temperature; it seems likely that those who died will have had to do more exercise (particularly the boys who were not wearing their lifejackets properly) than the survivors who were resting, tied to the upturned hull of the boat. The boat may also have provided them with some protection from the prevailing conditions. One of the children (Steven Ridley) was reported to have been seasick before the accident. Seasickness accelerates deep body cooling on immersion in cool water.

With the exception of the father (Sean Ridley) all of those involved in the accident can be regarded as being “lightly clad”. The thermosuit worn by Sean Ridley may have provided some additional insulation, but it is noted that he was thin, of average height and was wearing an XL suit. This, combined with the absence of waterproof seals on the garment, suggests that water will have been able to flow freely beneath the garment, negating most of the insulation it provided.

Although a lifejacket is an essential piece of lifesaving equipment, if it is poorly fitting (e.g. child wearing an adult sized jacket) or not donned properly, it may not function adequately. It is reported that the children were wearing lifejackets but these were not secured correctly. If this is the case, then their airway may have been submerged when they lost consciousness due to hypothermia. The result would be drowning and a shorter survival time than would be predicted for someone wearing a functioning lifejacket, who would have their airway supported clear of the water when unconscious. In such circumstances, victims do not die until deep body temperature has fallen to levels at which hypothermia interferes with cardiac function. In the accident under investigation it is possible, given the circumstance in which the father (Sean Ridley) was found (each arm through a lifejacket, wearing a buoyancy aid and quite clear of the water in a reclined position) and the relatively calm sea state, that his airway remained clear of the water following unconsciousness and he proceeded to die as a direct result of hypothermia

Nothing those involved in the accident did prior to their entry into the water is likely to have extended their survival time beyond that which would normally be expected. Indeed, being fatigued, hungry (hypoglycaemic) and seasick can all reduce survival time. Even entering the water hot has no impact on predicted survival time.

CONCLUSIONS

On the basis of predicted survival time in cold water, and what is known about the factors influencing this time, it is possible to explain why some individuals survived this accident and some did not.

It is probable that those who died during this accident did so within the times given in Table 2 above. Indeed, there are reasons (children were involved, thin individuals, poorly fitting lifejackets) why the survival times may have been somewhat shorter than those given in Table 2.

FURTHER READING

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BRIEF CV: MICHAEL JOHN TIPTON
Head of Environmental Medicine Division, Institute of Naval Medicine, UK/
Professor of Human & Applied Physiology, University of Portsmouth, UK

Educated at the Universities of Keele and London, Professor Tipton joined the University of Surrey in 1986. After 12 years in the Robens Institute and European Institute of Health and Medical Science he moved to the University of Portsmouth in 1988. In addition to his University positions, Professor Tipton has been based at the Institute of Naval Medicine (INM) since 1983 and Consultant Head of the Environmental Medicine Unit of the INM since 1996.

Professor Tipton has spent over 17 years researching and advising in the areas of thermoregulation in hot and cold and survival in the sea. He has published over 150 scientific papers, reports, chapters and books in these areas. In July 2002 Professor Tipton and Dr Golden published a book entitled "Essentials of Sea Survival".

Professor Tipton lectures and provides advice on issues relating to survival in the sea to a range of universities, government departments, industries, medical, search and rescue and media organisations.

ANNEX 2

Risk evaluation sheet

RTMRCC/SC WATCH LEVEL RISK EVALUATION SHEET
Annex to OAN 150
Saturday 12th July 2003 - nightshift

1. Hazard Identification

HAZARD	CURRENT EVALUATION
Changes from current weather pattern	S-SE 3-5 inshore, 5-7 offshore.
Level of commercial shipping activity	Medium – lower levels of ferry traffic at night.
Level of fishing vessel activity	High
Level of recreational boat activity	High
Level of shore based recreational activity	High
School Holidays	Yes
Time of day, weekend, Public Holidays	Saturday nightshift
Tide (time of high or low water/ tidal streams)	Greenock HW 2340 LW 0508 UTC

2. Risk Evaluation

Operations Room Activity Level	High				X
	Moderate				
	Average				
	Low				
SAR Co-ordination Level		Insignificant	Minor	Moderate	Major

3. Watch Level Set

	Number	Experience[1]			Period	Date
Watch Manager	1	E			2000-0800	12/07/2003
Watch Officer	1		C		"	"
Watch Assistant	2		CC		"	"

Watch Level Set meets minimum requirements (OAN 122)	**YES**	
Watch Level Set meets recommended requirements (OAN 122)		**NO**

4. Remarks

1. **1 x CWA(P) on long term sick leave. 1 x CWA on short term sick leave. 1 x WO and 1 x CWA(P) on leave.**
2. **1 x CWA brought in on overtime to bring watch up to minimum level.**
2. **Although watch at minimum level, risk assessment considering experience / competence of staff and probability / scale of incident(s) that might occur indicate that watch is of sufficient strength.**

3. Two adults recovered from water by yt CATALINA from Loch Ryan. One adult and two children still missing. Major search involving numerous SAR units. One adult body and one childs body recovered. Search continues for missing child.

5. Authorisation

Name	Signature	Date
Author: M. J. Miller		12/07/2003
Approval:		

[1] E = Experienced, C= Competent, P = Probationer or Deputising Officer

MRCC/SC WATCH LEVEL RISK EVALUATION SHEET
Annex to OAN 150

1. Hazard Identification

HAZARD	CURRENT EVALUATION
Changes from current weather pattern	AS FORECAST
Level of **Commercial Shipping Activity**	NORMAL
Level of **Fishing Vessel Activity**	NORMAL
Level of **Recreational Boat Activity**	MODERATE
Level of **Shore Based Recreational Activity**	MODERATE
School Holidays	YES
Time of Day, Weekend, Public Holiday	WEEKEND NIGHT
Tide (Time of high or low water/tidal streams)	HW 2152
	LW 0414 (13TH)

2. Risk Evaluation

Operations Room Activity Level	High				
	Moderate	M			
	Average		M		
	Low				
SAR Co-ordination Level			M		

3. Watch level Set

	Number	Experience[1]			Period	Date
Watch Manager	1 WO(AWM)			P	121800 UTC	130600 UTC JUL
Watch Officer	1 WO(T&G)			P	" "	" "
Watch Assistant	1 CWA(UT)			P	" "	" "

Watch Level Set meets minimum requirement (OAN 122)		NO
Watch Level Set meets recommended requirement (OAN 122)		NO

4. Remarks

12TH JULY CELEBRATIONS OVER THIS WEEKEND.

5. Authorisation