Report on the investigation of the

loss of the fishing vessel

Meridian KY147

with the loss of four crew

160nm due east of Aberdeen

on 26 October 2006

Marine Accident Investigation Branch
Carlton House
Carlton Place
Southampton
United Kingdom
SO15 2DZ

Report No 20/2007
September 2007

Extract from

The United Kingdom Merchant Shipping

(Accident Reporting and Investigation)

Regulations 2005 – Regulation 5:

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

NOTE

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

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

CG	-	Coastguard
CoG	-	Course over the ground
DSC	-	Digital Selective Calling
EPIRB	-	Emergency Position Indicating Radio Beacon
FV	-	Fishing vessel
GM	-	Transverse metacentric height (an indication of a vessel's stability)
GMDSS	-	Global Maritime Distress and Safety System
GPS	-	Global Positioning Satellite Navigational System
kg	-	kilogram
km	-	kilometre
kts	-	knots
kW	-	Kilowatt
LOA	-	Length overall
Mb	-	millibar
MBE	-	Multibeam echosounder
MCA	-	Maritime and Coastguard Agency
MHz	-	megahertz
MRCC	-	Maritime Rescue Co-ordination Centre
nm	-	Nautical miles
RCC	-	Rescue Coordination Centre
ROV	-	Remote operated vehicle
Rpm	-	Revolutions per minute
SAR	-	Search and Rescue
SFF	-	Scottish Fishing Federation
SFPA	-	Scottish Fisheries Protection Agency
SIB	-	Stability Information Booklet
SMS	-	Short Message Service
SoG	-	Speed over the ground
SSS	-	Side scan sonar
UTC	-	Universal Co-ordinated Time
VHF	-	Very High Frequency (Radio)

SYNOPSIS

(All times are UTC)

The 22.63m fishing vessel *Meridian* left Aberdeen on 11 October 2006 for a provisional 2 week tour of duty as one of three guard ships in the Blane Development Field about 160 miles east of Aberdeen. She had her owner/skipper and three experienced fishermen on board. On the evening of 26 October, weather conditions deteriorated rapidly and *Meridian* would have experienced storm force or stronger wind speeds.

At 2055 on 26 October 2006, a transmission from the emergency positioning indicating radio beacon (EPIRB) was received by Falmouth Coastguard (CG).

At 2102, a second transmission from the EPIRB was received and this enabled a position to be estimated about 160nm due east of Aberdeen, at the edge of the UK/Norwegian oil sectors. The CG confirmed that the EPIRB was registered to *Meridian* and began attempts to contact the vessel. Soon afterwards, a request was made to the vessels operating in the vicinity to begin searching for *Meridian.*

At 2358*,* control of the search and rescue operation was handed over to the Norwegian rescue services as the location of the search area was in the Norwegian sector of the North Sea. The first rescue helicopter arrived on scene soon afterwards.

The original search box areas were increased in size as time progressed and to fit the SAR services' computer drift models produced for both floating vessels and persons in the water. A number of search craft, including fixed and rotary wing aircraft, oil industry vessels and fishing vessels combined to search these boxes.

At 0113 the following day, the EPIRB was located and retrieved 6nm south-east of the location of the original EPIRB hit and, at 1430 that day, the body of one of the crew was found. During the day, search and rescue craft also located and recovered some other equipment and one of the liferafts, which was found fully inflated but empty. Although the aircraft and vessels continued searching until 28 October, nothing further was found and the search was stopped.

On 6 November 2006, an underwater search for *Meridian* was commenced by MAIB with the assistance of Talisman Energy Inc, the oil company that had contracted *Meridian* for guard ship duty. The search was constantly hampered by poor weather, and having completed an area of 86km² on 4 December, a decision was taken to stop the search until better weather could be expected in the spring of 2007.

On 21 April 2007, the search was resumed but, unfortunately, *Meridian* was not found. On 24 April, after having searched an area of 206km² with the most up-to-date electronic equipment, the search was called off.

The MAIB commissioned an independent study to evaluate and analyse the stability of *Meridian*. The analysis concluded that *Meridian* was a very stable vessel which comfortably complied with the minimum required stability criteria. Among other things, the analysis highlighted an unusually high transverse metacentric height (GM) for a fishing boat, which would have made the vessel "stiff" in heavy weather. Further research indicated that this would have made her vulnerable to suffer synchronous rolling in the sea conditions that prevailed at the time of the accident.

After considering what was known about the vessel, her crew, and the events of 26 October various possible loss scenarios were analysed. The MAIB concluded that the accident was almost certainly brought about by a combination of several factors, and a most probable loss scenario was formed. It is considered likely that as *Meridian* attempted to turn in the prevailing heavy weather conditions, she experienced synchronous rolling as she came beam on to the seas. With each roll angle getting larger, waves began depositing more and more water on deck. This then probably initiated a capsizing moment, and major flooding followed as she lay heeled over and became damaged by the force of the waves. She would have fully capsized and foundered a short time later.

Recommendations have been made to SFF Services Ltd to ensure that the lessons from this accident are included in future safety briefings to guard ship skippers and to ensure that, in future, guard ships are furnished with good quality long range weather forecasts. In addition, the MAIB has published a 2-page flyer, highlighting the accident and advising and reminding fishermen of the dangers of operating in heavy weather and the precautions to take, including gaining the best early warning of worsening weather.

Figure 1

Meridian

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *MERIDIAN* KY147 (Figure 1) AND ACCIDENT

Vessel details

Registered owner	:	Martin Gardner
Manager(s)	:	Aberdeen Inshore Fish Selling Co Ltd
Port of registry	:	Kirkcaldy
Flag	:	British
Type	:	Pair Trawler
Built	:	1976
Construction	:	Steel
Length overall	:	22.63m
Breadth	:	6.85m
Gross tonnage	:	117
Engine power and/or type	:	317kW diesel
Other relevant info	:	On guard vessel duty

Accident details

Time and date	:	Capsize at approximately 2055, 26 October 2006
Location of incident	:	Approximately 57˚ 03.11N 002˚ 45.66E 160 nautical miles east of Aberdeen
Persons on board	:	Four
Injuries/fatalities	:	Four crew lost
Damage	:	Total loss

1.2 BACKGROUND

1.2.1 *Meridian*

Meridian was rigged as a pair, seine net trawler. She was registered in Kirkcaldy, but operated mainly out of the port of Aberdeen. She was a steel hulled, under 24m vessel built in 1976 by McTay Marine, Merseyside.

She had been owned since 1988 by Martin Gardner and had carried out guard duty on a number of previous occasions – eight since 2001, ranging in duration of between 1.5 and 17 days. Five of these were carried out during the winter months.

1.2.2 Fishing vessels being used as guard ships

The development of the North Sea oil and gas industry has resulted in an increase in the number of exposed pipelines and other structures on the seabed. To protect these from damage and prevent potentially dangerous incidents occurring, the oil and gas industry has developed a number of measures to discourage fishing on or over these structures.

One of these measures has been the introduction of guard vessels to protect particularly vulnerable subsea structures from trawl fishing gear and also to prevent loss, or damage to, trawlers and their gear.

In the UK sector, guard vessels have, commonly, been drawn from the fishing fleet, which suits the needs of both industries. From the oil industry perspective, they are confident that they are using experienced seafarers who know the North Sea, are able to cope with the harsh conditions often found in winter, and can liaise well with other fishing vessels actively engaged in fishing. For the fishermen, it provides a welcome boost to their income without being as physically demanding, or dangerous, as fishing operations.

A single UK company, SFF Services Ltd, Aberdeen (SFF), provides the necessary intermediary services between the two industries. SFF draws up a list of candidate guard ship vessels on a register and provides instructions on the work to be carried out, the duration, location and other relevant information to the delegated vessels.

1.3 NARRATIVE OF FINAL VOYAGE

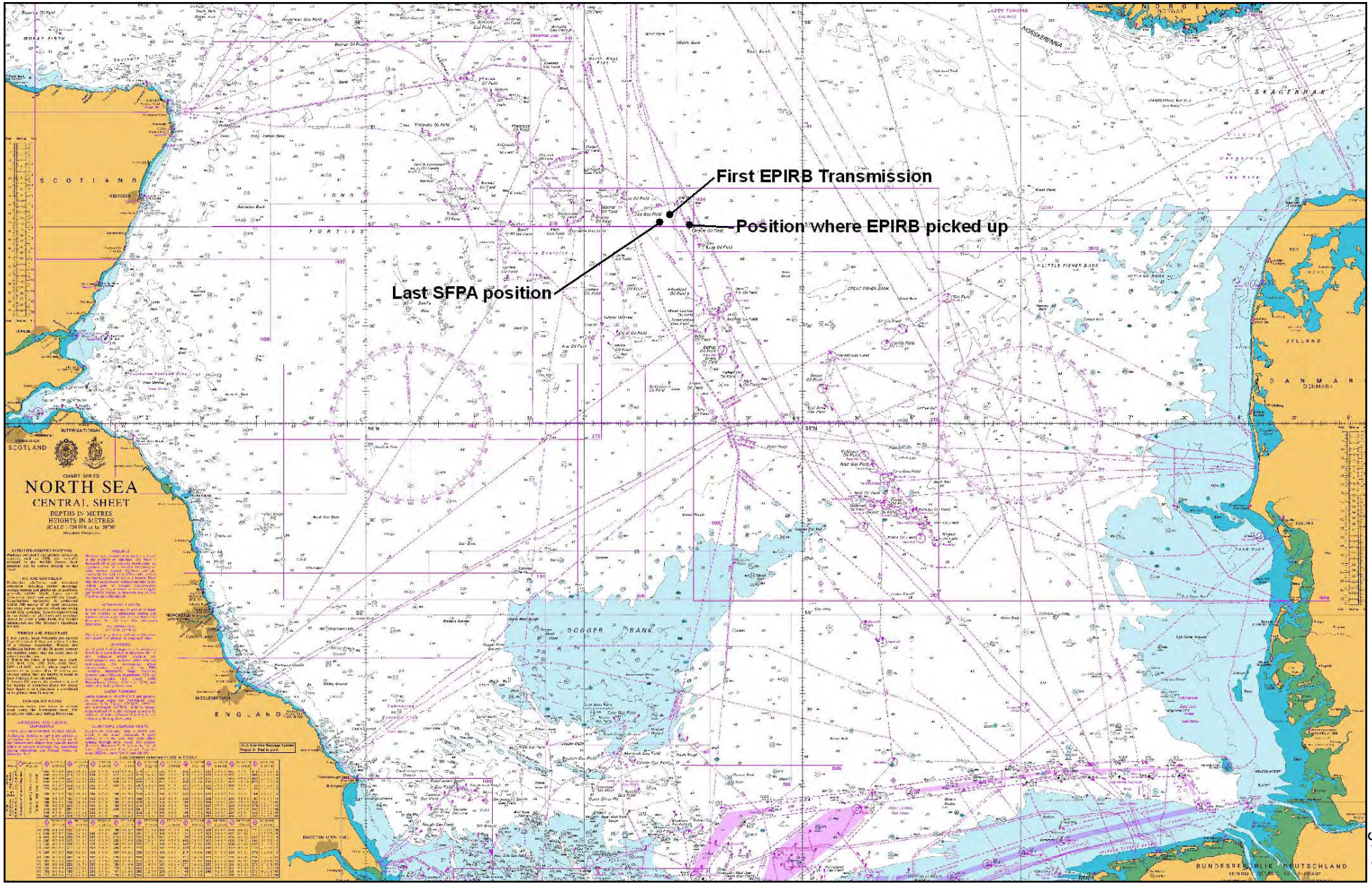
On 11 October 2006, *Meridian* KY147 sailed from her usual port of Aberdeen along with another fishing vessel, *Duthies II* PD97. The two vessels headed due east for the border between the UK and Norwegian sectors of the North Sea **(Figure 2)**.

They, along with a third fishing vessel, *Fruitful Bough* PD109*,* had been contracted by the SFF to carry out a 14 day period of guard duty above a 33km section of seabed pipeline under construction by the Canadian oil company Talisman Energy, as part of the Blane Development Project, which lay almost entirely in the Norwegian sector.

Once on site, *Duthies II* took up position at the southerly end of the NE/SW pipeline (guard vessel 1), while *Meridian* took up the middle section (guard vessel 3). Within a couple of days *Fruitful Bough* arrived and took up her position guarding the northerly section (guard vessel 2) of the pipeline in the vicinity of the Norwegian Ula platform installation **(Figure 3)**.

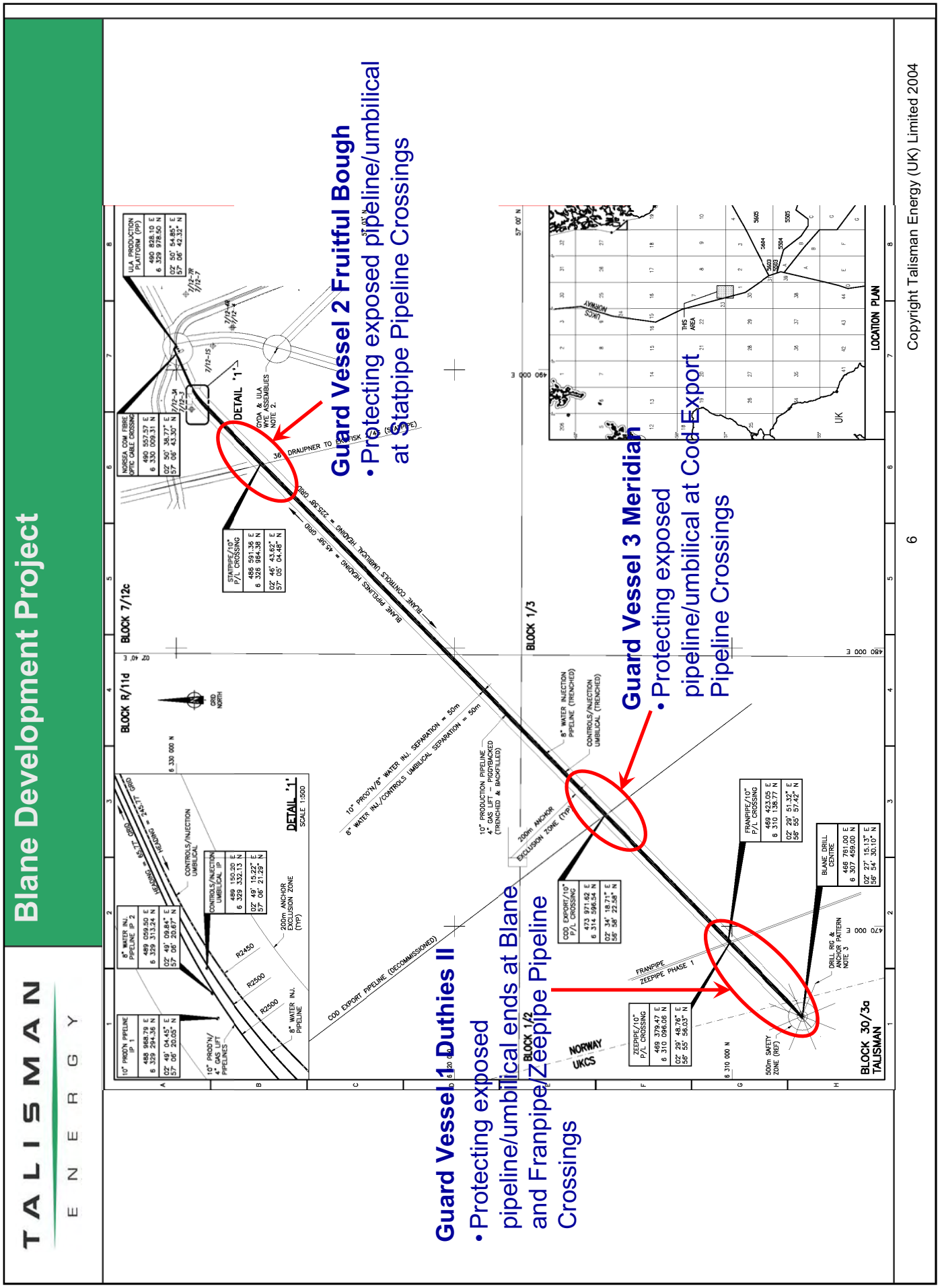
Meridian had sailed from Aberdeen with about 15000 litres of fuel, and she had about 1.2 tons of fresh water on board. No ice or fish boxes were carried.

Reproduced from Admiralty Chart 2182B by permission of
the Controller of HMSO and the UK Hydrographic Office



BA 2182B North Sea

Figure 2



Talisman guard vessel plan

The weather conditions at the beginning of the voyage were benign, and the daily radio reports by the skipper of *Meridian* to SFF indicated no problems with either the vessel or the guard duty.

On 12 October, *Meridian* and *Duthies II* were requested to extend their duty period by 6 days, to be relieved on 31 October. This was not an unusual request and, as the vessels had sufficient stores, it was agreed to.

At 1936 on 26 October, the Scottish Fisheries Protection Agency (SFPA) vessel position reporting system (see Section 1.6.3) received a position from *Meridian* which was close to the Norwegian Ula platform, at the northern end of the Blane Field. The proximity to the Ula platform gave the crew the opportunity to use their mobile telephones. At 1920 Edward Gardner sent a short message service (SMS) text to his wife in which he described the weather conditions as poor.

An hour later, at 2036, the SFPA reporting system received a position of 57º 01' 55"N 002º 43' 48"E, and the information that *Meridian*'s course over the ground (CoG) was 348º and her speed over the ground (SoG) was 0.4kts **(Figure 4)**.

At 2055, Falmouth coastguard received a transmission from a vessel's emergency position indicating radio beacon (EPIRB). A position could not be deduced. A short while later, at 2102, a second transmission was received and which enabled a position of 57º 03' 11"N 002º 45' 66"E to be estimated. This was in the Norwegian sector of the North Sea, 5nm SW of the Ula platform.

The CG confirmed that the EPIRB was registered to *Meridian* and began attempts to contact the vessel. As the position derived from the 2102 UTC transmission was in the vicinity of Ula offshore oil installation, a request was made to the vessels operating in the vicinity of the installation to try contacting and, subsequently to begin searching for *Meridian.*

No other distress signal was seen or heard.

Subsequent EPIRB transmissions were received at 2113 and 2242 which indicated a north-easterly to easterly drift. This was confirmed by trajectory models formed by the coastguard. The decision to scramble the first helicopter was made at 2233.

At 2358, control of the search and rescue (SAR) operation was transferred to the Rescue Coordination Centre (RCC) at Sola, Stavanger.

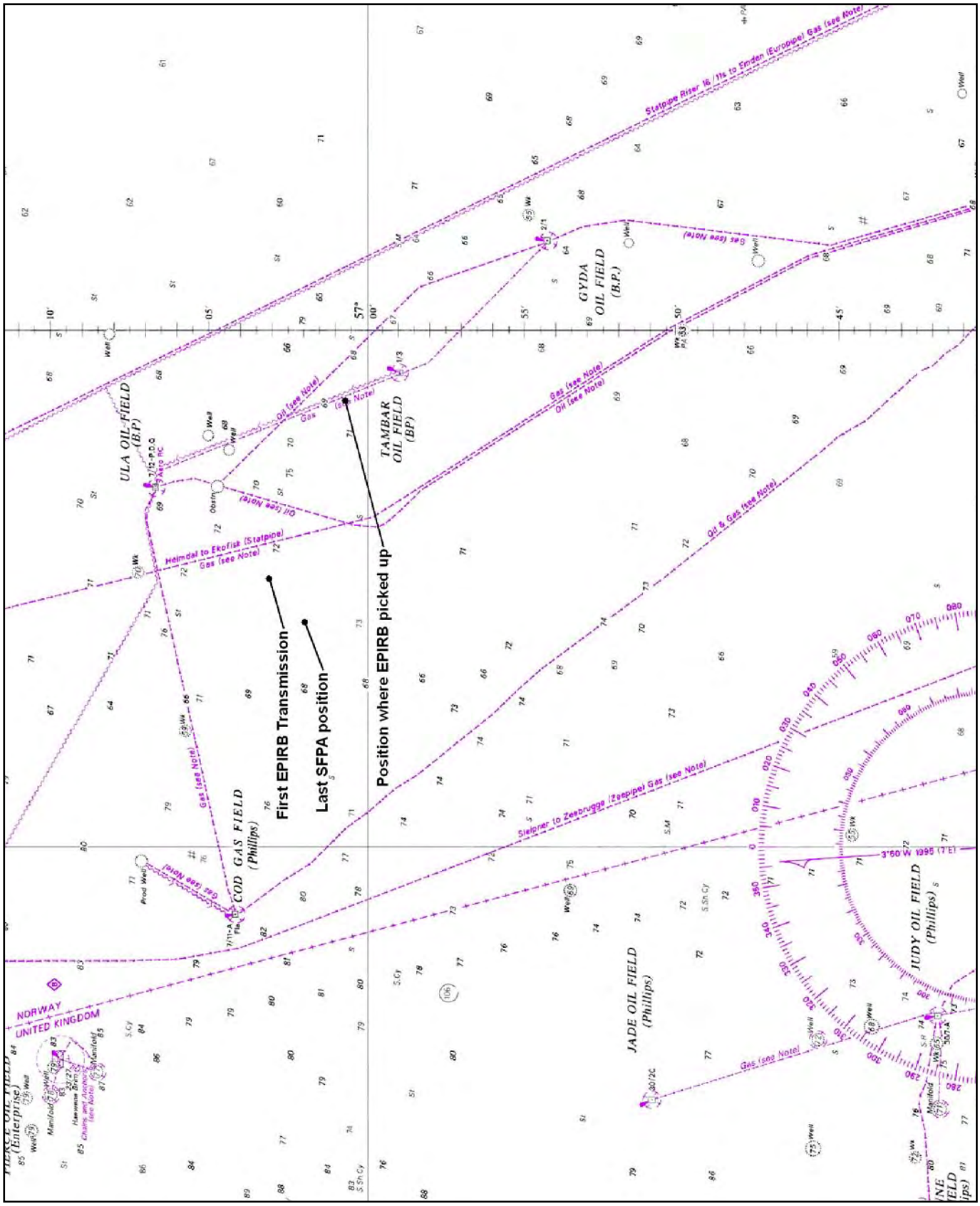
1.4 SEARCH AND RESCUE (SAR)

The first helicopter arrived on scene at 0103.

A large number of search craft, including three UK based Nimrod aircraft, UK and Norwegian helicopters, a Scottish Fishery protection vessel, oil industry vessels and fishing vessels combined to search for *Meridian*.

At 0113 on 27 October, the EPIRB was found in position 57˚ 00.7N 002˚ 56.2E and, at 0135, one of the vessel's liferafts was located by a rescue helicopter a short distance away **(Figure 4)**. The liferaft was inflated and empty, and no rations or safety equipment appeared to have been used.

Figure 4



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At 0840 that day, some pieces of fishing gear, which included a fishing net, buckets and a yellow Wellington boot, were located further to the south-south east.

At 1430 the body of Edward Gardner was located and recovered from position 56º 55N 003º 01E. He was wearing casual clothing and no lifejacket.

The locations of Edward Gardner and the various items of equipment matched the expected drift pattern of the trajectory model and were within the SAR search boxes.

Subsequently, a dinghy or liferaft was seen 93nm south-south east of the search area but, due to the poor weather conditions, the craft could not be retrieved. No markings associating it with *Meridian* were seen because it was upside down, and it has not been reported again.

At midday on 28 October, the search by the Norwegian authorities was suspended.

1.5 ENVIRONMENTAL CONDITIONS

1.5.1 Forecasts

The shipping forecasts issued by the Meteorological Office on behalf of the Maritime and Coastguard Agency (MCA) gave the following information for "Forties" – *Meridian'*s operational area.

Issued at 0015 - 26 October 2006:

Forties, Cromarty, Forth:

"South-easterly veering westerly 6, increasing 7 to severe gale 9, perhaps storm 10 later in Forties and Forth, occasional rain, moderate or good."

Issued at 0505 - 26 October 2006:

Forties, Cromarty, Forth:

"Easterly veering northerly 6, increasing 7 to severe gale 9, perhaps storm 10 later in Forties and Forth, rain then fair, moderate or good."

Issued at 1130 - 26 October 2006:

Forties, Cromarty, Forth, Tyne, Dogger:

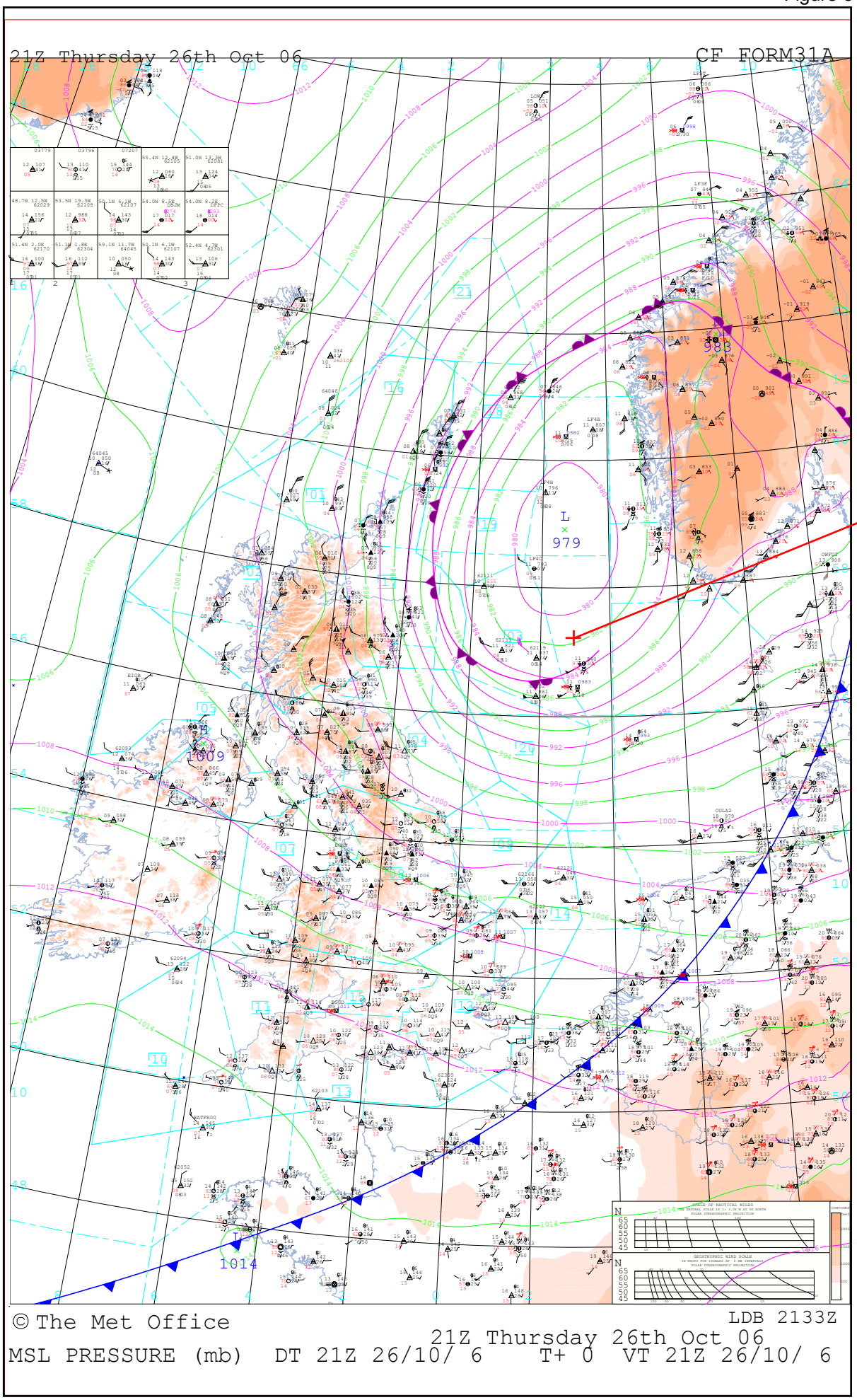
"Cyclonic gale 8 to storm 10, becoming north-west 4 or 5 later, occasional rain, moderate or good."

1.5.2 Recorded data

The Meteorological Office surface analysis charts covering the UK, North Sea and Norway showed a fast moving depression on a NE x E track **(Figure 5)**. Surface wind speed data obtained from the Meteorological Office for the area in which *Meridian* was operating indicated an increase from 10 m/s (Force 5) on the morning of the 26th, peaking at 21.5 m/s (Force 9) at 2100.

The last report that was sent from *Meridian* on the morning of 26 October gave the conditions as: SE force 6-7 and visibility of 4-5 miles **(Figure 6)**.

Figure 5



Met Office chart 2100Z

SFF SERVICES LIMITED

24 RUBISLAW TERRACE – ABERDEEN – AB10 1XE
TELEPHONE: 01224 646966 – FAX: 01224 647078

Client / Project	Talisman: Blane Field Development – Guard Area 3
Today's Date	26 October 2006
Report Number	24

Relief Guard Vessel	**Vessel Name:**	MV "Meridian" KY147
	Skipper:	Martin Gardiner
	Call Sign:	ZKZF
	Mobile No:	07712 431111
	Telex No:	423392210
	Sat Tel No:	00881631417786
(Provisional) Changeover Date/Max Duration Limit		
Guard Locations	56° 58.34'N, 02° 34.22' E – 16" Cod Export Pipeline Crossing	

Activity Report

From 0800 hours Wednesday 25 October to 0800 hours Thursday 26 October 2006
Weather conditions: south east force 6-7, visibility 4-5 miles

At 0720 hours "British Esteem" steaming East on passage, passed 1.5 miles North of guard area, no contact established.
No fishing activity to report in the immediate guard area during the period.

Constant visual/radar watch being maintained at all times.
Guard Vessel issuing regular Security Broadcasts.
Guard Vessel continuing to liaise with the local Standby Vessel and other Guard Vessels

NOTE: Guard vessel changeover on schedule for 2400 hours on Tuesday 31 October 2006. Relief guard vessel will be MV "Adele" BCK36, vessel call sign: ZCYCY, mobile no: 07887756430, telex no: 423516610, sat tel no: 00 88 213 852701. Crew details will be provided in due course.

Incident Report	No incidents to report
Security Messages	Issued regularly at 3 hourly periods and adhoc as necessary
Crew Safety onboard G Vessel	No incidents to report
Safety Observations	No bad practices to report
Date / Time	26 October 2006, 1000 hours

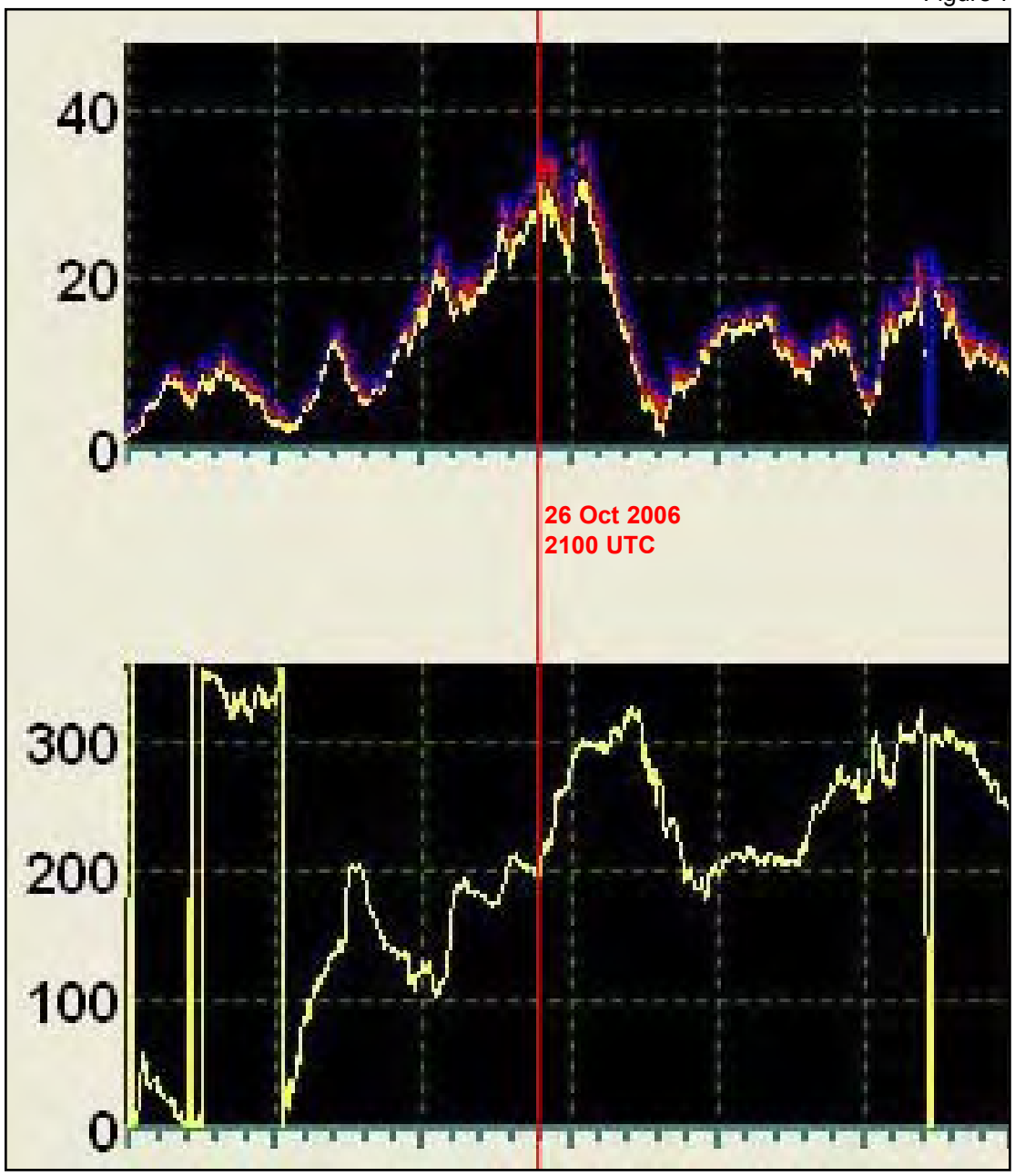
The weather data recorded by the nearby Ula platform (at the height of the platform) showed a continual pressure drop from 1000Mb on 25 October to eventually 974Mb on the evening of the 26th. Wind speeds consequently increased from 12m/s (Force 6) from south-east to peak at a maximum of 36m/s (Force 12) from south-west on the evening of the 26th **(Figure 7)**.

A pipe laying vessel operating in the vicinity of Ula platform gave environmental conditions at 2300 (about 2 hours after the accident) on 26 October as:

Wind:	SW 50 -55 knots (Force 10)
Sea:	SW 4 metre, period: 5 seconds
Swell:	SW 6 metre, period: 7 seconds

On 27 October 2006, at the approximate location of the last EPIRB transmission, sunrise occurred at about 0645 UTC.

Figure 7



ULA platform weather data

1.6 *MERIDIAN*

1.6.1 Crew

The skipper, Martin Gardner, was 49 years old and was also the owner of *Meridian.* He had owned the vessel since 1988 and had worked as a fisherman ever since leaving school in 1976. He was a fully qualified fishing vessel skipper and had also recently gained his GMDSS qualification.

Edward Gardner, no relation to Martin Gardner, was 50 years old and had also worked on board *Meridian* since it had been purchased by Martin Gardner. He had worked as a fisherman for over 35 years.

Ian Donald was 55 years old and was also a long serving crew member on *Meridian* with over 35 years of fishing experience.

Sidney Low was 52 years of age and had worked on board *Meridian* for about 3 years. He had worked as a fisherman since leaving school.

All four crew had attended the mandatory basic sea survival, fire-fighting and first-aid courses.

1.6.2 General arrangement (Figure 8)

Meridian was of mainly steel construction with an aluminium wheelhouse and aluminium open gutting shelter forward of the deckhouse. She was of a three compartment, two watertight bulkhead design. The centre/forward fishhold was bounded fore and aft by the two bulkheads which finished at the weather deck.

Forward of the fish hold there was the forepeak store, which could be entered through a hatch, and below that, the 2130 litre fresh water tank. Above the weather deck there was a forecastle store with access to the main deck via a watertight door on the aft starboard side.

The fish hold was able to carry about 600 fish boxes of 59kg each when full. Access to the hold from the weather deck for the boxes was through a 1.22m x 1.2m hatch which was secured by 8 swivel toggles. Attached to the hatch for crew access was a hatch coaming and a smaller, 0.62m x 0.62m hatch. This was secured with 2 swivel toggles. Below the hold deck there was a bilge which ran the length of the hold and which, at the aft end, led to the bilge well. Within the well a bilge sensor alarm and bilge suction were fitted.

The engine room compartment was aft of the fish hold after bulkhead. A single diesel main engine of 317kW provided the propulsion, and an auxiliary diesel generator provided electrical power. Within the compartment, on the port and starboard sides there were diesel fuel tanks of 8900 litres capacity each. A bilge sensor with an independent “float” alarm was located at the forward end of the compartment. The vessel’s three bilge pumps comprised two 350 litre/minute powered pumps and one 25 litre/minute hand pump.

Also below the weather deck and adjoining the engine compartment there was a crew cabin with sleeping accommodation for all on board.

Above the weather deck there was a deckhouse/wheelhouse and an open gutting shelter. On top of the shelter was a hatch which was opened to allow the fish to fall through for gutting. The shelter was half open, to about waist height from deck, at the forward end, and open full height at the aft end on either side of the deckhouse.

The deckhouse/wheelhouse had several accesses. These included an emergency escape hatch from the engine room in the top of the deckhouse on the starboard side; a cabin escape door on the port aft side of the deckhouse; and an aft facing deckhouse door on the starboard quarter. Internal access was by two stairwells at the starboard aft end of the deckhouse. The forward of the two led down to the cabin, while the aft stairwell led up to the wheelhouse.

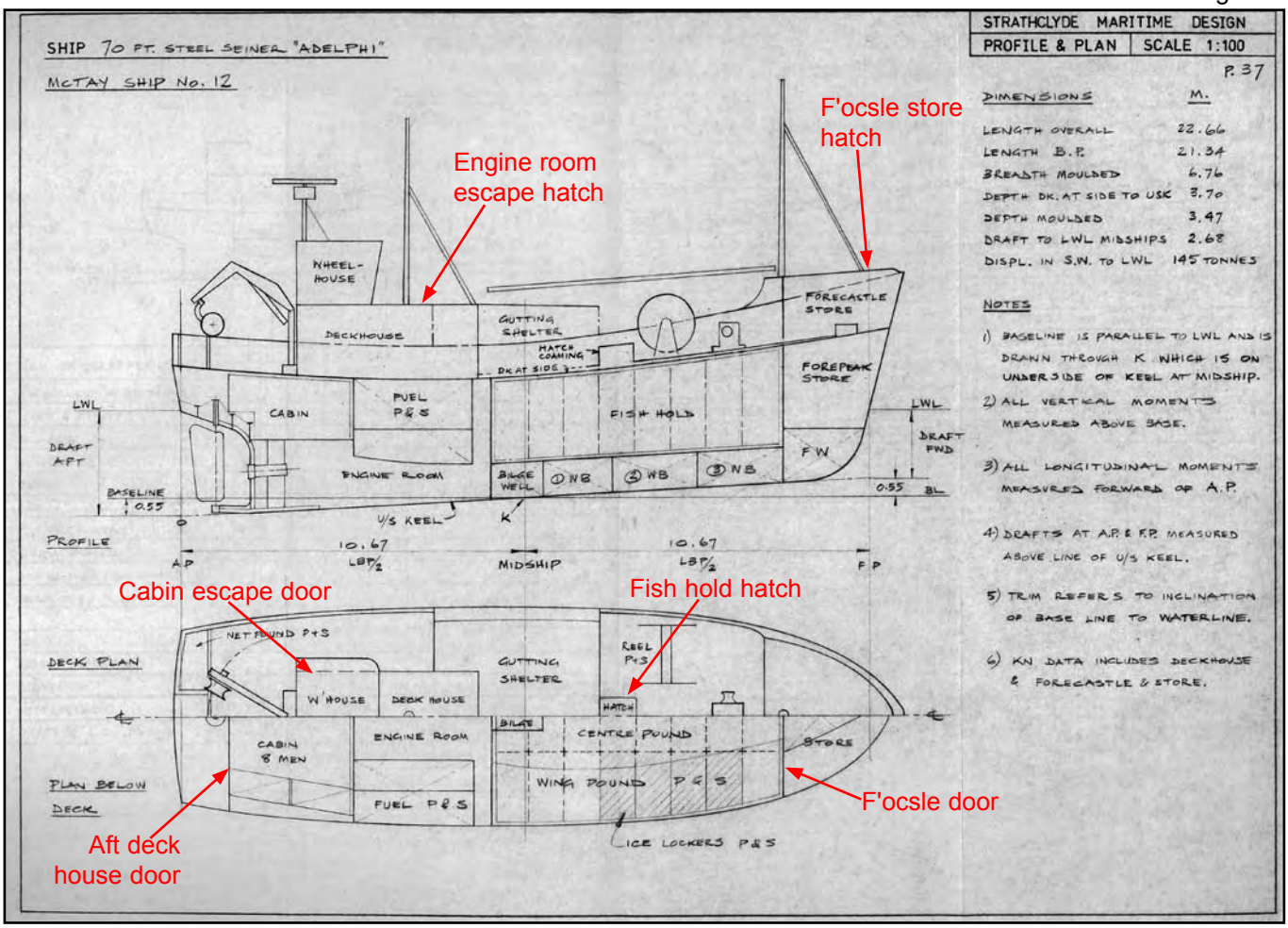
Meridian's freeing port arrangements comprised six each side, with the following dimensions and operating methods:

- Three of 1.05m x 0.42m with swivel flaps
- Two of 0.2m diameter, open
- One of 0.47m x 0.06m, open.

The total freeing port area per side amounted to 1.413m², compared with the statutory requirement of a minimum of 0.8451m².

Six sea inlets and seven discharges passed through the hull side and bottom plating, ranging in diameter from 20mm to 75mm.

Figure 8



Meridian - general arrangement plan

1.6.3 Safety equipment and certification

The vessel's Jotron TRON 40S EPIRB was a Cospas-Sarsat 406Mhz unit, which was located externally on the port forward corner of the wheelhouse. The internal battery had been renewed in June 2006 after an MCA inspection for the vessel's load line exemption certificate. The EPIRB was fitted with an Hydrostatic Release Unit with a renewal date of January 2008.

The bridge was equipped with VHF and MF radio Digital Selective Calling (DSC) installations, and a Navtex receiver. The vessel was also fitted with a satellite terminal capable of sending and receiving phone, fax and telex data.

Like other similar vessels, *Meridian* was equipped to comply with the reporting requirements of the SFPA. The SFPA equipment polled the vessel each hour, triggering data, including the vessel's position, speed over the ground and course over the ground, which was automatically transmitted. The data was used by the SFPA to monitor the movements of fishing vessels. The last data set from *Meridian* was received at 2036 on the evening of the accident.

A fire detection system was fitted, with an alarm unit in the wheelhouse and sensors in the engine room, galley and cabin. The system was last tested in June 2006. A fixed installation CO_2 system protected the engine room space; it had been serviced in April 2004 and the alarm tested in June 2006.

Meridian was also equipped with line throwing equipment; parachute distress flares (expiry May 2009); four Perrybuoy life rings; eleven lifejackets (including five self inflating type), which were stored in the cabin; and two, eight person, liferafts (stowed on top of the gutting shelter). The liferafts' hydrostatic release units were effective until June 2008. Four immersion suits were also carried.

Meridian was issued with her Fishing Vessel Certificate in April 2004 with an expiry date of February 2009.

Meridian had also been issued with her last load line exemption certificate in June 2006; expiry June 2007. Previous exemption certificates had been stamped to reflect annual guard ship survey reports by the Maritime and Coastguard Agency (MCA).

Evidence suggests that *Meridian* was a relatively well-maintained vessel.

1.6.4 Stability

Meridian was actually delivered to her original owners in 1976, so was required to comply with the Fishing Vessels (Safety Provisions) Rules 1975 which were in force at that time. The relevant required stability criteria are given in Appendix 1 of this report.

The stability information booklet (SIB) was approved by the Department of Transport on 28 August 1984 and is based on the result of an inclining test carried out on 12 April 1984 which satisfied the stability criteria.

During the life of the vessel, her stability was verified frequently by way of roll period tests and lightweight checks carried out by MCA fishing surveyors. Some minor alterations to the boat were carried out in 2000, but the lightweight check carried out after these alterations confirmed that there was no significant change to the lightweight. The latest lightweight check was carried out on 14 March 2004 and was found satisfactory. This check also confirmed compliance with the stability criteria contained in the Fishing Vessels (Safety of 15-24 Metre Vessels) Regulations 2002.

An independent assessment of *Meridian*'s stability commissioned by the MAIB, was undertaken by Marine Data International. Its report **(Appendix 1)** concluded that, apart from some minor variations, the values computed for the report are similar to, or exceed the values in the 1984 SIB. The report also highlights the fact that the stability data compiled for the SIB was based only on the underdeck volume of the hull, i.e. volume below the foredeck and main deck as is normal practice **(Appendix 1, Section 4)**. On *Meridian,* however, considerable additional buoyancy was provided by the deckhouse/ wheelhouse in certain circumstances – but only if windows and doors were closed.

The assessment of the likely condition of the vessel at the time of the accident assumes the deckhouse structure to be sealed, therefore the calculations take this extra buoyancy into account.

Although the vessel complied fully with the current regulations, the report highlights the above average high transverse metacentric height (GM) of the vessel, the significance of which is discussed in Section 2.4.

1.6.5 Freeboard

The Fishing Vessels (Safety Provisions) Rules of 1975 only required *Meridian* to have adequate freeboard for all foreseeable operating conditions. However, she was found to satisfy the more stringent minimum freeboard requirements that became mandatory under the Fishing Vessels (Safety of 15-24 Metre Vessels) Regulations which came into force in 2002.

1.7 GUARD SHIP DUTY

1.7.1 SFF Services Limited

SFF Services Ltd, a conglomeration of UK, but primarily Scottish, fishing industry associations provides the link between the fishing industry and the oil industry for, among other areas of mutual interest, guard vessel duty for exposed subsea oil/gas industry structures.

As a prerequisite to a fishing vessel operating as a guard vessel, SFF issues a list of requirements that must be met by the owner of the fishing vessel. These include:

- Membership of an SFF constituent association;
- Current Load Line Exemption Certificate, issued by the MCA;
- Length of Vessel; although there is no fixed minimum size, SFF requires that a vessel is at least 15m LOA for summer duty and at least 22.86m LOA for winter duty. The winter period is effective from 1 October to 31 March;
- Manning requirements should be sufficient for a 14 day tour of duty, and the bridge watchkeepers should have a good knowledge of the fishing industry and be capable of providing clear communications;
- Fully operational communications equipment should be fitted to the vessel to enable it to carry out the assigned duties;
- A fully operational Global Positioning Satellite Navigational System (GPS) should be fitted, and constant radio/radar monitoring should be maintained along with regular security messages being issued;
- Suitable insurance for the duty period.

1.7.2 Blane Development Project

The Blane oilfield straddles the UK and Norwegian oil sectors in the North Sea, approximately 160nm due east of Aberdeen. It is operated and managed by the Canadian oil company Talisman Energy Inc **(Figure 3)**.

Three wellheads in the UK sector are connected to the Norwegian Ula production platform by a combination of production and gas lift pipelines, a water injection pipeline and a control umbilical spanning the 33.1km between the wellheads and the platform. In addition, three existing pipelines (Franpipe/Zeepipe, Cod Export and Statpipe) cross the Blane pipelines within the Norwegian sector.

The water depth along the Blane pipeline averages around 70m and the seabed is typically sandy.

The guard vessel contract for the Blane development required any vessels which were not associated with the development to be kept at least 1 mile from the protection co-ordinates given to each guard vessel.

1.7.3 What *Meridian* was required to do

On arriving at the Blane development, *Meridian* was nominated to act as 'guard vessel 3' **(Figure 3)**. This entailed protecting the exposed pipeline/umbilical at the Cod Export as well as other pipe crossings in the central area of the development project.

It is understood that the crew of four men were operating a 3 hour watch rota. The 3 hours on duty would be spent keeping a visual and radar lookout for shipping transiting the area, and broadcasting security messages every 3 hours, or whenever necessary. It is likely that occasionally a rogue vessel, not heeding advice to give the area a wide berth, would require *Meridian* to try to make direct radio contact or to attract the vessel's attention by some other means.

When on guard duty, it was usual for the vessel to drift with the elements and just use the engines to reposition back to the limit of the area under its responsibility. When the weather deteriorated to an extent that this manoeuvre was not comfortable, the vessel would start 'dodging'. Dodging entails steaming very slowly upwind and, on reaching the limit of the guard area, turning around and steaming downwind with the engine in gear.

As part of her routine, *Meridian* would also remain in touch by radio with the local standby safety vessel and the other guard vessels for that development field, exchanging information on weather or expected encounters with traffic in the area.

*Meridian'*s last daily report to SFF indicated that everything was in order. It also mentioned the proposed changeover schedule, when the fishing vessel *Adele* BCK36 would take over from her on 31 October.

1.8 SEARCH FOR *MERIDIAN*

On 6 November 2006, an underwater search for *Meridian* was commenced by MAIB in partnership with Talisman Energy. *Fugro Mercator*, a specialist underwater survey and inspection vessel fitted with a dual frequency advanced side scan sonar system (SSS), a multibeam echo sounder (MBE), and an inspection class remote operated vehicle (ROV) was tasked with trying to locate *Meridian*.

Fugro Mercator sailed from Aberdeen and reached the search area on 7 November. Based on positional information and drift information provided by the coastguard, a 136km² search box, comprising four search grids S1 to S4 **(Figure 9)** was developed.

S1 and S2 covered the expected locations of the vessel, had she either sunk immediately in the probable area of the 2055 UTC EPIRB transmission, or had drifted for a short time before sinking.

Search boxes S3 and S4 were developed as more detailed drift information became available **(Figure 9)**.

The search was plagued by poor weather conditions from the outset, and on 4 December 2006, with 86km² having been surveyed (equating to 63% of the total planned search area), a decision was taken to stop the search until better weather could be expected in the spring of 2007.

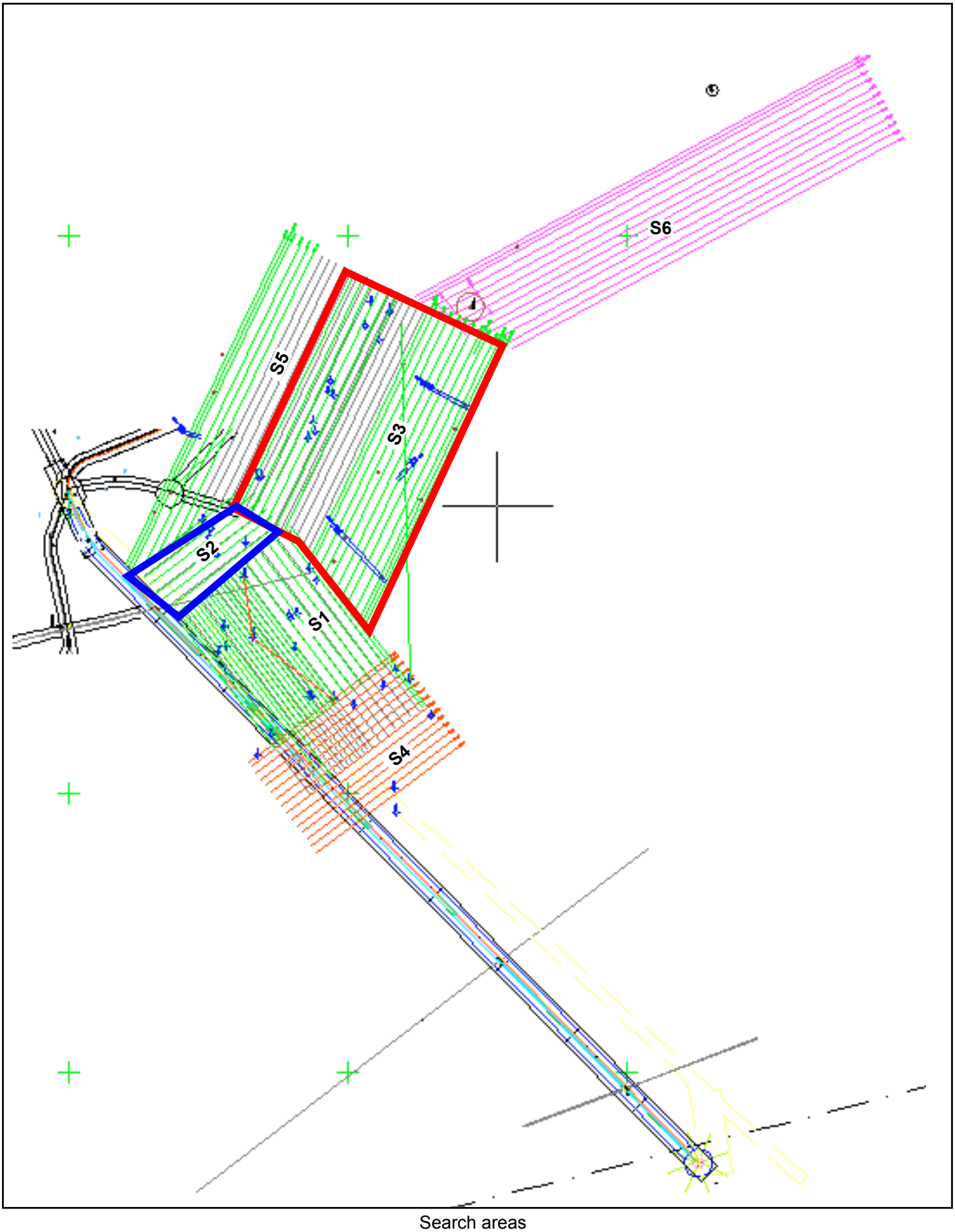
During this break in the search for *Meridian* the MAIB re-evaluated all the information that had been collected from various sources. As a result, two further search areas were identified, S5 and S6 **(Figure 9)**.

The search was resumed on 21 April 2007 using the vessel *Kommandor Iona,* which was equipped with an MBE and SSS. The vessel did not have an ROV, but it was the planned intention to return with a vessel equipped with a ROV to survey any "high confidence contacts" which were identified.

Kommandor Iona arrived on site on 22 April 2007 and commenced searching the remaining areas using the MBE in the first instance and then the SSS to closely inspect any contacts. Although some contacts were discovered, they were subsequently all discounted by this method.

On 24 April 2007, having by then searched a total area of about 206km², the search for *Meridian* was called off. The search team had exhausted all logical possibilities of where the search for *Meridian* could be extended. The MAIB was very grateful for the assistance it received throughout the whole operation by a representative of the families, who contributed invaluable specialist knowledge and expertise about *Meridian*.

Everyone involved was extremely frustrated and disappointed in not finding the vessel. However, bearing in mind the technology that had been used, they were confident that she was not lying in the area searched.



Search areas

SECTION 2 - ANALYSIS

2.1 AIM

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

2.2 FATIGUE

Guard duty work is generally considered relaxing by comparison to the rigorous working hours and physical demands often undertaken during normal fishing operations.

The environmental conditions for most of the duty period since leaving Aberdeen had been good; it is likely that the crew were therefore well rested.

Additionally, with four crew on board working a 3 hour watch pattern, it is considered unlikely that fatigue played a part in the events leading to the loss of *Meridian.*

2.3 *MERIDIAN*'S ESTIMATED STABILITY CONDITION

The investigation considered the stability of *Meridian* in her estimated condition while she was engaged in guard ship duties.

It is known that the vessel left Aberdeen on 11 October carrying an almost full tank of fuel, and water and rations to last for the next 14 days. Although the exact consumption is not known, it is estimated that, at the time of the accident, the vessel had probably used about 50% of her fuel and water. It is also known that she sailed without her usual load of block ice in the fish hold and that, when carrying out guard ship duties, the vessel would keep her ballast tanks pressed up.

As there was no similar condition included in the SIB, MAIB employed a consultant to determine the vessel's stability in this estimated condition. The data computed for this condition confirmed that even after taking into account maximum free surface moments, the vessel had a good level of intact stability with all measured characteristics in excess of the minimum requirements **(Appendix 2 of the Stability Report)**.

2.4 FACTORS AFFECTING POSSIBLE LOSS SCENARIOS

As *Meridian* was not found and there were no survivors, the MAIB has used other evidence and testimony to piece together what might have happened to her.

In forming the most likely loss scenario a number of factors have been considered. These are discussed below:

2.4.1 The structural condition of the vessel

Meridian held a valid Fishing Vessel Certificate, issued in 2004. She was also examined by the MCA in June 2006 for the purpose of being issued with a load line exemption certificate. A few minor deficiencies were noted at that time, which were later rectified, and she was issued with a new certificate.

Past MCA survey reports and inspections do not highlight any major problems. Testimony obtained from the regular mate of the vessel indicates that *Meridian* was well cared for by the owner and well maintained by the crew.

2.4.2 The fact that no wreckage was found

Apart from the EPIRB, liferaft and a lifebuoy, no wreckage or oil slick was sighted by the search and rescue units. Weather conditions improved overnight, and they provided the air and surface search units good conditions the following day.

This factor leads to the probability that *Meridian* suffered a catastrophic event such as a capsize, and that she sank without breaking up on the surface, certainly before daylight, but probably before the air search teams arrived on site.

The above hypothesis is supported by the fact that the only body that has been found is that of Edward Gardner. It is possible that he was on watch at the time of the accident and that, for this reason, he might have been the only one who would be able to escape from the vessel. Additionally, the fact that he was not wearing a lifejacket suggests that the accident happened rapidly, and he probably did not have the time to collect and don one.

2.4.3 The possibility of collision

The investigation analysed the radar data recorded by nearby Ula and Gdya oil platforms but could not locate any transiting vessels around *Meridian'*s last known position. This, and the lack of wreckage, allowed the possibility that she had had a collision with a large vessel to be discounted.

2.4.4 *Meridian*'s unusual stability characteristics

Meridian easily complied with minimum stability requirements. However, the stability report highlights two unusual points: the very high GM and the potential additional buoyancy provided by the volume of the wheelhouse and deckhouse **(Appendix 1, Section 4)**.

The effect of an unusually high GM was for the vessel's motion to be "stiff" in a seaway and to roll in bad weather with a violent motion. In certain circumstances, particularly if the vessel was rolling synchronously (see paragraph 2.4.5 below), this might have caused more water than usual to collect on deck.

The consequence of the additional buoyancy on this vessel was to resist capsizing forces and assist her to remain on her side rather than fully inverting in certain circumstances. The positive effect of the buoyancy is, of course, dependent on the spaces remaining intact and watertight **(Appendix 1, Section 10)**.

2.4.5 Synchronous rolling

Synchronous rolling is a dangerous and undesirable condition which can occur when the natural period of roll of a vessel is equal, or nearly equal, to the period of the waves. Each successive wave tends to increase the angle of roll for the vessel, bringing the danger that she exceeds the angle where, instead of righting levers, capsizing moments are produced.

In the case of *Meridian,* the roll period in her estimated condition was calculated to be about 5.5 seconds. This is very close to the period of the waves (5 sec) at the time of the accident, which was recorded by a nearby pipe laying vessel (Section 1.5).

Synchronous rolling has therefore been considered as a possible factor in the events which led to the loss of *Meridian.*

2.4.6 The lack of a distress signal

At the time of the accident, the significant wave height was estimated to be about 4-5 metres, with the possibility of a maximum wave height of up to 8-9 metres. It is possible that a large wave could have come over *Meridian*'s bow and damaged all her communications antennae. This would explain why no distress signal was sent using her main radio station.

However, the vessel was still equipped with pyrotechnics, and she was probably within range of the mobile phone booster station located on the Ula oil platform, and therefore able to send out a message. The vessel was also equipped with a hand-held VHF radio, and it is known that apart from *Duthies II* and *Fruitful Bough*, there were other vessels in the vicinity which would have probably picked up even a weak radio signal.

The lack of any distress signal is further indication of an unexpected and rapid catastrophic accident.

2.4.7 Engine failure

Although evidence indicates that the vessel was well maintained, it still would have been possible for the engine to have stalled in heavy weather or failed due to mechanical failure. This might have resulted in her lying beam-on to the seas, making her more vulnerable to heavy rolling and taking seas on deck. The engine might have stalled if sediment in the fuel tanks got stirred up with the severe motion and then choked the filters.

Although possible, this is considered unlikely to have been the principal cause of the accident because if the engine had stalled, it should have been possible to quickly remedy the situation by switching the fuel system to the standby set of fuel filters. In the event that the engine could not be restarted, the crew might then still have had time to send out a distress signal and prepare to abandon to the liferaft, if necessary.

2.4.8 Weathertight integrity of the vessel

Meridian had a very good range of intact stability, but this could be seriously affected by downflooding through an open vent or weathertight door.

Evidence suggests that the crew were conscientious seamen and were aware of the dangers of not keeping the vessel weathertight, especially in bad weather. However, anecdotal evidence indicates that the forecastle door was often left open to help ventilate the forecastle store. This possibility is discussed and analysed in the following sub section on flooding.

If the main door to the entrance into the deckhouse had been left open, or had been opened during the emergency, when crew had tried to escape from the vessel for instance, sufficient downflooding could have occurred to capsize her.

It is thought very unlikely that this door was left open because poor weather was forecast, and anecdotal evidence indicates that it was normally kept closed at sea. However, the chance that it was opened during the emergency cannot be discounted.

Some vents would have been left open, like the ones for the engine room, but these vents were small and were not large enough to allow major downflooding.

2.4.9 Insipient Flooding

Insipient flooding of a major compartment, the engine room or fish room for instance, has caused the sudden and unexpected capsize of a number of fishing vessels in the past. In these cases, flooding normally occurred through hull fittings or through faulty salt water pipework.

Meridian was known to be well maintained and, in particular, attention was generally paid to regular testing of the bilge alarms fitted in the vessel's fish room and engine room spaces. Insipient flooding is therefore considered an unlikely principal cause of the vessel's loss. However, the effect of flooding on the stability of the vessel has been explored as detailed below:

The possibility that the forecastle store weathertight door might have been left open, leading to flooding in the forecastle space, was considered **(Appendix 1, Section 9)**. However, the calculations confirmed that, if this space was flooded, the vessel would still have had adequate reserve stability. Although this flooding could have contributed to the accident, it would not have been severe enough to put the vessel in such a condition that her crew were not able to send out a distress signal.

The investigation also considered flooding of the engine room due to a failed skin fitting, leaking salt water pipe or an open hatch door. Calculations which assumed the introduction of 9.6 tonnes of water revealed that, although the flooding was severe, the vessel still complied with the minimum intact stability requirements **(Appendix 1, Section 9)**. The fact that the bilge alarm was tested regularly indicates that it would have raised an early alarm, and even if such an event had taken place, the crew should still have had time to send out a distress signal, launch the liferafts and abandon the vessel.

The investigation also explored the possibility that significant flooding had taken place in the fish hold. Assuming an arbitrary ingress of 40 tonnes, calculations confirmed that, although the vessel no longer complied with the minimum intact stability requirements, she would still have had a good reserve of stability. This should have given her crew enough time to raise the alarm once the flooding had been detected.

2.4.10 Capsize due to weight of water on deck

The design of the gutting shelter provides the possibility that a large amount of water could get momentarily trapped on deck, causing the vessel to capsize.

This scenario is based on the presupposition of a large wave breaking from the stern quarter and becoming trapped under the gutting shelter between it and the bulwarks **(Appendix 1, Section 9)**. Calculations based on an arbitrary quantity of 19 tonnes trapped in the shelter indicate that this scenario would have led to the capsize of the vessel.

However, it is thought unlikely that this was the sole cause of the accident because the water would have started to drain immediately over the bulwark and through the freeing ports as the vessel heeled over in response to the weight on deck. It is likely, however, that the volume of water trapped on deck was a contributory factor in the loss of *Meridian*.

2.4.11 Damage to the wheelhouse windows

It is not unusual for vessels to suffer heavy weather damage which results in bridge windows being damaged. Although MAIB records indicate only 34 reported cases of damaged bridge windows due to heavy weather, it is considered that the actual figure may be higher because many incidents of this nature are not reported.

Broken bridge windows could result in the bridge being flooded, with the resultant loss of all navigation and communications equipment. In extreme cases, where waves continue to break over the vessel, a considerable amount of water could enter the deck housing and severely compromise her stability.

Although it is possible that loss of the wheelhouse windows, with consequential flooding of the deckhouse, could have contributed to the loss of *Meridian*, it is unlikely that such an event, in isolation, would have led to a rapid and catastrophic loss of stability. If flooding of the deckhouse through the bridge window had occurred, the crew should have had sufficient time to raise the alarm and/or abandon the vessel before she was lost.

2.5 THE MOST LIKELY LOSS SCENARIO

Although it is not possible to conclude with certainty what happened to *Meridian*, this section attempts to present what MAIB believe to be the most likely scenario, based on known facts, evidence obtained during the investigation, and experience gleaned from other MAIB investigations.

The fact that *Meridian* had good stability characteristics and in particular, an unusually large range of stability, suggests that the vessel should not have been vulnerable to the weather and sea conditions prevailing at the time of the accident. But this was not the case. A single factor should not have caused the vessel's demise, however a combination of events and factors could have led to a sudden and catastrophic loss of stability.

The weather had deteriorated significantly during the afternoon and early evening of 26 October. At the time of the accident, the weather was severe and *Meridian* was probably 'dodging', that is, manoeuvring at slow speed. From the positional information obtained from the SFPA's reporting system, it appears likely that she had reached the limit of her patrol area and could therefore have been attempting to turn around.

In attempting to turn around to the weather, she would have found herself beam on to the seas, and as a consequence might have experienced synchronous rolling. It is possible that the engine stalled at this time. With each roll angle getting larger, seas would have begun to break over her and deposit water on her deck, with some force. Such water, even if trapped on deck only momentarily, would have created a capsizing moment on the vessel. As she lay heeled over, possibly on her side, one of the major openings in the hull might have given way to the weather. This could have been bridge windows, a watertight door or hatch, or a weak part of the structure, which allowed a large volume of water to rapidly flood the vessel and destroy her residual stability. She would then have capsized, possibly inverting, and foundered soon afterwards.

2.6 SHOULD *MERIDIAN* HAVE SOUGHT SHELTER?

Although *Meridian* was contractually bound to keep her station, her skipper was at liberty to seek shelter if stress of the weather caused him concern for the safety of the vessel or its crew.

SFF, who are, in effect, the charterers of the guard vessels, issue each vessel with a set of operational procedures which cover, among other things, inclement weather. The procedures leave the decision with the skipper to decide if the vessel should leave its station, with the proviso that the skipper keeps SFF informed. Where seeking shelter from stress of weather is justified, guard vessels remain on hire for this period of time off station.

The 24 hours shipping forecast which was issued by the Met office at 1130 on 26 October 2006, on behalf of the MCA, gave the forecast for the 'Forties', the area in which *Meridian* was operating, as "cyclonic gale 8 to storm 10….." This weather was attributed to a fast moving depression of 977Mb, which was predicted to be clear of the area in the next 24 hours. Earlier forecasts had indicated only the possibility of storm force winds in the area.

Bearing in mind the speed of the vessel, for *Meridian* to have decided to seek shelter, her skipper would have needed a very strong indication of severe conditions at least 36 hours before their onset, and preferably even earlier.

Accounts from the other guard vessels and the survey vessel associated with the Blane Development indicate that, although the weather had deteriorated during the afternoon of 26 October, they had no cause for particular concern at that time.

Evidence obtained from SFF also reinforces this general appraisal of the weather because, out of 29 vessels on guard duty in various locations, only 4 opted to seek shelter that day.

Given the absence of any real financial penalty if the vessel was taken off station, *Meridian*'s skipper probably would have had no hesitation in seeking shelter if he had considered it necessary. As the earlier forecasts available to the skipper did not give a definite warning of very severe conditions, his decision to remain on station is understandable.

2.7 SIMILAR ACCIDENTS

Since 1991, a large number of accidents have been reported to the MAIB concerning fishing vessels that have suffered some form of flooding or capsizing. Of these accidents, 106 have resulted in fishing vessels of length between 15 – 24 metres being lost due to capsizing, listing, foundering or flooding.

One particular accident, which is similar to the loss of *Meridian*, happened on 12 December 1990, when the 22.5 metre fishing vessel *Premier* capsized and sank with the loss of 6 lives. An EPIRB alert triggered a full scale search and rescue operation which resulted in the capsized hull being found. However, it sank a few hours later.

The MAIB investigation into the loss of *Premier* found her to be well maintained, with sufficient freeing port arrangements. The previous survey reports also showed the vessel to comply with the required stability criteria; she was thus considered to be a good sea boat. The vessel was fitted with a similar half shelter to that of *Meridian.*

The weather was known to be severe, and a series of stability calculations confirmed that if the vessel had taken a large quantity of water over her foredeck, between the whaleback and the half-shelter, she would have become unstable and capsized.

The findings of the investigation were that the loss of crew members' lives was as a direct result of the vessel foundering, and that her foundering was a direct result of severe weather conditions. It was considered by the MAIB that she became overwhelmed by the sea during a storm and capsized.

Although the loss of *Premier* bears some similarities to the loss of *Meridian, Meridian* appears to have had much better initial stability than *Premier.*

As a result of the accident to *Premier*, the MAIB (report on www.maib.gov.uk) made recommendations to the Department of Transport concerning freeing port areas and half-shelters, and in particular that, in the long term, consideration should be given to the fitting of full shelters rather than half-shelters.

SECTION 3 - CONCLUSIONS

3.1 SAFETY ISSUES THAT HAVE GIVEN RISE TO ACTION

1. As well as having a great beneficial impact on her overall stability, *Meridian*'s unusually large GM had the following detrimental effects:
   - In certain circumstances it made her motion "stiff", and the consequent resistance to the forces induced by the sea made her vulnerable to take more than normal amounts of water on deck;
   - It shortened her natural roll period so that it became very close to the period of the sea waves and made her vulnerable to synchronous rolling.

   [2.4.4; 2.4.5] [Recommendations; Flyer]

2. It is likely that the catastrophic chain of events which led to the loss of *Meridian* included a large amount of sea water being trapped momentarily on deck between the vessel's half-shelter and her bulwarks.

   [2.4.10] [Recommendations; Flyer]

3. In her intact condition, *Meridian* was almost unsinkable. For her to have foundered she must have suffered downflooding through an open door or hatchway, or because of the failure of one or more parts of her structure.

   [2.4.8; 2.4.9; 2.5] [Recommendations; Flyer]

4. It appears certain that the crew had no time to retrieve lifejackets, launch and embark a liferaft or send any form of distress signal.

   [2.4.2; 2.4.6] [Recommendations; Flyer]

5. The skipper and crew of *Meridian* needed to have the best possible early warnings of approaching severe weather in order to decide whether to seek shelter. Because of the location of their work area, they needed this information at least 36 hours in advance. The 24 hours Met Office Shipping Forecasts were therefore insufficient.

   [2.6]; [Recommendations; Flyer]

SECTION 4 - ACTION TO BE TAKEN

The MAIB will publish and distribute a 2-page flyer to fishermen. The flyer highlights the lessons to be learned from this tragic accident which led to the loss of four lives. It reminds fishermen, or other people operating small craft, of some particular dangers they may encounter while operating in heavy weather conditions and the precautions that they should take.

SECTION 5 - RECOMMENDATIONS

2007/175 **SFF Services Limited** is recommended to:

- Include the safety lessons of this accident in all pre-departure briefings to skippers who are about to take up guard ship duties.

- Require companies, who contract the services of guard vessels through SFF Services Ltd, to provide long range warning of severe weather directly to those vessels in time to assist the skipper in any decision to seek shelter.

Marine Accident Investigation Branch
September 2007