Marine safety investigation report

GROUNDING OF THE OCEANOGRAPHIC VESSEL *MARION DUFRESNE* ON 14 NOVEMBER 2012 IN THE WESTERN APPROACHES OF ÎLE DE LA POSSESSION (CROZET ARCHIPELAGO)

Bureau d'enquêtes sur les évènements de mer

Report published on : November 2013

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MARION DUFRESNE

ON 14 NOVEMBER 2012
IN THE WESTERN APPROACHES
OF ÎLE DE LA POSSESSION

(CROZET ARCHIPELAGO)

Warning

This report has been drawn up according to the provisions of Transportation Code, specially clauses L1621-1 to L1622-2 and to the decree of enforcement No 2004-85 passed on 26th January 2004 modified relating to technical investigations after marine casualties and terrestrial accidents or incidents and in compliance with the « Code for the Investigation of Marine Casualties and Accidents » laid out in Resolution MSC 255 (84) adopted by the International Maritime Organization (IMO) on 16 May 2008.

It sets out the conclusions reached by the investigators of the *BEA*mer on the circumstances and causes of the accident under investigation.

In compliance with the above mentioned provisions, the analysis of this incident has not been carried out in order to determine or apportion criminal responsibility nor to assess individual or collective liability. **Its sole purpose is to identify relevant safety issues and thereby prevent similar accidents in the future**. The use of this report for other purposes could therefore lead to erroneous interpretations.

For your information, the official version of the report is written in French language. The translation in English language is proposed to facilitate the reading of this report to those who are not French speakers.

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APPENDIXES

Abbreviations and technical terms glossary

***BEA*mer**	:	*Bureau d'enquêtes sur les évènements de mer* - MAIB French counterpart
BV	:	Bureau Veritas
CMA CGM	:	*Compagnie Maritime d'Affrètement - Compagnie Générale Maritime* French shipping company
CD	:	Compact Disk
CSN	:	*Centre de Sécurité des Navires* – Ships Inspection centre
DP	:	Dynamic Positioning
DZ	:	Helicopter platform deck
ECDIS	:	Electronic Chart Display Information System
ECS	:	Electronic Chart System
ENC	:	Electronic Navigation Chart
FO	:	Fuel Oil (used also, followed by a figure, to identify a ballast tank, ex: FO 2)
FR	:	Frame
FW	:	Fresh Water (used also, followed by a figure, to identify a ballast tank, ex: FW 1)
GIE MD II	:	*Groupement d'Intérêt Economique Marion Dufresne II* – Financial structure
GIS	:	Geographic Information System
GO	:	Gas Oil (used also, followed by a figure, to identify a ballast tank, ex: GO 4)
GPS	:	Global Positioning System
IHO	:	International Hydrographic Organization
IPEV	:	*Institut polaire français Paul-Émile Victor* – French polar institute
MGO	:	Medium Gas Oil
MRCC	:	Maritime Rescue Coordination Centre
NH	:	*Niveau Haut* – High Level
OPEA	:	Person in charge of Operations and Austral Expeditions (on board *MARION DUFRESNE*, he represents the charterer and the subcharterer, in the present case, he represents the TAAF)
OOW	:	Officer Of the Watch

Portière : kind of raft, towed by a tender, used to land equipment from *MARION DUFRESNE* at anchor to TAAF bases

SHOM : *Service Hydrographique et Océanographique de la Marine*
UKHO French counterpart.

SITREP : SITuation REPort

SSE : Safety - Security - Environment (formerly SDS)

SW : Sea Water (used also, followed by a figure, to identify a ballast tank, ex: SW 2)

TAAF : *Terres Australes et Antarctiques Françaises*
French Southern and Antarctic Territories, also short for TAAF Administration

TC : Time Chart

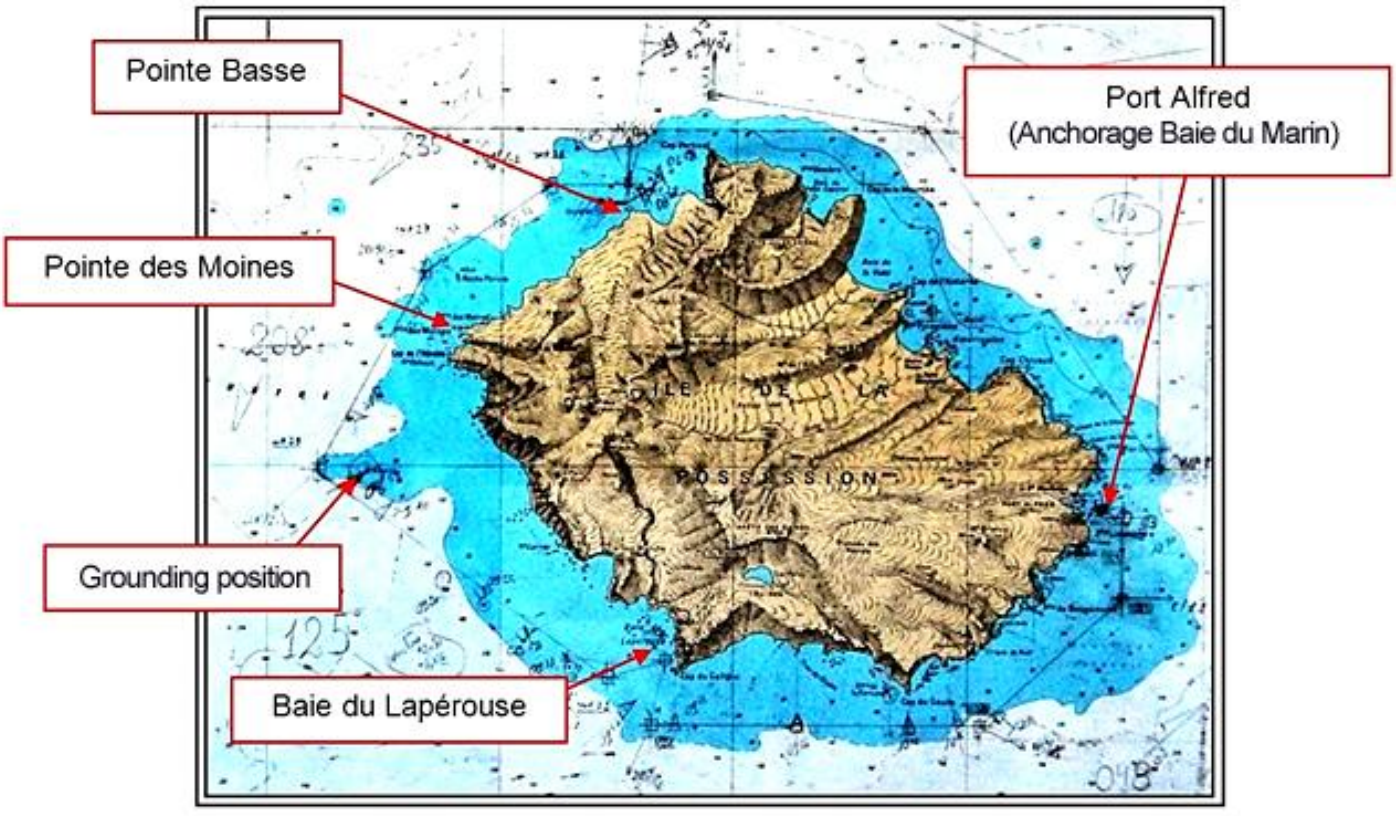
UTC : Universal Time Coordinated

VDR : Voyage Data Recorder

VHF : Very High Frequency

WGS : World Geodetic System

WP : Waypoint



1 CIRCUMSTANCES

As part of her third mission of the year for the TAAF, *MARION DUFRESNE*, who sailed on 7 November 2012 from La Réunion with 97 passengers and 48 crew members on board, arrived during the 13 November night in sight of Île de La Possession, in Crozet Archipelago.

She cast anchor at 0.45 mile in the North of Pointe Basse at 5.50 am. The unloading of the equipment for the scientists' shelter had been achieved around 8.00 am.

The vessel sailed bound to another shelter in front of which she would cast anchor for a similar operation. Baie du Lapérouse, located in the south-west of the Island, is a dozen miles away. The course shaped was rounding the western end of the Island. A helmsman was steering.

At 8.44 am, in the west of Pointe des Moines, the master handed over the manoeuvre to the OOW. A few minutes later, when the vessel was closing the waypoint between the 208° and 125° courses plotted on the chart (WP28), the OOW began to alter course. Considering it to be too early, the master took over the manoeuvre back and ordered to set the helm midships then a few moments later, hard-a-starboard. An impact was then felt the vessel took on a starboard list. The speed of the vessel suddenly decreased from 11 to 6 knots. The master reduced speed to slow ahead.

He requested to close the watertight doors and to activate immediately the damage control procedures.

Soon before 9.00 am, several compartments were reported (remote water level sensors and alarm control panel) flooded by seawater, the vessel was normally floating and making her way slowly ahead.

The master decided to proceed to his final destination, the *Baie du Marin*, located at the eastern end of the Island opposite to Port Alfred, where is the main research station of *Crozet* archipelago, well protected from the westerly swell. He cast anchor there around 11.00 am.

Until 17 November, all the passengers and the half of the crew members had been taken ashore on the Island, in very rough weather conditions due to a succession of strong low pressures.

On 23 November, the French cable vessel *LÉON THÉVENIN,* chartered for assistance, arrived off Baie du Marin and sent divers ashore. On 24 November, they carried on investigations of the hull which led BV to give, on the same day, its agreement for a single voyage. A provisional navigation license had been issued for the voyage to South Africa by the vessel safety centre of La Réunion in the early evening. *MARION DUFRESNE* sailed immediately, escorted by the tug *CORAL SEA FOS* sent in the area.

On 3 December, around 5.00 am, the vessel arrived on roads at Durban.

After some controls (particularly for pollution risks) by the harbour authorities, she was allowed to enter the port where she came alongside in the early afternoon. The technical stop had lasted almost two months.

2 BACKGROUND

MARION DUFRESNE is owned by GIE MD II (99% TAAF and 1% CMA).

The vessel is bare boat chartered by CMA CGM, which ensures the technical management and equipment of the ship. The ship management is entrusted to CMA Ships, a CMA CGM subsidiary.

TAAF charters the vessel under a twenty year time charter contract until 2015.

The Institut Polaire Français Paul Émile Victor (IPEV) charters the vessel to TAAF 217 days per year for oceanographic surveys in all the oceans, off-ice.

All the passengers are managed by the TAAF during logistical voyages towards Austral Islands and aboard under the master's responsibility.

The charterer (TAAF) is represented aboard by the person in charge of Operations and Austral Expeditions (OPAE). He supervises all the persons aboard who are not part of the crew: scientists, persons on mission, in transit, or passengers.

After *GALLIENI* then the first *MARION DUFRESNE*, her predecessors, the second *MARION DUFRESNE,* has been designed for the transportation of personnel and equipment to the territories (TAAF public service mission, 120 days per year) and, in addition, to participate in various oceanographic surveys (IPEV). She has been specially built in 1995 to perform this multi-purpose task. Notice particularly, that the subdivision of the double bottoms and the bilge pumping system had been specially designed to ensure the vessel's buoyancy, taking into account the operation areas, unsurveyed or poorly surveyed, and submitted to inclement weather conditions.

Studies are on-going to prepare a major technical stop in order to extend her career for fifteen years.

The mission (OP3-2012) in which the vessel was involved at the time of the accident was a TAAF mission, one of the four undertaken each year by the TAAF in *Crozet* Archipelago, in March, August, November and December. In the TAAF area, the chart coverage and the navigational documents are based on a limited knowledge of the local hydrography.

3 VESSEL

MARION DUFRESNE has two main missions: the logistic support of the French Austral Island stations (Crozet, Kerguelen, Amsterdam, Saint-Paul) as well as those in Îles Éparses (Glorieuses, Juan de Nova, Bassas da India, Europa, Tromelin) and the scientific research and the ocean surveys.

Main characteristics:

- IMO registration number : 9050814;
- Registration number : RI 829498 D;
- Call sign : FNIN;
- MMSI number : 227235000;
- Length overall : 120.60 m;

- Length between perpendiculars : 107.60 m;
- Breadth overall : 20.60 m;
- Maximum draft : 6.95 m;
- Main engine power : 6 000 kW (2 x 3,000 kW diesel-electric);
- 2 propellers;
- 2 Becker flap-rudders;
- Dynamic positioning system;
- Service speed : 14 knots;
- Tonnage (London) : 9403 UMS;
- Deadweight capacity : 4871 MT;
- Bow thruster : 1 x 736 kW;
- Hull scantling : steel 13 mm.

The keel had been laid on 23 August 1993 at the Société Nouvelle des Ateliers et Chantiers du Havre shipyard. She had been delivered on 9 May 1995.

MARION DUFRESNE is a multi-purpose oceanographical survey vessel fitted for navigation in the first category:

- Passenger vessel. She is designed for a maximum complement of 50 crew members and to accommodate a maximum of 160 persons on board. A total of 114 passengers and scientists can be aboard.
- Cargo vessel - 108 20ft-containers in holds or on deck.
- Oil carrier vessel (limited to 1,000 m^3).
- Special purpose ship according to Resolution A.534(13),
  « *For the purposes of this code a special purpose ship is a ship of not less than 500 gross tonnage which carries more than 12 special personnel, i.e. persons who are specially needed for the particular operational duties of the ship and are in addition to those persons required for the normal navigation, engineering and maintenance of the ship or engaged to provide services for the persons carried on board.* »

She is fitted with storage capacities in order to enforce the oil discharge ban in special areas and particularly in the Antarctic.

MARION DUFRESNE has been operated intensively in rough sea conditions since her commissioning in 1995 as she has been at sea or mooring more than 93 percent of the time with an average number of passengers of 56 per day. She is assessed by her operators and users as a reliable and safe vessel.

She has two work launches (tenders) used for passengers disembarkation or embarkation, but also for towing equipment on « portières » (cf. glossary) and for hydrographic surveys. They have to be operated in sight and in VHF radio range from the vessel, for navigations restricted to sheltered waters.

During TAAF support missions, she is fitted with a helicopter.

Several scientific laboratories are aboard *MARION DUFRESNE*, who is fitted with a multibeam sounder and a giant corer (60 m).

4 CREW

The crew of the vessel is made of 48 persons among whom:

10 officers and a cadet : 1 master, 1 first officer, 3 deck officers, 1 dual-purpose officer, 1 electronics radio officer, 1 chief engineer, 1 second engineer and 1 engineer officer.

On 14 November 2012, except for two Romanian deck officers, all the officers were French.

38 ratings: 21 Malagasies, 10 Romanians and 7 French.

The working language on board is the French language.

The master

The master, 55 year old, holds an unlimited master certificate.

He has been in a master position for 16 years: from 1996 to 2006 in the Delmas company then, since August 2006, in the CMA CGM company (at the date of the event, it was his 21st posting as a master for CMA CGM). He commanded most of the ship types of the company, particularly container ship of any size.

He joined *MARION DUFRESNE* for the first time in March 2012. It was his third posting aboard this vessel. He joined the ship on 7 November at La Réunion.

The deck officer (OOW) at the time of the event

This deck officer, 31 year old, has been holding a dual-purpose officer certificate since 2008 which is consistent with his deck officer's position aboard this type of vessel.

He has been going to sea for this company since 2005.

His first officer's posting took place in 2008. He held then 6 deck officer's positions and 2 engineer officer's positions aboard container ships.

It was his first appointment on board *MARION DUFRESNE*.

He joined on 8 October at La Réunion and took part in the oceanographic campaign from 8 to 25 October. During this first part of this period aboard, he had already been in charge of the bridge watch 15 to 20 times, among which, with the previous master, a landing at La Réunion port.

It was his second bridge watch since the departure from La Réunion.

His position aboard was *« lieutenant Océano »*:

« The "Lieutenant Océano" belongs to the team in charge of the conduct of the vessel and takes part in the monitoring of the cargo work when the vessel is in port. He is responsible for the tasks assigned to him by the master or by the first officer in the limits related to the prerogatives of his certificate, under the authority of the first officer, reports to the first officer and to the master of the vessel.

He is in charge of the bridge watch at sea and at anchor according to the watchkeeping schedule issued by the first officer, he participates in the manoeuvring stations and he operates the scientific equipment according to the first officer's orders. »

His fitness for service medical examination was up-to-date at the time of the event.

The three other deck officers

The navigation officer, 30 year old, has been a CMA CGM deck officer since 2008. It was his first appointment on board *MARION DUFRESNE*. He joined the ship on 2 November at Mauritius.

The prevention (SSE) officer was 35 years old. She has been a CMA CGM deck officer since 2007. It was her first appointment aboard *MARION DUFRESNE*. She joined on 2 November at Mauritius. She was in charge of the watch from 4.00 am to 8.00 am on the day of the event.

The administration officer was 29 years old. He has been a CMA CGM deck officer since 2009. He had already several postings aboard *MARION DUFRESNE*. He joined on 8 October at La Réunion.

The helmsman was 46 year old. He has been a CMA CGM seafarer since 2006. It was his first appointment on board *MARION DUFRESNE*. He joined on 4 August at La Réunion.

5 SEQUENCE OF EVENTS

Local times (UTC + 4)

On Wednesday 7 November 2012

At **5.12 pm**, *MARION DUFRESNE* sailed from Le Port (La Réunion) bound for Île de La Possession (Crozet Archipelago) with 48 crew members and 97 passengers (TAAF and IPEV members as well as 9 fare-paying passengers).

On Wednesday 14 November 2012

The morning weather conditions were as follows (source: SITREP):
Cloudy / westerly wind force 4 / slight sea state / small swell / good visibility.

At **5.00 am**, the master came up to the bridge.

At **5.50 am**, the vessel was at anchor at 0.45 mile in the North of Pointe Basse (Île de La Possession). Equipment for surveys and scientific works had been carried by helicopter to a shelter ashore.

At **7.40 am**, the « *lieutenant Océano* » came up to the bridge to take over the watch from the prevention officer who was in charge of the watch from 4.00 am to 8.00 am. She informed him of the situation (vessel still at anchor) and showed him the successive courses to be followed towards the Baie du Lapérouse anchorage at the south-western end of Île de la Possession for a second operation scheduled around noon.

At **8.00 am**, the « *lieutenant Océano* » took over the watch, the prevention officer remained on the bridge.

At **8.08 am**, the operations were achieved and the helicopter was secured in its shed.

At **8.16 am**, the anchor was aweigh and the vessel got underway under the master's con towards Baie du Lapérouse.

The helm was under manual control.

At **8.36 am**, the OPEA requested the passengers to leave the left wing of the bridge to facilitate the work of the crew, the passengers complied.

At **8.41 am**, a new group arrived and settled. The OPEA requested them to move away or to go up to the upper bridge.

The master stayed on the bridge, assisted by the OOW, the helmsman was steering.

At **8.44 am**, the vessel rounded Pointe des Moines at 0.55 mile in the west (radar fix).

The master handed over the responsibility of the watch to the OOW who took it up, he drew his attention on the breakers and went on the bridge port wing. The helmsman kept on steering.

The vessel was heading 212° at 11 knots. The course laid off was 208°, the radar fix was on the inshore side of the laid off course, the course was altered to come back on the initial track.

At **8.52**, the OOW made a radar fix and plotted it on the chart.

The position plotted showed that the vessel was at 0.2 mile on the inshore side of the laid off track and at 1 mile from the WP n° 28 (in the west of the breakers) marking the next course alteration point.

At **8.53 am**, the OOW ordered the helmsman: « port ten ». As the vessel was veering quickly on port, the OOW ordered: « Steady as she goes » (i.e. steer on the course of the vessel at the time of the order). The helmsman « met the helm » quickly in order to keep on at the course which was then 180°.

At **8.55 am**, assessing to have the breakers abeam, the OOW would have ordered (he does not remember to have given this order) to the helmsman to turn to the heading 125°. The helmsman came gently on port.

Seeing the vessel veering and understanding that the course alteration was premature, the master came back to the centre of the bridge. He observed that the vessel was frankly on the inshore side of the laid off track.

At **8.56 am**, the master ordered then the helmsman to set the helm midships, which he did.

A few seconds later, he ordered to put the helm hard-a-starboard and at the same moment an important impact was felt on the bow. The vessel heeled violently on starboard. The speed decreased from 11 to 6 knots.

The master slowed down to « slow ahead ».

At **8.57 am** / **8.58 am**, as ordered by the master to the OPEA, the passengers left the bridge silently and mustered in the scientific control room.

At **8.59 am**, the vessel was normally « afloat » and was making her way slowly.

The initial emergency measures had been immediately implemented:

- The watertight doors had been closed;
- The bilge pumps had been set on;
- The passengers still on the bridge had been evacuated;
- Patrols had been undertaken in the engine room as well as a check of the bow capacities in order to identify damages.

The master decided to cancel the call scheduled at Baie du Lapérouse anchorage and to proceed to Baie du Marin, which is located in the south-eastern end of the island, opposite to Port Alfred (Archipelago main base) and relatively sheltered from severe weather coming frequently from the west in this area.

From **9.00 am to 10.00 am**, the chief engineer, who was on the bridge, ordered to carry on the pumping of the flooded compartments while the crew was investigating.

At **9.02 am**, the watertight doors were remotely closed.

At **9.05**, the master triggered the VDR data backup, and headed to Baie du Marin, sheltered from the north-westerly wind to cast anchor safely.

From **8.57 am** to **10.14 am**, a succession of numerous alarms occurred:

- **8.57 am** / NH (high level) cofferdam;
- **8.58 am** / NH echo sounder room;

- **9.03 am** / NH bilge 1 port well;
- **9.21 am** / NH bilge 1 starboard well;
- **9.30 am** / NH bow thruster room;
- **9.39 am** / echo sounder room flooded;
- **9.48 am** / NH fresh water cross-pipe ;
- **10.14 am** / bow thruster room flooded.

At **9.45 am**, rounded « Cap Gallieni » at 8 cables in the south,

At **10.02 am**, first call to La Réunion MRCC,

At **10.45 am**, the vessel was anchored with 5 shackles in the water, in Baie du Marin, at 0.5 mille in the south of a position defined by the crossing of the alignments.
At this time, the assessment of most of the damages was achieved.

At **11.33 am**, first call to the owner on the emergency line.

From **2.40 pm** to **2.50 pm**, 16 passengers had been landed in 4 helicopter rotations.

An ongoing monitoring of the flooded fore compartments had been established through the permanent presence of personnel on a four shift basis, in constant liaison by walkie-talkie with the bridge.

During the 14 November, the wind increased to west-south-westerly 8, the master paid out two more shackles, the holding was good.

On Thursday 15 November 2012

At **7.30 am**, north-westerly near gale, a visual draught survey had been done at anchor from the Zodiac: 5.60 m F; 6.70 m A.
At the same time probes showed that except for GO4, all the ballast tanks affected by the event were full.

At **10.00 am**, the bow thruster room was bailed out and made temporarily watertight.

At **11.00 am**, the water level in the echo – sounder room began to decrease.

From **4.00 pm** to **4.20 pm**, 20 passengers had been landed in 4 helicopter rotations.
In the evening winds freshened to Force 8.

On Friday 16 November 2012

The weather conditions improved in the early morning.
Equipment unloading operations:

- from **6.40 am** to **7.49 am**, with the launch and the « portière »;
- from **9.15 am** to **0.25 pm**, with the helicopter;
- from **3.20 pm** to **5.39 pm**, landing of the 61 passengers still aboard.

In the evening, north-westerly gale, the anchor was holding good and the drainage of the flooded compartments was carried on (bow thruster room and echo – sounder room).

On Saturday 17 November 2012

The wind was falling, veering south-south-easterly. A storm was forecast for the next day.

From **3.00 pm** to **3.35 pm**, landing of 20 crew members. Only volunteers (23 persons) stayed on board.
The drainage of the flooded compartments was carried on, the breaches were made watertight with cofferdams.

On Sunday 18 November 2012

West-north-westerly gale becoming quickly a violent storm veering southerly, with 75 knot gusts of wind.

Pictures taken by the master
on 18 November in Baie du Marin

Anemometer display
on the same day

On Monday 19 November 2012

The weather conditions fell to west-south-westerly near gale, with 40 knots gusts of wind.

The anchor had dragged on a hundred metres (later on, it had been observed that one of the links of the cable had been distorted, it is probable that it happened at this time).

The wind fell during the night and veered north-westerly.

On Wednesday 21 November 2012

At **1.50 pm**, the Zodiac was launched for a survey of the draughts, which remained stable.

On Friday 23 November 2012

Island supply operations by helicopter.

On Saturday 24 November 2012

At **2.24 am**, arrival of the cable ship *LÉON THÉVENIN*. *MARION DUFRESNE* left her mooring spot to the latter.

At **5.44 am**, *CORAL SEA FOS* arrived in the area.

From **6.00 am** to **7.55 am**, the passengers were transferred from the base on *Ile de La Possession* on board *LÉON THÉVENIN* with the Zodiac and the launch.

From **9.20 am** to **1.40 pm**, diving operations under the hull in order to assess the damages. The pictures taken had been transmitted to BV which maintained her class.

At **8.25 pm**, the CSN of *La Réunion* issued a navigation licence limited to a single voyage to a shipyard for repairs. *MARION DUFRESNE* began to heave up anchor.

At **8.35 pm**, the anchor broke out, the vessel was under way bound to Durban or Mauritius.

At **9.00 pm**, « Full away » signal. The vessel was escorted by *CORAL SEA FOS*.

0n Monday 26 November 2012

As of now, the destination was set as Durban.

From Sunday 25 November to Sunday 2 December 2012

At the beginning of the week, succession of westerly to north-easterly gales, sea rough to moderate. The vessel was labouring due to pitching and rolling which was causing fatigue to the crew. From Wednesday, weather permitting, 160 metric tons of fuel had been transferred in order to empty, as far as possible, the damaged tanks.

On Monday 3 December 2012

At **7.30 am**, End of « Full away ».

From **08h30 am** to **10h00 am**, inspection on roads of the vessel by the South-Africa authorities.

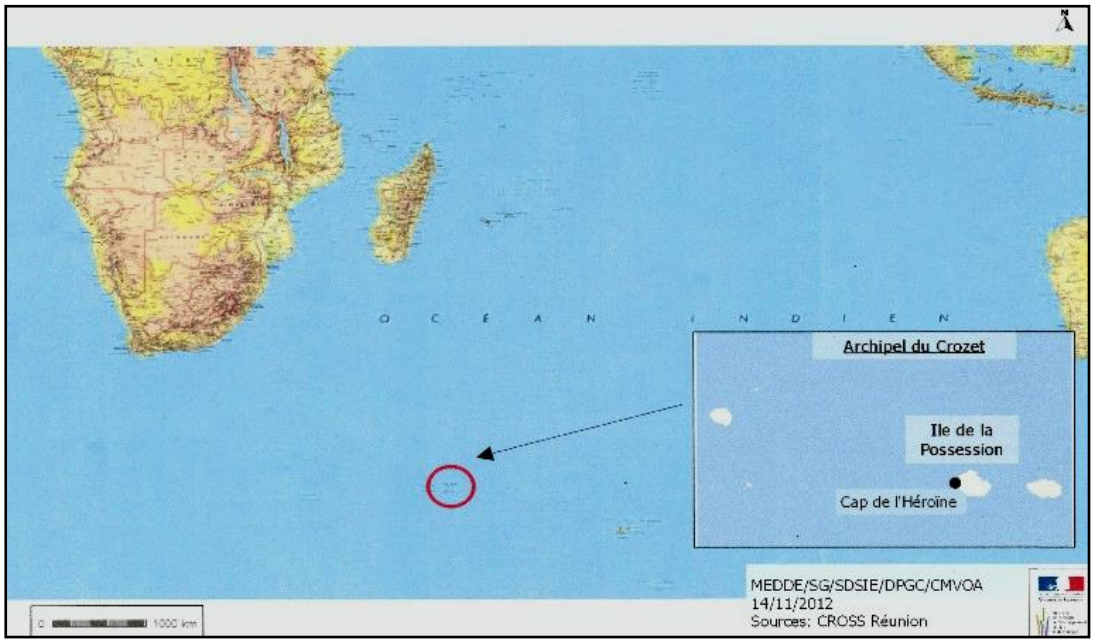
At **10.00 am**, underway then waiting.

At **noon**, Authorisation to enter the port of Durban granted.

At **1.42 pm**, finished with engines, starboard alongside at mole 1 berth 102.

At this time, the vessel had been « weighted »: her displacement was 9 100 metric tons instead of 7 800 metric tons corresponding to the displacement observed at the time of the previous dry-docking.

The technical stop for the repair of the damaged hull had been 2 months long.



6 ANALYSYS

The method selected for this analysis is the method usually employed by *BEA*mer for all its investigations**,** in compliance with the « Code for the Investigation of Marine Casualties and Accidents » laid out in Resolution MSC 255(84) adopted by the International Maritime Organization (IMO).

The factors involved have been classed in the following categories:

- **natural factors ;**
- **material factors ;**
- **human factor ;**
- **other factors.**

In each of these categories, *BEA*mer investigators have listed the possible factors and tried to qualify them relatively to their characters:

- **certain, probable, hypothetical ;**
- **causal or underlying ;**
- **circumstantial, inherent ;**
- **aggravating ;**

with the aim to reject, after examination, factors with no influence on the course of events and to retain only those that could, with a good probability, have a real influence on the course of facts. The investigators are aware that maybe they have not given an answer to all the issues raised by this accident. Their aim remains to avoid other accident of the same type; they have privileged with no *a priori* an inductive analysis of the factors which have a significant risk of recurrence due to their inherent character.

Important:

It had been impossible for technical reasons to extract data from the VDR although the device had been analysed by its manufacturer after the event.

The factual elements on which is based the analysis of this event are therefore the master's sea protest, the documents collected on board the vessel, the pictures of the damages and the testimony of the crew members and of the available passengers.

6.1 Natural factors

When the vessel touched the bottom, by daylight, the weather and sea conditions were good as well as the visibility (cf. sequence of events).

On 14 November 2012, the tidal range was 107, the low-water took place at 7.07 am (UTC + 5) with a 0.05 m height of water and the high water at 1.10 pm with a 0.30 m height of water.

Neither the range of tide nor the tidal stream could therefore have contributed to the event.

The vessel had been able to free herself quickly from the reef.

No natural factor had any direct influence on this event.

6.2 Material factors

The vessel is fitted with the regulatory navigation equipment.

Nevertheless, several factors related to the navigation equipment and to nautical documents used when touching the ground have been identified:

6.2.1 The navigational equipment

6.2.1.1 The GPS navigation satellite receivers:

The bridge is fitted with 7 GPS receivers connected to the various navigation or communication devices, 3 of which are directly used for navigation.

The reference ellipsoid is always WGS 84.

The GPS displays used for navigation are arranged as follow:

- The DGPS Furuno navigator GPS 90 is fitted on the navigation centre console;
- The navigation GPS Trimble NT 100 and NT 200 are fitted on both sides of the chart table and give the position to the plotter and to the 3 and 10 cm radars.

The wheelhouse console located on starboard with the plotter on the left and the ECS on the right.

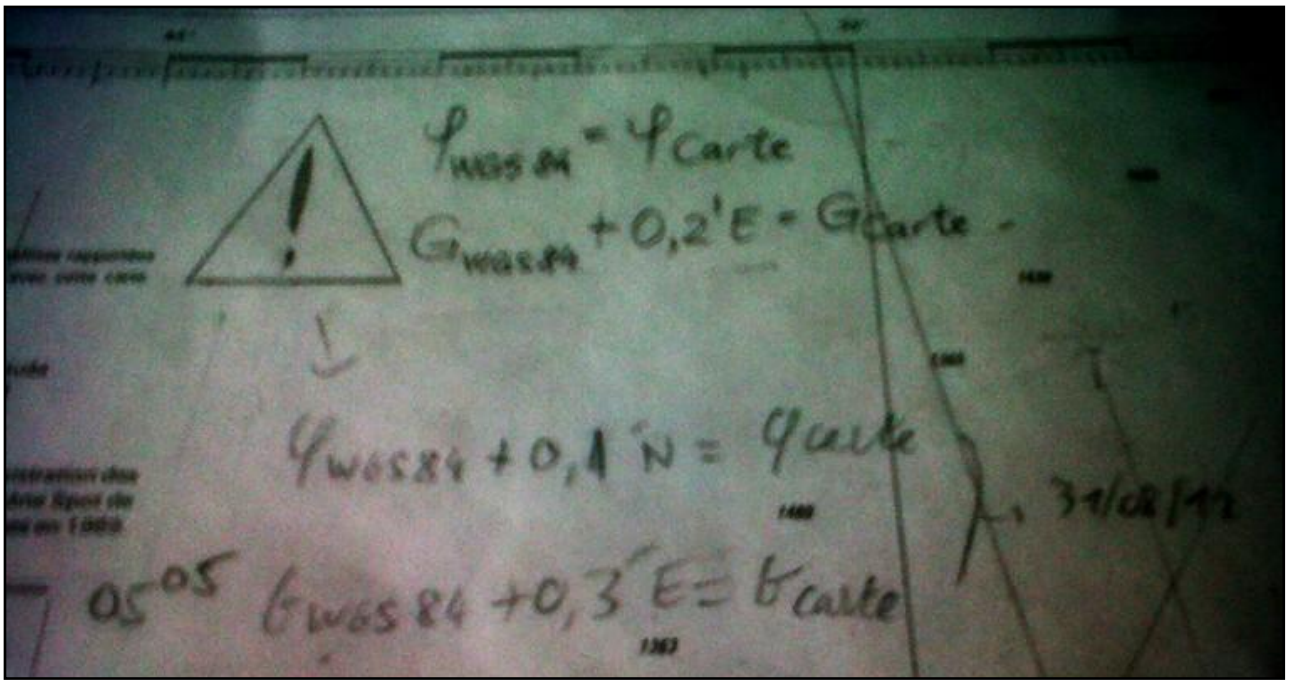
6.2.1.2 The plotter

On the « Nautoplot » plotter, the SHOM 6497 paper chart had been set at 5.00 am on 14 November and the changes made to match the plotter and the GPS geodesic coordinate.

The proper use of this plotter supposes that the chart has been perfectly positioned and that its positioning is checked on a regular basis.

Picture of the Nautoplot plotter taken by a passenger.

It is on the top of this chart that are mentioned the changes to the geodesic system, which are used for its positioning. It appears on the picture below that at the time of the grounding, the positioning of the plotter was taking account of the last change done.



Corrections « done aboard » written on the paper chart SHOM 6497. The second one corresponds to an observation done by the crew before the exact values had been received from the SHOM.

However it had not been taken into account for the use of the ECS (see § 6.2.2.1).

6.2.1.3 The ECS

The ECS (TRANSAS navigation system), which display is located on the right of the plotter, is connected to the gyro compass in use, to the Doppler log and to a GPS receiver. On a label placarded on the left hand side of the control keyboard, it is specified that the ECS is not an approved navigation system. This has been reminded by a circular of the company technical service (cf. in appendix and on the picture of page 25).

6.2.1.3.1 The type of charts and their updating

The charts which are in the Transas system memory are mainly Brittish charts. The changes are sent aboard on a CD by Transas via a Belgian provider. The French chart changes (and particullarly chart 6497) are unlikely to be taken quickly into account.

6.2.1.3.2 The typography used

On chart SHOM 6497, the 100 m line of soundings which is located in the west of *cap de l'Héroïne* is a broken line. This means that the position of this isobath is unaccurate. It is observed on the ECS display that, although the reference mentionned is chart SHOM 6497, this 100 m line is a continuous line (see appendix page 48).

The chart used by the ECS is therefore slighly different from the reference chart as at least one information is found lost.

This unaccuracy is an **underlying factor** of this event.

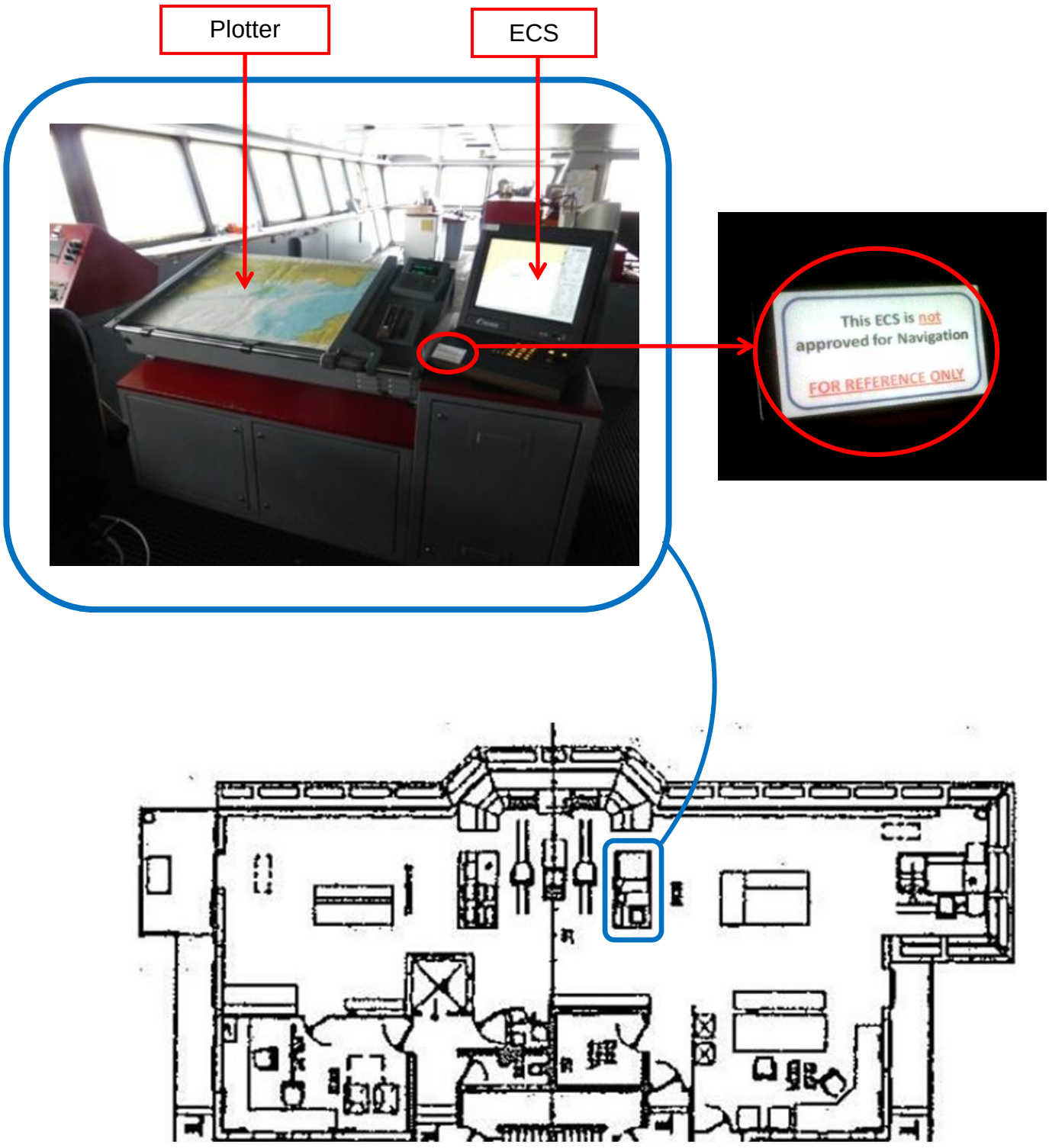
Curently, for your information, the IHO has defined the **ENC** (Electronic Navigation Chart), a vector electronic chart produced by an accredited hydrographic service conforming to S57 norm, and the **RNC** (Raster Nautical Chart) produced by an accredited hydrographic service conforming to the norm - The UKHO producing a range of charts in this format, baptised « ARCS » (Admiralty Raster Chart Service). There is at present no medium or large scale ENC or RNC covering *Crozet* archipelago.

These official charts, used with an ECDIS are the only ones to comply with the requirements of regulation V-19 § 2.4 of the SOLAS Convention about the chart carriage requirements, RNC are permitted exclusively in areas where ENC of an appropriate scale are not available.

The other charts, named ECS (Electronic Chart System), **are not** admitted by the SOLAS Convention.

*MARION DUFRESNE'*s ECS , even fitted with official electronic charts, cannot thus meet the chart carriage requirements as defined in the SOLAS Convention.

That was, as it happens, clearly stated on the recommendation displayed on the device (see picture next page).



The navigation equipment (radars, sounders, plotter, etc.) worked correctly. On the other hand, the ECS is not approved for navigation (see above). A navigational equipment malfunction cannot be thus retained as a causal factor of this accident. Nevertheless, the significant error (which will be assessed later) observed on the ECS display contributed to the grounding. Taking into account the too much exclusive use of this equipment for the navigation, this error will be studied as a human factor.

6.2.2 The nautical publications

6.2.2.1 The Chart

The chart in use was chart SHOM F 6497 « *Archipel des Crozet – Groupe de l'Est ÎLE DE LA POSSESSION – ÎLE DE L'EST* ». Scale 1: 75,000.

This chart had been issued complying with the former norms according to geodesic system IGN 62.

A magenta printed advice on the top right mentions: « *The positions referenced to the WGS geodesic system got from a satellite positioning system (for example from a GPS receiver) must be corrected to agree with this chart. See nota: Satellite positioning.* »

This nota appears on the top left of the chart in the form of an affixed chart appendix.

In 2012 two changes had been notified by a notice to mariners and made with a chart appendix:

The first, which date back to July:

X 12 27 106. INDIAN OCEAN. Crozet archipelago. - Geodesic systems. Chart appendix (card, 12-69 SHOM/DOPS/MIP).

— Chart 6497 (10)

Affix the chart appendix F.20 46 11.20 S – 51 42.00 E (central position)

The chart appendix F 20 corresponding to change 27106 (i.e. change number 106 issued during week 27 - from 1 to 8 July 2012 -) is as follows : « *Satellite positioning: The positions referenced to the WGS 84 geodesic system got from a satellite positioning system must be corrected of 0.03' southwards and of 0.02' eastwards to agree with this chart* ».

The second, which dates from the beginning of September:

X 12 37 107. INDIAN OCEAN. Crozet archipelago. - Chart appendix. Geodesic systems (card, 12-69 SHOM/DOPS/MIP).

— Chart 6497 (11)

Affix the chart appendix F.30 46 11.20 S – 51 42.00 E (central position)

The chart appendix F 30 corresponding to change 37107 (i.e. change number 107 issued during week 37 - from 10 to 16 September 2012 -) is as follows:

« Satellite positioning: The positions referenced to the WGS 84 geodesic system got from a satellite positioning system must be corrected of 0.08 'northwards and of 0.37' eastwards to agree with this chart. »

These changes (27106 from July 2012 and 37107 from September 2012) do not add up, the second includes the first.

At the time of the accident, two changes (see page 23) were affixed on the chart, one (12 27 106) received from SHOM and the other coming from the crew's observations who doubled the error given by the first. This paper chart was located on the Nautoplot plotter used and positioned in accordance with the last plotted observation. The OOW stated that he did not take it into account, at the moment of the accident as he did not use the plotter, but the ECS.

Even though the observation had been plotted on the paper chart (used on the plotter), the change, issued by the SHOM about 2 months before the accident, had not been used for navigation by *MARION DUFRESNE*'s officers (information not yet received on board).

The error between the Radar fix and the GPS position plotted at **8.52 am** represents the value of the correction of the chart appendix F 30. The difference of geodesic reference between chart 6497 and the navigational equipment, which had not been taken into account by the OOW, as he used the ECS and not the up-to-date chart, constitutes an **underlying material factor** of this event.

6.2.2.2 The sailing directions

In the sailing directions L9 « INDIAN OCEAN ISLANDS (Southern part) », one can read in the 2001 edition in the chapter dedicated to *Ile de la Possession* in *Crozet* archipelago page 329 § 8.3.4.2 (North-West and South-West coasts / 07) : «*Cap de l'Héroïne, (…) Breakers located at 2 M in the SW of the cape, probably indicate hazardous rocks.* »

This sentence has not been modified by a notice to mariners.

In the 2012 edition of these sailing directions, published at the end of September 2012, which had not yet been received aboard, the following information is written in the chapter dedicated to the same island, at page 432 § 9.5.4.2 (North-West and South-West coasts / 013): « *At about 2 M in the SW of Cap de l'Héroïne, western end of the island, breakers probably indicate hazardous rocks.* »

One notices notably that the word « about » has been added concerning the position of the breakers relatively to Cap de l'Héroïne, which takes into account the changes transmitted by the Notice to Mariners number X 12 27 106 and X 12 37 107 reminded in the previous subparagraph concerning the geodesic system.

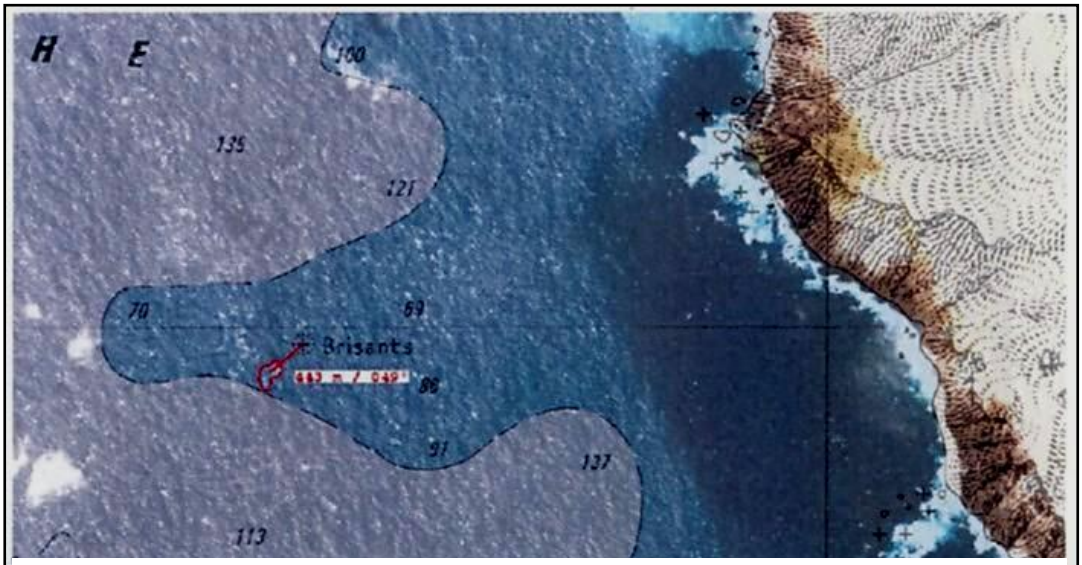
The reading of this extract from the sailing directions stresses, if proofs were needed, the need that the track laid takes into account the inaccuracy of the position of hazardous rocks and for the OOW to follow the laid track.

6.2.3 The position of the breakers

The « Brisants » (breakers) which appear on chart 6497 and which are mentioned by the sailing directions L9 were not visible on the day of the grounding due to fair wind and sea conditions. Years ago, they had been reported to the SHOM by the first *MARION DUFRESNE* who, after *GALLIENI* was then the main source of nautical information in the TAAF and was thus upstream from SHOM.

Nowadays, the amount of information provided to SHOM by *MARION DUFRESNE* is significantly less. The few items collected by the SHOM come, actually, from vessels of the TAAF and those of Marine nationale.

For your information, the instruction from the prime minister about the collection and the broadcast of the nautical information n°228/SGMer issued on 03 May 2002 designates the captains of military vessels and the masters of the vessels among the authorities responsible for the search, the collection and the transmission of information which could alter nautical publications.



Overlapping in a GIS map of the Pléiades satellite picture taken on 26 March 2013 and the marine chart 6497. The breakers of the marine chart are at 443 m in the 049° of the detected reef.

Following this maritime casualty, the SHOM, concerned by the safety of navigation in the areas where the bottom is not fully charted, has ordered satellite pictures of this coast of Île de La Possession. The processing of these pictures had been complex, because the area is frequently cloudy and the submerged rocks are difficult to identify. The picture above, got on 26 March 2013, overlapped with the marine chart 6497, proves that the breakers are located on the marine chart at 443 m in the 049° of the detected reef (this picture had been provided to *BEA*mer by the SHOM).

This discovery was the object of change 19158 (issued during week 19, i.e. from 5 to 11 May 2013) to chart 6497:

13 19 158. . INDIAN OCEAN. Crozet archipelago. Île de La Possession. In the SW of Cap de l'Héroïne. — Rock. (SHOM, FE N°24 DOPS/MIP/GEO/NP issued on 11/04/2013).
— Chart 6497 (12) draw « Brisants » (breakers) (a) 46 25,18 S 51 36,96 E
Delete « Brisants » (breakers) in the vicinity of (a) in the NE

MARION DUFRESNE could not, in November 2012, be informed of the true position of these breakers. They have been re located in the vicinity of the broken 100 metres line of soundings, just on its inshore side.

The inaccurate position of the breakers on chart 6497, and though on the ECS display, constitutes also an **underlying material factor**.

6.3 Humans factors

6.3.1 Laying the track on the map

The passage plan had been established in January 2009 and had been the reference to lay the courses for this voyage.

This laid off track left little room for error given the uncertainties raised by the sailing directions (cf. appendix C) in this unsurveyed and unmarked area.

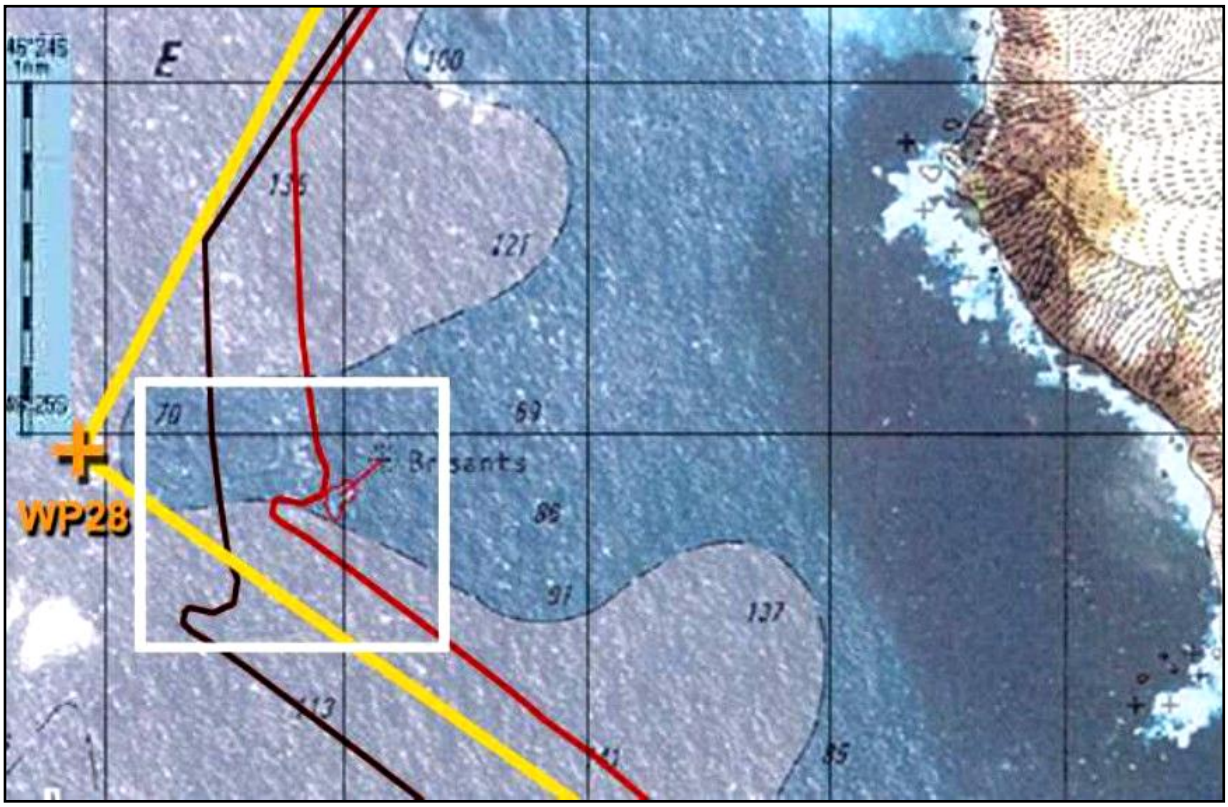
Given the error observed by the SHOM between the horizontal datums which has been published by a notice to mariners, the track laid off according to the passage plan established in January 2009, had a reduced margin of safety at this place. The laid off track constitutes thus an **underlying factor**.

6.3.2 The navigation itself

Courses were laid off by the navigation officer under the control of the master to round the island to the west, at the edge of the 100 metres line of soundings.

The major identified and borne hazards were the breakers of Pointe Basse located at 0.4 mile of the anchoring point, the Île de La Roche Percée which was rounded at 0.4 mile and the breakers located in the south-west of Cap de l'Héroïne that the course laid off rounded at 0.8 mile to the west.

The ECS is based on chart SHOM F 6947 and on the display, the vessel was, soon after **8.55 am**, close to WP 28, in the vicinity of the label « Brisants » (breakers).



This picture is the result of the overlapping of chart 6497 processed by the SHOM (cf. § 6.2.3), data from satellite imagery which shows the real position of the shoal and the chart used by the ECS.

On the picture:

the yellow track represents the course laid off according to the passage plan;

the black track represents the plot of the positions recorded by the ECS;

the red track represents the actual course on the ground reconstructed by BEAmer given the real position of the collided reef, the grounding sequence of events and the damages observed on the hull of the vessel (port bow).

The white frame is zoomed on next page.

The OOW followed the black track while he was actually on the red one. He was therefore at 0.38 mile in the 049° of the position he thought to be his (i.e. 0.24 mile more north and 0.43 mile more east).

The processing of the information « Brisants » (breakers) on chart 6497 supposed that the two following correction items had been taken into account:

- The first, « 0.03' of latitude towards the south and 0.02' of longitude towards the east ».
- The second, « 0.08' of latitude towards the north and 0.37' of longitude towards the east » which cancels and replaces the first.

They were available before the accident on the website of the SHOM. These correction items were not taken into account for the navigation with the ECS (non approved equipment for navigation).

On the chart above, the changes are indicated by the points **A_1** and **A_2**.

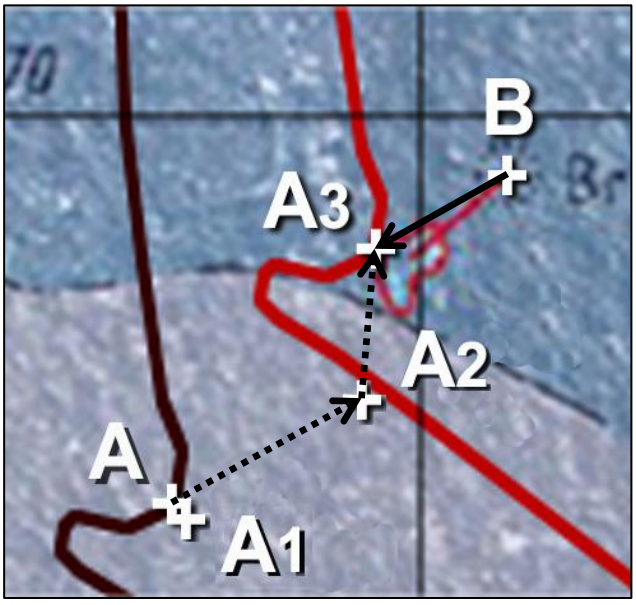
- The third element lies in the choice of the ECS for the navigation :

The impact of the vessel's hull on the north-western part of the reef (real position SHOM) leads to a difference with the position indicated by the ECS of « 0.17' of latitude towards the north and 0.02' of longitude towards the east ». This error is thus attributable to the ECS.

On the chart below, the grounding position is indicated by point **A_3**.

The error between point **B** (« *Brisants* » (breakers) indicated on chart 6497 before change 13.19.158) and point **A_3** is the result of the repositioning of the reef done by the SHOM which put the hazard closer to the 100m line of soundings.

This information, later than the accident, was not available at the time of the event.



The failure to take into account the difference of horizontal datum for the navigation with the ECS at this position, the poor management of the inaccuracy of the positioning of the breakers and the use of the ECS as the unique navigation aid are elements the addition of which is a **causal factor** of the grounding.

It has not been possible for *BEA*mer to analyse to what extend the depth indications got from the echo sounder had been used for navigation before touching the ground. It is certain that because of the vicinity of broken isobaths, the use of the echo sounder would have given an alert for the vicinity of the shoal.

6.3.3 The course alterations

From the previous way point, WP27, taken on the inshore side of the laid off track, the vessel had always been sailing on the inshore side of this track, at about 0.4 mile.

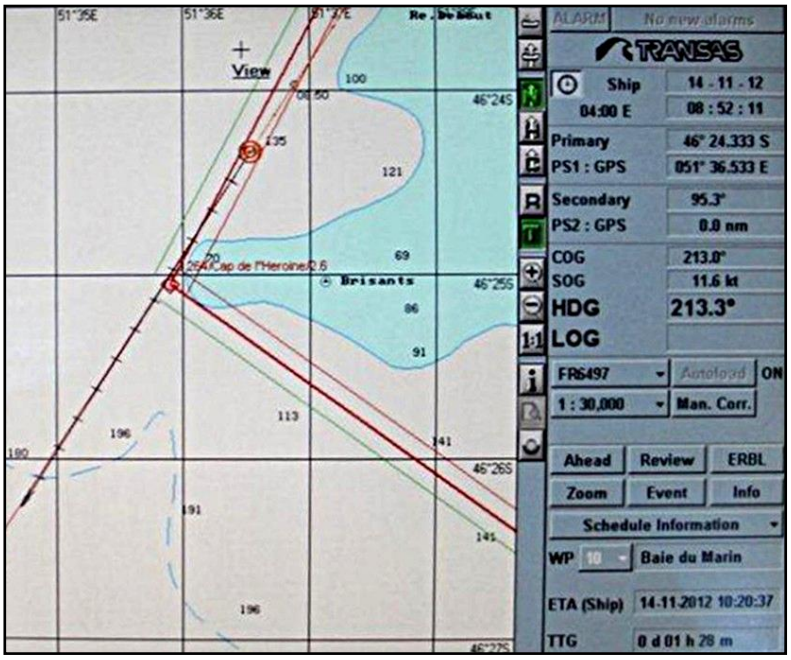
At **8.44 am**, the OOW had taken over the effective responsibility of the watch a few minutes before the accident, but he had been on the bridge for more than one hour and he laid off himself the radar fixes on the chart since getting underway.

When the master handed over the con to the OOW, he reminded him the presence, on the chart, of breakers to round (this had been confirmed by both of them). Therefore he had these well in mind and he knew that he should alter course to 125° in the west of these breakers in order to head to Baie du Lapérouse anchorage.

The cross track error was then similar to the error between the equipment horizontal datum WGS 84 and the chart horizontal datum IGN 62, i.e. almost 0.4 mile.

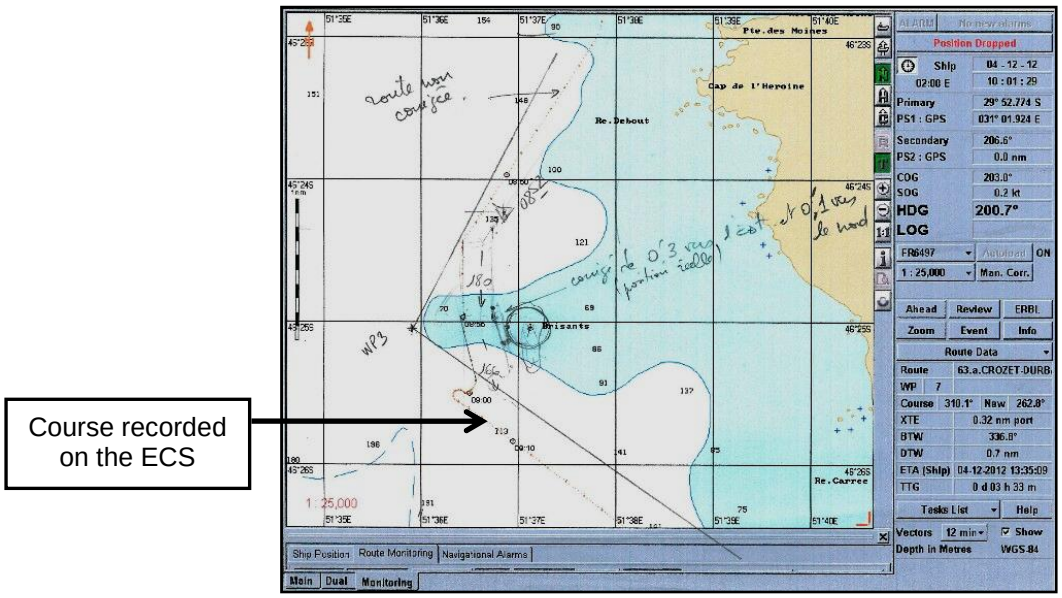
Although GPS fixes positioned *MARION DUFRESNE* on the inshore side of the laid off track, the OOW anticipated the course altering by cutting the corner between the current heading 213° and the next 125°.

It appears that at this time, the OOW was confident in the position displayed on the ECS to the detriment of the positions that he laid off himself on the chart from radar bearings and distances.



This ECS picture had been recorded at 8.52 am, a moment before the vessel altered course to 180°. The heading was then 213°.

The reference displayed on the device is chart 6497, but the line of soundings appears as a continuous line.



The anticipated course alterations compared to the laid off course, approximately sailed along, constitute an **aggravating factor** of the previously identified factors.

However, **the fact that the master stopped the turning, when he realized what manoeuvre was on going, saved the vessel.**

6.4 Other factors

6.4.1 The choice of the navigational documents by the company

The company uses mainly the « Admiralty charts and publications » whose updating is transmitted by its provider through the Internet. The chart of *Crozet* archipelago is not part of the « Admiralty portfolio ». The only existing chart is the SHOM chart whose horizontal datum is not the WGS 84.

The changes to the SHOM charts are downloaded by the competent department (NAVCOM) of the company on the SHOM website and transmitted to the vessel on a compact disc.

The SHOM last change (n° 12 37 107 broadcast and available on the Internet on 15 September 2012), concerning the latitude and longitude errors related to GPS coordinates (which happened to be close to the indications laid off on the chart on 31 August 2012 (0.1' N and 0.3' W)), had not been downloaded by the vessel at the time of the grounding.

This constitutes an **underlying factor**.

In this respect, it should be noted that the vessel does not have any Internet access for her administration and nautical management, and that the chart appendix F30 (see page 24) had not been included in the corresponding sending by the « Navcom » department of the company.

6.4.2 The presence of passengers on the bridge

This vessel carries regularly several dozen of passengers, many of whom are scientists. She carries also fare-paying passengers (9 of them during this voyage).

The free access to the bridge, while approaching the islands is one of the most attractive aspects of this scientific survey vessel. All of the passengers are not yet conscious of the level of concentration required to practice navigation on the bridge. Nevertheless, this matter is systematically drawn to their attention as soon as they join the vessel. Their interest in navigation and in maritime landscape is natural (it is particularly the case of the ornithologists presents during this mission).

On this day during the 30 minutes before the grounding, the OPEA had to intervene twice to request passengers to leave the space in and around the bridge.

Nevertheless, a picture (§ 6.2.1.2) showing the plotter and the light point representing the vessel's position, had been taken by a passenger when touching the ground.

People not involved in the navigation where thus, at this moment, in the vicinity of the navigation position on the bridge.

However the OOW stated that the passengers (about twenty of them) who were on the bridge did not disturb him. Nevertheless, the fact that the OOW could have been disturbed, even unknowingly, by the presence of numerous passengers cannot be set aside.

The presence of a great number of passengers on the bridge in a context of navigation close to shore or when manoeuvring is an **underlying factor of this event**.

6.4.3 The selection of the sailors for *MARION DUFRESNE* crew list

In matter of choice and management of the officers and crew members, the policy of the company takes into account commercial and nautical characteristics of the vessels as well as the areas where they operate.

7 MEASURES TAKEN

The ship-owner installed in the month following the event:

- a new VDR on board;
- a new process of assessment of all the sailors joining the vessel and at the time of recruitment.
- In the frame of a training and familiarization project :
  - A course « Management and psychological risks » for masters and senior officers;
  - A specific training for entrants in the company;
  - An improvement of simulator training.
- In terms of crisis management, the training of persons in a manager position aboard *MARION DUFRESNE* (sailors or not).
- A crisis management plan in the *Terres Australes*.

The ship-owner has reminded, in the master's permanent orders, the latitude given to the OOW, to request people not involved in navigation to leave the bridge whenever it is necessary.

According to circular MSC 1/1222, the VDR is subjected to an annual visit (the last one took place on 18 May 2012 and the test proved conclusive).

8 CONCLUSION

On 14 November 2012, nearly one hour after getting underway from the anchorage at Pointe Basse in the north-west of Île de la Possession, bound to the next anchorage, at about two hours sailing, the master handed over the watch to the OOW.

Assessing that his position allowed it, the OOW altered course, cutting the corner, from heading 208° to heading 125°. This premature decision had been taken in the following context:

- The vessel was sailing along a track on the inshore side of the laid off track;
- The position of the shoal touched by the vessel was not known accurately;
- The last change concerning the horizontal datum of the chart in use had not been taken into account in the ECS;
- The too exclusive use of the ECS.

The last minute manoeuvre initiated by the master did not prevent from touching the ground but saved the vessel. After the emergency measures and the damage assessment achieved, the vessel sailed to Durban for repairs, after the passengers had been landed.

This event could have had worst consequences if the crisis management on board and ashore had not been perfectly controlled, especially as, in this remote area, the weather conditions are often severe.

9 RECOMMENDATIONS

The *BEA*mer reminds:

To ship-owners, masters and navigation officers:

1 - 2013-R-053: navigation equipment not approved by the IMO should be used with prudence, and the positions have to be systematically cross-checked by other approved systems (radar), particularly in confined waters or close to the shore.

To persons in charge of maritime training:

2 - 2013-R-054: to warn, even more, cadets of the risks inherent to the use of navigational electronic aids (particularly the GPS) without cross-checking with visual and radar observations.

The *BEA*mer recommends:

To the CMA CGM company and more generally to ship-owners:

3 - 2013-R-055: to make sure that the charts, particularly electronic charts and the sailing directions are kept up-to-date, underlining that the use of such a documentation should be done with the concern to select the best available source in the geographical area of operation.

To the SHOM:

4 - 2013-R-056: to republish the chart SHOM 6497 with the horizontal datum WGS84.

To the CMA CGM company and owners of vessels carrying passengers:

5 - 2013-R-057: to develop written procedures in order to preserve, on the bridge, the quality of the lookout and the necessary concentration for the practice of navigation, particularly during manoeuvres and in hazardous navigation areas.

To the TAAF Prefect:

6 - 2013-R-058: to coordinate the requirements for nautical information and for buoying in the TAAF in cooperation with the maritime players interested in navigation in these areas.

APPENDIXES LIST

A. Enquiry decision

B. Pictures and charts

C. Documents

Appendix A

Enquiry decision

Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE

Bureau d'enquêtes sur
les évènements de mer

BEA mer

Paris, le 20 NOV. 2012

N/Réf. : BEAmer

000011

Décision

La Ministre de l'Écologie, du Développement durable et de l'Énergie ;

Vu le code des transports, notamment ses articles L1621-1 à L1622-2 ;

Vu le décret n° 2004-85 modifié du 26 janvier 2004 relatif aux enquêtes techniques après évènement de mer, accident ou incident de transport terrestre ;

Vu le décret du 2 août 2012 portant nomination du Directeur du Bureau d'enquêtes sur les évènements de mer ;

Vu le SITREP 0648 établi le 14 novembre 2011 par le CROSS La Réunion ;

DÉCIDE

Article 1 : En application de l'article L1621-1 du code des transports, une enquête technique est ouverte concernant la voie d'eau suite au talonnage du navire océanique de recherche *MARION DUFRESNE II* survenu le 14 novembre 2012 sur les récifs au large du Cap de l'Héroïne (Île de la Possession).

Article 2 : Elle aura pour but de rechercher les causes et de tirer les enseignements que cet évènement comporte pour la sécurité maritime, et sera menée dans le respect des textes applicables, notamment les articles du code des transports susvisé et la résolution MSC 255 (84) de l'Organisation Maritime Internationale.

L'Administrateur Général des Affaires Maritimes
Daniel LE DIREACH
Directeur du BEAmer

Ministère de l'Écologie,
du Développement durable
et de l'Énergie
BEAmer
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Bea-Mer@developpement-durable.gouv.fr

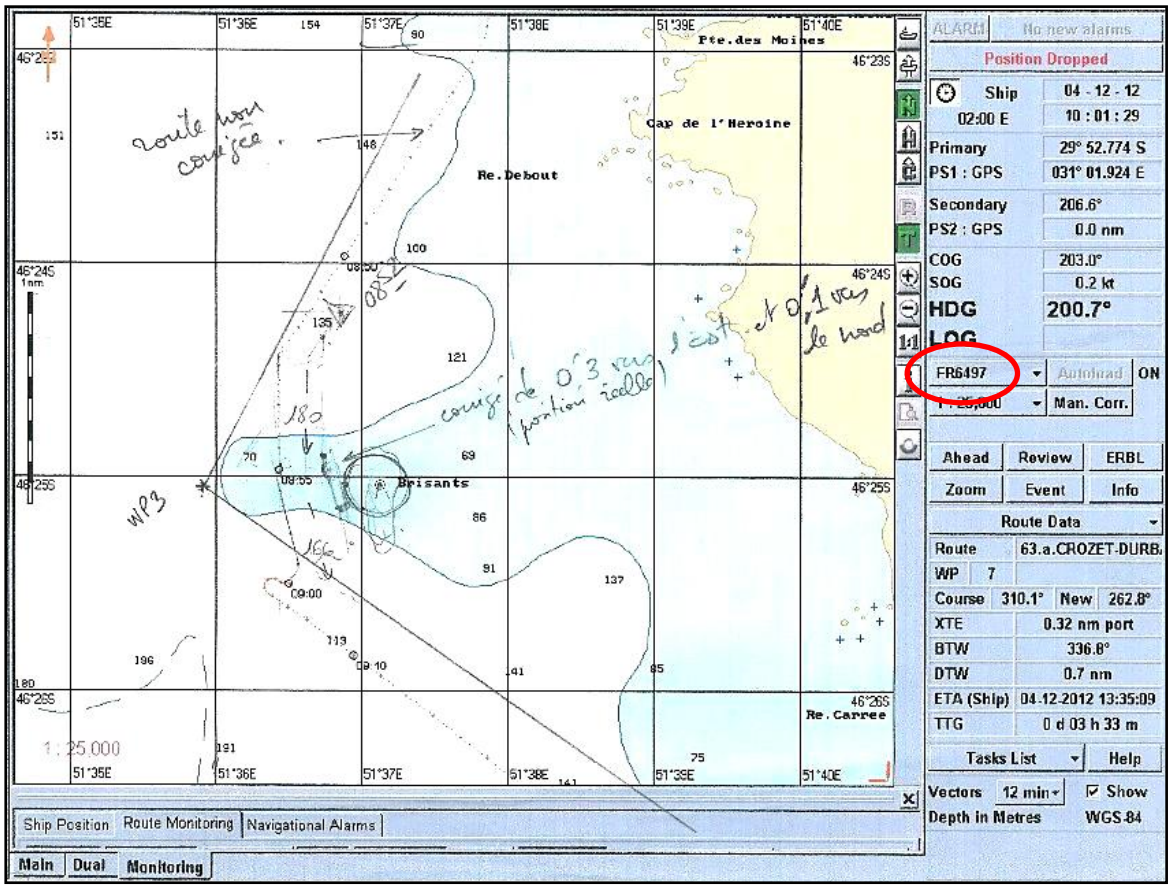
FRANCE

Appendix B

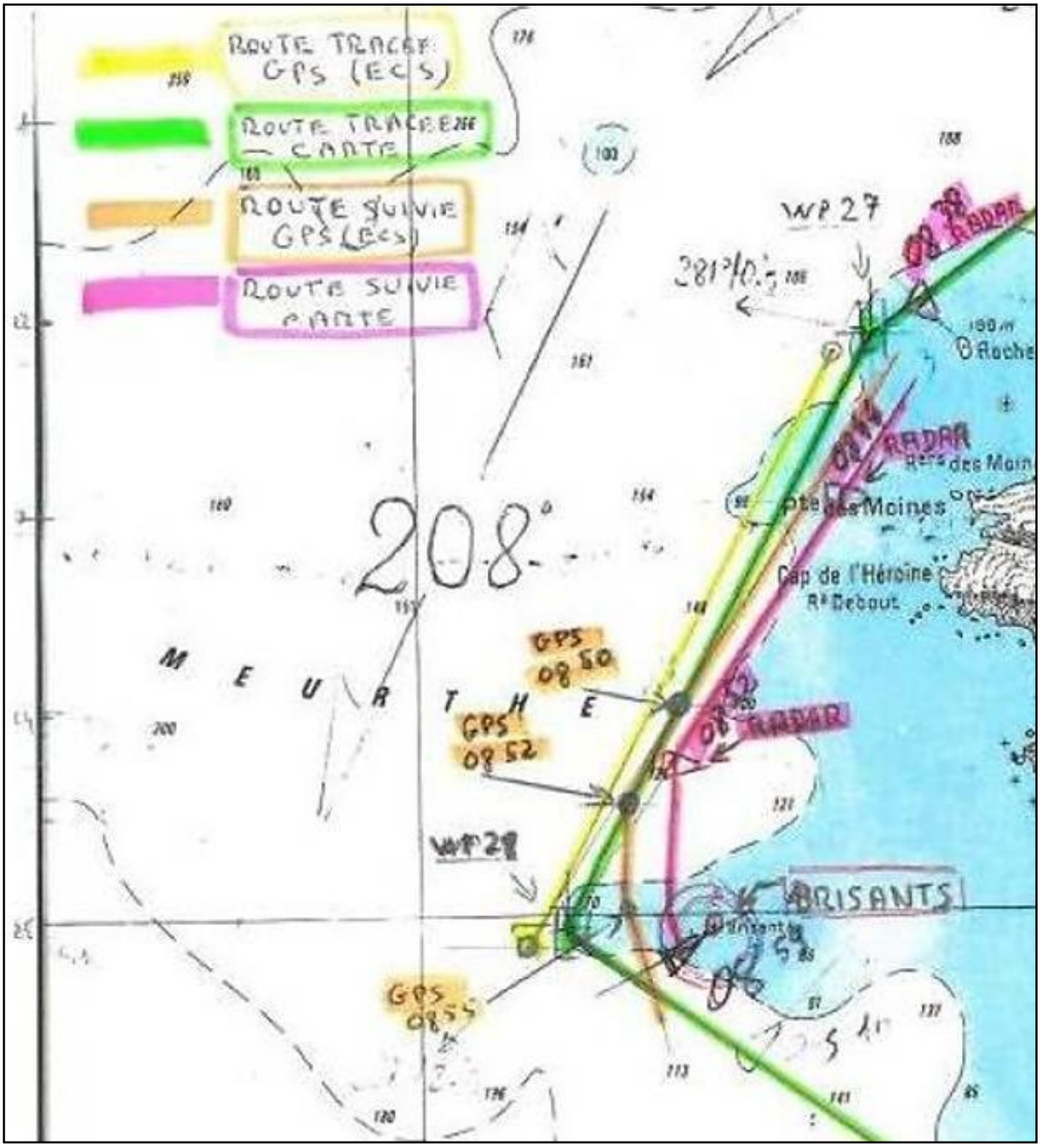
Pictures and charts

Picture of MARION DUFRESNE in Brest (credit CMA CGM)

Picture CMA CGM (2009)



This picture of the display had been taken a few days after touching the ground while the vessel was approaching Durban for repairs.



Reconstruction of the courses on paper chart 6497

Appendix C

Documents

The passage plan

CMA SHIPS MARION DUFRESNE	MANUEL PASSERELLE	PROCEDURE NAVIRE
Fiche No **Bridge-075**	Version2009-01-01	**Page 1 sur 3**
PLAN de TRAVERSÉE		

De:	**POINT BASS**
A:	**BAIE DU MARINS**

Distance Quai à Quai **23.1 Nm** **Niveau de Sureté navire:** 1

Distance Route Libre **23.1 Nm**

Vitesse Moyenne Nds	Temps de Traversee
12.0 Kn	0d01h55m
13.0 Kn	0d01h46m
14.0 Kn	0d01h39m
15.0 Kn	0d01h32m
16.0 Kn	0d01h26m

Transas: 63. I POINT BASS-BAIE DU MARIN .OUEST
GPS: 6

Point	Lat/Long	Wpt. No.	Rv	Distance	Parcouru	Reste
N/P-te Bass/0.4	46°20'80 S 051°42'50 E	25			0.0	23.1
			270°	1.1		
282/Pte Bass/1.2	46°20'80 S 051°40'90 E	26			1.1	22.0
			235°	2.3		
281/Roche Piercee/0.45	46°22'10 S 051°38'20 E	27			3.4	19.7
			208°	3.4		
228/Cap de l'Heroine/2.6	46°25'05 S 051°35'90 E	28			6.8	16.3
			125°	5.2		
264/Cap du Gallieni/1	46°28'10 S 051°42'10 E	29			12.0	11.1
			074°	0.9		
Baie du Laperouse	46°27'85 S 051°43'35 E	30			12.9	10.2
			196°	1.0		
205/Cap du Gallieni/0.8	46°28'80 S 051°42'95 E	31			13.9	9.2
			090°	4.9		
115/Cap du Gauss/1.1	46°28'80 S 051°50'05 E	32			18.8	4.3
			048°	2.8		
E/Pte du Bougainville/1.2	46°26'95 S 051°53'05 E	33			21.6	1.5
			000°	1.2		
120/Pte Seince/0.55	46°25'78 S 051°53'05 E	34			22.8	0.3
			324°	0.3		
Baie du Marin	46°25'54 S 051°52'80 E	35			23.1	0.0

01 **8.3.4. ÎLE DE LA POSSESSION.**

07 *Carte 6497.*

01 **8.3.4.1. Généralités.** — L'**Île de la Possession** s'étend sur 9 M du NW au SE, et sur une largeur d'environ 6 M. Elle culmine à 934 m au **Pic du Mascarin** (46° 26' S — 51° 45' E) qui domine la côte SW. Les sommets de l'île sont généralement enneigés ; le plus souvent, ils sont masqués par les nuages.

07 Les versants SW des montagnes sont assez abrupts ; les pentes des versants Est sont plus douces.

13 Les précipitations régulières et abondantes, ainsi que la fonte des neiges, entretiennent, dans les parties basses de l'île, une humidité permanente qui favorise la prolifération des mousses et d'une végétation exclusivement herbacée. Dans la partie basse de la Vallée des Branloires, qui débouche sur la Baie Américaine (§ 8.3.4.3), le terrain spongieux est hérissé de petites buttes cylindriques hautes d'environ 1 m, sur lesquelles les albatros établissent souvent leur nid afin de le soustraire à la fraîcheur du sol.

19 La Base de « Port Alfred » (§ 8.3.4.4) est située sur le rivage de la Crique du Navire, sur la côte orientale de l'île. Cette base abrite la station météorologique « Alfred-Faure ». C'est aussi la résidence du Chef de district des Crozet (DISCRO) [§ 0.5.3].

01 **8.3.4.2. Côtes Nord-Ouest et Sud-Ouest.** — Les côtes NW et SW, exposées aux vents dominants et battues par la grosse houle d'Ouest, sont généralement inabordables.

07 Le **Cap Vertical** (46° 20,3' S — 51° 44,5' E) est un promontoire massif, de couleur sombre ; il forme l'extrémité Nord de l'Île de la Possession. Le **Cap de l'Héroïne**, distant de 5 M au SW, est l'extrémité Ouest de l'île. À environ 1 M au Nord de ce dernier cap, la **Roche Percée**, haute de 100 m, est un bon amer. Des brisants qui se trouvent à 2 M au SW du cap, marquent probablement des roches dangereuses.

13 Entre le Cap de l'Héroïne et le **Cap du Galliéni** situé à 6 M au SW, la côte SW est malsaine et bordée de hautes falaises escarpées. La **Baie du Lapérouse** s'ouvre immédiatement au NW du Cap du Galliéni. Elle est parsemée de roches dangereuses. Par temps très calme, elle est réputée être abordable.

19 Le **Cap du Gauss** (46° 28,3' S — 51° 48,7' E) est l'extrémité Sud de l'île.

01 **9.4.5. Île de la Possession**

07 Carte *6497*.

01 **9.4.5.1. Généralités**

07 L'**Île de la Possession** s'étend sur 9 M du NW au SE et sur une largeur d'environ 6 M. Elle culmine à 934 m au **Pic du Mascarin** (46° 26' S — 51° 45' E) qui domine la côte SW. Les sommets de l'île sont généralement enneigés et masqués par les nuages. Leurs versants SW sont plus abrupts que leurs versants Est.

13 Les précipitations et la fonte des neiges entretiennent, dans les parties basses de l'île, une humidité permanente qui favorise la prolifération des mousses et d'une végétation exclusivement herbacée. Dans la partie basse de la vallée qui débouche sur la Baie Américaine (§ 9.4.5.3.), les petites buttes cylindriques hautes d'environ 1 m permettent aux albatros d'établir leur nid pour le soustraire à la fraîcheur du sol.

19 La base de « Port Alfred » (§ 9.4.5.4.), située sur la côte orientale de l'île, abrite la base permanente « Alfred-Faure ». C'est aussi la résidence du chef de district des Crozet (DISCRO) [§ 1.5.9.].

01 **9.4.5.2. Côtes Nord-Ouest et Sud-Ouest**

07 Les côtes NW et SW, exposées aux vents dominants et battues par la grosse houle d'Ouest, sont généralement inabordables.

13 À environ 2 M au SW du **Cap de l'Héroïne**, extrémité Ouest de l'île, des brisants marquent probablement des roches dangereuses.

19 La **Baie du Lapérouse**, parsemée de roches dangereuses, est réputée être abordable par temps très calme.

CMA SHIPS

CMA CGM group

FLEET MANAGEMENT CIRCULAR LETTER

TO	All vessels			FMCL-034-1-12
SUBJECT	ECS - Not approved for navigation			
BASS code *(if any)*	000		*Keyword*	NAVIGATION

Reference: *Nil*

To be read in conjunction with: *Nil*

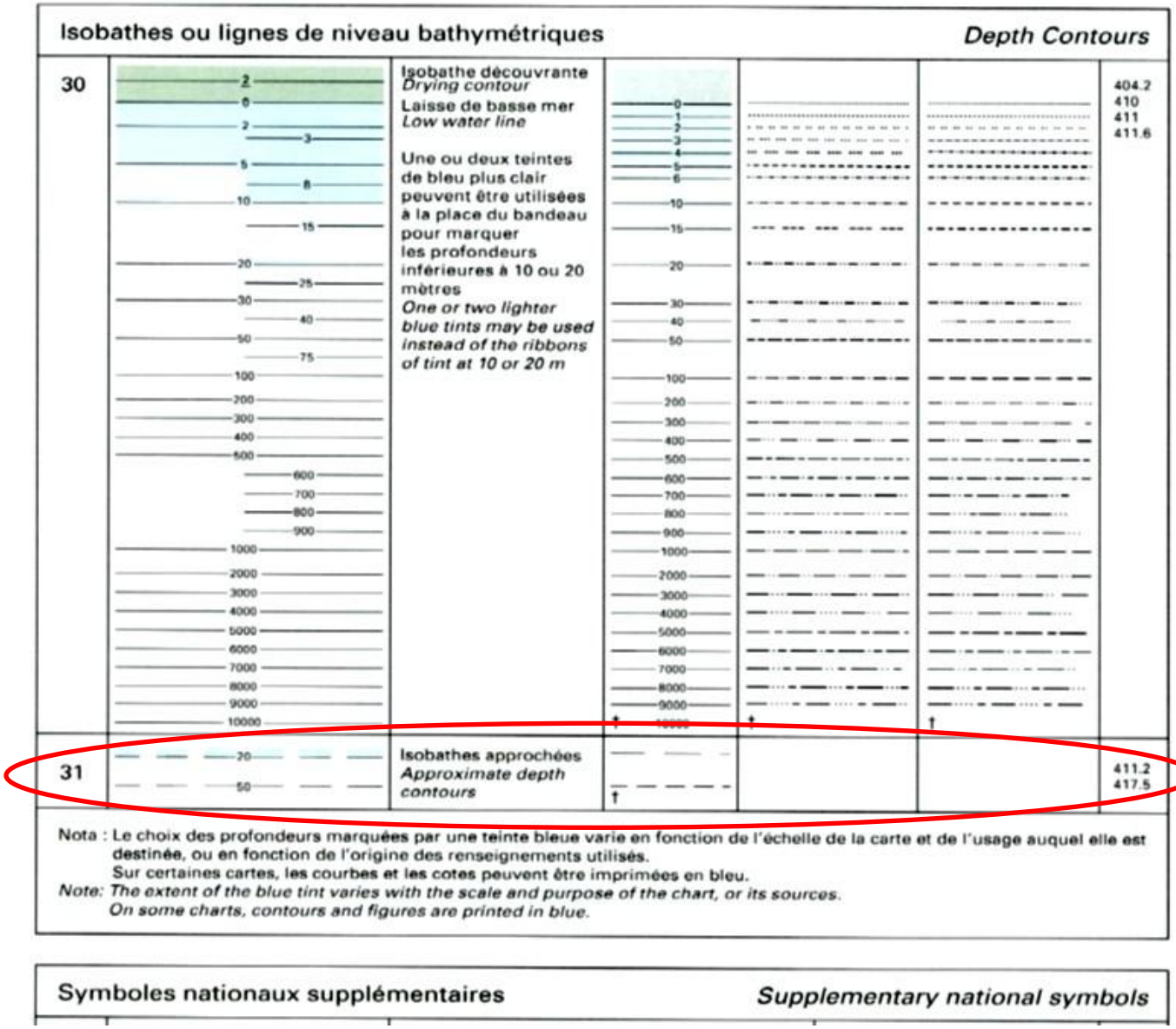
Annexes to circular letter: *Nil*

Main modifications

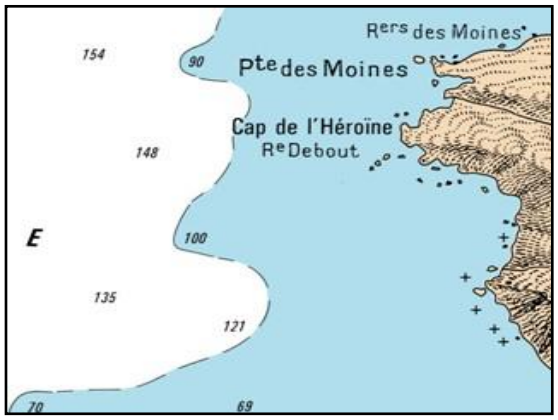
Date	Purpose	Reviews
11/04/2012	Remind that ECS is not approved for navigation	
17/08/2012	Inspection of Form E (Form C for some vessels)	

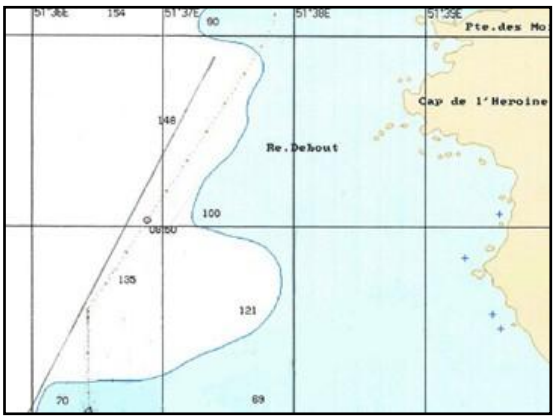
Extract from booklet SHOM 1 D Edition 2012

« SYMBOLS, ABREVIATIONS AND TERMS used on marine charts »



Here below, on the left, an extract of SHOM chart and on the right an extract of the chart used by the ECS TRANSAS system.





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