

## Sea Search Operations for the Airbus A330 Flight AF 447

### 1. Phase 1: 10 June – 10 July 2009

The first phase involved the search for the flight recorders via the signals transmitted by the underwater locator beacons (ULB), each recorder being equipped with a beacon designed to transmit a signal for a notional period of at least thirty days when it is immersed. In the first few days after the accident, a search zone of the order of 17,000 km<sup>2</sup> was defined within a circle with a radius of about 40 NM (around 72 km), which represents the maximum distance that the airplane could have flown from the last known position.

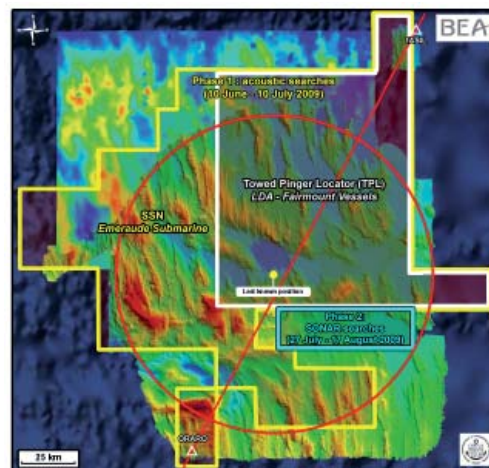
The French Navy deployed two ships - "BPC Mistral" and the frigate "Ventôse" - and "the Emeraude" nuclear submarine. The United States made available a team of specialists and technical equipment.

The BEA chartered three ships the "Pourquoi pas ?" from IFREMER and two tugs - Fairmount Glacier and Fairmount Expedition - from Fairmount Marine, a subsidiary of Louis Dreyfus Armateurs. This operation required establishing an appropriate formal legal framework immediately after the accident to ensure mobilisation of:

- ❑ Equipment from IFREMER in the context of a procurement contract signed by the BEA within the context of article 35-II of the public works contract regulations, taking into account the over-riding urgency of this commitment.
- ❑ Ships to tow the US Navy's acoustic systems. These were chartered as early as 5 June by the BEA under the terms of a contract established under Dutch law that was signed with the Dutch company FAIRMOUNT MARINE.

### 2. Phase 2: 27 July – 17 August 2009

The objective of the second phase was to search for the airplane wreckage with the aid of towed sonar and Victor 6000 and Nautilie underwater vehicles. This phase made it possible, in addition, to complete the bathymetry inside the 40 NM circle around the last known position.



Zones covered during phases 1 and 2

### 3. Preparation of Phase 3: September 2009 – January 2010

During the preparatory work analysis of the data from the previous phases and modelling of the structures of the sea currents made it possible to estimate the drift of the airplane debris between the date of the accident on 1<sup>st</sup> June, and the time of recovery from 6 June onwards.

This work led to a significant reduction in the area of the zone, which was thus reduced from almost 17,000 km<sup>2</sup> to around 2,000 km<sup>2</sup>.

The zone is located around 1,100 km from the coast of Brazil on the Atlantic ridge with very rough terrain on the sea floor, which has variations in depth of between 700 and 4,600 metres.

In January 2010, an international call for tenders made it possible to select candidates and offers from international operators. This required a complex legal framework that included:

- ❑ A charter contract under US law between the BEA and the two companies selected, Seabed AS and Phoenix International Inc., in accordance with maritime practices;
- ❑ Two service contracts, respectively under Norwegian and US law, with these two companies;
- ❑ An amendment to an intergovernmental agreement in order to be able to pay for services provided through the US Navy.

The above services were financed thanks to a fund set up with Airbus and Air France, who each provided 6.5 M€.

In February 2010, the BEA chartered two ships with the most high-technology equipment on board that could operate down to depths of 6,000 metres:

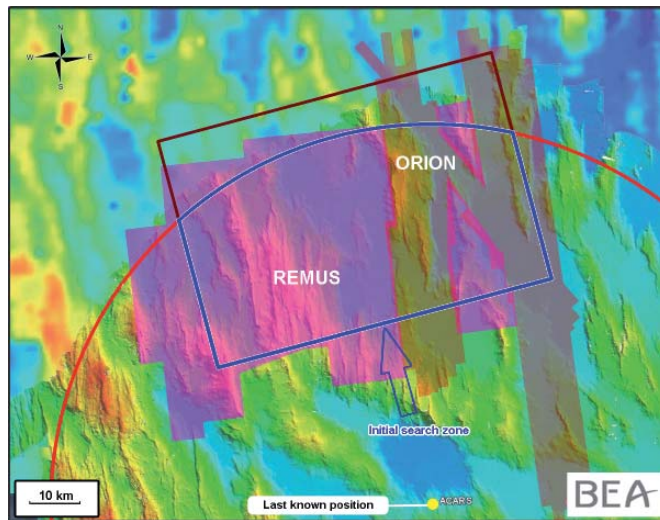
- ❑ The American ship Anne Candies from Phoenix International Inc. equipped with an ORION deep towed sonar and a CURV 21 remotely operated vehicle (ROV) belonging to the US Navy;
- ❑ The Norwegian ship Seabed Worker from the Seabed AS company equipped with one Triton - XLX 4000 remotely operated vehicle (ROV) and three REMUS 6000 autonomous underwater vehicles (AUV) operated by the American Woods Hole Oceanographic Institution (WHOI), of which two belonged to the Waitts Institute for Discovery (WID) and one to GEOMAR, the German oceanographic institute

### 4. Phase 3: 2 April – 24 May 2010

*1<sup>st</sup> period: from 2 to 25 April 2010*

The ships left the port of Recife (Brazil) on 29 March and the sea searches took place from 2 to 25 April 2010, which was when the ships left the search zone. They arrived in the port of Recife on 28 April 2010 for a technical stopover.

At the end of this first period, an area of around 4,500 km<sup>2</sup> had been explored.



Zones covered between 2 April and 25 April 2010

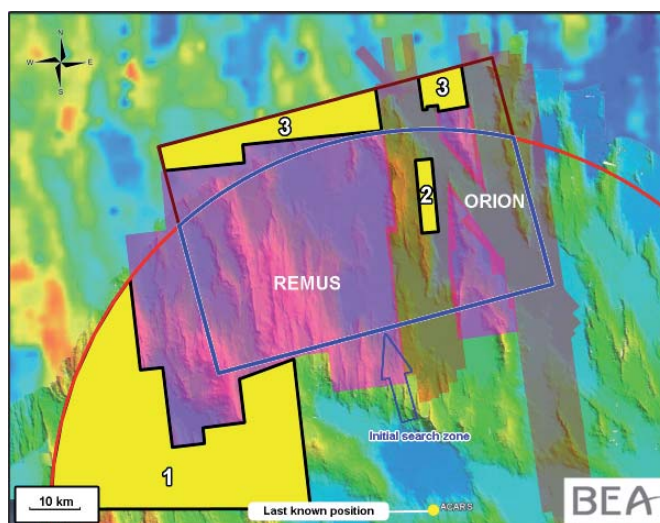
*2<sup>nd</sup> period: from 3 to 24 May 2010*

In order to take advantage of the means already mobilized for this operation, it was decided to extend the searches.

Since the US Navy ROV and sonar, installed on board the Anne Candies, were no longer available as a result of an American military operation, and the GEOMAR Remus had to participate in a scientific operation, the sea search operations continued with the Seabed Worker and the two Remus operated by WHOI.

The Seabed Worker left Recife on 30 April. The searches in the zone began on 3 May and were scheduled to explore:

- A zone adjacent to the initial zone and situated to the north-west of the last known airplane position ("zone 1");
- An area already covered in the initial zone whose re-exploration appeared to be necessary due to very rough sea floor terrain ("zone 2");
- Finally, the northern part of the rectangle defined by the scientific work ("zone 3").

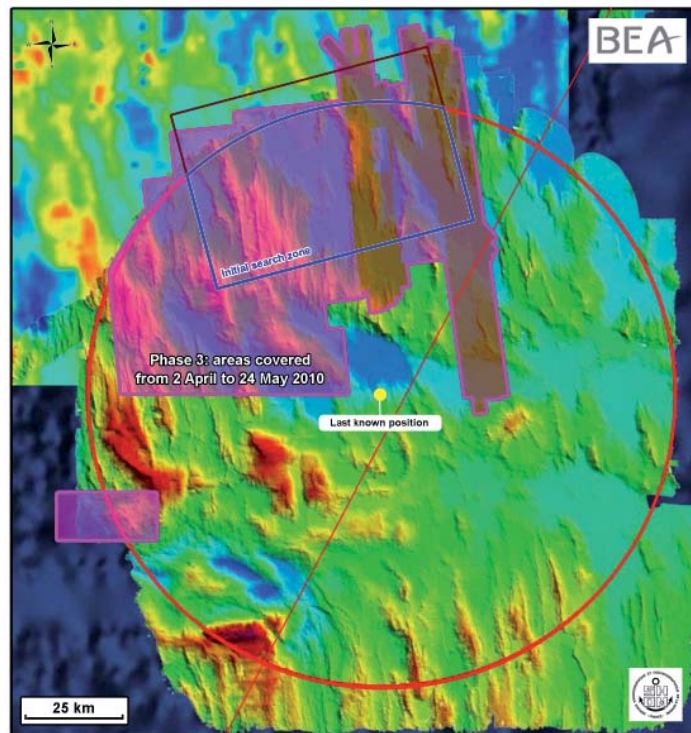


On 6 May, the French Ministry of Defence provided information on the results of the analytical work carried out on the data recorded on 30 June and 1<sup>st</sup> July 2009 by the Émeraude nuclear submarine, during the first phase of the searches. The BEA thus decided to extend its searches: a zone was defined based on the French Navy's identification of acoustic signatures similar to those transmitted by an Underwater Locator Beacon (ULB) during post analysis of the data.

The Seabed Worker thus sailed to an area located south-west of the last known airplane position. It was explored from 7 to 12 May 2010 without any success in localising the airplane wreckage. After ensuring optimal coverage of the whole of the zone, the BEA decided to go back to the searches originally planned.

The Seabed Worker continued its searches in zones "1" and "2" from 13 to 24 May, which was when the ship left the zone to sail to the port of Praia (Cabo Verde).

During this second period, an area of almost 1,800 km<sup>2</sup> was explored, including the zone of around 300 km<sup>2</sup> defined on the basis of the data provided by the French Navy.



In total, an area of nearly 6,300 km<sup>2</sup> was thus explored between 2 April and 24 May 2010, but without having been able to find the airplane wreckage.