Australian Government
Geoscience Australia

MH370 Data Review – Final Report

8 March 2022

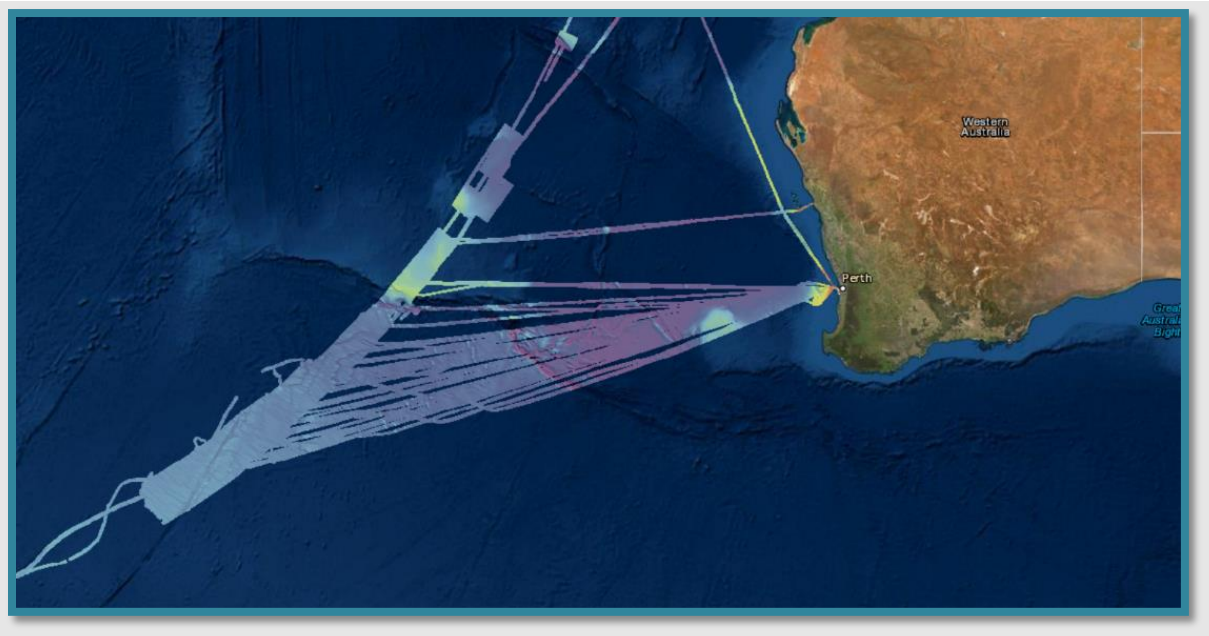

Image: Multibeam bathymetry data collected from the MH370 search.

Executive Summary

In January 2022, the Australian Transport Safety Bureau requested Geoscience Australia review existing data from the original seafloor search for flight MH370 based on a new report by Mr. Godfrey that proposed a crash location within the previous search area. Review of the existing data within a 40 nautical mile (~74 km) radius from this location determined that it is highly unlikely that there is an aircraft debris field within the area reviewed. However, there are significant regions, mainly beyond the 10 nautical mile radius from the proposed crash location, that have either no data, data collected by Ocean Infinity that is not part of this review, or data collected using shipborne multibeam sonar, which has insufficient resolution to identify an aircraft debris field.

The data reviewed included existing high-resolution (10 cm to 1 m) sonar datasets acquired during Phase 2 of the original search for MH370 using deep tow synthetic aperture sonar, deep tow and autonomous underwater vehicle (AUV) multibeam and sidescan sonar (image below), along with shipborne multibeam sonar. Geoscience Australia identified eleven contact sites not analysed during the original search. However, an independent external review of these contacts by an expert in deep water search and salvage operations (Andrew Sherrell) determined that none of the contacts were likely from an aircraft debris field. Eight were identified as most likely geological features and three as possible anthropogenic features. As each of the anthropogenic contacts was identified in physical isolation of other contacts, they were not categorised as being associated with an aircraft debris field. Verification of these objects would require further data acquisition.

The data reviewed covered an area of approximately 4,900 km^2, which represents 29% of the 17,000 km^2 area requested. The remaining area (71%) contained either Ocean Infinity search data, shipborne low-resolution (>30m) multibeam sonar data acquired during Phase 1, or no data. There are also 72.79 km^2 of 'holidays', i.e. areas with a dimension greater than 100 m where no data, or delineated lower quality data exist. The majority of these 'holidays' were previously documented, with some of a sufficient size to possibly contain an aircraft debris field. Additional data acquisition would be required in order to definitively ascertain if the aircraft rests in these areas.

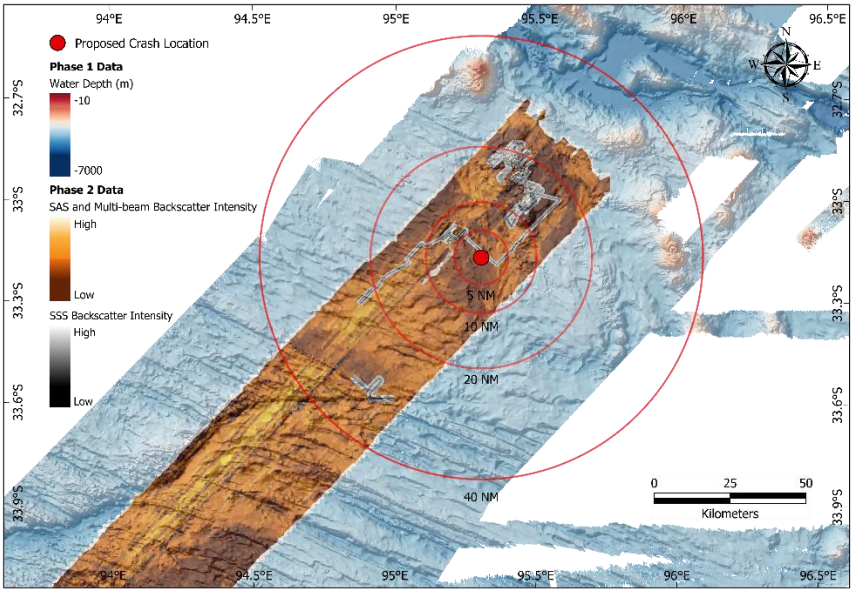

Image: Visual summary of the 2022 MH370 data review, which includes the Phase 2 datasets from the synthetic aperture sonar (SAS) and multibeam sonar (brown), and the sidescan sonar (SSS, grey scale). Image also shows the extent of the low resolution shipborne multibeam sonar data (blue/red scale) acquired during Phase 1

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Introduction

On 31 December 2021, British aerospace engineer Mr Richard Godfrey, in a 124-page report analysing Global Detection and Tracking of Any Aircraft Anywhere (GDTAAA) software based on Weak Signal Propagation Reporter (WSPR) data, concluded a crash location of MH370 at around 33.177°S 95.3°E[1]. In January 2022, the Australian Transport Safety Bureau (ATSB) requested Geoscience Australia (GA) review the existing data from the MH370 search located within a 40 nautical mile (~74 km) radius from the proposed crash location. This review aimed to re-validate that no items of interest were detected in the data captured during the original search in that area (Figure 1).

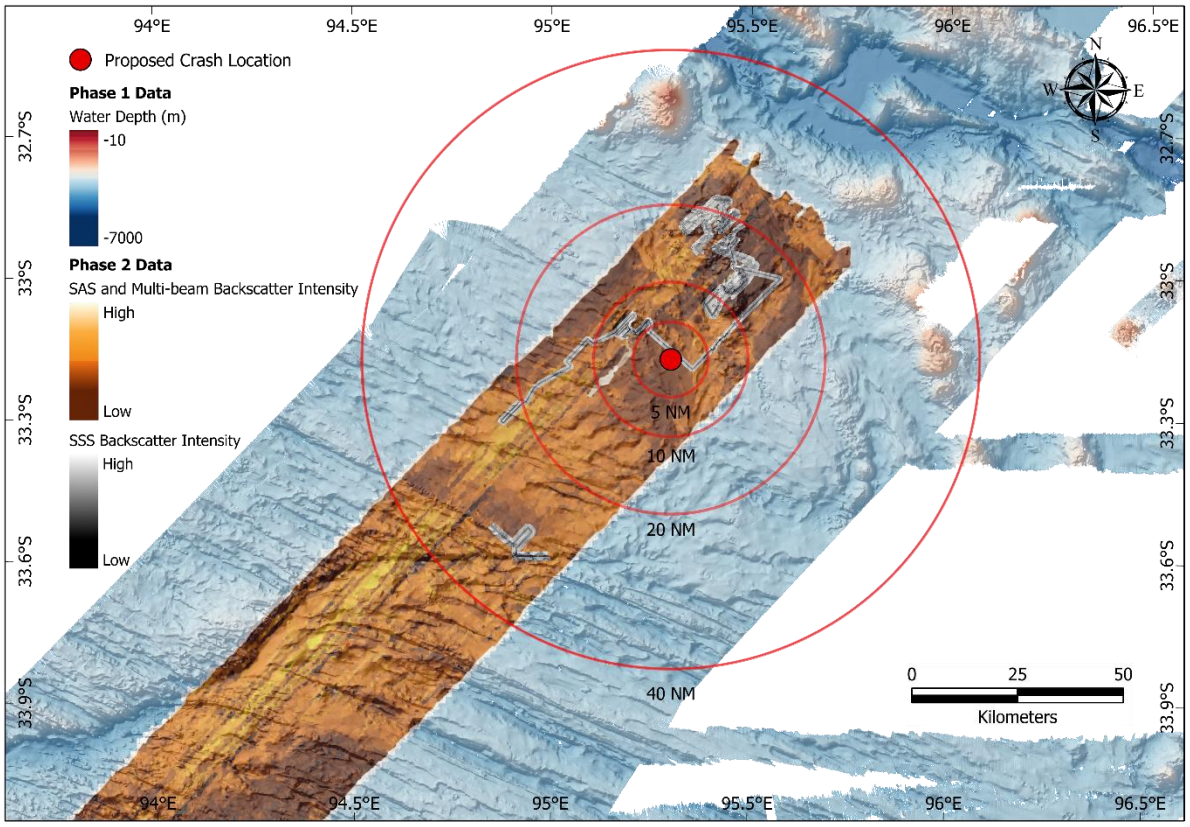

Figure 1. Proposed crash location identified by Mr. Godfrey with the 40 NM review radius over the data acquired during the original seafloor search for MH370. Data include Phase 1 low-resolution shipborne multibeam data and Phase 2 deep tow synthetic aperture sonar (SAS), multibeam backscatter (MBES) and sidescan sonar (SSS) data.

Method

The data reviewed included high-resolution sonar datasets acquired during Phase 2 of the original search for flight MH370 (Figure 1). These covered an area of ~4,900 km^2, or 29% of the area requested (17,000 km^2). Datasets were collected using synthetic aperture sonar (SAS), sidescan sonar (SSS) and multibeam sonar (MBES) (Table 1). These datasets included approximately 80,000 files (~3 TB of data) predominantly consisting of ten-centimetre resolution GeoTIFFs of SAS

[1] Godfrey, Richard. MH370 GDTAAA WSPRnet Analysis Flight Path Report, 2021, https://www.mh370search.com/2022/03/14/mh370-wspr-technical-report/

data, plus additional datasets of one-metre resolution MBES and ten-centimetre resolution SSS data used to fill gaps. GA used GIS and Sonarwiz software to perform the review.

Datasets acquired during Phase 1, using shipboard sonar, were not reviewed as their low resolution (>30m) does not permit identification of an aircraft debris field. Phase 1 data were collected to provide safe and efficient navigation for the underwater vehicles operated close to the seafloor during Phase 2 given the unknown composition and topography of the seafloor in the area when the search commenced.

Data collected by Ocean Infinity during a Malaysian Government-contracted survey in January 2018 were also not reviewed as part of this process as Geoscience Australia did not have access to these data.

Contacts were identified following principles and examples detailing wrecks from ships and aircraft in other reports (Appendix A). Hence, the GA team sought debris fields or plane-sized linear objects displaying strong sonar signal returns as expected from sonar sound reflecting off metallic surfaces.

Table 1. Information on the sonar datasets reviewed.

Survey ID	Vessel	Sonar Type	Resolution	# of files
MH370 Search	Go Phoenix	Synthetic Aperture (SAS)	10 cm	81,100
MH370 Search	Go Phoenix	Multibeam backscatter (MBES)	1 m	130
MH370 Search	Fugro Equator	Sidescan (SSS)	1 m	85

Results

Contacts

GA identified eleven contacts in addition to those identified during the previous search (Table 2; Figure 2). Eight were identified as most likely geological in nature and three as possibly anthropogenic in nature. As each of the anthropogenic contacts was identified as a single feature in physical isolation of other contacts (>20NM apart), they were not categorised as being associated with an aircraft debris field.

All contacts were independently reviewed by Andrew Sherrell, who confirmed that none of the contacts were likely from an aircraft debris field. However, verification of these objects would require further data acquisition.

During the review, GA provided weekly contact reports to ATSB. These reports included four additional contacts that are not presented here as they were identified as sonar noise artefacts by Andrew Sherrell.

Table 2. Summary of additional contacts identified with their likely origin. Note: The MBES backscatter lines have the same line names as the SSS and SAS data.

Contact ID	Sonar line names	Likely origin
GA_01	Z2L8N	Geological
GA_02	Z2L2S	Geological
GA_03	Z2L14S	Anthropogenic
GA_04	Z2L5S	Anthropogenic
GA_05	Z2L24	Geological
GA_06	Z2L28S	Geological
GA_07	Z2L24	Geological
GA_08	Z2L2S	Geological
GA_09	Z2L24N	Geological
GA_10	Z2L8N	Geological
GA_11	Z2L19N	Anthropogenic

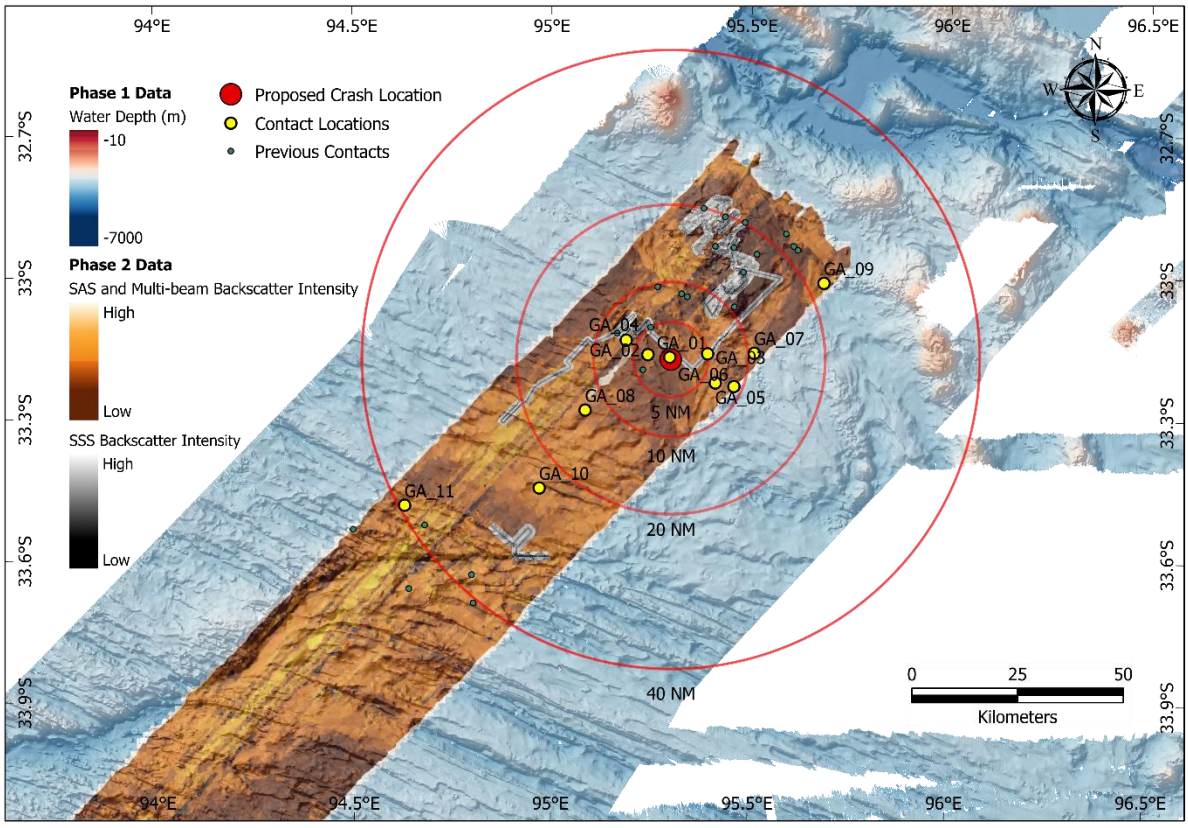

Figure 2. Location of the contacts identified by GA within the 40 NM radius of the proposed crash location identified by Mr. Godfrey over the data acquired during the original search for MH370. Data include Phase 1 shipborne multibeam water depth data and Phase 2 deep tow synthetic aperture sonar (SAS), multibeam backscatter (MBES) and sidescan sonar (SSS) data. Contacts identified by Geoscience Australia are displayed on this map and labelled in order of proximity to the proposed crash location.

Data Gaps and 'Holidays'

Data coverage within the 40 NM radius of the proposed crash location was examined for data gaps and 'holidays'. Data gaps are areas where sonar data was not collected. Data holidays are small gaps (greater than 100 m) within the data, attributed to numerous factors such as equipment failure, low data density, or the vessel being temporarily off track.

Of the total 17,000 km^2 requested review area, only about 4,900 km^2 or 29% contained high-resolution data from Phase 2 of the search. The area within 10 NM from the proposed crash location, however, was nearly all covered by data, with the exception of only a small gap to the SE. The remaining area beyond 10 NM was either covered by Ocean Infinity search data, which Geoscience Australia did not review, or low-resolution shipborne multibeam sonar data.

During Phase 2 of the original search, holidays and low-probability detection areas (LPDs) totalling 71.22 km^2 were documented (Table 3; Figure 3). In this review, GA identified a small number of additional holidays totalling 1.57 km^2 (Figure 3). The largest holiday was identified in the original search and is a long, narrow, low-probability detection area of about 21.7 km^2 (Figure 3). Overall, holidays and LPDs represent 1.5% of the total area reviewed.

Table 3. Sources of holidays and low-probability detection areas within 40NM of the proposed crash location.

Mechanism for holidays and LPDs	Area (km^2)
Additional missing data	1.57
Equipment Failure	5.37
Lower probability of detection (LPD)	48.91
Off-tracks	0.17
Terrain avoidance	8.44
Shadow zones	8.33
Total	72.79

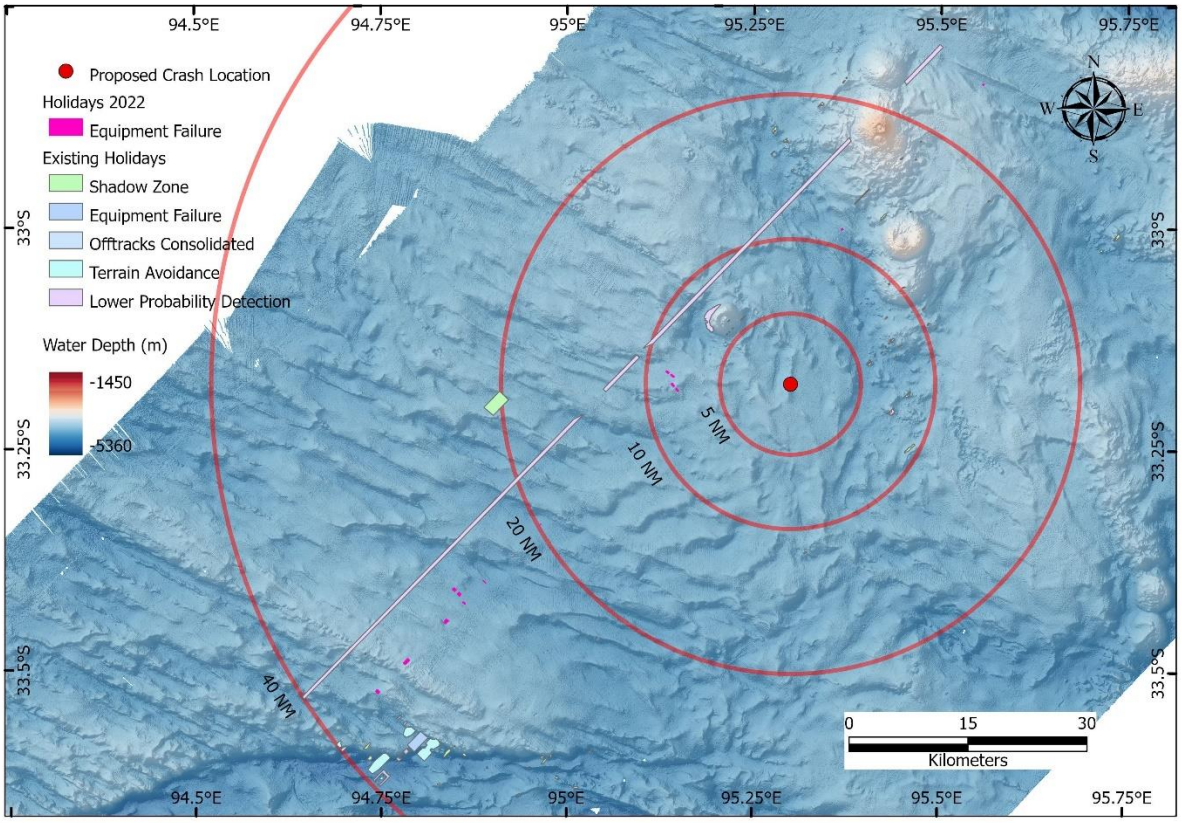

Figure 3. Additional holidays (bright pink) identified during this review presented alongside previously identified holidays. Largest holiday previously identified is partly shown as the long purple sliver crossing the radii markers.

Conclusion

This review led to the identification of eleven additional contacts by GA. However, an independent external review of these contacts by an expert in deep water search and salvage operations determined that none of the contacts were likely from an aircraft debris field. As each of the anthropogenic contacts was identified as a single feature in physical isolation of other contacts, they were not categorised as being associated with an aircraft debris field. Verification of any features would require further data acquisition.

This review, therefore, concludes that it is highly unlikely there is an aircraft debris field within the existing Phase 2 datasets reviewed. However, there remains a significant area of 12,100 km^2 within the 40 NM radius from the proposed crash location as well as 72.79 km^2 area of gaps and 'holidays'. Review of the Ocean Infinity search data and additional data acquisition would be required in order to definitively ascertain if the aircraft rests in these areas.

Appendix A: Aircraft debris field example

This appendix contains examples from an underwater aircraft debris field (1) and a shipwreck (2) in sidescan sonar imagery. Images and descriptions from the associated reports helped guide the MH370 data review by providing constraints in terms of scale, signal strength and contact geometry for the same type of data in a similar context.

1. Airplane debris field – AF447

Vessel: M/V Alucia

Date: 20 April, 2011

Target Criteria:

The expected sonar anomaly created by a jet aircraft such as MH370 would be a circular or oblong scatter field of highly reflective debris. Taking into consideration the deep water depths in the survey area, the scatter field is expected to be larger than 100 m and could be spread over several kilometres. The following image example is of a typical scatter pattern made by a passenger aircraft that crashed into the sea.

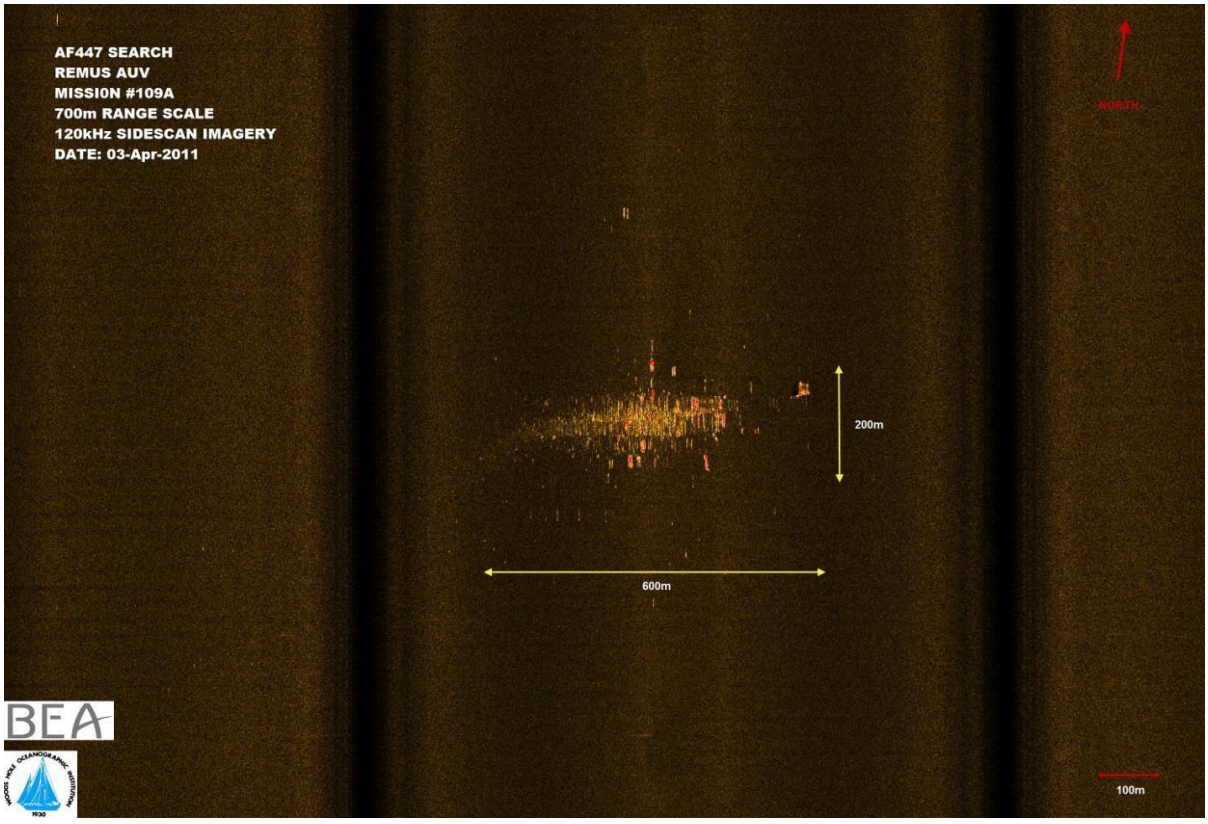

Figure A.1. Typical scatter pattern of a crashed airplane in SSS data. Source: BEA, Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile report.

2. Shipwreck debris field

Vessel: SV DONG HAI JIU 101

Date: 19 April, 2016

Target Criteria:

A scatter pattern that may be similar to a plane wreck, including an oblong spread with high intensity signals. Below is the expression of a low lying and highly deteriorated known wooden shipwreck debris field in SAS and SSS imagery (contact ID DJ-008_FE0019_FS0055).

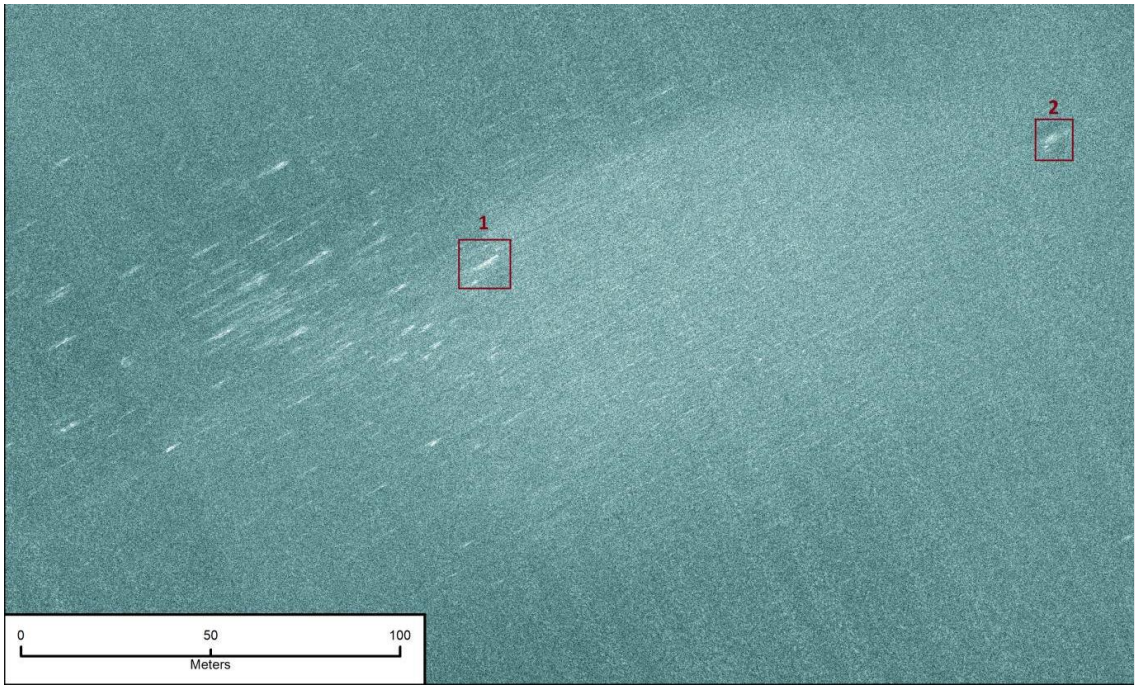

Figure A.2. Enlarged image of a known shipwreck in SAS data. Source: Contact Investigation Report DJ-008_FE0019_FS0055.

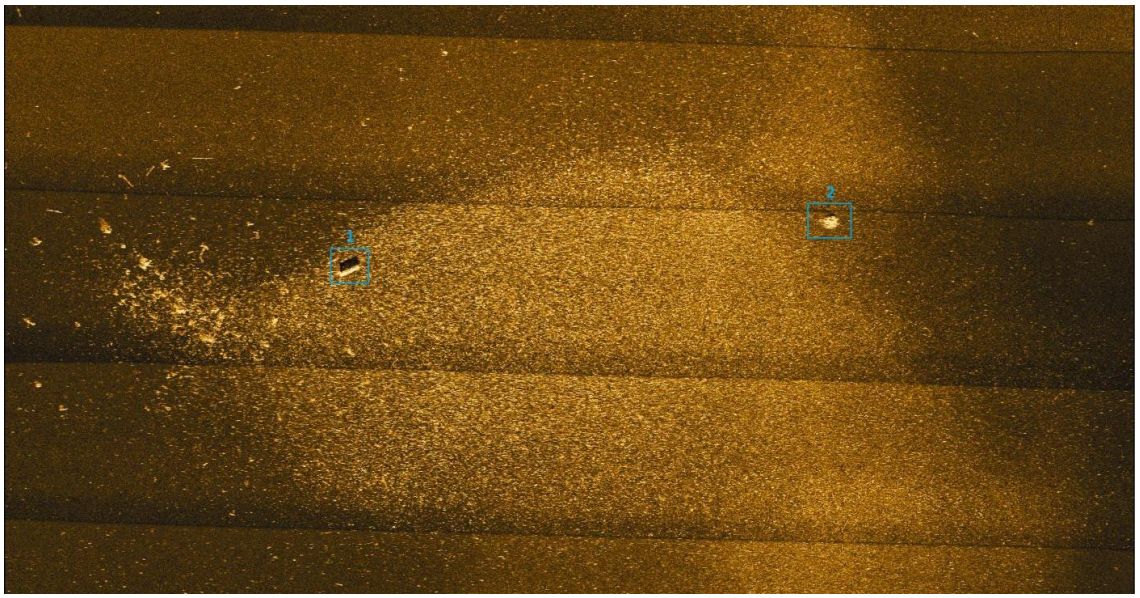

Figure A.3. Enlarged image of a known shipwreck in high frequency SSS data. Source: Contact Investigation Report DJ-008_FE0019_FS0055.