Media Release

Curtin University

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Curtin researchers in search for acoustic evidence of MH370

Curtin University researchers have been examining a low-frequency underwater sound signal that could have resulted from Malaysian Airlines Flight MH370.

The signal, which was picked up by underwater sound recorders off Rottnest Island just after 1:30 am UTC on the 8^{th} March, could have resulted from Flight MH370 crashing into the Indian Ocean but could also have originated from a natural event, such as a small earth tremor.

However, there are large uncertainties in the estimate and it appears it is not compatible with the satellite 'handshake' data transmitted from the aircraft, which is currently considered the most reliable source of information.

Scientists from Curtin's Centre for Marine Science and Technology along with colleagues from the United Nations' Comprehensive Nuclear-Test-Ban Treaty Organisation (CTBTO) and Geoscience Australia have been involved in the search for sounds that might help with search efforts.

Dr Alec Duncan, Senior Research Fellow and part of Curtin's Centre for Marine Science and Technology team, explained that a passive acoustic observatory 40 kilometres west of Rottnest Island that forms part of the Commonwealth-funded Integrated Marine Observing System (IMOS) had provided the potential lead.

"Soon after the aircraft disappeared, scientists at CTBTO analysed data from their underwater listening stations south-west of Cape Leeuwin and in the northern Indian Ocean. They did not turn up anything of interest," Dr Duncan said.

"But when the MH370 search area was moved to the southern Indian Ocean, scientists from Curtin's Centre for Marine Science and Technology decided to recover the IMOS acoustic recorders located west of Rottnest Island.

"Data from one of the IMOS recorders showed a clear acoustic signal at a time that was reasonably consistent with other information relating to the disappearance of MH370.

"The crash of a large aircraft in the ocean would be a high energy event and expected to generate intense underwater sounds."

Dr Duncan said the signal could also have been due to natural causes – such as a small earth tremor – but the timing made it of interest in the search for MH370.

"It has since been matched with a signal picked up by CTBTO's station south-west of Cape Leeuwin.

"A very careful re-check of data from that station showed a signal, almost buried in the background noise but consistent with what was recorded on the IMOS recorder off Rottnest," Dr Duncan said.

"The CTBTO station receives a lot of sound from the Southern Ocean and Antarctic coastline, which is why the signal showed up more noticeably on the Rottnest recorder.

"Using the three hydrophones from the Cape Leeuwin station, it was possible to get a precise bearing that showed the signal came from the north-west.

“Comparing the arrival time of the signal at the IMOS recorder with the time of its arrival at the Cape Leeuwin station, it was possible for Curtin’s Centre for Marine Science and Technology team to come up with an approximate distance to the source of the sound along this north-west bearing.

Dr Duncan said Curtin’s Centre for Marine Science and Technology team would continue to work with search authorities.

“Although we have now completed our analysis of these signals, Curtin’s Centre for Marine Science and Technology still has several recorders deployed that could conceivably have picked up signals relating to MH370.

“Due to various factors, we consider it very unlikely that they would have done so and have therefore not recovered them to date. We will, however, be carefully analysing their recordings when they are recovered in due course,” Dr Duncan said.

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High-resolution diagrams and a map detailing the estimated uncertainty region are available to download on the Curtin Media Centre: http://news.curtin.edu.au/media-centre/

Notes to editor

- This has been a large-scale effort involving a number of researchers and support staff from Curtin’s Centre for Marine Science and Technology as well as scientists from the United Nations’ Comprehensive Nuclear-Test-Ban Treaty Organisation (CTBTO) in Vienna and Geosciences Australia. Institutions that have been critical to this work include Curtin University, Geosciences Australia, the CTBTO, the Australian Government funded Integrated Marine Observing System (IMOS), the Australian Department of Defence, and the Centre for Whale Research.
- Sounds associated with the impact of an aircraft on the ocean surface and/or collapse of sinking wreckage would include a substantial amount of energy at very low frequency (less than 100 Hz) much of it too low for humans to hear.
- Low frequency sounds can travel thousands of kilometres underwater, partly because sound is absorbed much more slowly in water than air and partly because the way temperatures and pressure change with depth in the ocean results in a minimum sound speed at a depth of about 1000 metres.

- This sound speed minimum creates a duct in which sound is prevented from interacting with the sea surface or seabed, markedly reducing the loss of intensity with distance. This duct is known as the Deep Sound Channel.
- There are several underwater listening stations in the Indian Ocean. Curtin's Centre for Marine Science and Technology has underwater sound recorders permanently deployed about 40km west of Rottnest Island, offshore from Perth, Western Australia. These recorders form part of the Integrated Marine Observing System (IMOS), which is funded by the Australian Government under its National Collaborative Research Infrastructure Scheme (NCRIS), and are used for studies of the movements of great whales and other marine animals, as well as studies of other natural and man-made underwater noise sources. These recorders are autonomous, single hydrophone devices that are deployed for periods of up to a year. This is a very cost-effective way of making underwater sound recordings but the data are only available once the recorder is recovered. For more about IMOS see: http://www.imos.org.au/.
- The CTBTO has two operational hydroacoustic monitoring stations in the Indian Ocean. One, designated HA01, has an array of three hydrophones in the Deep Sound Channel, southwest of Cape Leeuwin, Western Australia, and the other, HA08, has two arrays, each with three hydrophones, in the British Indian Ocean Territory / Chagos Archipelago in the northern Indian Ocean. Only the southern HA08 array was operational at the time MH370 was lost. These stations are part of the verification network for the Comprehensive Nuclear-Test-Ban Treaty and are intended to detect clandestine nuclear tests. The hydrophone signals are transmitted to shore through undersea cables and the data are transmitted to the CTBTO headquarters in Vienna in real time. Precise synchronisation of the recordings from the three hydrophones in each array allows accurate direction of arrival information to be obtained. Geosciences Australia has direct access to the data from HA01 and delayed data from all stations is available for scientific research. For example, Curtin's Centre for Marine Science and Technology has used data from HA01 for tracking blue whales, and data from both HA01 and HA08 for quantifying noise due to the breakup of ice along the Antarctic coast as part of climate change studies. More information about the CTBTO verification regime can be found here: http://www.ctbto.org/verification-regime.
- More information about Centre for Marine Science and Technology's research can be found here: www.cmst.curtin.edu.au

Acoustic signal plots and map are attached below.

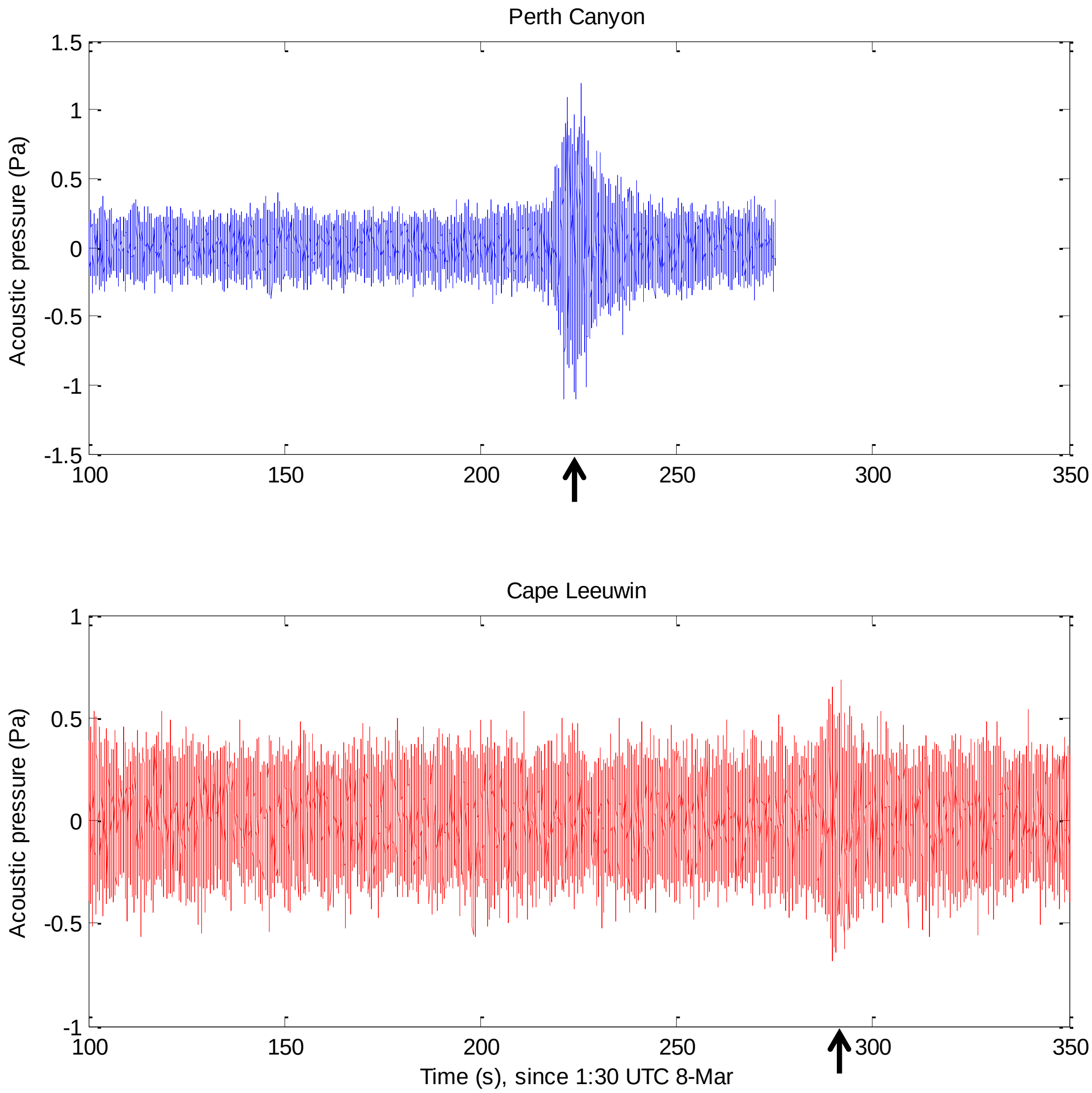

Fig. 1. Acoustic signals recorded by the Integrated Marine Observing System (IMOS) sound recorder west of Rottnest Island (top) and by one of the hydrophones of the CTBTO's HA01 hydroacoustic station off Cape Leeuwin (bottom). Arrows show the arrival time at each station of the peak energy of the signal.

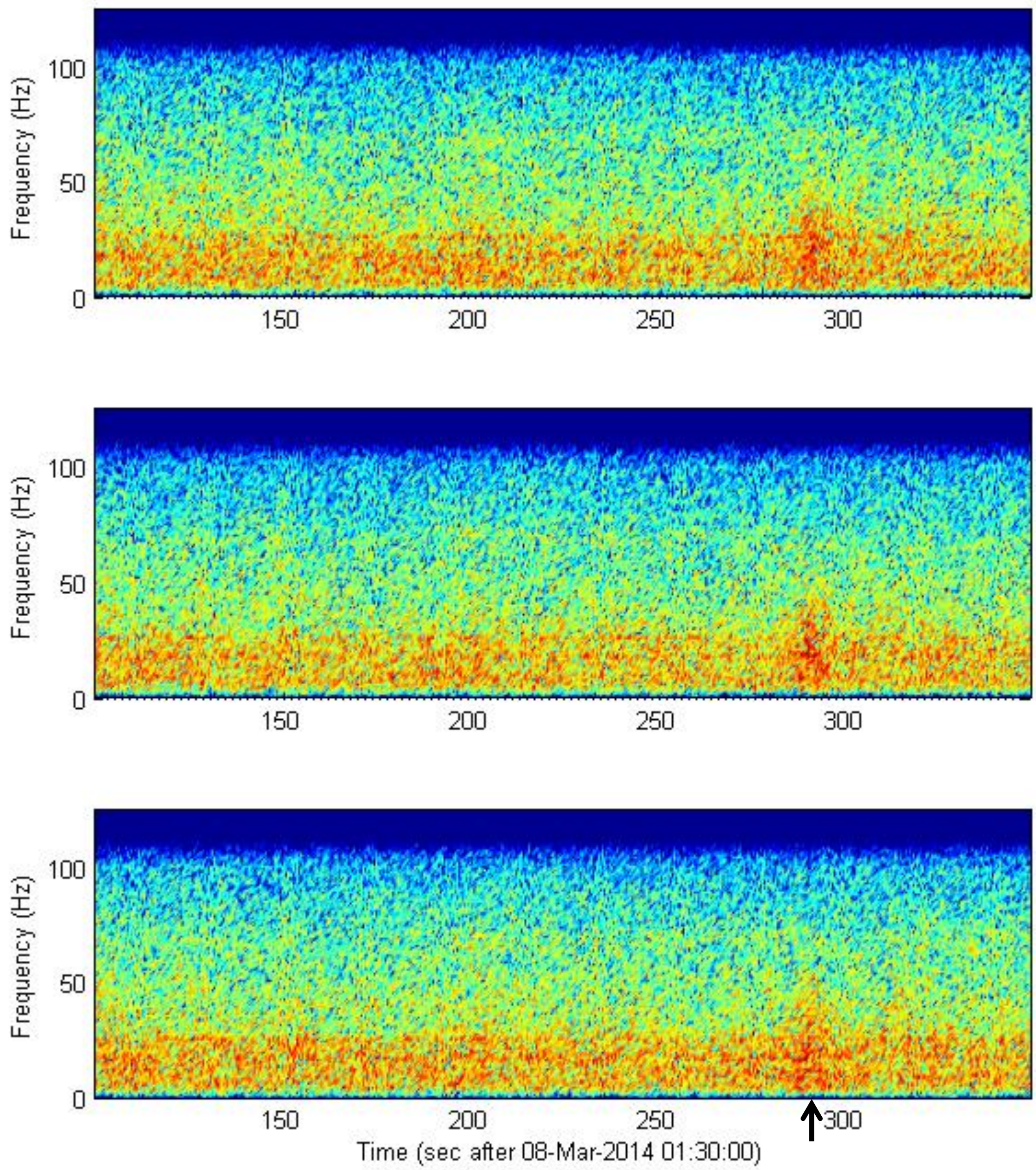

Fig. 2. This plot shows how the frequency content of the underwater sound arriving at the three HA01 hydrophones varies with time. The arrow shows the arrival time of the peak energy of the signal we have been analysing. A mathematical process called correlation can be used to measure small differences between the times of arrival of the signal at the three hydrophones, from which the direction of the source can be calculated. The relatively high noise levels below 25 Hz are probably from shipping.

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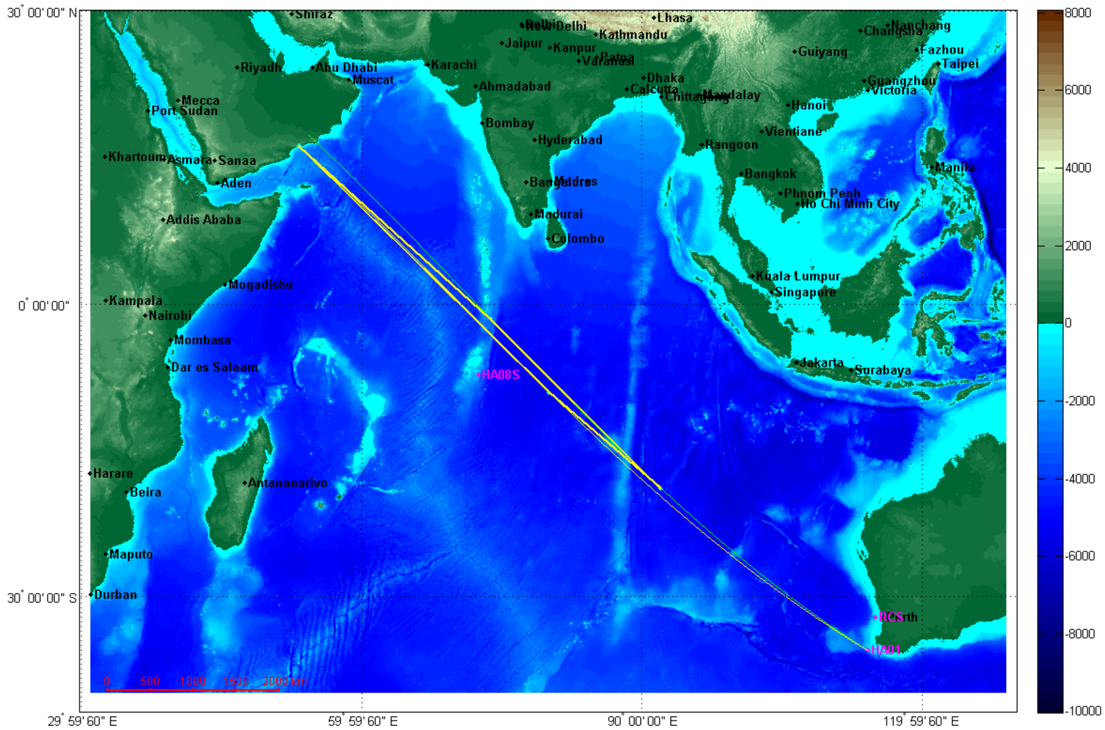

Fig. 3. Map showing estimated uncertainty region (yellow box) for the source of the signals shown in Fig. 1. Magenta points and text show the locations of the various recording stations. RCS is the IMOS recorder west of Rottnest Island, HA01 is the CTBTO station off Cape Leeuwin, and HA08S is the southern CTBTO BIOT/Chagos Archipelago array. The fix was calculated using data received at RCS and HA01. The signal was not received at HA08S which could be due to it being blocked by shallow water to the north or northwest of this station or poor coupling of the signal into the Deep Sound Channel due to an unfavorable seabed slope.