PAWSEY supercomputing centre

PARTNER INSTITUTION
THE UNIVERSITY OF WESTERN AUSTRALIA

REVEALING SECRETS FROM OCEAN CURRENTS

PROJECT LEADER
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SYSTEM
MAGNUS

TIME ALLOCATED
100,000 HOURS

AREA OF SCIENCE
PHYSICAL OCEANOGRAPHY

APPLICATIONS USED
ICHTHYOP
CRAY COMPILER
MPI
PARCELS
NETCDF

On March 7, 2014, a commercial aircraft carrying 239 passengers vanished. Flight MH370 was scheduled to travel from Kuala Lumpur to Beijing, yet disappeared from civilian radar screens only one hour into the planned six-hour flight.

Despite exhaustive international searches within the South China Sea and Indian Ocean, investigators were unable to locate MH370.

In a new chapter of the search for MH370, investigators called on the expertise of oceanographers to pinpoint a crash site of the aircraft. Prof Charitha Pattiaratchi and Dr Sarath Wijeratne, oceanographers from The University of Western Australia, used the Magnus supercomputer at Pawsey Supercomputing Centre to conduct oceanic drift modelling and predict the trajectory of aircraft debris from MH370.

Utilising the world class facilities at Pawsey, Prof Pattiaratchi focused on debris which washed up at Reunion Island, tracing it back to its original location through ocean currents. The pattern of debris dispersal in the ocean was used to assist search team investigators in locating a possible crash site.

2018

SIMULATIONS OF DEBRIS MODELLING ASSOCIATED WITH MH370

THE CHALLENGE

For reasons yet unknown, flight MH370 deviated from its original flight path. Experts believe the aircraft to have crashed into the Indian Ocean. Initially, the search area for MH370 was defined by a series of seven satellite pings relayed from the plane's engines that told the now famous story of the plane going off-course in its final moments.

The Australian Government, with assistance from Malaysia and China, were faced with a 120,000 square kilometre stretch of search area in the Indian Ocean near Western Australia. This search area, based upon the projected flight path provided by the satellite pings and some early oceanic debris modelling, was unfortunately found empty.

Now, UWA oceanographers have used a new model to run complex numerical simulations to search for the real crash site of MH370.

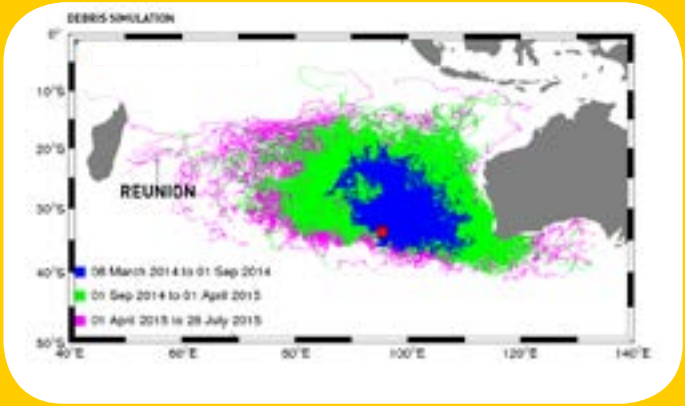
"We were able to run 50,000 individual debris drift simulations at 25 locations over a 2 year period to identify the possible location of the crash site," said Prof Pattiaratchi.

The calculations require far more than standard computational power, so to unravel this riddle, Prof Pattiaratchi and his team required the state-of-the-art infrastructure at Pawsey Supercomputing Centre. With it, UWA oceanographers could perform extensive dispersion modelling to investigate possible MH370 debris origins.

THE SOLUTION

With the discovery of a piece of a wing called a flaperon, Prof Pattiaratchi was able to calculate an approximate location of MH370 by predicting the debris path and the time that it took to Reunion Island.

Mapping the dispersion of flight crash debris requires complex mathematical equations to represent all the natural forces the debris encounters to affect its path. Light debris will float upon the surface and be subject to different forces than the heavier debris that sinks to the ocean floor.



"The drift models that simulate objects at the surface or at depth take into account the current field; the wind and wave field (if at the surface), as well as object-specific drift properties to advect the drifting object. In our models the 50,000 particles are used to propagate a range of debris behaviour statistically and deterministically" said Prof Pattiaratchi.

Whilst drift modelling can tell the story of airplane crashes, it can also be applied to a wide gamut of other situations where a subject's location is determined by ocean conditions. The dispersion model was run to include a range of different problems, to maximise the research benefit.

"The drift modelling conducted with the Magnus Supercomputer was designed to include practical applications, not just for the search of MH370, but also for oil spill prediction, problems with seagrass wrack in Geographe Bay; turtle tracks, the exchange of larva in marine populations, and marine debris pathways."

OUTCOME

The search for MH370 was suspended last year by authorities until credible new information could be found; but thanks to the work of Prof Pattiaratchi and others, the search began again on January 5 this year. Though the crash site for MH370 has not yet been found, the debris modelling pointed to a new, significantly smaller, 25,000 square kilometre area – further north than previous predictions – which is currently being searched.

The research done with Pawsey has turned up promising leads. It was used to guide the search for MH370 coastal debris, to great success.
"Of the 22 pieces of debris found, the location of 18 were predicted by our UWA model. Those not predicted were in Mauritius and Rodrigues Islands which may not be well represented in the oceanographic model."
Thanks to the help of Pawsey and UWA, the desperate search for answers to the MH370 mystery might soon come to an end for both the government and the loved ones of those lost passengers.