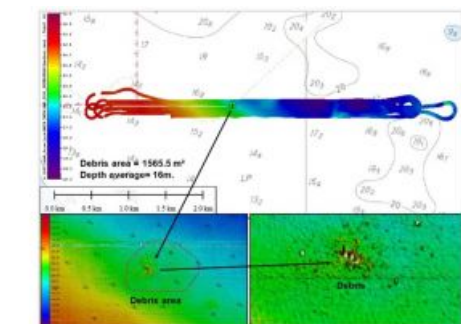


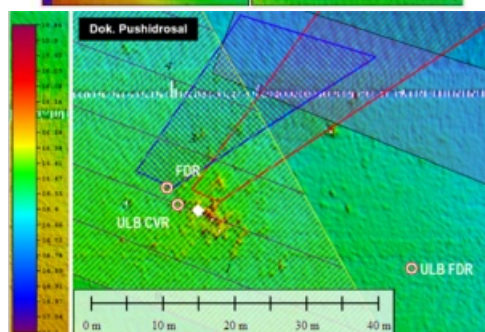
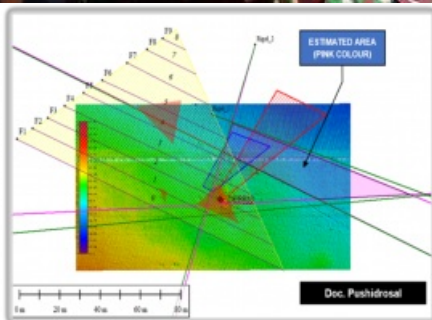
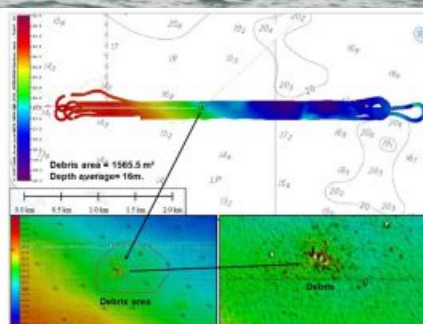
# A SEARCH AND RESCUE MISSION IN INDONESIA

## Key Role for Hydrography in Black Box Search Operation



Sriwijaya Air Flight 182 was an Indonesian domestic flight from Soekarno-Hatta International Airport in Jakarta to Pontianak, Indonesia. On Saturday 9 January 2021, the Boeing 737 crashed into the waters of the Thousand Islands just four minutes after take-off. The President of the Republic of Indonesia, Joko Widodo, immediately ordered all authorized agencies to carry out search and rescue (SAR) operations.

The SAR operation for Flight 182 involved several government agencies, including the National Search and Rescue Agency Republic of Indonesia, the Indonesian National Armed Forces, and the Indonesian National Police. The Indonesian Navy Hydro-Oceanographic Center (Pushidrosal) immediately dispatched the hydrographic survey vessel KRI Rigel-933 to carry out search operations at the crash site. KRI Rigel-933 is



a survey ship made by the French shipyard OCEA in 2015, with sophisticated hydrography and oceanography survey equipment.

After receiving an order from the Commandant of the Indonesian Navy Hydro-Oceanographic Center, Vice Admiral Dr Agung Prasetiawan, M.A.P, KRI Rigel-933 immediately made preparations for the SAR operation. Once these were complete, KRI Rigel-933 departed at 00:40 (local time) on January 10 2021 from the Jakarta Naval Base to the crash site. KRI Rigel-933 arrived in the Thousand Islands waters at 03:15 on 10 January 2021 and a search operation was begun immediately.

Figure 1: KRI Rigel-933.

### Search Operation with Multibeam Echosounder

The first step taken by KRI Rigel-933 at the search location was to search for debris using a multibeam echosounder (MBES). Sweeping suspected areas was successful in detecting seabed targets that were analysed as Flight 182 debris, and the position of the debris eventually became the main location of the SAR operations. The sea depth where the debris was found was around 14–20 metres, with a mud sand seabed. Underwater visibility at the location also allowed a black box search by divers. KRI Rigel-933 also conducted a magnetic anomaly survey using a magnetometer to determine the position of the debris distribution.

□ Figure 2: Search and Rescue (SAR) preparation.

## Black Box Signal Detection by HiPAP 501

After the discovery of the debris, the next step taken by KRI Rigel-933 was to detect the black box signal using HiPAP in the area where the aircraft debris was found. The HiPAP on the KRI Rigel-933 is positioning equipment for the AUV. The HiPAP equipment has the capability to detect a 37.5kHz acoustic signal (up to 5,000m) from an Underwater Locator Beacon (ULB) mounted on the black boxes (the flight data recorder (FDR) and the cockpit voice recorder (CVR)).

In this operation, a signal was detected by HiPAP, but the only information received in this way is distance information. Therefore, to obtain position data using the signal from the black box, the next step was to use the triangulation method to detect black box signals from at least three different positions. The intersection of the signals from the three or more data collection positions produced an area that was estimated to be the location of the black box. Although the position obtained by this triangulation method was not an accurate position, it narrowed the black box search area so that the search operation could focus on that area. The search for the black box was then continued using divers in the position that was obtained.

□ Figure 3: The result of the multibeam echosounder seafloor sweep.

## Black Box Search by Divers

The search for the black box was continued by deploying the Frogman Forces Command (Kopaska) and Indonesian Navy divers to the search area according to the results of the HiPAP position. The dive area was divided into sections to speed up the search. The divers were equipped with a transponder, a ping locator and underwater communication, and all movements were monitored and guided directly from KRI Rigel-933. Searching for a black box by diving is quite difficult and time-consuming because, at some locations, the diver must first remove debris before continuing the search for the black box.

## ROV Deployment

In this search operation, KRI Rigel-933 also deployed a remotely operated vehicle (ROV) in the same area as the diver search. The ROV was equipped with cameras and underwater lighting so that the search operation could continue at night. The limitation faced by the ROV in this operation was that it was unable to search inside the dense and buried debris.

□ Figure 4: Triangulation method to determine the estimated position of the black box.

## Discovery of the Black Boxes

On 12 January 2021, on the third day of the search operation, one of Flight 182's black boxes was finally found. This was the FDR. Not long after, a ULB was also found that was estimated to be the ULB from the CVR. The position of the ULB was not far from the location where the FDR was found. The FDR black box was found by the Navy and handed over to the National Transportation Safety Committee for further investigation. The search operation was continued to find the CVR.

After a long search, the SAR team finally found the CVR on 30 March 2021, and its position was not far from the FDR position. This had taken such a long time because the CVR had been separated from its ULB, making it impossible to detect its position with HiPAP or a ping locator. The CVR was also thought to have been buried in the seabed, making it difficult to find by diving. Because of the conditions, the search had been continued with diving but also using suction equipment on a trailing suction hopper dredger, which is how the CVR was found.

## Conclusion

The Flight 182 black boxes would not have been found without the support of the Indonesian Navy Hydro-Oceanographic Center. This support made it possible to find the debris and to determine the position of the black boxes, which greatly assisted in the search operation. This shows how important the role of the hydrographic office is in SAR operations at sea. The success of the Indonesian Navy Hydro-Oceanographic Center would not have been possible without its professional staff and sophisticated survey equipment.

□ Figure 5: The Position of the FDR, ULB FDR and ULB CVR.