

*INTERNATIONAL CIVIL AVIATION ORGANIZATION***FIRST MEETING OF THE REGIONAL AVIATION SAFETY GROUP -
ASIA AND PACIFIC REGIONS (RASG-APAC/1)***Noumea, New Caledonia, 10 - 11 October 2011***Agenda Item 4: Member State Presentations****ACCIDENT INVESTIGATION –
LOCATING A SMALL OBJECT UNDERWATER**

(Presented by Hong Kong, China)

SUMMARY

This paper provides experience sharing on locating a small object underwater by the Accident Investigation Division, Hong Kong Civil Aviation Department.

1. INTRODUCTION

1.1 On 3 July 2010, an Agusta Westland AW139 helicopter, registration B-MHJ, operated by East Asia Airlines and bound for Macao, had an accident shortly after taking off from the heliport ashore Hong Kong Victoria Harbour. The entire tail rotor assembly became detached from the helicopter whilst climbing at an altitude of approximately 350 ft. The flight crew immediately put the helicopter into autorotation and made a controlled ditching in the Harbour. The two pilots and 11 passengers were rescued by the nearby vessels. The helicopter subsequently overturned but the emergency floats kept the helicopter floating upside down. Six hours after the accident, the wreckage was recovered from sea. However, the top section of the vertical tail, the 4-blade tail rotor, the tail gearbox and the associated drive shaft, control rods and cover fairings of the helicopter were found missing.

1.2 The tail rotor and tail gearbox were eventually salvaged as an assembly from the Victoria Harbour on 14 July 2010 but one of the four blades of the tail rotor could not be found. Several attempts were made to locate the missing blade and helicopter parts without success. After the last attempt made on 3 November 2010, the mission was stopped.

1.3 Due to the small size of the missing parts and the environmental conditions of the Victoria Harbour, the underwater search posed a major challenge to the accident investigation team. This discussion paper reports the recovery plan, the locating process and the overall experience gained during the mission.

2. DISCUSSION**2.1 The Recovery Plan**

2.1.1 After the inspection of the recovered wreckage, the investigation team determined that the missing parts from the helicopter, particularly the tail rotor and tail gearbox, are critical

evidence to the investigation and should be recovered as soon as possible. The immediate action was therefore the initiation of a recovery plan.

2.1.2 Due to the close proximity of the accident location to sea, the recovery team included, amongst others trained Inspector of Accidents of the Civil Aviation Department (CAD) who had previously attended underwater search workshop.

2.1.3 CAD also immediately notified other government departments, including Marine Department, Fire Services Department, Civil Engineering and Development Department of the occurrence and invited them to join the recovery team. These departments provided support on nautical information, surveying, search and recovery equipment, and divers, etc.

2.1.4 Before the accident, CAD had limited experience on similar search and recovery at sea. Therefore, CAD sought advice from other investigating authorities overseas. While there were positive replies and suggestions, no other investigating authority had indicated experience on similar environment in the past.

2.1.5 In preparing the search and recovery, CAD had also sought advice from the helicopter manufacturer and evaluated the expertise and resources of external contractors. The evaluation had given considerations on the use of Remote Operating Vehicle (ROV), alternative scanning system and contracted divers.

2.2 **The Locating Process**

2.2.1 At the time of the accident, Hong Kong was in the hot summer. Conducting underwater search in Victoria Harbour in this period was a very difficult and time consuming process due to the following reasons:

- a) The harbour traffic area was very heavy and occupied with operating vessels most of the time. This posed risk to working personnel, survey vessel and equipment. To minimise the risk, the search area of the sea had to be cordoned off;
- b) The visibility at the seabed was very low, typically of one meter range. Most of the seabed area was covered with a thick layer of silt. Divers could only use hand search method and ROV was not suitable;
- c) The prevailing weather condition was not favourable to sea search as a typhoon was approaching Hong Kong then;
- d) The search could only be done during the daytime and the duration of search was limited to less than four hours per day due to the sea current and tidal effect;
- e) The resources of the various government departments involved are occupied by other commitments to the community of Hong Kong.

2.2.2 The recovery team understood that the search had to be well-planned in view of the large area to be covered. After careful considerations and taking into account the available resources, two reference aids were identified that might help the search process. The first one was suspected high spots at the seabed that might indicate the presence of an object of reasonable size. These suspected high spots were established by means of scanning using multi-beam echo sounding system installed on a survey vessel. The second one was Closed-circuit Television (CCTV) tapes that might

have captured the accident scenario. CAD had approached management office of harbour-side buildings to review if they own such useful tapes.

2.2.3 The location of the first stage scanning was based on position data downloaded from the flight data recorder of the helicopter. The data provided information on the approximate location of the tail rotor departure. Twenty suspected high spots on the seabed were identified and searched by divers using radial hand search method but with negative results.

2.2.4 The multi-beam echo sounding system was normally used for scanning large objects. However, the missing parts of the helicopter are too small. In order for small objects to be picked up as suspected high spots, the sensitivity of the system had to be adjusted accordingly and every scan could only cover a very small area.

2.2.5 A CCTV tape was subsequently found that had captured a falling object in the air. However, there was no evidence on the same CCTV tape that was relevant to the missing parts. The investigation team, together with the surveying specialists, continued the efforts in searching for CCTV evidence. During an on-site surveillance on the heliport from which the accident aircraft took off, the team had found two other CCTV cameras that might have captured evidence of the accident scenario. The associated CCTV tapes were then reviewed frame by frame carefully. Subsequently, the team identified water splashes from the two CCTV tapes that might represent the entry point of the missing parts into water.

2.2.6 Based on the crucial evidence from the two CCTV tapes and applying surveying techniques, the surveying specialists were able to ascertain the approximate geographical location of the actual entry point of the missing parts into water. The survey vessel then made another in-depth search over the area. Eight suspected high spots on the seabed were identified. The divers eventually found the tail rotor and tail gearbox assembly at the location of the sixth suspected high spot. However, one of the four blades was found missing from the tail rotor.

2.2.7 The search for the missing tail rotor blade continued with further underwater search attempts made. After the detailed review and discussion of the investigation and the search teams, it was considered that the chance of recovering the blade was very remote due to its small size and the possibility of either embedded or drifted to other location by sea current. The search mission was therefore stopped after the last search attempt made on 3 November 2010 without success.

2.3 Experiences Gained

2.3.1 The provisioning of emergency response plan of the government allows timely coordination amongst various government departments and speedy mobilisation of resources, which contributed significantly to the subsequent recovery of the tail rotor and tail gearbox assembly.

2.3.2 Underwater search, particularly for small items, is an area where CAD has limited experience before this accident. Various equipment and resource options are available from both within the government and outside agencies. Associated knowledge in underwater search related field is important in the determination of a timely decision. In this case, the knowledge acquired by CAD from the participation of the underwater search workshop aided the decision making process.

2.3.3 The provisioning of CCTV cameras proved useful. Without evidence from these cameras, the recovery of the tail rotor and tail gearbox assembly would be more difficult, if not impossible.

2.3.4 Despite the fact that no CCTV tape was initially reported that might have captured the accident scenario, the earnest efforts made by the team in identifying possible CCTV evidence, reviewing frame by frame of the CCTV tapes, and conducting further systematic search were instrumental to the recovery of the missing part.

2.3.5 Periodic exercise involving colleague government departments and outside agencies would enhance the coordination and communication amongst working personnel and the application of procedures. In addition, the sufficiency, readiness and use of specialised equipment can also be checked. These allow timely coordination and actions on search and recovery when an accident occurs. In this regard, the CAD accident investigation exercise conducted in early 2010 had proved useful in establishing the latest information from colleague departments such as focus point of contact, expertise, resources and equipment, etc.

3. ACTION BY THE MEETING

3.1 The Meeting is invited to note the discussion contained in this Paper.

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