



**Aviation Safety Council, R.O.C.**

# **Aviation Occurrence Investigation Report**

**May 21<sup>st</sup> 2011**

**National Airborne Service Corps, Ministry of Interior**

**Aircraft type      UH-1H**

**Registration      NA-511**

**Personnel Fall Off During Training in Pingtung County  
Due to Malfunction of Rescue Hoist Device**

## History of Flight

On May 21<sup>st</sup> 2011 National Airborne Service Corps (NASC), Ministry of Interior, a UH-1H helicopter, registration No. NA-511, had the captain and co-pilot, one flight engineer and 3 rescuers from Special Search and Rescue Team of National Fire Agency, Ministry of Interior on board. It took off at 09:13 hours from Tainan Airport for Longxiang Riverside Park on the right bank of the Gaoping river at Ligang Township, Pingtung County (position: N22°48'26.7", E120°31'33.2", altitude 250ft), to have recurrent rescue hoist training.

According to the on-site investigation record, on-ground mission briefing was performed at 08:40 hours, including information about maintenance preparation, weather condition, participants, weight and balance, equipment list, training content, operation procedures and safety matters. After engine run-up was completed, ground staff, flight engineer and rescuers released the wire rope to 100ft and retrieved it after checking and confirming the rope's function and outlook were normal. At the same time captain and flight engineer performed the override switch check, and the condition was normal.

At 09:13 hours the helicopter took off from Tainan Airport and landed at 09:30 hours at Longxiang Riverside Park on the right bank of the Gaoping river at Ligang Township, Pingtung County, to let 3 rescuers disembark. After those 3 rescuers got off the helicopter, captain, co-pilot and flight engineer started hovering exercise, flight route planning and inspection procedures for hoist operation. During the process the indication and operation of the hoist were normal. The hoist up training started at 09:45 hours with one rescuer at a time; the captain first performed 3 flights to hoist up 3 trainees, then the co-pilot performed 2 flights of hoist down operation; which were completed smoothly.

Afterwards, when the co-pilot performed the hoist up rescue training, the helicopter was in normal condition during approach with a stable hovering altitude of 60 feet. Flight engineer released the wire rope and started to retrieve the rope to hoist personnel after seeing the end of the rope was hooked well with the trainee. Then the helicopter started moving forward slowly, and at the same time the flight engineer kept on retrieving the wire rope. At 30ft from the ground the flight engineer felt the rope retrieving process was stopped and the rope started to slip down. After inspection flight engineer found that the pulling device could not be controlled, which led the rope to slip downwards and saw the hoisted personnel falling off to the ground, so he called out immediately to stop the helicopter moving ahead and continued to release the rope. Then the captain took over to perform descent and landing, and let the injured person get on board. Flight engineer retrieved the wire rope manually back to the cabin. The helicopter flew back to Tainan Airport and landed at 10:40 hours; the injured personnel was sent to Tainan City Hospital. The helicopter had no damage.

## Chapter 3 Conclusion

### 3.1 Findings related to possible causes

1. During overhaul the hoist device had a wrong measurement for the axial gap value, which caused the axial gap of the coupling oversized after the assembly. During hoist operation when the coupling face length of the drive gear decreased from 0.074 inch to 0.015 inch, the maximum stress the drive gear wall could take was over the yield strength and damaged; the drive gear could not take the load of the coupling stress from the driven gear and began to slip. The driving gear was over-driven by the load to rotate in the opposite direction, which led the hoisted personnel to fall off. (1.16.4, 2.2)

### 3.2 Findings related to risks

1. SN 388 and 387 were the first two hoist devices that overhauled by the maintenance crew. The thickness value of the implanted shim was not obtained by following proper procedures and the recorded shim thickness was not correct. Afterwards the over size of the axial gap caused a significant incident after overhaul, which showed that Air Asia did not meet the standard of the manufacturer's overhaul manual for the operation of the axial gap measurement during the hoist device overhaul. (2.3.1)
2. During the overhaul of the hoist device the technician used a non-standard bearing positioning tool that easily made the lateral of the bearing get stuck, which was leading to be mistaken as if the bottom of the bearing had been contacted; then an erroneous value was measured and caused the axial gap to become over size. (2.3.1)
3. During the overhaul the operation of the axial gap measuring has not yet met the standard of manufacturer's overhaul manual. (2.3.1)
4. The personnel who overhauled the hoist device had taken professional training provided by Air Asia, but still failed to get accurate axial gap value; which showed that this training was not completely implemented and improvement was still required. (2.3.2)
5. The OEM's overhaul manual for the rescue hoist device did not define the visual inspection and measurement inspection of drive gear and driven gear, so that the wear of the contact between drive gear and driven gear failed to be evaluated and discovered promptly. (2.3.3)

### 3.3 Other findings

1. NASC did not set up regulations and records concerning qualification and training to the existing flight engineers. (1.5.2)
2. According to the material test result from Chung-Shan Institute of Science and Technology, the planet gear axis was in accordance with AMS 6415 specification and met the original design requirement. (1.16.3)
3. Air Asia, holding the authorized license from the hoist device OEM, was qualified to overhaul this type of hoist device. The overhaul facilities were spacious with good illumination, normal air conditioning and full equipment dedicated for overhaul; which was in accordance with OEM's specification and could have normal operation. (1.16.2, 2.3.1)
4. Both overhaul manual from OEM and Air Asia's work order were found with the same defect that figures were not in agreement with text description. Air Asia did not request for prompt correction, which resulted in inaccurate overhaul records. (2.3.3)
5. The records from SN 388 showed that Air Asia needed to improve the control operation of the scheduled inspection items. (2.3.4)

6. During the occurrence, the flight crew flew the helicopter to move forward at the same time using the wire rope to hoist personnel back to aircraft, which practice was not stated in standard operation procedure. (1.15, 2.4)
7. Flight Line Operation and Maintenance Manual provided by hoist device OEM have listed the limit and inspection procedures for flight line operation, which was not included in rescue hoist operation procedures that flight engineer should have followed.
8. At the time of occurrence, the hoist device operation from Special Rescue Team members and NASC flight engineer was normal. (2.4)
9. ASC evaluated it would take longer time if the injured was sent to any of the 6 hospitals nearby than to Tainan City Hospital. The decision made by the Special Rescue Team leader to send the injured to Tainan City Hospital was correct. (1.15, 2.5)
10. In the past no trainee from Special Rescue Team has ever been injured during training, so there was neither guideline nor relevant mechanism to be followed concerning the sending of the injured to hospitals. (1.15, 2.5)

## **Chapter 4 Flight Safety Recommendation**

In this chapter, recommendations are issued and listed in 4.1 according to the investigation results. During the investigation, those recommendations that have already been implemented by relevant authorities and organizations or are still under process are listed in 4.2. As ASC has not yet verified the implementations, those safety recommendations are still listed in 4.1.

### **4.1 Recommendations**

#### **4.1.1 Interim Flight Safety Bulletin**

Reference No.: ASC-IFSB-11-06-001

Date: June 1<sup>st</sup> 2011

To operators of hoist device HS-20200-501 and similar types of hoist device

1. Inspect the wear condition of hoist device's interior coupling mechanism and contact with the manufacturer for advice.
2. Inspect if the axial gap of hoist device's interior coupling mechanism is over limit and contact the manufacturer for advice.

#### **4.1.2 Flight Safety Recommendations**

##### **To National Airborne Service Corps, Ministry of Interior**

1. Supervise Air Asia to overhaul hoist device by following precisely overhaul manual to meet the standard requirement for the axial gap. (ASC-ASR-12-06-001)
2. Inspect and establish relevant training and audit mechanism for flight engineers. (ASC-ASR-ASR-12-06-002)
3. Reinforce hoist operation procedures for each fleet, provide operation limit and inspection procedures from hoist device OEM's manuals and implement personnel training. (ASC-ASR-12-06-003)

##### **To National Fire Agency, Ministry of Interior**

1. Establish the guideline or relevant mechanism of sending the injured personnel during training to hospital for Special Rescue Team to follow. (ASC-ASR-12-06-004)

##### **To Air Asia**

1. Use standard tool for bearing positioning during hoist device overhaul and establish a method to ensure the bearing in position. (ASC-ASR-12-06-005)
2. Reinforce audit mechanism of overhaul training for this type of hoist device and ensure trainee's skill meet overhaul standard. (ASC-ASR-12-06-006)
3. Improve to have figures in agreement with text description concerning work orders of hoist device overhaul. (ASC-ASR-12-06-007)
4. Improve the control operation of scheduled inspection items for rescue hoist device and do not have overdue items again. (ASC-ASR-12-06-008)

## **To National Transportation Safety Board, U.S.A.**

Please advise BREEZE-EASTERN Corporation following safety recommendations:

1. Revise visual inspection and measurement test standard of drive gear and driven gear in OEM's overhaul manual. (ASC-ASR-12-06-009)
2. Improve the defect of the figures that do not agree with text description in OEM's overhaul manual. (ASC-ASR-12-06-010)

### **BREEZE-EASTERN Co. Response:**

The Aviation Safety Council received response from BREEZE-EASTERN Corporation on June 13th, 2012. The BREEZE-EASTERN Corporation released a Technical Publication Deficiency Report which clarifies the procedure of cover and motor housing installation to correct the mislabeled figures in the overhaul manual.

#### **4.2 Safety Actions Accomplished or Being Accomplished**

The rescue hoist manufacturer, BREEZE-EASTERN Corporation, released a Technical Publication Deficiency Report, BE-Tracking # TD03003TPDR061112010 May 10<sup>th</sup>, 2012. The technical publication effected is CMM TD-03-003. Subject of Discrepancy: Clarification of cover and motor housing installation.