

B-31118 Occurrence Investigation

Executive Summary

On June 10th 2017, an Emerald Pacific Airlines helicopter, type BELL-206B3, registration number B-31118, was conducting an aerial filming mission by Above Taiwan Cinema, Inc. at southern Taiwan and Hualien-Taitung area. The helicopter took off about 1045hrs from Temple Fah-Lin, Chishang Township, Taitung County. There were 1 pilot and 2 aerial photographers, total of 3 people on board. Around 1154hrs, the helicopter crashed on Ranch Sie-Jin, Hualien County, the helicopter was destroyed by fire, the 3 people on board sustained fatal injuries.

The helicopter was not equipped with a flight recorder, lacking flight operational conditions and engine status prior to crash, wreckage and engine examinations are also limited due to post-impact fire that burned out majority of the fuselage. A numerical simulation on wind condition cannot be validated without adequate observed data. Therefore, the investigation was done according to interviews, maintenance records, site survey, limited wreckage examination, medical examination, simulation tests and onboard video recording analysis to determine the probable causes and risks associated with this occurrence.

According to the Republic of China (ROC) Aviation Occurrence Investigation Act, and the content of Annex 13 to the Convention on International Civil Aviation, the Aviation Safety Council (ASC), an independent aviation occurrence investigation agency, was responsible for conducting the investigation. The investigation team also included members from Bell Helicopter, Rolls-Royce, CAA Taiwan, Emerald Pacific Airlines, Institute of Forensic Medicine, Ministry of Justice, Criminal Investigation Bureau, and other relevant organizations.

The 'Draft Final Report' of the occurrence investigation was, in accordance with the procedures, reviewed at ASC's 70th council meeting on August 31st, 2018 and then sent to relevant organizations and authorities for comments. After comments were collected and integrated, the Final Report was reviewed and approved by ASC's 72th council meeting on October 18th, 2018.

There are a total of 18 findings from the final report, and 18 safety recommendations issued to the related organizations.

Findings as the result of this investigation

Findings Related to Probable Causes

1. The collected evidences show that the captain encountered the following conditions: possible side effect of Chlorpheniramine, one kind of antihistamine, a minimum rest period allowed by regulations before the occurrence, high flight time, long duration of helicopter vibration, low altitude and mountainous area operation, high temperature in cockpit, which possibly caused the captain fatigued, or was in a state of reduced mental or physical performance. However no direct evidence is able to illustrate effects of the above issues that could impair captain's alertness and ability to safely operate the helicopter.
2. Weather information near crash site and flight simulation results both show that wind condition was within the operational limits; however, the actual weather condition cannot be confirmed due to fast-changing weather at the mountainous area, and simulated results were not validated with observed data.
3. Without flight information from flight recorder(s), no wreckage and powerplant examinations due to post-impact fire, flight control system and powerplant conditions cannot be determined.

Findings Related to Risk

1. Drowsiness and muscle weakness could present when antihistamine concentration is over 17 ng/mL for normal human, while the captain's was over 24 ng/mL. This residual antihistamine concentration in captain's blood is resulted from a normal dosage of medication; nevertheless, the extent of antihistamine's effect (on the captain's capability) cannot be determined.
2. Residual concentration of the antihistamine, was discovered in captain's blood test. Both ICAO and FAA recommend that it is inappropriate for flight crew to conduct flight mission when dosing antihistamine. According to several research works, antihistamine would affect flight crew's capability in operation. The CAA has not referred to existing guidelines, establish a guidance of medication usage/ dosage for pilots and medical personnel.
3. In the occurrence mission, the captain did not communicate and evaluate completely before changing the flight plan, and did not prepare, plan, communicate and brief in detail which did not comply with the spirit of crew resource management, it increases the operational risk while the flight environment changes.
4. The work time recorded in the field operations log book of the Emerald Pacific Airlines (EPA) deviated from the actual flight duty period of the flight crew. The EPA also did not have other management system to record FDP. This means that the existing systems of the EPA failed to correctly record the FDP during field operations and made it difficult to verify regulation compliance of the flight duty and rest period.
5. The CAA failed to identify the deficiencies in the EPA's recording system of flight duty and rest period. This was because the CAA estimated the possible flight duty and rest period on a basis of flight time records and

relevant rules of the flight operations manual during the records inspections, instead of directly inspecting the field operations log book.

6. The Emerald Pacific Airlines revised its flight time rules, that flight crew flight hours cannot exceed 6 hours per consecutive 24 hours, in the flight operations manual with poor consideration, and then failed to identify differences between the real practices and requirements in the FOM. This implies that the EPA shall enhance the rules revision consideration and its FOM compliances
7. The Emerald Pacific Airlines' training manual didn't clearly define the standard operation procedures for aerial photo/aerial surveillance mission, assessment of temporary demand, and mission abort operation, which affected the safety of mission operations.
8. Emerald Pacific Airlines had several mishaps against company manual rules during the aerial photography mission, including: use of electronic devices in flight, crew embark/disembark during engine-on refueling, transport of dangerous good (fuel sample). The mishaps endangered safety of both flight crew and ground crew, and elevated risk for safety.

Other Findings

1. There was no abnormality in the fuselage structure of the occurrence helicopter before the crash. The engine should be in operational status and transferring power before impacting the ground, but the amount of power output could not be judged due to insufficient evidence. The freewheel was not in the same status as before the crash, whether the torque transferring of powerplant was originated from the engine power or main rotor rotation was unknown; it is impossible to know whether there was an autorotation before hitting the ground either. The main rotor rotational speed had dropped before the crash.
2. In the 10 groups of warning lights, the filaments of 7 groups of warning

lights were all intact, indicating that the relevant systems of these 7 groups of warning lights of the occurrence helicopter were not activated before the crash. For the other 3 groups of warning lights, 1 group of 「ENG OUT」 warning lights should not be illuminated, 1 group of 「TRANS OIL PRESS」 warning lights should be in a state of cold (not illuminated) shock fracture, the other 1 group of 「ROTOR LOW RPM」 warning lights should be in a state of hot (illuminated) shock fracture.

3. There was no fuel leakage resulted smoke or fire of the occurrence helicopter before the crash. There were no gunpower or explosive remnants existed in the cargo hold, the explosion or burning of the occurrence helicopter due to the explosives should be precluded.
4. The strong shock of the occurrence helicopter during crash caused the fuel line to break from the junction of the fuel tank. The splashed fuel was ignited by the high temperature of the adjacent engine. The fire turned toward the ruptured fuel tank below the fuselage which caused severe combustion.
5. The crash site is surrounded by mountains on three sides, no high-voltage cables or cables used to good transport are found.
6. The sampled fuel quality used by the helicopter during the occurrence flight was passed.
7. The relevant certificates of the flight crew comply with the provisions of the existing civil aviation regulations. The occurrence was irrelevant to weight and balance of the helicopter. The list of supplemental type certificate and the related documents of the airborne camera supplemental type certificate all meet requirements. The airborne photography operation of the occurrence helicopter complied with civil aviation regulations.

Safety Recommendations

To Emerald Pacific Airlines

1. Refer to CAA's guideline, establish a guidance of medication usage/dosage for pilots, and enhance related promotion, training, and risk control.
2. Establish an executable risk assessment procedures to reduce risks associated with different flying environment for helicopters, in particular mountainous area.
3. Review flight data monitoring methods, well utilize data recorded by lightweight recorders to identify flight risks to elevate safety.
4. Provide human fatigue relevant training or information to flight crew on a basis of the characteristics flight tasks for the enhancement of fatigue awareness and management.
5. Establish the mechanisms to ensure the flight crew can understand the operational and performance limitations of the aircraft, and to comply with the requirements of the flight plan related to flight operation manual, the safety items to be noted, and the risk assessment before the flight.
6. Review and enhance the field operations management, and require flight crew to comply with flight plans.
7. Revise flight operation manual to address the difference in practice regarding pilots' flight hour limit of 6 hours in consecutive 24 hours. Improve record archiving system on pilots' logged flight / rest time to comply with CAA regulations.
8. Develop detailed procedures, standards and the mission abortion criteria for aerial photogrammetry or aerial survey mission that are truly practical.
9. Establish and promote a mechanism to request both flight crew and ground crew to comply, including: no use of electronic devices in flight, work flow during engine-on re-fueling, dangerous good transport such as fuel samples, and any other operations related to safety.

To Civil Aeronautics Administration, Ministry of Transportation and Communications

1. Refer to existing guidelines, establish a guidance of medication usage/ dosage for pilots and medical personnel. Supervise Emerald Pacific Airlines to establish a guidance of medication usage/ dosage for pilots and enhance related promotion, training, and risk control.
2. Supervise Emerald Pacific Airlines to establish an executable risk assessment procedures to reduce risks associated with different flying environment for helicopters, in particular mountainous area.
3. Review risk assessment and flight data monitoring methods, well utilize data recorded by lightweight recorders for general aviation to elevate flight safety.
4. Supervise Emerald Pacific Airlines to provide human fatigue relevant training or information to flight crew on a basis of the characteristics flight tasks for the enhancement of fatigue awareness and management.
5. Supervise Emerald Pacific Airlines to establish the mechanisms to ensure the flight crew can understand the operational and performance limitations of the aircraft, and to comply with the requirements of the flight plan related to flight operation manual, the safety items to be noted, and the risk assessment before the flight.
6. Supervise Emerald Pacific Airlines to review and enhance the field operations management, and require flight crew to comply with flight plans.
7. Supervise Emerald Pacific Airlines to revise flight operation manual to address the difference in practice regarding pilots' flight hour limit of 6 hours in consecutive 24 hours. Improve record archiving system on pilots' logged flight / rest time to comply with CAA regulations.
8. Supervise Emerald Pacific Airlines to develop detailed procedures, standards and the mission abortion criteria for aerial photogrammetry or aerial survey mission that are truly practical.
9. Supervise Emerald Pacific Airlines to establish and promote a mechanism

to request both flight crew and ground crew to comply, including no use of electronic devices in flight, work flow during engine-on re-fueling, dangerous good transport such as fuel samples, and any other operations related to safety.