

Executive Summary

B-77009 Occurrence Investigation

On October 16, 2013, at 0808 Taipei local time (0008 UTC), Sunrise Airlines, a MBB/Kawasaki BK117B-2 helicopter, bearing registration B-77009, was loss of control during landing and crashed about 175 meters NE of Yushan Weather Station. The B-77009 departed with 2 pilots and 1 passenger aboard, all of the 3 members were killed. The helicopter was hull loss.

The helicopter took off from Taipei (Sungshan) Airport at 0638 to the Tataka landing area (elevation 2,610 meters) which is about 8 km from the Yushan Weather Station (elevation 3,825 meters). The Tataka landing area served as an intermediate area for loading and offloading supplies/passengers. The plan required three trips to finish all supplies and passengers transportation.

The first trip, at time 0750 the helicopter took off from Tataka with two pilots, one passenger and some cargo on board. At time 0755 the helicopter landed at Yusan Weather Station and stayed about two minutes for offloading and loading. With two pilots, one passenger and some cargo on board, the helicopter returned to Tataka about 0802. The second trip, at time 0804 the helicopter took off from Tataka with two pilots, one passenger and some cargo on board. About time 0808, the helicopter performed landing at Yushan Weather Station. When the helicopter was hovering over the landing area about 3-4 feet height above ground, the helicopter yawed to the right suddenly. The helicopter rose higher and

began spinning clockwise with slightly left banking. The helicopter flew away from the landing area with clockwise rotating. The helicopter continued rotating about 3 turns and flew lower, then the main rotors collided with terrain and helicopter crashed.

According to Article 6 of the ROC Aviation Occurrence Investigation Act, the Aviation Safety Council (ASC), an independent agency of the ROC government responsible for civil aviation occurrences investigation, immediately launched a team to conduct the investigation. The investigation team also included members from Sunrise Airlines, Taiwan Civil Aeronautics Administration(CAA), Japan Transport Safety Board (JTSB), Kawasaki Heavy Industries/Japan, German Federal Bureau of Aircraft Accidents Investigation (BFU), National Transportation Safety Board/United States of America (NTSB), and Honeywell Aerospace/USA. The Final Report was reviewed and approved by ASC's 26th Council Meeting on September 30, 2014.

There are a total of 24 findings and 11 Safety Recommendations from the Final Report.

Findings related to the probable causes

1. Neither did the flight crew precisely calculate the aircraft loading, nor did the ground staff actually weight the loading at the sites, and the flight crew did not request ground staff to perform it. This above mentioned operation could not confirm and control the loading of the aircraft; therefore the gross weight may exceed the performance limits of the aircraft. Conservatively estimated the gross weight of the

aircraft at the occurrence flight, it would exceed the limit of hover ceiling in ground effect on the flight manual. Based on the assessment of the aircraft manufacturer, the aircraft tail rotor performance may have been in a critical condition while it conducted the landing on the Yushan heliport.

2. The tail rotor control margin may have been in a critical condition when the occurrence aircraft was landing under overweight condition. Following the negative impact of inappropriate operation of the flight crew or the gust wind, it may lost the tail rotor effectiveness which then caused the aircraft yawing to the right. The Cockpit Voice Recorder (CVR) and video indicated that the wind speed and direction at 0808:42.4 to 0808:56.7 time period were normal while the aircraft approaching to the Yushan heliport. The aircraft descended obviously at about 13 feet height above the heliport. At 0808:58.1 aircraft hovering about 3-4 feet height above the ground, it suddenly yawed to the right and rose aloft. This phenomenon may be caused by the flight crew rising the collective lever to control the rate of descent for landing. Due to the aircraft overweight, the tail rotor may not have sufficient thrust to balance the increased torque of the main rotor, and then following yawing to the right. At the same period, it may be also possibly affected by the gusts which severely increased the rate of rotation.
3. In accordance with the Federal Aviation Administration (FAA) AC90-95, the situation of occurrence aircraft (high gross weight, high altitude, high power, low air speed, right turning at landing phase, power increased) are either the conditions or factors which could conducive the unanticipated right yaw. There was no available

information of wind speed and direction at occurrence site, but according to the video data, the aircraft suddenly yawing to the right, the unexpected gust wind may contribute the aircraft loss its tail rotor effectiveness.

4. The situation awareness and knowledge related to loss of tail rotor effectiveness of flight crew were insufficient which resulted in aircraft existing in situations that was prone to loss of tail rotor effectiveness. When the aircraft encountered the loss tail rotor effectiveness, there was probably no more rudder available to stop the right yawing even the flight crew applied full left rudder. When the aircraft off from the heliport, the flight crew probably was unable to take proper action to escape due to the aircraft rapid spinning and the surrounding terrain. Finally the aircraft was loss of control and crashed into terrain.

Findings related to risk

1. The ground staff neither prepared scale for this mission, nor joined the briefing of this mission with the relevant personnel. It would increase the risk of mission conducting.
2. The flight crew did concern about the aircraft loading, but they did not aggressively handle the related concerns and issues.
3. The flight crew were lack of discipline to comply with requested procedures, it may not adequately control the risk when aircraft encounters abnormal or emergency situations.
4. The high altitude training programs of the Sunrise Airlines were insufficient which may impact the safety of the high altitude operations. Although the annual recurrent training program did

include the loss of tail rotor effectiveness, the topics and time span may not appropriate to the trainee for fully understanding.

5. There were various operation deficiencies including over-weight landing, insufficient training and weight/balance records keeping of the occurrence. These deficiencies showed that the Sunrise Airlines did not continuously and completely implement the inspection recommendations by the CAA.
6. The Sunrise Airlines Flight Safety Office may have difficulties to implement risk assessment and corrective action and review the overall risk factors with limited manpower.
7. The Self-Audit Plan of the Sunrise Airlines did include the items of weight and balance, hook operation's weight control, records keeping; however, it is difficult to find the deficiencies of personnel adhere to procedures and identify the operational risk factors with the inappropriate checklist and the ways of conducting the self-audit.
8. The Sunrise Airlines Station Operation Manual did not include job functions of ground personnel and required equipment list when operating at the outstation. Despite the partial procedures of the Helicopter Hook Operation Manual may be used in outstation operation, there were no statement of the Manual applicable to the outstation operation.
9. The current civil aviation law or regulations does not prescribe the limits of performance and operation of the helicopters which were certified as airworthiness transport category A or category B before December 13, 2007.
10. The physical area of the heliport sited in Yushan Weather Station is not large enough to comply with the BK117 related requirements

from "Civil Heliport Planning and Design Standard" issued by CAA Taiwan.

11. According to the injury patterns and aircraft wreckage inspection, these two pilots may not fasten their shoulder harnesses at impact. There is no evidence to prove they would survive in this occurrence with fastening shoulder harness, however it may increase the person's survivability.

Other findings

1. The certificates, duty and rest requirements of flight crew were in accordance with Civil Aviation Regulations.
2. During the occurrence, the Sunrise Airlines did not keep the flight plan in the departure station which is required by the Civil Aviation Regulations.
3. Due to the payload, the flight operation inspector of the CAA did not perform the cockpit observation check to Yushan Weather Station at previous inspection. The route inspection would be a efficient way to evaluate the execution of flight plan of pilots and check the weight and balance calculation.
4. Based on the Sunrise Airlines organizational chart and management status, the workload of the Director, Training Manager and Chief Pilot may adversely effect their planning, organization, command and control of the flight operation management.
5. If the Sunrise Airlines could establish a mountain flight approach and landing briefing procedures for flight crew, it may help the flight crew's cooperation and disposition when they encounter the anomalies in flight.

6. If the Sunrise Airlines BK117 Aircraft Operations Manual could include a set of check list and crew cooperation procedure for high altitude approach/landing, the flight crew may effectively control and handle the anomalies during the high altitude approach and landing.
7. There was no abnormal entry on the records of Daily Check, Preflight Check and Transit Check during the period from three months before the occurrence to the date of occurrence. The related checks and corrections of work orders been issued within one year before the occurrence all complied with requirements. The affected Airworthiness Directives, Maintenance Difficult Reports and the corrections of Deferred Defects all complied with specified time constraints and controls.
8. According to the transcript of Cockpit Voice Recorder, Revolution per Minute records of main rotor and live video recording, the main rotor, gear box and engines were all probably still in normal operational statuses before helicopter hit terrain obstacles of nearby mountain valley. The low rotor speed warning recorded in Cockpit Voice Recorder may be due to the main rotor hit terrain obstacles.
9. The schematic diagram of the heliport sited in Yushan Weather Station drawn by the Sunrise Airlines for application to CAA Taiwan provided either the incorrect heliport's area or lack of legends. It may mislead the reviewers to issue the permission.

Safety Recommendations

To Sunrise Airlines

1. Request the flight crew and ground staff shall conduct the flight plan, briefing, loading calculation and weighting in accordance with

standard operation procedures.

2. Enhance the topics and the associated time span of annual recurrent training; also enhance the contents and qualities of high altitude flight training, including the loading consideration and calculation, the crew disposition in flight concern, caution items in high mountain operation, the judgment during approach, the theory and operation of loss tail rotor effectiveness.
3. Enhance the flight crew to follow the related operation procedures and standard calls.
4. Review the necessity to initiate the briefing procedures, checks and standard calls for high altitude approach & landing to improve the safety of high mountain flights.
5. Review the effectiveness of related flight operation management personnel; and enhance the corrective actions and preventive measures of all safety events.
6. Review and enhance the items and measures of self-audit program to effectively identify the safety hazards. Also enhance the statistics and analysis of self-audit results.

To Civil Aeronautics Administration

1. Supervise Sunrise Airlines the flight crew to follow the related operation procedures and standard calls, and enhance the topics and the time span of annual recurrent training, the contents and qualities of high altitude flight training.
2. Supervise the Sunrise Airlines the effectiveness of related flight

operation management, enhancement of the corrective actions and preventive measures of all safety events, improvement of self-audit program and assist Sunrise Airlines to establish a proactive risk management system.

3. Review the relevant current civil regulations to prescribe the limits of performance and operations of the all helicopters which are certified as airworthiness transport category A or category B.
4. To supervise the relevant airlines to provide correct information and data of heliport operation application, and to enhance the approval process.
5. To supervise airlines pilots to follow the regulation regarding to fasten the shoulder harnesses during take-off and landing according to " Aircraft Flight Operation Regulations".

This Executive Summary in English includes only the History of flight, Findings as the result of this investigation and Safety Recommendations. Although efforts are made to translate it as accurate as possible, discrepancies may occur. In this case the Final Report in Chinese version will be the official version.