

Sunrise Airlines BK-117 Occurrence Investigation Report

Executive Summary

On July 10, 2009, a Sunrise Airlines Corp. BK-117 helicopter national registration B-77088 had captain, co-pilot and one EMT (Emergency Medical Technician) on board. When having a NDB/DME instrument approach to Kinmen Airport in Shang-I, the helicopter crashed into the sea at 1 nautical mile south off Shang-I. The captain survived, the co-pilot and EMT were killed and the helicopter was totally destroyed.

At 08:08, on July 10, 2009, ASC was notified by CAA, and at 08:30 the Investigator-in-Charge launched a Go-team to Kinmen Island. The Go-team started the data collection on July 11 and started victim search at 09:00 on July 12, 2009; same day at 11:53 the remains of the victims were found. The Go-team finished on-scene investigation at 12:50, after Cockpit Voice Recorder (VCR) was recovered.

Findings Related to Probable Causes

1. The helicopter should have been operated by 2 pilots. However the co-pilot was asleep during approach phase and failed to monitor instrument and to call the captain's attention to course deviation, low altitude and drastic descending rate.
2. During visual approach the captain, affected by clouds and lights outside, was unable to keep visual reference then over operated the variation of the aircraft altitude. Due to the inertia from high descending rate the helicopter was at lower altitude than expected, and then it crashed into the sea unexpectedly.
3. The captain might have had a so-called black-hole-illusion, which led him take a higher angle to approach during descent and miss-estimate the altitude. He did not realize the altitude was way too low until the helicopter crashed into the sea in the relatively brighter area.

Findings Related to Risks

1. The captain might have had overconfidence that he could maneuver Controlled Flight Into Terrain (CFIT) and was lacking of cognition of visual illusion, so he let co-pilot rest and operated the helicopter alone; which naturally increased the risk of the occurrence.
2. The captain failed to keep the helicopter on approach track with deviation of 38 degrees, which was over the standard limit of 5 degrees; thus increased the chance of being unable to conduct visual approach.
3. The captain did not approach from Runway 06, instead he flew over the runway to land; which might shorten the time of approach, but in this way he conducted the approach from the sea. Without guidance of approach light system at nighttime, it increased the risk of visual illusions.
4. From 02:53 hours, when the helicopter took off from Songshan Airport, to 04:19 hours, when it crashed into the sea, was the usual time of sleep for pilots and that is the period when circadian rhythm (biological clock) was least active, combined with the noise and vibration from helicopter operation that might speed up the fatigue - which existed a condition for fatigue formation.
5. The captain had symptoms of lower attention, poor judgment and response, deterioration of orientation ability, deterioration of visual function and hand-eye coordination; which might not exclude that the captain's performance was affected by fatigue. The co-pilot's eyes were closed before approach and VCR had no voice record from the co-pilot; which showed that the co-pilot might have been asleep during approach due to fatigue.
6. ICAO, British and Australian civil aviation regulations or technical guidelines showed that stand-by was not time to rest. However Sunrise dispatched Helicopter Emergency Medical Services (HEMS) to Kinmen for a stand-by duty and stand-by was considered as off-duty, which resulted that the pilots were under stand-by status for a long time.
7. Pilots have reflected the issue of fatigue during nighttime HEMS to Sunrise and have suggested having an adjustment to duty dispatch, but Sunrise did not accept it for contractual reasons. Sunrise set up a preliminary crew in

Taipei that had duties only when the flight time of HEMS in Kinmen would be over regulation limit. The risk of nighttime fatigue was not well in control.

8. Sunrise requested that before duty pilots should fill up the evaluation form of risk on duty, but the benefit from the evaluation of pilots' fatigue was limited. Pilots could not take advantage of it to obtain risk factors when conducting CFIT during approach. Sunrise still needed to reinforce their overall management system of risk on duty.
9. Concerning revisions and management mechanism of flight operation related manuals, Sunrise failed to ensure the integrity, accuracy, consistency and convenience of relevant manuals. Though CAA has pointed out defects from Sunrise's flight operation manuals before the occurrence, the defect items were not corrected in time.
10. It required reinforcing Sunrise's pilot trainings related to prevention of CFIT occurrence, nighttime vision limitation, visual illusion and fatigue. The recurrent training of crew resource management was not consistent with flight operation related manuals; which showed that Sunrise failed to ensure the accuracy and appropriateness of training materials and failed to reinforce the training that corresponded to the duty demands.
11. National regulations related to HEMS dispatch were consulted with part of FAR 135.271 regulations. When reviewing the relevant regulations and technical guidelines, the characteristics of HEMS operation in our country may be considered.
12. The rule making of the Aircraft Flight Operation Regulations related to the flight time limitation of HEMS pilot should add matching requirement of off-duty time and the characteristics of HEMS with studies or investigation related to fatigue.
13. Though Sunrise has amended manuals to request pilots to wear life-vest when flying over water, it still requires to establish an alert mechanism for EMT during take-off and landing to ensure the safety of all passengers.

Other Findings

1. Though tropical depression was affecting the east and south part of Taiwan with showers or thunderstorms before and after the occurrence, it did not affect Kinmen area where weather condition was ok.
2. Before the occurrence all helicopter systems were normal and equipments and maintenance met with airworthiness requirement. The probable cause to aircraft crash due to mechanical malfunction may be excluded.
3. The pilots were holding valid licenses issued by CAA and no evidence showed the occurrence was affected by medication or alcohol.
4. The Aircraft Flight Operation Regulations did not define nor limit stand-by time, so it may not be determined if the off-duty time of the pilots before duty was violating the regulations.

National HEMS at the off-islands demand higher work pressure and to perform duties under poor flying environment; which meets the requirement to have the installation of GPWS or similar systems. One of the Advisories made by FAA in USA to HEMS operators was to install GPWS.

5. CAA has requested Sunrise helicopters to return to Kinmen during daytime after performing nighttime HEMS from Kinmen to Taipei; however this request involved with the contract between Sunrise and Kinmen county government. After negotiation made by Sunrise, it was not accepted by Kinmen county government. HEMS operators in USA, in order to decrease the occurrence rate, have had long term cooperation projects together with government authorities, HEMS operators, civil organizations and research institutes to reduce HEMS risk effectively to an acceptable level; which showed that to decrease HEMS occurrence rate requires related organizations and authorities to have sufficient communications, cooperation and co-ordinations.
6. The standard of HEMS operation is to be compliance with regulations. Even with equipments, methods or management tools that can promote the safety, HEMS operators would not adopt when there are no regulation requirements or incentive.
7. As the helicopter crashed into the sea and sank unexpectedly, 3 crew members on board could not react to evacuate in time. Though two pilots

escaped from the helicopter to the sea, they did not use life vest or any related emergency evacuation equipments so they could not wait till the rescue to arrive; which caused casualties. EMT sank with the helicopter during sleep and was killed.

8. Kinmen Airport's operation after the occurrence was compliance with emergency response procedures, concerning to verify, notify, communicate and request Fire department and the military to proceed with research, and to establish 'Air disaster emergency response team'.
9. The helicopter crashed and sank into the sea with antenna, so ELT signals could not be transmitted.
10. Before the occurrence Sunrise performed the annual check of the flight recorders as per 07-02A Aircraft Flight Operation Regulations, but failed to discover CVR's poor recording quality and defect of the main rotor.

FLIGHT SAFETY RECOMMENDATIONS

To Sunrise Airlines

1. Reinforce pilot training on decision-making to approach, prevention on CFIT occurrence, night visual illusion and fatigue management and the mechanism of risk evaluation; require stringently pilots to follow on-duty regulations. (ASC-ASR-11-03-001)
2. Review a reasonable way to dispatch HEMS pilots and consider the time difference between stand-by and off-duty to reduce damage caused by the fatigue of pilots. (ASC-ASR-11-03-02)
3. Review the management mechanism of pilot training to ensure the accuracy and appropriateness of training material and the mechanism of reinforcing the content of training to meet the duty demands. (ASC-ASR-11-03-003)
4. Reinforce the management system of on duty risk to effectively identify and control the risk in HEMS. (ASC-ASR-11-03-004)

5. Review revisions and management of flight operation related manuals to ensure the integrity, accuracy and convenience of the manuals. (ASC-ASR-11-03-005)
6. Due to high risk in EMS, consider to install GPWS or similar systems on helicopters to alert pilots when they are flying into the ground or any obstacles. (ASC-ASR-11-03-006)
7. Set up a communicating, coordinating and cooperating mechanism related to flight safety issues with CAA, organizations or research institutes that have HEMS demands. (ASC-ASR-11-03-007)
8. Set up an effective mechanism to ensure EMT's alertness during take off and landing and to ensure all on board members get emergency evacuation instructions to use emergency evacuation equipment. (ASC-ASR-11-03-008)
9. Implement the inspection procedures of flight recorders during annual check to ensure CVR's recording quality and the integrity of the main rotor's record. (ASC-ASR-11-03-009)

To Civil Aeronautics Administration

1. Reinforce audit to HEMS operators, supervise them to set up an appropriate mechanism concerning pilot dispatch, duty risk evaluation, revisions and management of flight operation manuals, pilot training related to CFIT/nighttime flight/fatigue and emergency evacuation. (ASC-ASR-11-03-010)
2. Consult international occurrence investigation reports, research, regulations and technical documents about HEMS, review and amend national regulations and technical guidelines to reinforce flight safety of HEMS. (ASC-ASR-11-03-011)
3. Review the application and procedures of HEMS flight time limitation, adopt pilots' opinions and fatigue related research or investigations, and consider the possibility to amend flight time limitation. (ASC-ASR-11-03-012)

4. Set up a communicating, coordinating and cooperating mechanism related to flight safety issues with organizations or research institutes that have HEMS demands. (ASC-ASR-11-03-013)
5. Supervise Sunrise to implement the annual check control of flight recorder inspection. (ASC-ASR-11-03-014)

To Department of Health, Executive Yuan

1. Invite CAA, HEMS operators and academic or research institutes to set up a HEMS communicating, coordinating and cooperating mechanism related to HEMS operation; consider equipments, applications or management tools that are above regulation requirement and help to improve flight safety. (ASC-ASR-11-03-015)