

Executive Summary

B-31019 Occurrence Investigation

On December 18, 2014, Emerald Pacific Airlines, a Bell 206B3 helicopter, bearing registration B-31019, performed insulator washing of high voltage power lines with water in the air in Changhua area. The plan required 8 trips of insulator washing on the occurrence day. The aircraft was loss of engine power at the last trip and forced landing on grass field. One pilot and one hydraulic nozzle operator aboard were suffered minor injuries. The helicopter was suffered substantial damage.

There were one pilot and one hydraulic nozzle operator on board when performing the operation of insulator washing. The pilot who was sitting in the right side in the cockpit operated the aircraft, and the hydraulic nozzle operator who was sitting in the back operated the nozzle to wash insulators. The first trip started at 0805 Taipei local time¹. It took about 30 to 40 minutes to finish one trip. The 7th trip was finished at 1520. During the last operation of insulator washing of the day, about 1540, the aircraft was suddenly loss of power with loud noise from the engine at about 70 ft above ground level. The aircraft was forced landing on the grass field which was about 25 meters away from the power tower. The helicopter was suffered substantial damage with landing gears broken and tail boom bent.

According to Article 6 of the ROC Aviation Occurrence Investigation Act, the Aviation Safety Council (ASC), an independent agency of the ROC

¹ Taipei local time is UTC time + 8 hours

government responsible for civil aviation occurrences investigation, immediately launched a team to conduct the investigation. The investigation team also involved members from Taiwan Civil Aeronautics Administration (CAA), Emerald Pacific Airlines, Transportation Safety Board / Canada, National Transportation Safety Board (NTSB) and Rolls-Royce Corporation / USA. The Final Report was reviewed and approved by ASC's 40th Council Meeting on 29 December, 2015.

There are a total of 13 findings and 9 items of Safety Recommendations from the Final Report.

Findings as the result of this investigation

The Aviation Safety Council presents the findings derived from the factual information gathered during the investigation and the analysis of the occurrence. The findings are presented in three categories: **findings related to probable causes**, **findings related to risk**, and **other findings**.

The **findings related to probable causes** identify elements that have been shown to have operated in the occurrence, or almost certainly operated in the occurrence. These findings are associated with unsafe acts, unsafe conditions, or safety deficiencies associated with safety significant events that played a major role in the circumstances leading to the occurrence.

The **findings related to risk** identify elements of risk that have the potential to degrade aviation safety. Some of the findings in this category identify unsafe acts, unsafe conditions, and safety deficiencies, including organizational and systemic risk, that made this occurrence more likely;

however, they cannot be clearly shown to have operated in the occurrence alone. Furthermore, some of the findings in this category identify risks that are unlikely to be related to the occurrence but, nonetheless, were safety deficiencies that may warrant future safety actions.

Other findings identify elements that have the potential to enhance aviation safety, resolve a controversial issue, or clarify an ambiguity point which remains to be resolved. Some of these findings are of general interests that are often included in the ICAO format accident reports for informational, safety awareness, education, and improvement purposes.

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Findings related to probable causes

1. The aircraft loss of engine power was determined the separation of the 3rd stage blade of engine compressor. The probable causes of blade separation are: (1) an airfoil fracture initiating in a corrosion pit, which then progressed in high cycle fatigue until the blade separated in overload, or (2) blade tip rub caused by delamination of the case plastic lining due to corrosion underneath the vane outer band..
2. The probable cause of the corrosion of the compressor is the improper compressor maintenance during operation in a corrosive environment. The M250-C20 Series engine Operation and Maintenance Manual contains warnings that: salt laden humidity and chemicals will corrode compressor blades and vanes and cause them to fail.

Findings related to risk

1. The aircraft operator was not aware that the whole Taiwan island is classified as the severe corrosion operating environment by the Operation and Maintenance Manual and did not follow the manual to perform a water rinse of the compressor after daily flight which allowed the contamination accumulated on the compressor and resulted in corrosion to the compressor.
2. The limit of engine shutdown period prescribed in the aircraft operator's continuous airworthiness maintenance program was not compliance with the engine manufacturer manual. The aircraft operator did not follow preservation procedure and allow the engine shutdown period frequently exceeded 5 days limit. Engine shutdown

in long period without proper preservation in corrosive environment would cause the corrosion on the compressor.

3. The aircraft operator did not follow the procedures to inspect the erosion and corrosion of the compressor blades and vanes when performing the 300 Hour inspection of compressor. It missed the chance to detect the serious corrosion of the compressor during the last time inspection before occurrence.
4. The line maintenance personnel was lack of sufficient knowledge and experience of the engine maintenance.
5. The training program related to engine maintenance of the aircraft operator was inadequate and resulted in the lack of expertise of the line maintenance staff in engine maintenance.
6. The oversight of Civil Aeronautics Administration was unable to identify and/or rectify the operator's safety deficiencies including engine maintenance incompliance with appropriate maintenance manual, insufficient training of maintenance personnel, discrepancy of maintenance program, and not properly updating the engine maintenance manual.
7. The aircraft operator did not follow the Operation and Maintenance Manual to adjust the interval of compressor 300 Hour inspection based on the corrosion condition of the compressor.
8. The aircraft operator once exceeded the interval of 300 Hour inspection and 1,750 Hour inspection prescribed in the Operation and Maintenance Manual.
9. The aircraft operator did not properly update and manage the Operation and Maintenance Manual. It would lead to maintenance personnel performing the tasks without the latest updated information.

10. The Civil Aeronautics Administration's maintenance inspector was lack of understanding of aircraft operator's engine maintenance procedure. That deprived the inspector of an opportunity to recognize the operator's maintenance defects during supervision process.

Other findings

1. Qualifications of the flight crew complied with current civil aviation regulations. Flight crews' activities within 72 hours before the occurrence were normal. There was no evidence to show that the flight crew had any influences from drugs during the flight. The weight and balance of the accident aircraft was within the limitation. The weather, when the accident happened, was good in that period of time, and there were no existing weather factors to influence the operation. The accident was unrelated to flight operation.

Safety Recommendations

To Emerald Pacific Airlines

1. Enhance the engine maintenance training for maintenance personnel, and ensure the engine maintenance personnel clearly understand the contents of Operation and Maintenance Manual and the job cards.
2. Reevaluate the company's maintenance capability of 300 Hour inspection on Rolls-Royce 250-C20J engine to ensure the inspections to be performed properly.
3. Review and revise the company's continuous airworthiness maintenance program to ensure the contents complied with the engine manufacturer's standard.

4. Enhance the control mechanism of the manuals updating and job cards management to ensure latest maintenance information timely available for maintenance personnel.
5. Enhance the operation control of performing maintenance and inspection program to ensure the inspection intervals will comply with the engine Operation and Maintenance Manual.

To Civil Aeronautics Administration

1. Require Emerald Pacific Airlines, to provide proper engine maintenance training for maintenance personnel and ensure the engine maintenance personnel clearly understand the contents of Operation and Maintenance Manual and the job cards
2. Require Emerald Pacific Airlines, to reevaluate the company's maintenance capability of 300 Hour inspection on Rolls-Royce 250-C20J engine to ensure the inspections to be performed properly.
3. Require Emerald Pacific Airlines, to revise the company's continuous airworthiness maintenance program to ensure the contents are complied with the engine manufacturer's standard, and to enhance control mechanism of the manuals updating and job cards management to ensure latest maintenance information timely available for maintenance personnel.
4. Review the maintenance supervision of general aviation to enhance the capability of identifying and addressing the systemic failure of the aircraft operator. And require the general aviation maintenance inspectors to be knowledgeable about the type aircraft and engine operated by the assigned operator to identify the maintenance

discrepancies during supervision.

Note:

The language used in occurrence investigation Final Report is in Chinese. To provide general understanding of this investigation for non-Chinese reader, the Executive Summary of the Final Report was translated into English. Although efforts are made to translate it as accurate as possible, discrepancies may occur. In this case the Chinese version will be the official version.