

Executive Summary

GE515 Occurrence Investigation

The Aviation Safety Council (ASC) released the investigation report of TransAsia Airways Flight 515, an ATR-72 airplane, the left engine blade fracture due to problems occurred during molding process. The left engine blade debris caused the scavenge tube impact damage; a big amount of oil ejected backwards, cause the engine fire after the oil contacting with the high-temperature engine tail pipe.

On May 2, 2012, TransAsia Airways Corporation ATR-72-212A with registration number B-22810 had a scheduled passenger flight GE 515 and took off at Taipei Songshan Airport for Magong Airport, Penghu with 2 flight crew members, 2 cabin crew members and 72 passengers on board. During climb, the ENG 1 FIRE warning light came up, the flight crew requested radar vector air-turn-back to Songshan Airport. The flight crew started to perform the QRH 'IN FLIGHT ENG FIRE' procedures.

At 1806:16.5, Taipei Approach Control informed that the aircraft was at 12 nautical miles from the airport and instructed it to turn 070 degree right, descend and remain 2,800 feet until intercepted the localizer and then issued the ILS approach clearance on Runway 10 and handed over to the Songshan Tower. AT 1808:01, the Enhanced Ground Proximity Warning (EGPWS) of the aircraft went off at 2,710 feet and the aircraft was kept descending. The Songshan Tower tried to confirm if the aircraft had intercepted the approach course and reminded that the aircraft was deviating 2

nautical miles left to the course and then instructed the aircraft to climb up to 5,000 feet to avoid ground obstacles. At 1809:13, the aircraft kept descending to 1,954 feet and then started to climb. During climb, the stall warning came up three times. At 1810:57.4, Taipei Approach Control confirmed with the flight crew that whether they could maintain visual flight, the first officer responded that the aircraft was flying in the clouds and they were unable to remain visual. The EGPWS warning were emitted in the cockpit afterward. During the EGPWS recovery procedure, the aircraft shortly turned right and then kept turning left and the stall warning has been emitted several times again in the cockpit. At 1812:06.5, the captain mentioned that Tamsui River was within vision. When the aircraft climbed over 5,009 feet at 1814:42, Taipei Approach Control instructed the aircraft to perform ILS approach on Runway 10 and the aircraft landed at 1826:56 without casualties.

The ASC launched investigation according to the Aviation Occurrence Act after the occurrence. Parties to the investigation are the Civil Aeronautics Administration (CAA), TransAsia Airways, Transportation Safety Board, Canada (TSB), Pratt & Whitney Canada (P&WC), BEA (Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile) and ATR. Investigation report was published after approval by the ASC council members on March 26, 2013, at the 8th Council Meeting.

Findings related to probable cause is the engine no. 1 PT 1 blade lightening hole area material had shrinkage-porosity defect due to molding process; which led to the fracturing of the blade after fatigue propagation. The blade debris inside the

liberated section caused the impact damage to the remaining PT 1 blades, housing, LP turbine housing and the vibration generated by the imbalance of the PT rotors delivered to the no. 6 and 7 bearing housing to lead the holding scavenge tube of the no. 6 and 7 bearings to rupture; a big amount of oil ejected backwards from the rupture and then ignited after contacting with the high-temperature engine tail pipe and causing the engine fire.

Findings related to Risks include maintenance related, flight operations and Air Traffic Control (ATC):

Maintenance related finding include the no. 2 engine throttle did not reach the rated torque output of target value and meet the requirement of the flight operation in the occurrence.

Flight Operations related findings include the flight crew did not initiate ENG Fire memory items immediately prior to request air-turn-back, did not prioritize the tasks and flight management which increased the work load and influence the aircraft operation; the flight crew neither mention the aircraft was under single engine operation nor announce the emergency situation during the air-turn-back, therefore the controller was unable to acknowledge the situation, unfavorable for controller's judgment, planning and assistance; the aircraft did not capture the ILS due to the flight crew did not Arm App Mode immediately, set the correct course and turn left heading to 45 degrees, the deviation was 1.273 dots and the aircraft was passing through the course; the flight crew altered the default altitude to 3,800 ft and cancelled AFCS ALT HOLD MODE

of 2,800 ft and continue descending without receiving any updated clearance or GS MODE activation, the aircraft might deviated from the assigned attitude and closed to the ground obstacle; the flight crew did not climb immediately and obtain maximum obstacle separation as ATR72 EGPWS Enhanced Mode warning and recovery procedures required, led the aircraft emitted stall warning and temporary abnormal condition; the TransAsia Airways (TNA) ATR FCTM of EGPWS Mode 2 warning procedure was pitch the aircraft up to 25 degrees, this procedure might led the aircraft to stall condition due to the aircraft might be under low speed, different configuration, engine failure and other abnormal condition; the aircraft might have different configuration and need to maintain maximum climb speed when encountering EGPWS warning, the manufacture ATR-72 FCOM EGPWSs Mode 2 warning recovery procedure might need further explanation from the manufacture prior to flight crew initiate the procedure.

ATC related risk findings include when the approach control controller instructed GE 515 to intercept the final approach course, the aircraft was higher than the glide path; the approach control's Air Situation Display (ASD) no longer displayed the Air Traffic Management System (ATMS) warning of the aircraft after the approach control handed over to control tower, the approach control was unable to initiate the potential safety risk reminder to the tower. There are 5 other findings in the report.

Regarding to the recommendations related to the subject issue of 1st stage PT blade failures on PW100 engines caused by the micro-porosity problem, P&WC is in the process of reviewing the

life limitation for 1st stage PT blades installed on the higher-powered PW100 engines. Maintenance Manual revisions to this effect are targeted to be released in the 2nd quarter of 2013. AD CF-2013-02, mandating compliance with P&WC SB 21823, requiring one time inspection of all PT blades been made between 2005 and 2008 period, in accordance with the enhanced X-ray inspection method introduced in March 2008, P&WC is also in the process of reviewing the inspection records of all 1st PT blades since the enhanced method was introduced to identify any quality escape due to human error. P&WC will release a new SB by the 2nd quarter 2013 to re-inspect all suspect blades post 2008. The ASC has incorporated the above information into the safety action taken accordingly.

A total of 17 safety recommendations issued to P&WC, ATR, TNA and CAA. Common Safety Recommendation both to **Pratt & Whitney Canada (P&WC), ATR and TransAsia Airways** is : Continued cooperating to solve the problem of no abnormality found under the routine engine performance monitoring performance data, the torque output does not reach the target value when the thrust setting was in the RAMP position (GE 515 occurrence). Recommendations to **TransAsia Airways** include : Enhance flight crew's capability and training of Undesired Aircraft State Management, Flight Management, EGPWS Enhanced Mode caution and warning operation; reinforce flight crew's single engine manual maneuver skill and follow ILS approach SOP, reinforce flight crew to set up correct approach course and adjust appropriate approach speed; review and revise operator and manufacture's relevant manuals (FCTM, AFM and FCOM) regarding ATR72

FCTM EGPWS Mode 2 caution and warning recovery procedures ; review and harmonize the stall warning and recovery procedure. Six common safety recommendations in accordance with the TransAsia Airways flight operations recommendations are also issued to Civil Aeronautics Administration; other recommendations issue to **Civil Aeronautics Administration** include : the ATMS safety warning shall display on the approach control's ASD after the approach control transferring an aircraft to the ATC; supervise Air Navigation & Weather Services the weather returned echo display function to be integrated with the ATMS problem at the earliest opportunity, so that controllers may provide relevant air traffic control services.