# Executive Summary

June 3, 2013, an Airbus A330-300 airplane, registration number B-18317, operated by China Airlines (hereinafter CAL) conducting a scheduled passenger flight CI781 from Taoyuan International Airport, Taiwan, for Tan Son Nhat International Airport in Ho Chi Minh, Vietnam (hereinafter SGN) with 2 flight crew members, 13 cabin crew members and 185 passengers, in total 200 people on board.

According to flight crew interviews, ATC transcript and Flight Data Recorder (FDR) data, The aircraft took off at 0747 Taipei time. Approximate one minute after take-off, ECAM (Electronic Centralized Aircraft Monitoring ) message “AIR ENG 2 BLEED FAULT” was displayed. The flight crew executed ECAM procedures after verification and continued climbing to the cruise altitude of 40,000 ft. The flight crew reset No. 2 engine bleed system at cruise altitude. No. 2 engine bleed system was momentarily recovered, then the same system failure message was displayed again. At 1017 hours, the aircraft started to descend around 110 nautical miles north east from SGN. One minute later (1018:27 hours), at the pressure altitude of 36,612 ft, ECAM message “AIR ENG 1 BLEED FAULT“ was displayed with 6,720 ft cabin altitude. Flight crew deployed speed brake to expedite descent with 7,696 ft/min maximum descent rate. At 1021:40 hours, pressure altitude 21,625 ft, ECAM message “CAB PR EXCESS CAB ALT” was displayed with cabin pressure altitude 9,536 ft. The flight crew donned oxygen masks in accordance with the procedure and announced “MAYDAY” to ATC. The descent was continued to the altitude of 10,000 ft. The maximum cabin altitude was11,136 ft.

At 1024:29 hours, the aircraft leveled at 10,000 ft. The condition cockpit and cabin were normal after flight crew’s inspection. The passenger oxygen masks did not drop. The cabin altitude was 10,500 ft at that time. For passenger’s comfort, the aircraft continue descent to 8000ft. The “MAYDAY” call was cancelled by the flight crew and the aircraft resume normal descent. The aircraft arrived at SGN on 1046 hours. There is no damage to the aircraft and no injury to the occupants.

CVR power supply CB (Q67/CV) should be pulled after landing, but only CVR automatic control CB (V09/CVR CTL) was pulled by CAL maintenance personnel.CVR lost its automatic shutdown mechanism. CVR remained operating for 2 hours and the CVR

data of the occurrence was overwritten completely.

No. 1 and no. 2 engine's Fan Air Valve Thermostats were replaced afterward and the systems were back to normal.

After being notified by Civil Aeronautics Administration and CAL on June 3, Aviation Safety Council (hereinafter ASC) had contact with Civil Aviation Authority of Vietnam (CAAV) immediately. In accordance with ICAO Annex13 paragraph 5.1, CAAV delegated ASC to be in charge of the investigation. The ATC recording and transcript of the occurrence were also provided by CAAV. ASC accepted the delegation and started investigation. Organizations and authorities were invited to participate in the investigation included: Civil Aeronautics Administrations, Ministry of Transportation and Communications, China Airlines, Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile (BEA), Airbus. AAIB Singapore (Air Accident Investigation Bureau of Singapore) on behalf of ASC witnessed the test of faulty parts at LIEBHERR Singapore factory and presented their witness report.

The 'Final Draft Report' of the occurrence was completed on September 3, 2013. In accordance with procedures it was reviewed and revised at ASC's 15th Council Meeting on September 29, 2013 and then sent to relevant organizations and authorities for providing opinions. After relevant opinions were collected and integrated, the investigation report was reviewed and approved by ASC's 16th Council Meeting on October 29 2013.

There are a total of 18 findings from the Final Report, 22 items of safety actions accomplished or being accomplished by the operator/manufacture.

## Findings as the result of this investigation

The 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 the probable causes, Findings related to risk, and other Findings.**

**The findings related to the 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. Further, some of the findings in this category identify risk that are unrelated 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 an issue of controversy, or clarify an issue of unresolved ambiguity. 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.

## CI781 OCCURRENCE

### Findings related to probable cause

Harden and broken of No.1 Fan Air Valve Thermostat's O-ring, internal contamination of No. 2 Fan Air Valve Thermostat, made the openings of No.1 Fan Air Valve and No. 2 Fan Air Valve reduced, engine bleed air temperature risen by insufficient cooling air, two engine's bleed air Pressure Regulating Valves were closed due to engine bleed air over temperature, which caused two engine bleed systems to fail, triggered "EXCESS CABIN ALTITUDE" warning afterward and led the flight crew to make emergency descent by the emergency procedure.

### Other Findings

1. There were no anomalies recorded on the daily checks, pre-flight checks, scheduled maintenance records and Technical Log Books of the aircraft within one month prior to the occurrence. Relevant airworthiness directives, maintenance difficulty reports, deferred defect items and the corrections of the discrepancies were duly performed and controlled.
2. Maintenance personnel replaced No. 1 and No. 2 Fan Air Valve

Thermostat on June 3, 2013 at SGN. When No. 2 Fan Air Valve Thermostat was removed, the O-ring was scattered due to damage resulted from material hardening. When No. 1 Fan Air Valve Thermostat was removed, the material of its O-ring was hardened though intact without any damage.

3. CVR power supply CB (Q67/CV) should be pulled after landing, but only CVR automatic control CB (V09/CVR CTL) was pulled by CAL maintenance personnel. CVR lost its automatic shutdown mechanism.CVR remained operating for 2 hours and the CVR data of the occurrence was overwritten completely.
4. Maintenance Operation Control engineer did not follow the Emergency Check List to verify that the maintenance representative abroad had completed pull-out of all relevant CBs according to Aircraft Maintenance Manual, resulted the CVR data of the occurrence was overwritten completely.
5. Maintenance Operation Control Emergency Check List did not include DFDR CB location information, which led engineer to stop conversations with the maintenance representative abroad to find DFDR CB location information. Then, CVR CB location information was not passed to the maintenance representative abroad, resulted the CVR data of the occurrence was overwritten completely.
6. The maintenance representative abroad is authorized maintenance personnel, in charge of aircraft's trouble shooting and maintenance release. CVR power supply CB (Q67/CV) location's information was not passed to the maintenance representative abroad and the maintenance representative abroad did not follow Aircraft Maintenance Manual to remove the electrical power of CVR, resulted the CVR data of the occurrence was overwritten completely.
7. Qualifications of the flight crew complied with current civil aviation regulations.
8. There was no evidence to show that the flight crew had any influences from drugs during the flight.
9. The "AIR ENG 1 + 2 BLEED FAULT" procedure is not integrated in ECAM system. If the situation occurs during flight, it increases the workload of the flight crew to execute this procedure due to its complexity.
10. There is no "Dual Bleed Fault" training in CAL A330 training syllabus.

11. Airbus and CAL did not set up the policy to limit the maximum flight level with single bleed system failed.
12. The CAL MEL revision process lacked of an inspection mechanism to keep the consistency of the relevant subject among manuals, which might easily generate a inconsistent problem in relevant manuals.
13. “AIR ENG 1+2 BLEED FAULT” procedure in CAL Airplane Operations Manual is different from those of manufacturer’s FCOM**.**

**Safety Actins Accomplished or Being Accomplished**

**China Airlines**

**Improvement Measures of Maintenance**

CAL informed by email on July 15, 2013 that improvement measures were issued regarding the Fan Air Valve Thermostat in this occurrence and the maintenance personnel’s negligence of CVR electric power removal, summarized as the following:

Improvement measures related to the Fan Air Valve Thermostat:

- ✧ Thermostat O-ring will be replaced at each C check by EO 333-36-11-0019.
- ✧ Fan Air Valve Thermostat exceeding 15,000 FH will be replaced first, Fan Air Valve Thermostat exceeding 9,000 FH will be replaced next C Check by EO 333-36-11-0020.
- ✧ Reliability of Fan Air Valve Thermostat has been analysed: According to Weibull analysis, the failure rate may be decreased to 25% within TSI of 9,053 FH (around 3,300 FC) EO 333-36-11-0020.
- ✧ Fan Air Valve Thermostat will be replaced at every 2C Check (around 9,000 FH). LH/RH Fan Air Valve Thermostat replacement will be staggered by each 2C.
- ✧ CAL has issued EO SMD-36-11-0017 with reference of VSB 398-36-05 on June 20, 2013 to upgrade Fan Air Valve Thermostat (ThC) PN 398B050000 to PN 398B060000.Two improvements after upgrade: 1. FILTER changed from P/N 398-21 to P/N 398-84 to reduce the risk that FILTER grips assembly body during replacement; 2. CLAPPER changed from P/N 398-24 to P/N 398-76 to reduce the risk that CLAPPER gets stuck.

Improvement measures related to the maintenance personnel’s

negligence of CVR electric power removal

- ✧ Produce Maintenance Check List for handling abnormal situation procedures at stations abroad, publish bulletins to request all stations abroad to have a clear understanding of the contents in the maintenance procedures of handling abnormal situations abroad.
- ✧ When a major maintenance occurrence takes place, CB shall be pulled out timely and it shall be recorded in Technical Log Book (TLB). (This procedure shall be listed in maintenance procedures of handling abnormal situations at stations abroad)
- ✧ Install red caps on CVR/DFDR C/Bs fleet-wide to facilitate personnel to verify C/B locations.
- ✧ The procedures of electric power and component of CVR/DFDR removal under abnormal situations will be added in Line Maintenance operating manual. The removal of power and component of CVR/DFDR will be MOC's responsibility.
- ✧ It shall be implemented in the training item at Engineering Section before personnel to be posted abroad and shall be listed in the evaluation.

**Improvement Measures of Flight Operations**

CAL informed by email on August 1 and August 9, 2013, safety actins accomplished or being accomplished as the following:

- ✧ "AIR ENG 1+2 BLEED FAULT" training will be implemented in the first half of annual recurrent training in 2014 to enhance flight crew's judgment and handling capability to the situation.
- ✧ CAL Flight Operations' existing manual revision process shall establish an inspection mechanism to keep the consistency of relevant subjects in different manuals.
- ✧ Existing MMEL and MEL remind flight crew with NOTE that when flight level exceeds FL 374 with the other bleed air system failed, there is a risk that oxygen masks may drop. However the flight altitude is not limited. CAL MEL will follow MMEL in general, however regarding this case discussion will be continuously proceeded in monthly flight safety meetings and fleet technical seminars to promote flight crew's judgment and handling capability to the situation so that the best option will be made with considerations of flight time, route structure, altitude limitation, ATC requirement and fuel remaining.
- ✧ When editing A330 QRH ENG 1 + 2 BLEED FAULT procedure,

the last black square （■）indent is different from the manufacturer's version. The reason could be the negligence of the correct location of the black square after turning to the next page. A Temporary Revision has been issued for correction on July 17, 2013.

- ✧ "Apply the AIR DUAL BLEED FAULT procedure" and "Refer to QRH/ABN-36 AIR ENG 1 + 2 BLEED FAULT" statements are still in the most recent AIRBUS MMEL issued on April 3, 2013, which caused the error of "Refer to QRH AIR DUAL BLEED FAULT" in CAL A330 MEL 36-11-01 (O) operational procedure. As that page was not listed in the content of revision nor with a highlight, personnel for revision failed to revise accordingly at the same time. Afterwards Airbus admitted the mistake and would correct it in the revision of December this year. CAL Flight Operations Standard department has made the correction in TR 2013-03. The relevant content in MEL will be revised as "Apply the AIR ENG 1 + 2 BLEED FAULT procedure" and "Refer to QRH/ABN-36 AIR ENG 1+2 BLEED FAULT", which will be consistent with the title of AOM/QRH and the revision has been accomplished on September 5 this year.

**Airbus**

According to Airbus email on October 11, 2013, "AIR ENG 1 + 2 BLEED FAULT" ECAM procedure has been implemented in Flight Warning Computer (FWC) standard T5 and certified in August 2013..