Islamic Republic Of Iran

Civil Aviation Organization

Aircraft Accident Investigation Board

Final Report

Basic Information:

State File Number: A961220TC-TRB

Type of occurrence: Accident

Date of occurrence: 11 March, 2018

Place of occurrence: near SHAHR-E KORD, Islamic Republic of Iran

Aircraft Model: Bombardier CL604 Challenger

Registration: TC-TRB

Operator: MC Aviation

Date of Issue: 10 March, 2020

---

http://www.cao.ir E-mail: AIG@cao.ir Fax: + 98 21 6601 8659 Tel.: + 98 21 6604 7965

Mehrabad International Airport Tehran/Iran PBO: 13445-1795

"In the Name of God"

FINAL REPORT ON AIRCRAFT ACCIDENT

CHALLENGER 604, TC-TRB

Operated by MC Aviation

Near SHAHR-E KURD IR OF IRAN

Table of Contents

Abbreviations

A/C	Aircraft
AAIB	Air Accident Investigation Board
ACC	Area Control Center
ADC	Air Data Reference
ADC	Air Data Computer
ADG	Air Driven Generator
ADS	Air Data System
AFCS	Automatic Flight Control System.
AFM	Aircraft Flight Manual
AIP	Aeronautical Information Publication
ALT	Altitude
AMM	Aircraft Maintenance Manual
AP	Autopilot
ATC	Air Traffic Control
ATM	Air Traffic Management
ATPL	Airline Transport Pilot License
ATS	Air Traffic Service
BEA	Bureau d'Enquête Et d'Analyses
CAO.IRI	Civil Aviation Organization Of Islamic Republic of IRAN
CAM	Cockpit Area Microphone
CCTV	video surveillance televisions for airports
CG	Center Of Gravity
COSPAS-SARSAT	International Satellite System For Search And Rescue
CPL	Commercial Pilot License
CRM	Crew Resource Management
CVR	Cockpit Voice Recorder
DCU	Data Concentrator Unit
DFDR	Digital Flight Data Recorder
DGCA	Directorate General Civil Aviation
DNA	Deoxyribonucleic acid
EASA	European Union Aviation Safety Agency
EFIS	Electronic Flight Indication System
ECP	Engine Control Pannel
ENG	Engine
FAR	Federal Aviation Regulations

FCC	Flight Control Computer
FD	Flight Director
FDR	Flight Data Recorder
F/O	First Officer
FCOM	Flight Crew Operating Manual
FCSSU	Flash Crash Survivable Store Unit
FIR	Flight Information Region
FL	Flight Level
IAS	Indicated Air Speed
IDG	Integrated Drive Generator
IRS	Inertial Reference Systems
KT	knot
MMO	Mach Maximum Operating
MTOM	Maximum Take Off Mass
PFD	Primary Flight Displays
QRH	Quick Reference Handbook
SPS	Stall Protection System
STBY	Standby
TCCA	Transport Canada Civil Aviation Authority
TSB	Transportation Safety Board
UEIM	Transport Safety Investigation Center of Turkey
ULB	Underwater Locator Beacon
UTC	Coordinated Universal Time
VDL	Correction For Defective Distant Vision
VMO	Velocity Maximum Operating

Foreword:

The Civil Aviation Organization, in accordance with international obligations and domestic regulation of the Islamic Republic of Iran, is in charge of monitoring the proper implementation of the laws and regulations and standards of flight in the civil aviation industry of the country. In order to identify the sources of threats on flight safety , based on the Regulations on the Investigation of Accidents and Civil Aviation Accidents, adopted in 2011 by the IR of Iran government and the International Regulations of the International Civil Aviation Organization (ICAO) Annex 13, the Aircraft Accident Investigation Board (AAIB) institutes the investigation of the civil Aircraft Accidents/Incidents, and after determination of the main cause and the contributing factors , will issue safety recommendations to prevent similar accidents and events in the future.

According to Aircraft Accident Investigation Regulation of the Islamic Republic of Iran for civil aircrafts:

"*Accident investigation shall be conducted separately from any judicial, administrative disposition, or administrative lawsuit proceedings associated with civil or criminal liability".*

Based on Annex 13 to the Convention on International Civil Aviation, Chapter 3, Paragraph 3.1, and Chapter 5, Paragraph 5.4.1; it stipulates and recommends the following;

The sole objective of the investigation of an incident or accident shall be the prevention of incidents and accidents. It is not the purpose of this activity to apportion blame or liability.

Any judicial or administrative proceedings to apportion blame or liability should be separated from any investigation conducted under the provisions of this Annex.

In the case of the accident on Mar 11, 2018, involving Bombardier CL604 aircraft with registration TC-TRB belonging to MC Aviation, the IRI CAO Aircraft Accident Investigation Board (AAIB) gathered whole information with coordination of related entities and approached the investigation as representative of State of occurrence.

According to International Law and Annex 13 to the Chicago Convention, the Notification was sent to the ICAO and the Canadian Transport Safety Board (TSB), as state of aircraft manufacturer and designer, and also to Transport Safety Investigation Center of Turkey (UEIM) as representing state of Registry & Operator. Both states have introduced their accredited representatives accordingly; however, both TSB and Bombardier Inc. had some limitations to support the Iranian investigation team under U.S. and Canadian law against standard 4.6 of Annex 13 to ICAO convention. The Turkish representative, in response to the announcement of the accident, sent a go-team to Iran and visited the accident site.

The Flight Data Recorders were sent to Aircraft Accident Investigation Board of France (BEA) for downloading with participation of IR of Iran, Turkey, and Canada Representatives.

The Iran AAIB sent draft of final report to the involved states. The comments from Canada (TSB, TCCA and Bombardier) were received and non-agreed comments were inserted to the report appendixes.

1-FACTUAL INFORMATION:

1.1 History of the flight:

On March 11, 2018, the Challenger 604 with registration TC-TRB took off from Sharjah Airport to destination of Istanbul Atatürk Airport. At 13:26 UTC, the aircraft entered Tehran FIR via GABCO in IMC condition and contacted Tehran ACC and was identified by ACC controller at 13:29 UTC. The pilot requested permission to climb to FL360 according to its pre-assigned flight plan which was granted immediately. About 14:32, the pilot requested FL380 which was never achieved and subsequently about two minutes later requested for FL370 due to malfunction. The left and right airspeeds began to diverge and autopilot was disconnected. Very shortly after reaching peak altitude, a series of stall warning began. Both engines eventually flamed out about 5 minutes later, the aircraft started to descend and pilot reported malfunction and tried to control abnormal situation until the end of flight. The aircraft impacted into a mountainous area at southwest of Shahr-e kord in Islamic Republic of Iran. Time of accident was about sunset time at the place.

1.2 Injures to persons:

Injuries	Crew Members	Passengers	Others
Fatal	3	8	-
Serious	-	-	-
Minore/none	-	-	-

The body of the captain was not found in the crash site and no human tissue was recognized to belong to her by the means of DNA testing.

1.3 Damage to Aircraft:

The aircraft was destroyed by impact forces and post-impact fire.

1.4 Other Damage:

There was no any other damage.

1.5 Personnel Information:

1.5.1 Flight crew:

Two pilots were certified by Turkish Civil Aviation Authority (DGCA). The captain held Airline Transport Pilot License (ATPL). The first officer held a Commercial Pilot License (CPL). They had Category I Medical Certificates which were valid and Challenger 604 aircraft type rating was endorsed to their licenses.

The research on all simulator records of both pilots showed that they passed all abnormal procedures in Approved Training organization (ATO GBR.ATO.0234). Both pilots had initial type rating courses by CAE , Emirate .

1.5.1.1 Captain:

Nationality	**Turkish**	**Gender**	**Female**
License No	TR-A 4964	**Age**	36
License Validity	Yes	**Type Endorsed**	Yes
Ratings	ATPL	**Restrictions**	VDL
Medical Expiry Date	21.12.2018	**Previous Accidents**	No

Captain's Flying Experience

Total Hours	**4880**
Total Past 90 Days	54
Total on Type Past 90 Days	54
Total on Type	1600

The Turkish Authortity confirmed that:
Complete type training and recurrent courses for Captain were done in CAE, Amsterdam by related training syllabus approved by EASA. She did her last LPC in CAE Amsterdam on May 13 2017 and covered all abnormal items both during training sessions and LPC check ride. Detailed training items were:

- under Flight Maneuvers and Procedures section, Pitot/Static system which isdirectly related to airspeed erros or unreliable indications covered,
- Stall warning system and stability augmentation devices were covered,
- Early recognition and countermeasures on approaching stall (up to activation of stall warning device) in takeoff configuration (flap in takeoff position), in cruising flight configuration, and in landing configuration and
- Recovery from full stall or after activation of stall warning device in CLIMB, CRUISE and approach configuration were covered.

Also, last OPC on aircraft type was made on 01.03.2018 and chapters 3.4.2 and 3.4.9 related to above annormal procedures were discussed and covered by TRE . During the last 3 years LPC, OPC and all abnormal procedures training were provided and covered repeatedly for the capitain.

1-5-1-2 First Officer:

Nationality	**Turkish**	**Gender**	**Female**
License No	TR-A-11467	**Age**	40
License Valid	Yes	**Type Endorsed**	Yes
Ratings	CPL	**Restrictions**	None
Medical Expiry Date	14.07.2018	**Previous Accidents**	Yes

- ✓ **Note:** During training flight with DA20 the First officer as flight instructor, experienced a hard landing while performing touch & go study of student pilot in June 2017.

First Officer's Flying Experience

Total Hours	**1132**
Total Past 90 Days	48
Total on Type Past 90 Days	48
Total on Type	114

Initial type rating course syllabus of copilot included all abnormal procedures. As a summary:

- on August 29 2017 during her intial training , session 5, she covered IRS and ADC failures.
- On September 4 2017, she covered item 11 Stall- Early Recognition and recovery and 12- Recovery from full stall.
- on September 5 ,2017, she covered EFIS-reversion, IRS/ADC failure again
- on September 7 during Remedial (extra) training, they covered stalls and unusual flight attitudes.
- on September 13 2017, item number 23 , she covered Pitot/Static system heater failure in icing conditions.
- on September 16 2017 , item ADC failure.

Both pilot training records indicated that they took necessary training and all abnormal procedures were covered with instructors or examiners, especially pitot/static system failures related to ADC failures. Also, all stall indication and warning systems with proper procedures which include recognition and recovery systems had been covered in their simulator trainings.

1-5-2 Air Traffic Controller:

The controller at Tehran ACC who was responsible for navigation of the aircraft is 36 years old. He is qualified for ACC & Radar services with License No; 1381 issued by Civil Aviation Organization of IR of Iran. He holds valid medical check Class III which expires on October 20, 2019, and has passed language proficiency requirement Level IV which is valid until June 15,2020.

1.6 Aircraft General Information:

The Bombardier Challenger 604 (previously known as the Canadair CL-604) is a sweptwing, dual engine monoplane business jet, certified in accordance with FAR 25, FAR 36 and their amendments on the FAA type Certificate Data Sheet A21EA. This type of aircraft has type certificate from EASA too. Maximum ramp and takeoff weights are 48,300 and 48,200 lb respectively. The aircraft is designed for two crew members with accommodation for 12 passengers, and is powered by two General Electric CF34-3B engines.

It is a low-wing, t-tail aircraft, with landing gear in standard retractable tricycle configuration. In the right aft part of the cabin a couch had been installed at right angles to the flight direction.

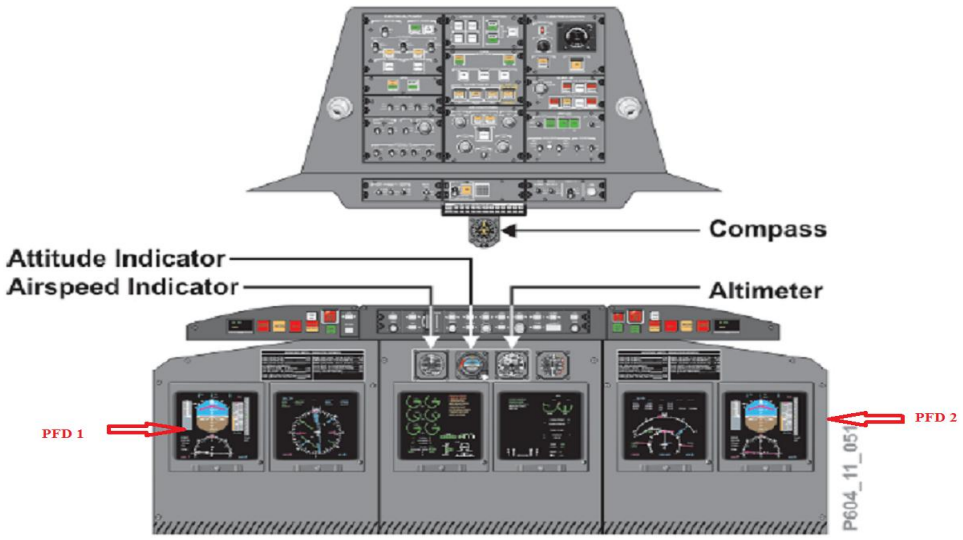
Manufacturer: Bombardier Inc. Canadair Group

Type: CL-600-2B16 (604 Variant)

Manufacturer's Serial Number (MSN): 5494

The aircraft had a valid Turkish Certificate of Registration and was operated by MC Aviation as a Turkish operator.

The aircraft's Mach Maximum Operating (MMO) value in altitudes between 30,990 ft and 41,000 ft is 0.85. Between 22,150 ft and 26,570 ft MMO was 0.78 and Velocity Maximum Operating (VMO) between 26,570 ft and 30,990 ft is 318 KIAS. Among other things, the aircraft is equipped with two Inertial Reference Systems (IRS). The IRS provided the different aircraft systems with attitude, directional, position and three-axis rate/acceleration data.



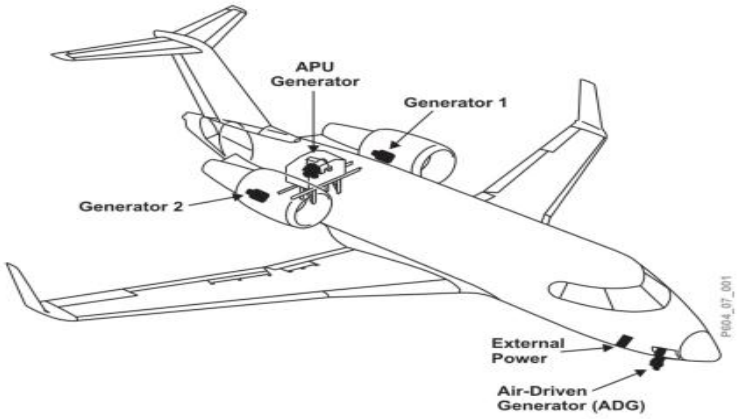
Standby Instruments Locator

The aircraft was equipped with an Electronic Flight Instrument System (EFIS). Part of the standby instruments were airspeed indicator, barometric altimeter, artificial horizon, and a magnetic compass. Some parts or systems related to the occurrence are descripted as:

ELECTRIC SYSTEM:
The Challenger 604 primarily uses 115 volt AC power and also 28 volt DC electrical power. Engine-driven Integrated Drive Generators (IDGs) supply the primary source of AC electrical power. A generator mounted on the auxiliary power unit (APU) provides an alternate source of AC electrical power. In flight, if a total loss of AC power occurs, the Air-Driven Generator

(ADG) should be deployed manually from the right side of the forward fuselage to provide an emergency source of AC electrical power.

External AC electrical power is supplied through an electrical power receptacle located on the right side of the forward fuselage.

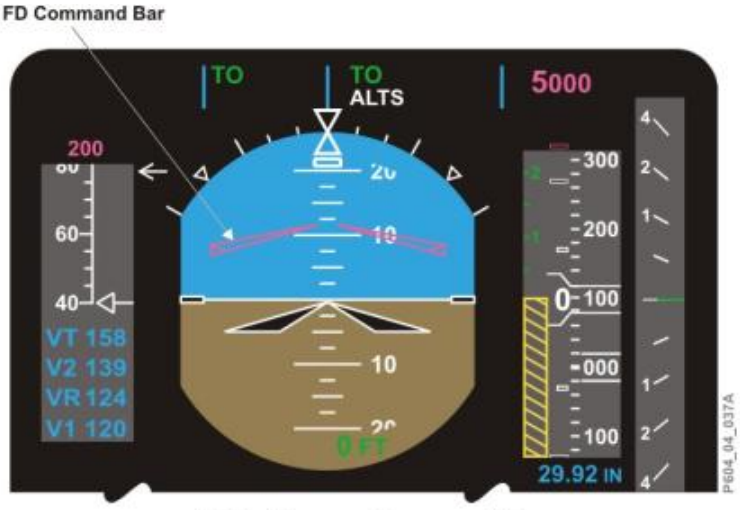


AC Electrical Power Sources

FLIGHT DIRECTORS:

The flight directors (FDs) are the visual representation of the commands generated by the flight control computers. The flight directors provide integrated pitch and roll guidance by means of magenta inverted V-shaped command bars on the ADI of the PFD. The command bars are always in view when the flight director is being used or when the autopilot is engaged. The command bars are out of view when the flight director is turned off or flagged, or when the aircraft's attitude is extreme.

The pilot can manually fly the aircraft by following the command bar guidance cues. When the autopilot is engaged, the FCCs issue steering commands to the aileron and elevator servos according to the flight director guidance instructions.



Flight Director Command Bar

There are two independent flight directors for each AFCS channel. They are designated as per the following table:

Flight Director Designation

AFCS CHANNEL	LEFT SIDE FCC	RIGHT SIDE FCC
1	FD 1	FD 2
2	FD 1	FD 2

In most flight director modes, only one FD provides guidance commands and flight mode annunciations to both PFDs. The other FD operates as a standby. This ensures that all FD mode annunciation and command cues displayed on the left and right PFD remain synchronized.
At power-up, both flight directors are off. FD 1 defaults as the active flight director, following selection of any lateral or vertical mode on the FCP. When FD 1 is active and the autopilot is disengaged, a white left-pointing arrow is displayed on the upper left side of both PFDs. The right PFD also displays a green FD 1 annunciation below the left arrow to indicate that right side FD commands are being supplied by FD 1.
When the left-seated pilot has control of the aircraft, FD 1 is normally selected and all flight guidance commands are derived using the left side systems (ADC 1, IRS 1, left side navigation source selection). Selecting XFR (transfer) on the flight control panel transfers to the cross-side active FD. It determines which FD guidance the autopilot will follow when engaged.

Air Data Computers (ADCs):
The ADCs are digital, microprocessor-controlled units. The two ADCs receive onside pitot and static air pressure information from the pitot-static system, and air temperature information from the TAT probe. The ADCs also receive operator/display selected input from the ADRPs and the automatic flight control system (AFCS). From these inputs, the ADC calculates all necessary air data parameters, and transmits the information to the applicable systems.

Standby Airspeed Indicator:
The airspeed indicator supplies non-corrected (indicated) airspeed. It uses the standby pitot source P3 and the standby static ports S3.

Indicated Airspeed:
The airspeed comparator is enabled if both sides are using different air data sources, both sides have not failed (no IAS flag), and the indicated airspeed is greater than 90 knots. If the airspeed comparator is enabled and the airspeed difference is greater than 10 knots, the airspeed comparator warning "IAS" shows on the upper portion of the airspeed scale. The following table summarizes the trip values for the full-time comparator monitoring functions:

Trip Values

SYSTEM	FLAG	VALUE
HEADING	HDG	>6°
ROLL	ROL	>3° Approach, >4° En route
PITCH	PIT	>3° Approach, >4° En route
ALTITUDE	ALT	60 ft with BARO set within 0.02 inches. The amount of difference required to trigger the flag increases as altitude increases.
AIRSPEED	IAS	>10 kts above 90 kts

Engine Indicating and Crew Alerting System (EICAS):

The function of the EICAS is to display the engine instruments and to provide visual and aural crew-alert messages and real-time interpretation of aircraft system operation.
Two EICAS displays present the data on different selectable display pages. Some display pages are shown by default, others are available through crew selection. The EICAS control panel (ECP), located on the center pedestal, controls the displayed information.
Engine indications are provided on the EICAS primary page. Color is used to depict normal and non-normal ranges of operation.

The Crew Alerting System (CAS) provides visual and aural alerts as determined by the Data Concentrator Unit (DCU) upon occurrence of a malfunction. The CAS prioritizes messages by order of occurrence and order of importance. The DCU's receive inputs from engine, landing gear, flap,…., air data computer simultaneously.

The EICAS control panel is located on the center pedestal. The panel remains illuminated during a complete AC power failure and the PRI, STAT, STEP and CAS keys remain operational.
The EICAS displays are computer-controlled video displays. EICAS display no. 1 (ED 1) is installed on the left of the center instrument panel and EICAS display no. 2 (ED 2) is installed on the right of the center panel.
The EICAS displays present system information on primary, status, synoptic and menu pages. ED 1 displays the primary page by default. ED 2 is defaulted to the status page. Page selection is accomplished via the ECP.

The master warning switch/lights are located on the glare shield. When the DCUs generate a warning message, the two master warning switch/lights flash red. A triple chime always accompanies the master warning lights and, in addition, dedicated tones or voice messages may sound.

LEFT GLARESHIELD RIGHT GLARESHIELD

A Master caution generates a Single Chime while a Master Warning generates a Triple Chime. Each Master Warning and Master Caution will generate a corresponding text message on the EICAS primary display.
The aural warnings generated by EICAS include inter alia:

- Cavalry charge (Autopilot disconnect)
- Engine oil (Synthetic voice) (Low engine oil pressure)
- Overspeed clacker (Audio signal for overspeed)
- WARBLER (Stall)
- C-Chord (Altitude Alert)

1.6.1 Airframe:

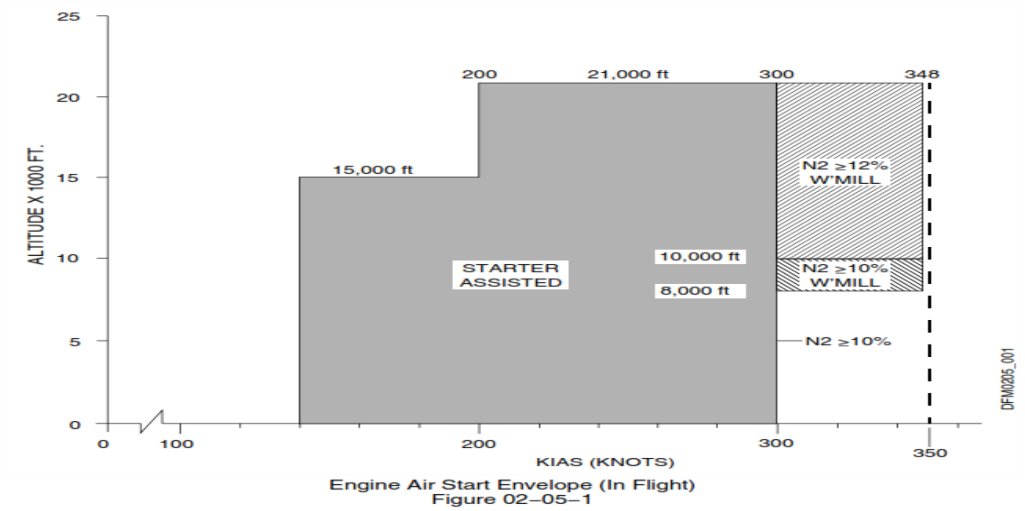
Manufacturer (TC Holder)	Bombardier Inc.
Type	CL 604
Serial number	5494
Registration	TC-TRB
Entry into service	2001
Certificate of Airworthiness	No 2603 dated 18 May 2016 issued by the Turkish DGCA
Airworthiness examination certificate	26/05/2017 valid until 24/05/2018
Utilization as of Mar. 11 2018	7935:35 flying hours and 3807 cycles

1.6.2 Engines:

	Engine No. 1	Engine No. 2
Manufacturer	General Electric	General Electric
Type	CF34-3B	CF34-3B
Serial No.	872997	872996
Installation Date	January 10, 2004	January 10, 2004
Total Running Time	7935:35 hours, 3807 cycles	7935:35 hours, 3807 cycles

1.6.2.1 Engine Relight (CONT'D)

Based on Aircraft flight manual, engine starting in-flight is permitted within the envelope defined in Figure 02−05−1 before 21000 feet and in the case of double engine failure on altitude more than 21000 feet QRH emergency procedure EMER1-5 should be followed.



Engine Air Start Envelope (In Flight)
Figure 02–05–1

BOMBARDIER CHALLENGER 604 | EMER 1-5 | REV 92, Mar 31/14

Double Engine Failure

.....Engine failure indicated by N1, N2, ITT, and fuel flow indications on EICAS

(1) CONT IGNITION ..... ON
(2) Airspeed ..... 240 KIAS minimum.

(3) Engine instruments.....VERIFY N_1, N_2 and ITT.

If engines continue to run-down:

(4) Thrust levers (both) .....SHUT OFF
(5) ADG manual deploy handle .....PULL for at least 1 second, then stow.
(6) AC ESS BUS..... CHECK POWERED

1.6.2.2 Double Engine Failure (Cont'd):

1. Between 21,000 feet and 10,000 feet, a minimum of 12% N2 is necessary for a windmill relight.
2. At 10,000 feet and below, a minimum of 10% N2 is necessary for a windmill relight.
3. Acceleration to VMO is recommended to attain the necessary N2 for a windmill relight.
4. The altitude loss when accelerating from 240 KIAS to VMO could be more than 5,000 feet.
5. A push-over to as steep as 15° nose down may be required.

1.6.3 Airspeed Indication and Miscellaneous Components:

The flight environment data system supplies flight environment data to the aircraft avionics systems. The data is collected by different sensors installed around the aircraft and is shown with the use of the electronic flight instrument system (EFIS).

The flight environment data system includes the systems that follow:

- Pitot Static System and Temperature Sensing System
- Standby Pneumatic Instruments System
- Air Data System (ADS).

The pitot static system includes two systems:

1. Main Pitot Static Systems

2. Standby Pitot Static Systems.

The main pitot static system supplies the pitot and static air pressures to the ADS.

The standby pitot static system supplies the pitot air pressures to the standby airspeed indicator. The aircraft was equipped with:

Pitot tubes Manufacturer: Rosemount Aerospace Inc in the USA

RH P/N: 0856KV10 S/N: 204605

LH P/N: 0856KV9 S/N: 202978

Air Data Computer Model Manufacturer: Rockwell Collins aerospace in the USA

R/H: PN: 822-0842-142 S/N: 5A9C

L/H: 822-0842-142 S/N: D87B

Airspeed indicator with P/N; 8059-2b manufactured by Ultra Electronics Flightline Systems in the USA.

1.6.4 Maintenance Operation Follow-up:

The maintenance program of the aircraft is performed in accordance with approved maintenance program on tasks prescribed at specific intervals. The task intervals consist of basic intervals and multiple intervals.

For the hourly tasks, the intervals are as follows:

- multiples of 100-400-600 -1200 hours

For the monthly tasks, the intervals are as follows:

- Multiples of 6-12 months until 192 months

Furthermore, there are some out of phase tasks that do not fit into the above schedule.

These checks were performed in accordance with the operator's maintenance program, drawn up on the basis of the manufacturer's recommendations and approved by the national authorities. The line maintenance up and including 1200 hours, 5000 cycles, and 36 months' checks carried out by MC aviation.

- ❖ According to approved maintenance program of CL604 , there were 2 main maintenance tasks related to pitot static probes used for airspeed indication system:
  1. Functional test of pitot static probes, performed on May 17, 2017 at MCM (Maintenance Center, Malta)
  2. Detailed inspection of the pitot static probes performed on June 23, 2016.

1.6.5 Pre-flight Inspection:

In order to ensure that the aircraft is fit to make the intended flight, a pre-flight inspection is performed by a technician or by the flight crew before each flight.

Content of the pre-flight inspection should include but not limited to all maintenance tasks involved in the approved maintenance program and the following items:

Control surfaces, landing gear locks, pitot/static covers, restraint devices and any other items mentioned in aircraft's MP. According to MC aviation policy, the captain had related authorization to do preflight inspection for releasing aircraft for flight.

1.7 Meteorological Information:

Based on the report of I.R. of Iran Meteorological Organization, the weather information for Airway UT430 on March 11, 2018, at 14:30 UTC, pertinent to the accident, was described as:

1.7.1 Surface Air Report (METAR):

METAR OIFS 11 1356Z 230 12KT 9999 few 040 14/M07 Q1015

METAR OIFS 11 1457Z 240 10KT 9999 few 040 11/M07 Q1017

1.7.2 Area Forecast:

SW: 7000 few 070 TEMPO LOC 3000 Du/Hz FEW 065 CB FEW 070 SCT 140

405012 300 03 410001 19010 420068 25022 4300096 25031 440002 25045

Central Area: 7000 FEW 070 SCT140 TEMPO LOC 4000 TS/RA/SA FEW 065CB SCT070 BKN110

4050 14 21005 410001 20011 42068 260 18 430097 240 31 440005 25043

SIGMENT 2 Valid 111610/111730 OIII - 011X Tehran FIR

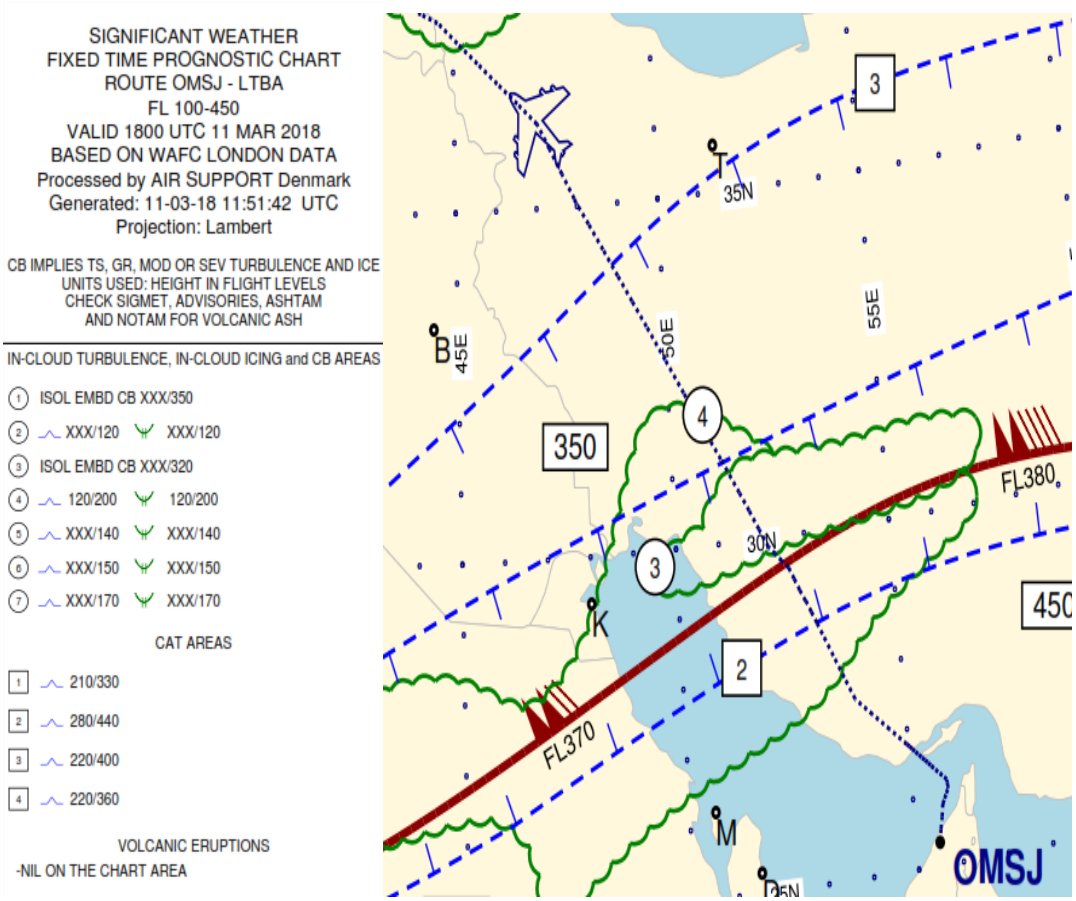
EMBD TS OBS/FCST WI N3855 E04634 -N3416 E0749- N3522 E06115

TOP FL320 MOV E/NE INTSF=

EMBD TS OBS/FCST WI N3030 E0481 -N3448 E06046 -N2922 E05040- N3206 E0652

TOP FL320 MOV E/NE INTSF=

Filed significant weather chart in flight documents shows observed and forecast thunderstorm activities along and close to route. The chart Indicated instability in the region with ISOLATED -EMBEDED-CB , and moderate up to sever turbulence and icing condition warning up to 45000ft. the accident site was located in an instable area.



1.8 Aids to Navigation:

The aircraft was equipped with standard navigation equipment required for that type and no difficulties with Navigation Aids were reported.

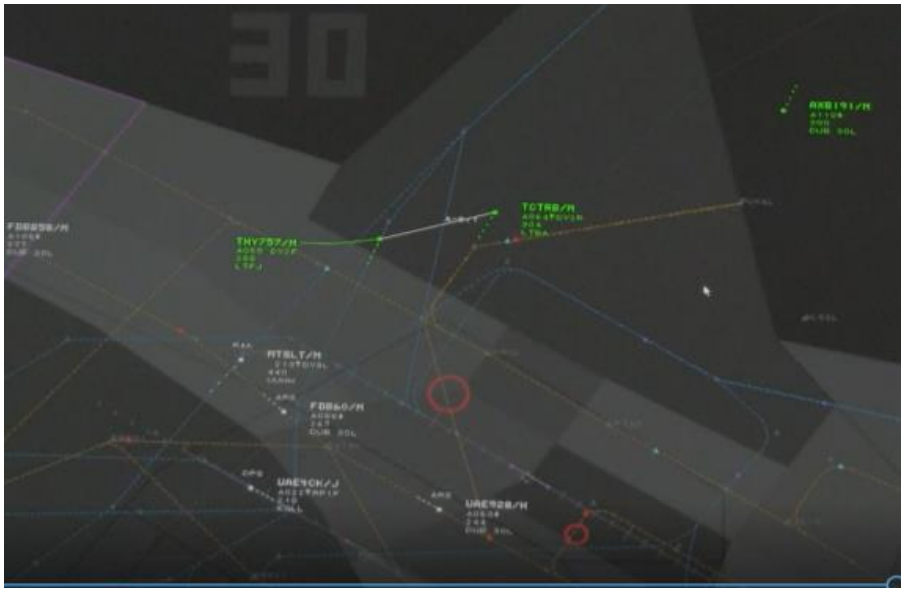
1.9 communications:

Challenger 604 registered as TC-TRB, was scheduled to take off from Sharjah International Airport (OMSJ) to Istanbul Atatürk International Airport (LTBA). The submitted ATS flight plan was as follows:

DAVMO M318 RADEB M317 ROTAL UP574 SYZ UT430 TUGEL DCT ALRAM UT888 SIV UA4 ERKAL

ETD was at 13:00, on March 11, 2018. At 17:05 (local time), the doors of the aircraft were closed at Sharjah International Airport. ATD was 13:17 UTC. The aircraft followed the SID, DAVMO TWO ROMEO DEPARTURE, and was initially cleared to 3000 ft. It had a normal take off followed by ATC clearance. The ATC Voice Recording Transcript for Sharjah Tower is in the attachment I.

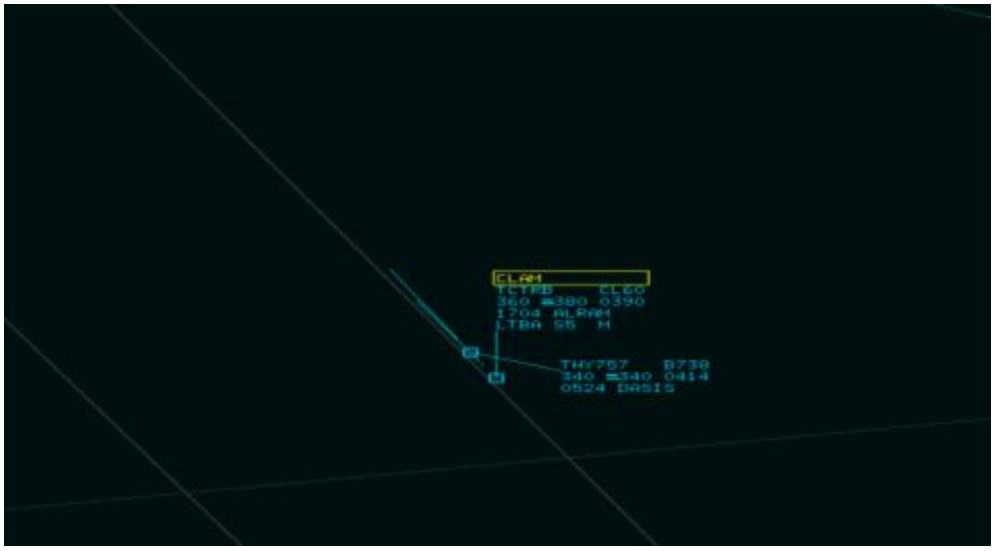
Another aircraft, a Boeing 737-800, call sign THY 757, departed at the same time from Sharjah International Airport to Istanbul Sabiha Gökçen International Airport.

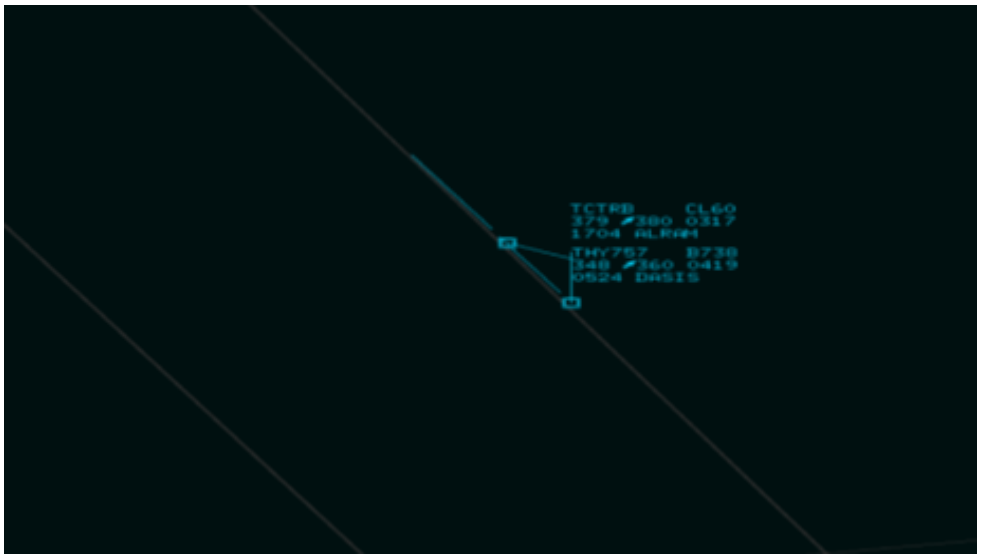


TC-TRB entered Tehran FIR at 13:26 via GABCO and contacted sector 5 of Tehran ACC on FREQ 132.10 while climbing to FL 230. Subsequently, it was identified by radar controller at 13:29. The pilot requested FL 360 according to its flight plan which was immediately confirmed by ACC controller.

At 14:28:48, TC-TRB called sector 3 of Tehran ACC and declared its flight level as FL 360. It was immediately identified by radar controller.

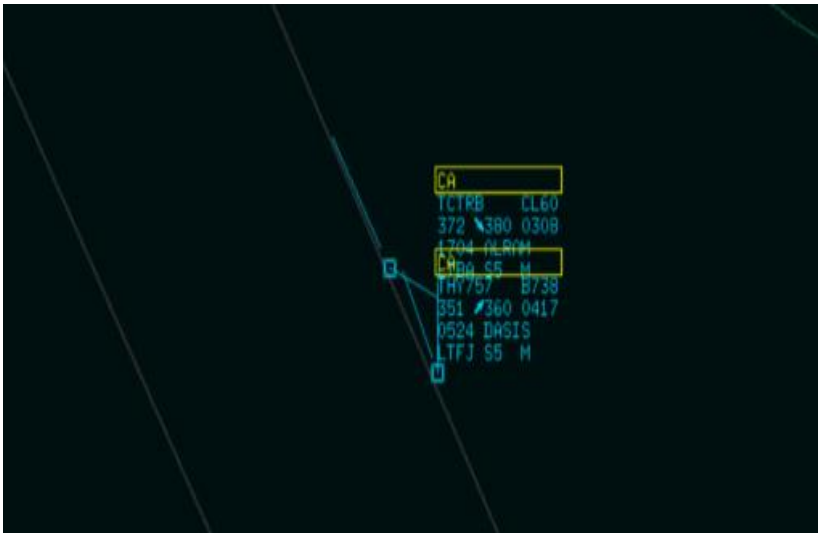
At 14:32:17, the pilot requested permission to climb to FL 380 which was approved by the controller.



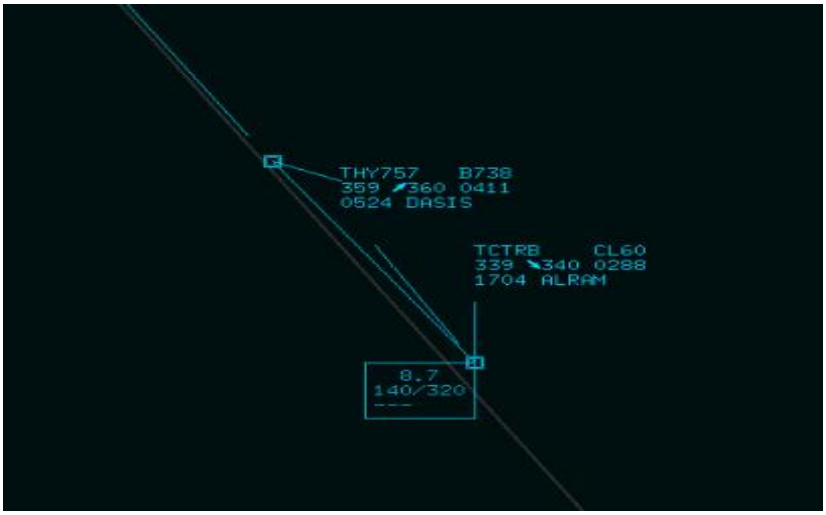


Following that, at 14:33:15, THY 757 which was flying ahead of TC-TRB at FL 340 on the same route, requested permission to climb to FL 360. Again, permission was approved by the controller.

At 14:34:37, while reaching FL 379, the pilot declared descending to FL 370 due to malfunction and started its descend to the wrong flight level without waiting for ATC approval. It was just after descending that the controller approved FL 370. Based on the information displayed on radar screen, the aircraft's speed was reduced from 390 kt at FL 360 to 316 kt at FL 379.



At 14:35:36, while aircraft's speed displayed on the radar further reduced to 288 kt, the pilot declared that they are continuing descend to FL340.



At 14:37:53, the aircraft could not maintain FL 340. Subsequently, the controller asked the pilot their desired flight level. The pilot's answer was not clear and the controller asked her to repeat it. The controller did not receive any message from the pilot afterwards.

At 14:38:43, in regard to the situation of the aircraft on the radar which was losing its altitude and speed simultaneously, the controller asked the pilot "Confirm situation normal?" but didn't receive any answer. Then, the controller tried to call the flight several times with no success. There was never any response to other messages.

At 14:39:48, the controller asked THY 757, which was 8 NM forward of TC-TRB, to call it. The pilot of THY 757 started to call TC-TRB using Turkish language but again did not receive any answer.

At 14:40:58, the controller shared information regarding TC-TRB with THY 757 that the aircraft disappeared from radarscope. The controller asked the pilot of THY 757 to call TC-TRB again. THY 757 tried to call it several times, again with no response. The pilot of THY 757 told radar controller that the last time he saw TC-TRB on TCAS display 6000 feet below his flight level, rapidly losing its altitude.

1.10 Airport Information:

The aircraft had been parked for three days before flight in Sharjah International Airport. During the time, dusty weather condition was reported on the airport. A witness reported that initially crew did not set cover on Pitot tubes when aircraft was parked but picture of aircraft in parking showed that it was done later.

Park position of aircraft in Sharjah (OMSJ)

The flight was planned from Sharjah Airport to Istanbul Ataturk Airport. The accident did not take place at an aerodrome.

1.11 Flight Recorders:

The aircraft was equipped with two flight recorders. The Flight Data Recorder and Cockpit Voice Recorder were found on accident site in damaged condition. The recorders and the FCSSU were brought to BEA facilities in Paris by the Investigator in charge on 10 Apr 2018. The opening and readout were performed the same day.

	FAIRCHILD A200S	**F1000**
		
Manufacturer	Fairchild A200S	Fairchild F1000
Part number	S200-0012-00	S800-2000-00
Serial number	337550	FCSSU only – 900-E0011-00

1.11.1 Flight recorder opening operations and readout:

1-11-1-1 CVR opening and readout:

The CVR opening operations took place in BEA facilities. A visual Assessment of the CVR was performed. The recorder was damaged. The ULB was still attached to the chassis.

The P/N and S/N of the CVR was confirmed by reading the identification plate.

Due to the recorder's damage, the chassis was cut with electrical grinder to have a clear access to the main processor PWA.

The main processor PWA was removed to access the FCSSU.

The FCSSU was opened and the metallic casing was extracted from the recorder.

The memory board was extracted from its metallic casing.

After visual inspection of the board and electrical checks, the memory board was connected to the BEA AIK modified chassis (P/N S200-0012-00 modified with AIK 147E1609-00).

The download was performed using L-3 COM official equipment (DAPU).

The download of the 4 High Quality tracks provided 4 files of 30 min 45 s.

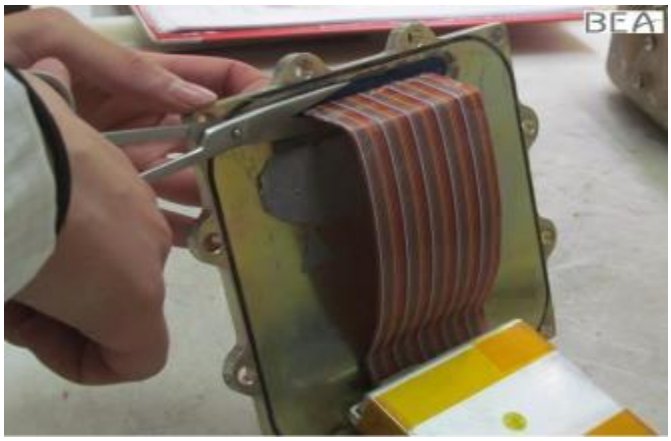
The download of the 2 Standard Quality tracks provided 2 files of 124 min 15 s.

The event was recorded on the audio data.

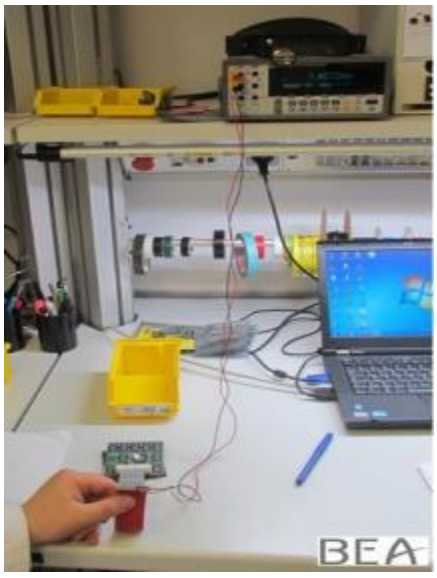
1-11-1-2 FDR FCSSU opening and readout:

The FDR FCSSU was visually checked. The connector of the memory board was damaged.

The FCSSU was opened, the metallic casing of the memory board was extracted and the ribbon cable was cut close to the cover of the FCSSU.



The metallic casing was removed, the memory board was visually inspected, a new fifty-pin connector was installed on the ribbon cable and electrical checks were performed on the new connector.



The values of electrical checks were coherent with the BEA database values.

It was then decided to connect the memory board to the BEA F1000 modified AIK chassis (P/N S800-3000-00).

The download was performed using the manufacturer official mean ROSE.

The download of the FDR was successful and a ".fdt" file was generated. It was decompressed using the official manufacturer decompressed software. A binary file was generated and then synchronized.

Around 75 hours of flight data were retrieved including the flight of the event.

The raw data were decoded using the 64 wps aircraft manufacturer's data frame.

1-11-1-3 Synchronization of recordings:

The time reference was created using the FDR recorded time parameters.

The CVR and FDR timelines were first synchronized using the A/P disconnect parameter, then confirmed based on both captain's and First Officer's VHF keying parameters.

1-11-1-4 CVR work:

No crew speeches were recorded on pilot microphone tracks, probably because crew members did not use headset during the flight. Hence, filtering operations on CAM tracks was necessary to make crew speeches audible and intelligible. Then, a sound and warning chronology was performed as following:

UTC TIME	SOUNDS, WARNINGS AND REMAKES
14h31min47	Pilot : Request 380
14h31min49	Pilot : I'm Climbing On Vertical Speed
14h31min53	Single Chime. 10 Kt. Speed Differences
14h31min55	Pilot: Allah …. Allah (Surprise) your and my speed is different
14h32min17	TC-TRB communicated to ATC [request climb to FL380]
14h32min22	Pilot : Pls. Open Check List
14h32min24	ATC communicated to TC-TRB [approval for FL380]
14h32min43	Sound shows Power Reduction
14h32min47	Single chime [Caution message]
14h33min01	pilot: Take Altitude Hold - Open Check List
14h33min05	Copilot: Instrument Index (Searching About EFFIS COM…)
14h33min07	Single chime [Caution message]
14h33min10	Copilot: Reading Definition Of Check List (EFFIS COM…)
14h33min16	Pilot : Please Request 370
14h33min31	C-Chord [Altitude alert]

14h33min33	Sound similar to thrust reduction
14h33min38	Crew concern regarding the airspeed
14h33min39	Pilot : your speed and mine is not the same
14h33min47	Copilot : Reading Definition Of Check List
14h33min53	MMO Clicker
14h34min02	Copilot : my Speed is decreasing
14h34min10	TC-TRB communication to ATC [request descend to FL370]
14h34min23	Copilot : captain lower nose down , you are not lowering nose
14h34min23	Crew confirm airspeed problem
14h34min32	Crew going through QRH
14h34min36	Starting Check List by Copilot
14h34min37	CLACKER [MMO over speed] duration:20s
14h34min37	TC-TRB communication to ATC [descend to FL370 due to malfunction]
14h34min38	Pilot : For One Minute, Wait pls
14h34min40	Pilot: There is No Problem (For Passengers)
14h34min45	Pilot : Tell ATC to descend 340
14h34min45	ATC communication to TC-TRB [maintain 380]
14h34min46	Crew concern regarding decreasing speed
14h34min46	CAVALRY CHARGE [AP disconnect] [manual or automatic to be determined]
14h34min52	TC-TRB communication to ATC [descend to FL370]
14h34min54	Pilot : We Are At 85
14h34min57	ATC communication to TC-TRB [descent acknowledgement]
14h34min57	WARBLER [Stall warning] + Stick-shaker activation
14h35min01	Pilot : I am 85 my N_1
14h35min00	WARBLER [Stall warning] + Stick-shaker activation
14h35min04	WARBLER [Stall warning] + Stick-shaker activation
14h35min06	Copilot : Leave It , why you are holding the nose
14h35min07	WARBLER [Stall warning] + Stick-shaker activation
14h35min13	C-Chord [Altitude alert]
14h35min15	WARBLER [Stall warning] + Stick-shaker activation

14h35min16	Captain: I am not holding nose. It is playing itself
14h35min20	WARBLER [Stall warning] + Stick-shaker activation
14h35min21	Copilot : why you are pulling, I don't understand
14h35min23	WARBLER [Stall warning] + Stick-shaker activation
14h35min26	Copilot: what can I do?
14h35min28	Similar to interruption of Stick-shaker drive
14h35min32	WARBLER [Stall warning] + Stick-shaker activation
14h35min33	Pilot : give me something
14h35min36	WARBLER [Stall warning] + Stick-shaker activation
14h35min37	TC-TRB com to ATC [Descend to FL340]
14h35min40	Copilot : we are losing altitude
14h35min40	Similar to interruption of Stick-shaker drive
14h35min44	Stick-shaker activation
14h35min47	Pilot to PAX: No Problem. no reason for afraid
14h35min49	WARBLER [Stall warning] + Stick-shaker activation
14h35min52	WARBLER [Stall warning] + Stick-shaker activation
14h35min53	Pilot : Turn Off Flight Director Please
14h35min56	WARBLER [Stall warning] + Stick-shaker activation
14h36min01	Pilot : N1 was lost
14h36min05	WARBLER [Stall warning] + Stick-shaker activation
14h36min09	WARBLER [Stall warning] + Stick-shaker activation
14h36min12	WARBLER [Stall warning] + Stick-shaker activation
14h36min15	WARBLER [Stall warning] + Stick-shaker activation
14h36min19	WARBLER [Stall warning] + Stick-shaker activation
14h36min22	WARBLER [Stall warning] + Stick-shaker activation
14h36min36	WARBLER [Stall warning] + Stick-shaker activation
14h36min45	Crew concern regarding N1(s)
14h37min17	TRIPLE ATTENTION [Warning message]
14h37min24	TRIPLE ATTENTION [Warning message]
14h37min27	TRIPLE ATTENTION [Warning message]
14h37min29	Synthetic Voice "*Engine oil*"

14h37min37	SINGLE ATTENTION [Caution]
14h37min49	SINGLE ATTENTION [Caution]
14h37min54	TRIPLE ATTENTION [Warning message]
14h37min56	WARBLER [Stall warning] + Stick-shaker activation [permanent sequence until the end of the CVR recording]
14h37min57	TC-TRB Communication to ATC [Declare an Emergency]
14h38min00	SINGLE ATTENTON [Caution]
14h38min04	SINGLE ATTENTON [Caution]
14h38min07	SINGLE ATTENTON [Caution]
14h38min08	TRIPLE ATTENTION [Warning message]
14h38min11	SINGLE ATTENTION [Caution]
14h38min13	SV "Bank angle, Bank angle" [TAWS Callout]
14h38min17	TRIPLE ATTENTON [Warning message]
14h38min21	SINGLE ATTENTON [Caution]
14h39min39	########## END OF THE CVR RECORDING #########

1-11-1-5 Flight recorder (FDR, CVR) findings:

- At 14:32:48, at FL360 left and right airspeeds began to diverge, with left side steady and right side decreasing, then two minutes later, the crew requested FL.380 so aircraft started to climb. During the climb, IAS continued to diverge with Left side increasing and right side continuing to decrease further.
- Shortly after climbing through FL370, crew reduced thrust to idle and continued the climb but at a reduced rate.
- Approaching FL380, the over speed aural warning began to sound, indicating airspeed exceeding M 0.85.
- The autopilot was disengaged and not long after, stall aural warnings began to sound, in addition to stick shaker activation. Abrupt pitch movement suggests stick pusher activation.
- During this time, the aircraft entered a series of pitch and roll oscillations.
- Engine power began to decrease on both sides until both engines shut down.
- FDR data was lost at this point.
- CVR recording continued for approximately a further 1 minute and 20 seconds.
- Stall warnings, stick shaker and stick pusher activations continued until the end of the recording.

Detailed Flight Recorder Observations

UTC Time	Parameters	Remarks
13:08:15 13:08:17	#1 Eng N1 0→2.1 #2 Eng N1 =25.88 Pressure Altitude =140 ft Heading =30 Passenger door=0	*#1 Engine starting* *Passenger door closed*
13:10:31 13:10:33	Heading 30→34 Ground speed 0→1	*Taxi was begun in Sharjah*
13:17:59	Radio Alt 0→4 IAS=148 kt Heading = -57	*Take off from RWY 30*
13:18:02 13:18:03	L/G Down 1→0 IAS=163 kt Radio Alt=42	*Landing gear retracted*
13:45:15	Pressure Alt =36000ft IAS=236 kt	*Cruise Level FL360*
14:28:07	Pressure Alt = 36000ft L/H IAS=259 kt R/H IAS=259 kt Ground speed =403 kt	
14:31:00 14:32:20	Pressure Alt =increased from 36000ft L/H IAS=256→256.8 kt R/H IAS=256→ 250 kt Ground speed =396→391 kt	*The speed began to diverge* *Then request FL380*
14:32:24	Pressure Alt = 36000ft L/H IAS=256 kt R/H IAS=249 kt Ground speed =391 kt	*ATC: TC-TRB Climb 380*
14:32:36	Pressure Alt = 36000 ft. L/H IAS=256 kt R/H IAS=249 kt Ground speed =391 kt Autopilot on Vertical Speed mode	*Changing cruise level FL360 → FL380*

UTC Time	Parameters	Remarks
14:32:47	Pressure Alt = 36113 ft. L/H IAS=258kt $N1_{1,2}$=92.2-91.5 R/H IAS=247kt $N2_{1,2}$=89.1-88.8 Ground speed =388kt	*CVR: Single chime due to 10kt difference on IAS*
14:33:07	Pressure Alt = 36352 ft. L/H IAS=262kt $N1_{1,2}$=92.0 -91.28 R/H IAS=241kt $N2_{1,2}$=88.9-88.5 Ground speed =382 kt	*Unreliable airspeed* *Reduction in ground speed* *CVR: single chime*
14:33:33 14:33:34	Pressure Alt = 37121 ft. L/H IAS=270 kt R/H IAS=228 kt $N1_{1,2}$=91.5 →84, 88→80 $N2_{1,2}$=88→84, 88→81 Ground speed =369kt	***CVR:*** *sound similar to engine thrust reduction* *LH IAS increased and Both engines power reduced. engine power continues to decrease down to 65% N_1 by 14:33:50*
14:34:10	Pressure Alt = 37625 ft	*CVR: crew requested FL370*
14:34:20 14:34:30		*Engine power increasing back up to 78% N_1*
14:34:37	IAS 1=276 (About Mach 0.85) IAS 2=192	*CVR: CLACKER [MMO over speed] duration:20s*
14:34:46	Pressure Alt = 37632 ft L/H IAS=276 kt R/H IAS=189 kt Ground speed =301 kt Autopilot disengaged(off) Pitch Angle=7	
14:34:49	Pressure Alt = 37872 ft L/H IAS=277 kt R/H IAS=187 kt $N1_{1,2}$=78.4 , 77.9 $N2_{1,2}$=82.5 , 82 Ground speed =299 kt Pitch angle =4.8	*Maximum Altitude*
14:34:57	Pressure Alt = 37632 ft L/H IAS=276 kt R/H IAS=186 kt $N1_{1,2}$=78, 77 $N2_{1,2}$=83, 81 Ground speed =303 kt ,Autopilot off	*Stall Warning + stick shaker* *Oscillation in Acceleration+ elevator position+ pitch angle*

UTC Time	Parameters	Remarks
14:37:27	Pressure Alt = 32700 ft L/H IAS=203 kt R/H IAS=185 kt $N1_{1,2}$=87 →78, 85→77 Ground speed =277 kt	*Reducing engine performance*
14:37:42	Pressure Alt = 31524 ft L/H IAS=182 kt R/H IAS=181 kt $N1_{1,2}$=76, 51 AOA=32.25 Ground speed =274 kt	*Engine #2 Flame out*
14:37:54	Pressure Alt = 30770 ft L/H IAS=182 kt R/H IAS=178 kt $N1_{1,2}$=57, 23 AOA=34.93 Ground speed =252 kt	*Engine #1 Flame out*
14:38:00	Pressure Alt = 31978 ft L/H IAS=190 kt R/H IAS=0 kt Ground speed =216 kt	*IRS #2 failed*
14:38:15	Pressure Alt = 30371 ft L/H IAS=146 kt R/H IAS=9 kt $N1_{1,2}$=14, 12 Ground speed =148 kt	*End of recording*

1.12 Wreckage and Impact Information:

General Description:

The investigation carried on Helen Mountain area along with the wreckage distribution pattern revealed that the initial contact with terrain has happened at an elevation of 7500 ft elevation, with the nose impacted first. As shown in the figures, the wreckage was scattered in an area of about 500 m long and 200 m wide on mountain slope. At the point of impact, there was a burned black hole about 3 m wide, 5 m long and 2 m deep. There was evidence of severe impact at this point with scattered parts from the cockpit, and nose section equipment of the aircraft. After the impact of the aircraft with the terrain, both engines were separated. Both engines were available at accident site and the condition of their rotating parts showed minimum engine rotation speed impact. The right and left wings as well as the forward fuselage including the cockpit, completely burned in the post-impact fire. It seemed that the aircraft had integrity before impact to mountain area.

Impact point and the wreckage of the aircraft

Impact point of the aircraft

Engine #2

Engine #1 Compressor

1.13 Medical and Pathological Information:

Autopsy reports and photographs of the victims found on the crash site were provided to the CAO.IR by the National Forensic of IRAN and TURKISH Authorities. The samples of DNA from blood of related family were caught in the Shahre-Kord. Also, the full data base of DNA samples of victims was sent to Iranian Authority by Turkish Authority. The victim's analysis was done in Shahre-kord then victims were released to transfer to Istanbul with Turkish rescue aircraft. Medical assessment and analysis by both Authorities confirmed DNA of ten victims losing DNA approval of Captain.

The National Forensic has successfully identified the resesmains for 10 victims of the crash site. The remains of the first officer was collected, examined and identified both morphologically and genetically. Specific emphasis was placed on the viable biological tissue

or residue sufficient to perform blood alcohol analyses and or toxicological analyses on. None was found given the degree of fragmentation and degradation discussed supra. In accordance with Forensic Medicine report, the cause of death for all of them was "heavy gross bodily trauma".

After CVR analysis and confirmation of two pilots in the cockpit, research for the corpse of the captain began and some small broken parts of bones were found and DNA analysis showed that belonged to the first officer and corpse of one passenger.

Some findings of Forensic Medicine report are:

- There were not monoxide appearances on the bloods or sign of Hypoxia for the onboard persons.
- There was no sign of criminal activity on shape of corpses.
- Two bodies of victim were burned by post impact fire.
- The physical characteristics of victims showed low-energy impact with mountain.

1.14 Fire:

The aircraft wreckage was destroyed by post impact fire. Due to the remoteness and impassableness of the accident site, and the time the wreckage was found, the fire rescue services could not be carried out and fire was extinguished temporarily by local witness people.

1.15 Survival Aspects:

On March 11, 2018 the Turkish registered aircraft (TC-TRB) Challenger 604 en-route phase crashed over Helen Mountain and all the onboard were killed (11 persons).

Accident Data Form		
No	Title	Description
1.	Accident date/time	11 march 2018/18:10(local time)/14:40(UTC)
2.	**A/C Register**	**TC-TRB**
3.	**A/C Type**	Bombardier CL604 Challenger
4.	**Flight Level**	FL377
5.	**Route**	Sharjah – Istanbul (ataturk) UT430
6.	**A/C Call Signe**	**TC-TRB**
7.	**Serial Number**	5494

8.	**A/C Colour**	white
9.	**Owner**	MC HAVACILIK A.C
10.	**Crew No.**	3
11.	**PAX No.**	8
12.	**DEP Airport**	UAE_ Sharjah
13.	**DEST Airport**	Turkey – Istanbul Ataturk
14.	**Alternate Airport**	-
15.	**A/C Speed**	-
16.	**LAST ATC Contact**	ACC: 14:37
17.	**Last RADAR Contact**	30 49 33 N 51 36 45 E
18.	**LAST ATC Message**	
19.	**Fuel**	Jet A1
20.	**Accident location**	Helen Mountain, Dourak Shapouri village , 70 nm SW of Shahr-e-Kord Airport, Chahrmahal Bakhtiari province 31 45 39 N, 50 45 27.2 E
21.	**Accident Time**	18:10(14:40 UTC)
22.	**Departure time**	16:47(13:17 UTC)
23.	**Arrival Estimate time**	17:50 UTC
24.	**Emergency phase**	Uncertainly phase☐ Alert phase☐ Distress phase■
25.	**ATC unit to be informed**	Tehran ACC
26.	**SAR unit to be active**	Red Crescent of Chahrmahal – Bakhtiari Province
27.	**cospas-sarsat**	Nil
28.	**Weather on Crash site**	Rainy

29.	**Geographical location of site**	Residential ☐ City ☐ Village ■ Military area☐
30.	**Topography of site**	Desert ☐ Jungle ☐ Mountain ■ Sea☐
31.	**Access to crash site**	By Mountaineering and by Air

Air crash Awareness and initial actions:

The awareness of crash made by Tehran ACC after declaration of the "Distress Phase" and the crash site identified by local people following observation of smoke and fire. The RCC located on a village near the geographical position of the crash site and the "Red Crescent" was selected as commander of the search and rescue operation.

The first person who arrived at the crash site was a local young man from Dourak Shapouri village. First report emerged from him and later verified independently by Red Crescent and police, confirming that none of the people onboard survived and that there were 10 bodies at the site. The bodies were brought down the mountain by helicopter. Transferring of the bodies started at 09:30 and terminated at 11:20. Unfortunately, the body of the pilot was not found. Subsequently, three attempts were made to find the missing body with no success.

The first picture from crash site

The route of flight

The SAR operation meeting near to the site with Governors

CVR

FDR

1.16 Tests and Research:

1.16.1 Research in Sharjah Airport:

The aircraft had departure from Sharjah International Airport (OMSJ)/United Arab Emirates. Required coordination with Emirates authorities was done to collect some information from aircraft history before departure. The information below was collected from aviation service providers and ground witness in the UAE:

- The aircraft arrived from Istanbul on Mar 08, 2018 (3 days before accident time) and engines were shut down and disembarked passengers at VIP terminal.
- The ATC ordered the pilot to start engines and transfer the aircraft to parking area on other side of airport.
- The pilot requested towing; it took a long time for coordination and towing. The pilots parked the aircraft and left.
- The residence of the pilots was in a different hotel from the passengers.
- The recorded films in Terminal cameras (CCTV) showed normal condition of crew and passengers. Also, the presence of pilot (captain) was confirmed from terminal video recorders.
- All communications with ATC were done by first officer at arrival and departure time at Sharjah Airport.
- The flight documents such as load sheet, refueling page-flight plan, preflight inspection checklist was signed by first officer for departure. (For arrival flight, the documents were signed by captain and found at the accident site). Two pilots were authorized to accept the mentioned documents based on MC aviation Operation Manual.

1.16.2 Flight Data Monitoring of the Airline:

The flight data monitoring for this type of aircraft is not mandatory based on ICAO requirements. MC aviation had not done any assessment of flight recorders data before, and only the related checks had been done by a German Maintenance base before.

1.17 Organizational and Management Information:

The aircraft belongs to the MC Aviation, which is a part of Basaran Holding Company. Brief information is provided on the company's structure:

a) The MC aviation as a private company has a valid Operating License from Turkish authority.
b) The company has valid certificate for continuing airworthiness management for the organization CAMO for two types of aircraft (including CL604)
c) The MC aviation had a fleet of only two aircraft which were operated by Turkmen Air before.
d) The line Maintenance of airline is done by the MC Aviation but for heavy maintenance tasks, the other MRO facilities are used.

1.18 Additional Information:

The Investigation team provided data access to the Bombardier Company as the aircraft manufacturer to analyze the accident. The design data of Airspeed indication system was also needed to find the nature of failure in aircraft system.

1.19 Useful or Effective Investigation Techniques:

The standard and normal techniques of Investigation were applied based on ICAO Aircraft Accident Investigation Manual (DOC.9756).

2 – ANALYSIS:

2-1 General:

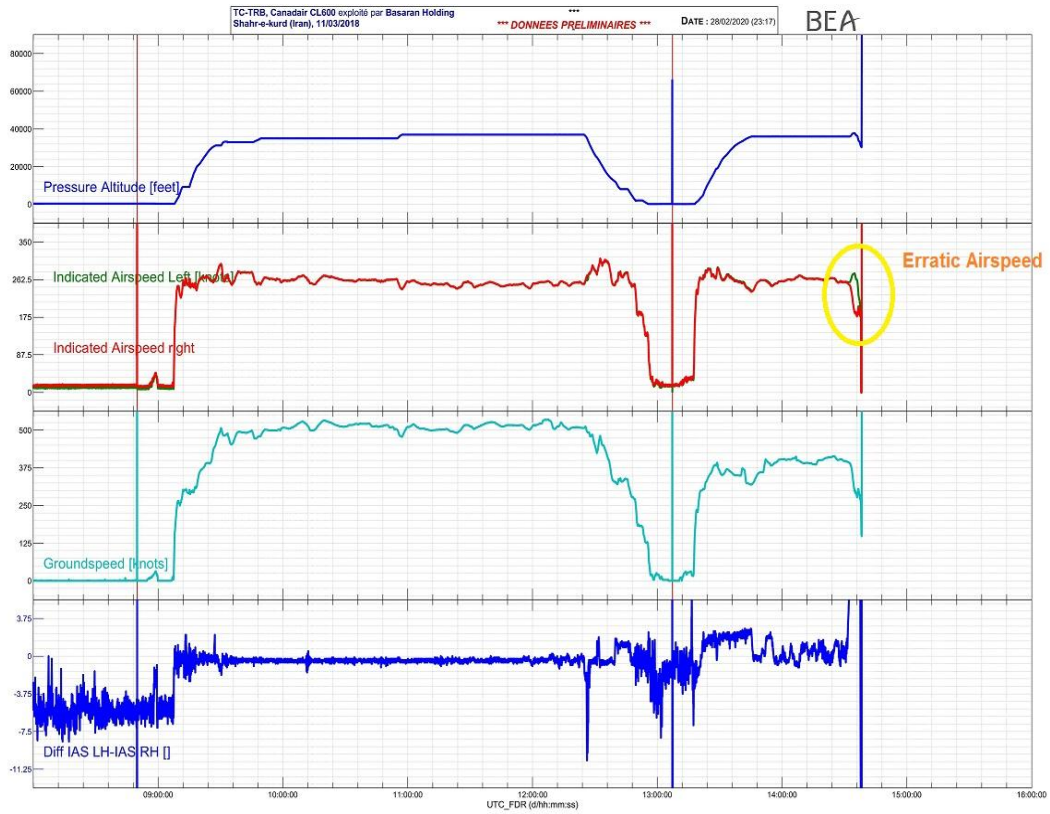
- The aircraft was registered / certificated by Turkish Civil Aviation Authority (DGCA) and had approval for the flight.
- Pilots were in possession of valid licenses rated on the Challenger 604. At the time of the accident, the pilots were declared medically fit. The pilots were therefore appropriately qualified on the type.
- There was evidence of malfunction of Airspeed indication of the aircraft, and no failure of power-plants or control surfaces that would have contributed to the accident.
- Wrong decision of pilot caused her to reduce the engine power based on failed airspeed indication No; 1 which ended in gaining stall speed and engine flameout.
- The accident was un-survivable, and the catastrophic impact caused the destruction of all aircraft components. All major structural pieces could not be recovered and examined due to the rocky mountain at the accident site. Based on the ground scars, distribution of the wreckage, damage to the horizontal stabilizer, elevators, outboard wing sections and the ailerons, FDR data and sounds recorded on the CVR, the investigation team concludes that components were not separated during the flight.

2-2 Sequence of Accident:

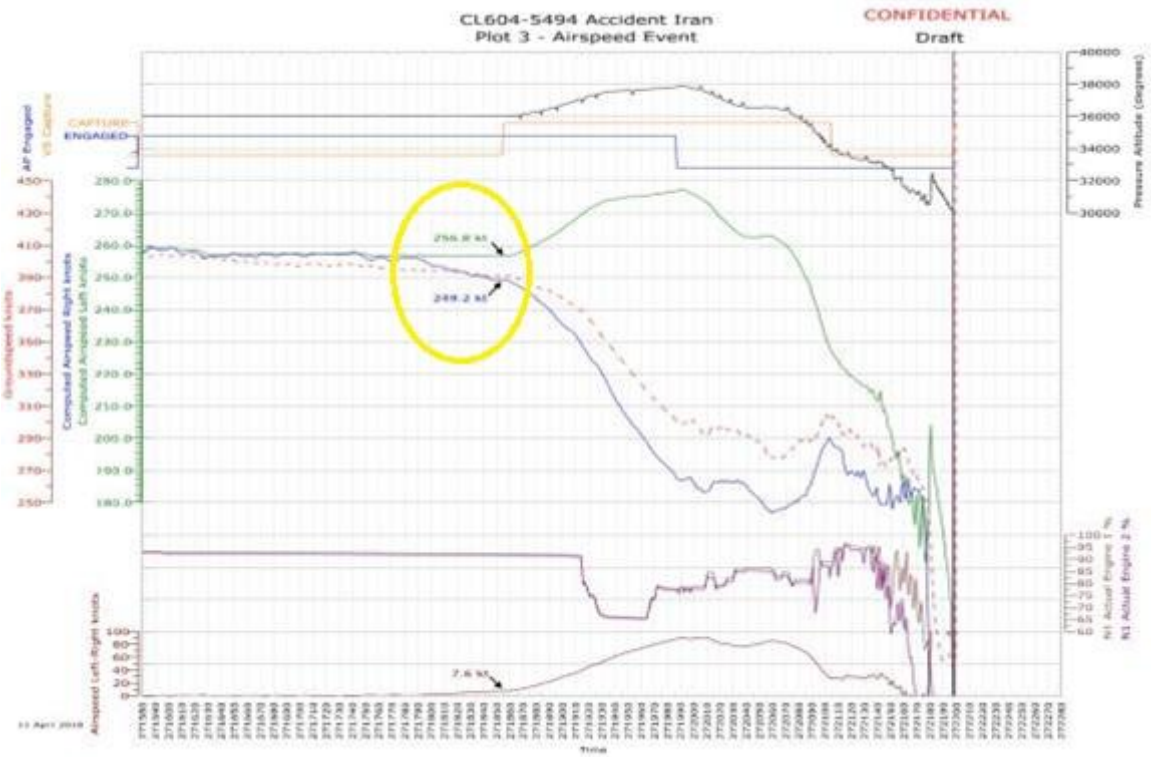
The Turkish Challenger 604 with register TC-TRB and the same call sign as its register had a flight from Istanbul to Sharjah on March 08, 2018. FDR data from the flight shows temporary anomalous behavior of the left-side airspeed, during the descent to Sharjah airport, but probably not to a degree that the crew focused on it and took remedial technical action on the aircraft. The aircraft was parked in Sharjah Airport parking area for three days. The aircraft took off from Sharjah Airport (OMSJ) to Istanbul, Ataturk airport (LTBA), according its flight plan, ETD was: 13:00 on March 11 2018, the aircraft had normal take-off and followed ATC clearance. The TC-TRB entered Tehran FIR via GABCO at the 13:26 and contacted Tehran ACC sector 5 and climbed to FL 230 and identified by radar controller at 13:29 the pilot requested to climb to FL 360 according its flight plan and was cleared by ACC controller. At 14:28:48 UTC, TC- TRB called Tehran ACC Sector 3 South and declared its Flight level 360 and was identified by Radar controller.

Evaluation of all of the evidence obtained during the investigation of this accident indicates that the flight operation was normal until 14:32 the aircraft was in stable cruise flight at FL360 on autopilot set on ADC1 (captain side) .

The parameters of two last flights which recorded flight recorder (FDR) were focused on to analyze the accident .



Previous Flight



Accident flight

At 14:32on FL360 the speeds of both side indicators began to diverge about 5 kt.

At 14:32:17 UTC, the pilot requested changing level from FL360 to FL380 to see change of airspeed indication. Flight crew initiated a climb to FL380 in vertical speed mode. They acknowledged difference (10 kt) during climb by related warning in IAS indicators.

According to FDR graphs a little time before the climb, left and right airspeeds began to diverge, with left IAS remaining steady and right IAS showing a slow decrease. During the climb, indicated IAS continued to diverge with left side IAS now increasing and right side IAS continuing to decrease further. A caution aural was heard on the CVR at about the same time as the difference between left and right airspeed more than 10 kt, suggesting that an EFIS COMP MON caution message appeared on the EICAS.

As the aircraft was climbing, crew reduced thrust to idle. Approximately 63 seconds later, while approaching FL380, the overspeed aural warning (clacker) began to sound, indicating that the indicated Mach had exceeded M 0.85. Based on QRH of the aircraft, the pilot flying should validate the IAS based on aircraft flight manual and define reliable ADC and select the reliable Air Data Source. If overspeed warning sounds, the pilot shall select the affected AUDIO WARNING switch to mute aural and disregard. The crew did not perform QRH to switch off the warning. Also, the crew should use the FD/autopilot in PTCH, ALT, HDG and ROLL modes to help reduce workload.

The accident aircraft was flying, the initial crew action must be troubleshooting the unreliable airspeed then focusing on CROSS CHECKING flight instruments and standby flight instruments and set AIR DATA source selector to reliable side. This action was not done by pilot and she reduced engine thrust directly based on Overspeed warning.

BOMBARDIER CHALLENGER 604	EMER 13-2
	REV 102, Aug 30/16

Unreliable Airspeed

EFIS COMP MON and **EFIS COMP INOP**

..... and/or amber IAS flag.

..... Pitch attitude, thrust setting or external noise not consistent with indicated airspeed.

..... Large airspeed difference between PFDs and/or Standby Airspeed Indicator.

..... Loss of multiple airspeed indication.

BOMBARDIER CHALLENGER 604	EMER 13-5
	REV 102, Aug 30/16

Unreliable Airspeed (Cont'd)

TROUBLESHOOTING

(1) ADC source selector ..... NORM

(2) Both PFDs and standby airspeed indicator ..... COMPARE

(3) Determine which of the following conditions apply:

- If no indicated airspeed is considered reliable, proceed to **CONDITION D**.
- If both PFDs agree and the indicated airspeed is considered reliable, proceed to **CONDITION A**.
- If one PFD and the standby airspeed indicator agree and the indicated airspeed is considered reliable, proceed to **CONDITION B**.
- If only one indicated airspeed is considered reliable, proceed to **CONDITION C**.

No indicated airspeed is reliable in the diverged airspeed condition so Condition D is recommended:

BOMBARDIER CHALLENGER 604	EMER 13-7
	REV 102, Aug 30/16

CONDITION D	If no indicated airspeed is consistent with pitch, thrust, external noise, and the expected airspeed from Table A:

(4) Airspeed indications ..... DISREGARD

(5) Pitch/N_1 ..... MAINTAIN

(6) Land at the nearest suitable airport.

The crew action and CVR containments showed that the crew never concentrated on the emergency procedure on unreliable airspeed.

Also, the pilot did not follow the abnormal procedure below and directly reduced engine power to decrease IAS while hearing clacker relied on left PFD. So, the actual airspeed reached the stall condition.

BOMBARDIER CHALLENGER 604	ABNORM 12-3
	REV 102, Aug 30/16

EFIS COMP MON

EFIS COMP MON AND

ALT or HDG or IAS or PIT or ROL or RA or LOC or GS

(PFD annunciation - flashing)

PFD	ACTION
ALT and/or IAS	(1) Flight instruments and standby flight instruments ..... CROSS CHECK (2) AIR DATA source selector ..... SELECT to reliable side. If any of the following occurs, refer to Unreliable Airspeed (See Page EMER 13–2): • Pitch attitude, thrust setting or external noise not consistent with indicated airspeed • Large airspeed differences between PFDs and/or standby instrument • Loss of multiple airspeed indication. **Refer to Aircraft Flight Manual, Chapter 6, PERFORMANCE – GENERAL, for alternate static system position error correction charts.**

The copilot tried to begin reading of unreliable airspeed checklist (EFIS COMP MON) for three times but due to the pilot's interruption, she could not complete it. Not long after decreasing speed, stall aural warning began to sound, in addition to stick shaker and stick pusher activating repeatedly. The crew failure to recognize/react about unreliable airspeed led to an aerodynamic stall. They should have referred to another emergency procedure to recover stall condition as:

BOMBARDIER CHALLENGER 604	EMER 10-10
	REV 97, Jun 11/15

Stall Recovery

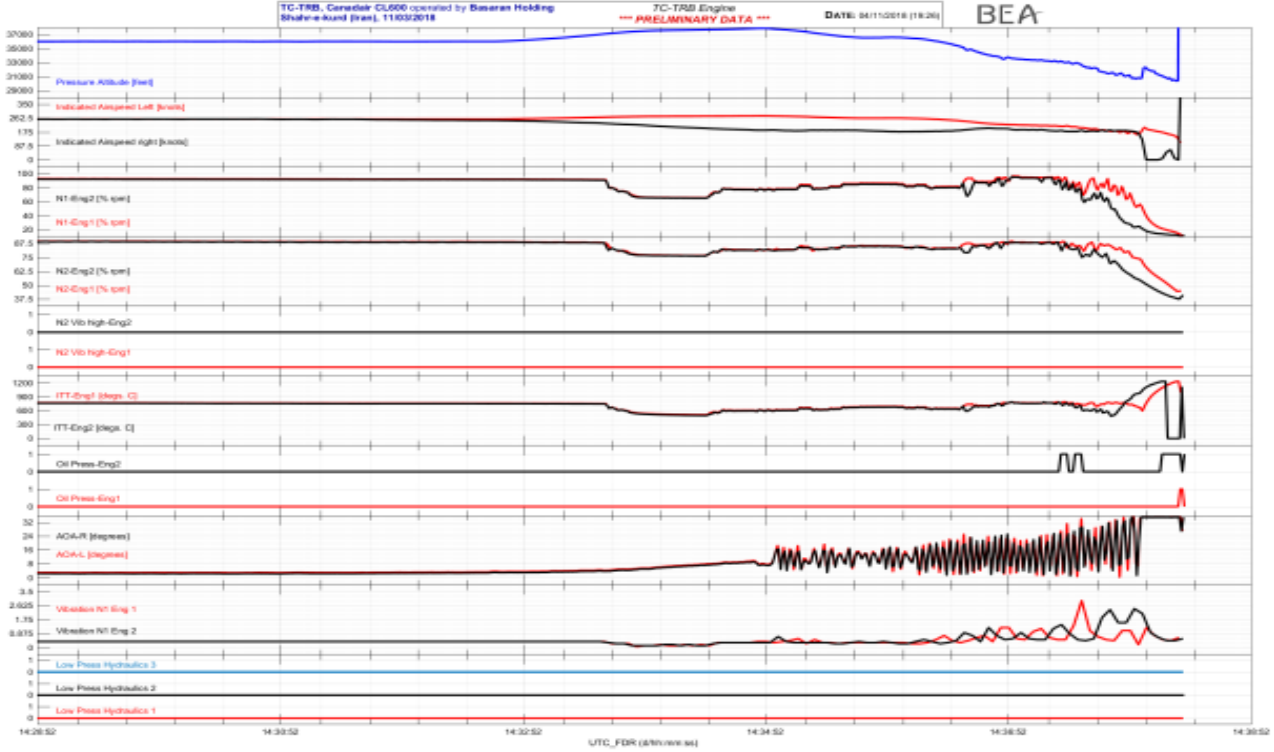
.....Aircraft buffet, uncommanded roll, stick shaker activated and/or stall warbler on.

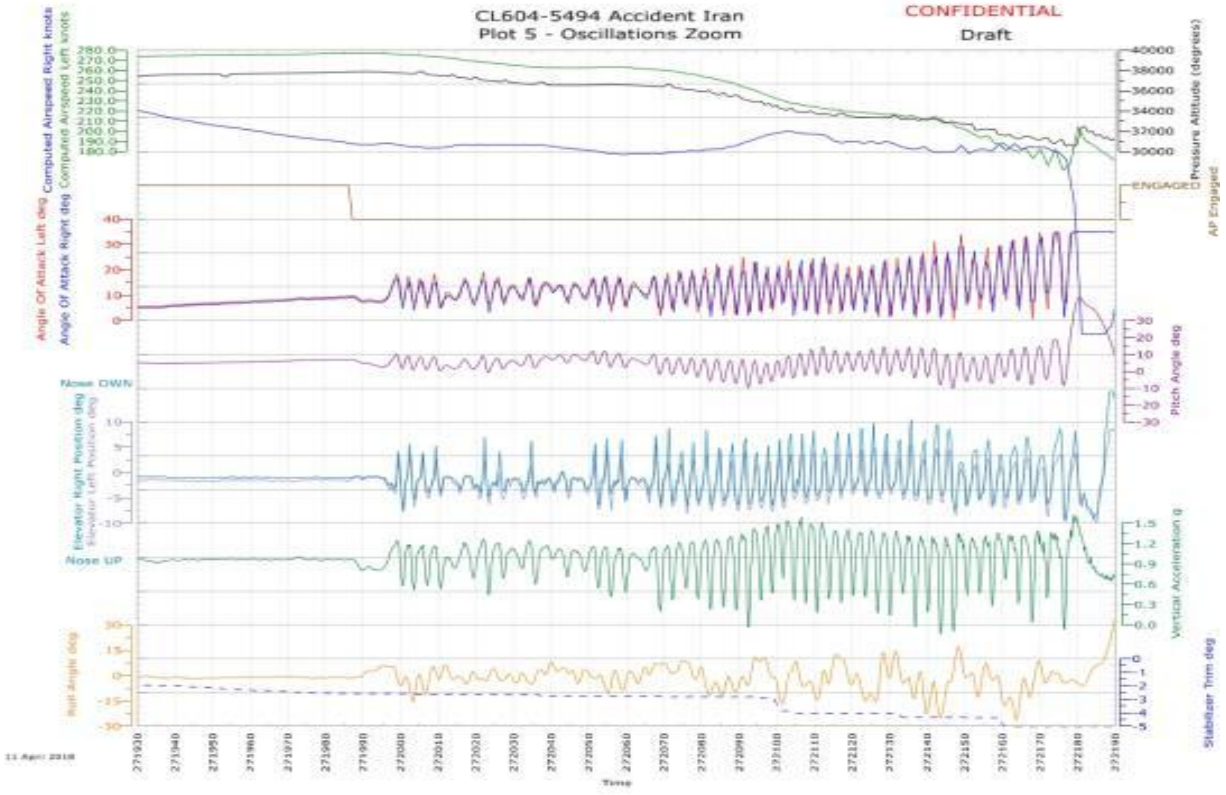
(1)	Autopilot	DISCONNECT
(2)	Pitch attitude	LOWER NOSE
(3)	Thrust levers	MAX POWER
(4)	Roll attitude	WINGS LEVEL
(5)	FLIGHT SPOILER lever	RETRACT

After airspeed increases and stall warning is extinguished:

(6)	Pitch attitude	ADJUST
(7)	Thrust levers and airplane configuration	ADJUST

While aircraft was descending through FL370, the engine power and actual aircraft speed had reduced to stall speed but overspeed clacker was activated due to failure on indication system. The pilot never followed stall recovery procedures because she had a mind of overspeed by clacker warning [MMO over speed] on the cockpit. The stick pusher acted to pitch down aircraft to prevent stall condition but the captain's reaction on the control column just was in the opposite direction. During this time, the aircraft entered a series of pitch and roll oscillations.





The autopilot was disengaged by the crew before stall warning, which ended in oscillation of control surfaces based on FDR information. Engine power began to decrease on both sides until both engines flamed out in stall condition and FDR data recording was lost at this point. Data from the FDR shows that the aircraft experienced close to about 50 rapid pitch cycles following the activation of the stall protection systems, the result of the crew actively fighting against the pusher system.

The data shows an eventual and progressive deterioration of engine performance parameters until shutdown of both engines. It is likely that the disturbed airflow caused by the rapid and repeated pitch oscillations eventually caused internal damage to the engines, resulting finally

in the inability of the engines to continue to operate. It is likely that the engines were sufficiently damaged as a result, such that it would have been impossible to re-start them following the shutdown.

CVR recording continued for a further approximately 1 minute and 20 seconds on emergency Electric Bus by using electric power of aircraft battery. Stall warnings, stick shaker and stick pusher activations continued until the end of the recording.

If the ADG could not operating properly to produce electric power and the aircraft is on battery power only, then all electrical power may be lost after 30 minutes, so the aircraft battery performance or related systems were not based on manufacturer's standard.

The aircraft lost both engines on altitude more than 31000 ft. The characteristics of the aircraft showed that specific sharp descent or critical condition of turbulence may cause dual engine flameout at any flight altitude that could happen on area out of the designed criteria. As Manufacturer believed inflight engine restarting procedures were extensively reviewed following the Pinnacle Airlines CRJ200 accident in 2004, and Bombardier did not show details of revised in-flight engine re-light AFM procedures. However the evidences of engine situation may define that the engines could not be restarted due to the damage they sustained while flaming out.

The erratic airspeed indication is a known problem in the flights and special operational and maintenance issues were considered by the aircraft manufacturers. The ongoing research shows that airspeed discrepancy or erratic indication can be caused by several factors such as:

- Pitot probe: tube obstruction by foreign materials (dust, fluid, insect, bird, ice, water), heater failure or deficiency, drain holes obstruction.
- Air Data error by related computer: DE calibration, sensor failures, perturbation by lightning.
- Total pressure lines: damaged drain valve and tubing, damaged quick disconnector or disconnection.
- Aircraft skin damage around the air data probes: airflow around the probes could be modified impacting static or total pressure measurement.
- Probe heating failure
- Angle of Attack (AOA) failure

The scenario of accident happened in cruise flight with erratic airspeed indications on PFD. The problem could be attributed to blockage on the pressure line of the left-side pitot-static system. The aircraft was parked for sometimes in dusty conditions. Also the aircraft crossed an area of heavy icing condition having a possible effect on probes because the accident site was located in an unstable area".

A number of in-service occurrences have been reported on CL-600-2C10 aircrafts regarding the loss of all air data system information provided to the crew. The air data system information was recovered as the aircraft descended to lower altitudes. The transport of Canada issued an AD CF-2017-01 and incorporated operational procedures on Aircraft flight manual which applied on the accident Aircraft. The manufacturer has not had detailed guidance aims for providing operators with the list of scheduled maintenance actions yet that will minimize occurrence of airspeed discrepancies, as well as the recommended actions to perform on aircraft whenever such an event happens.

3. CONCLUSIONS:

3.1 Findings:

These findings were expressed based on the available information in the Islamic Republic of Iran and some findings were gained with required cooperation by other related states.

- The pilots were licensed, medically fit, and qualified for the flight.
- Both pilots had been trained about abnormal and emergency procedures in approved training organizations and passed recurrent trainings, but evidence of the accident flight showed that the training was not effective in airspeed indication failure and Unreliable Airspeed appears to be poorly understood and trained. They could not detect reliable indicated airspeed.
- The aircraft had a valid Certificate of Airworthiness and was recorded as being serviceable before flight from Sharjah airport but the facts of the accident determined that the LH pitot and aircraft battery was not in good condition.
- The crew did not report any abnormality on previous flight and during Taxi – Take Off- Climb and Cruise prior to 14:34:37 UTC time.
- The aircraft encountered failure in airspeed indication attributed to blockage on the pressure line of the left-side pitot-static system.
- Flight crew could not perform emergency procedures both for unreliable airspeed and stall recovery.
- The captain's inappropriate response caused her to control airspeed by reducing engine power to solve overspeed warning condition which caused approaching stall condition, therefore stall protection system (SPS) was activated and aircraft started to push nose down but captain's reaction was pull up on control wheel repetitively and finally ended in dual engine flameout and stall condition accordingly.
- The cockpit crew coordination about the failures was not enough based on CRM principles.
- Both engines of the aircraft flamed out at about FL.310 and the condition was not matched for engine relight. The crew did not perform double engine failure checklist.
- The aircraft had integrity on the fuselage before stall but this cannot be confirmed while impacting to the mountain area.
- The research activities were not so enough to find corpse of the pilot.
- The manufacturer did not analyze failure of airspeed indication and electric systems to support investigation on the accident accordingly.

3.2 Main cause and contributing factors:

The accident was caused by insufficient operational prerequisites for the management of erratic airspeed indication failure by the cockpit crew. Contributing factors were:

- The aircraft designer/manufacturer provided insufficient technical and operational guidance about airspeed malfunctions that previously occurred.
- Lack of effective CRM.

4. SAFETY RECOMMENDATIONS:

Considering the final results of the investigation to prevent similar accidents and incidents, and to improve the safety of the flights, the Aircraft Accident Investigation Board (AAIB) issues the following safety recommendations:

SR No 961220 TRB;

To ICAO:

1- To encourage involved states to separate political sanction from civil aviation industries and take efforts for establishing ICAO standards in annexes to ICAO Convention.

To Interior Ministry / I.R of Iran:

2- Follow up to manage responsibilities of the involved organizations in crisis management for participation in Search and Rescue Program of aircraft accident with cooperation of aviation crisis management.

To the Transport Canada Civil Aviation to follow up from appropriate design authorities (FAA, EASA) the following items:

3- Take immediate actions and necessary measures to ensure that the risk of the failure of both engines on Bombardier aircraft on high level flights remains within acceptable limits for each aircraft affected by this problem.

4- Ensure that preventative actions in criteria of Erratic Airspeed Indication are taken by aircraft manufacturer and provide a technical directive for related operators.

5- Ensure that a general system of initial standard calls for the handling of abnormal and emergency procedures and also for unusual and unexpected situations is implemented on aircraft type.

To Transport Safety Investigation Center of Turkey (UEIM) to follow up from appropriate authority about the following items:

6- Ensure that aircraft operators will improve the training of the pilots on the simulator in the areas: airspeed indication failure, double engine failure, stall recovery procedures and CRM.

APPENDIX I; Comments to the Final Report

Index	*Source*	*Comments*	*Condition*
1-	*TCCA*	The report is referring to Bombardier Challenger 604— Emergency procedure 10-10, Stall Recovery. MAX POWER may not always be appropriate in a stall recovery and may exacerbate stall recovery or engine response under some circumstances	*Non-agreed*
2-	*TCCA*	The report does not indicate if an Airworthiness Directive (AD) review was carried out with respect to the airspeed system. Transport Canada would like to advise that the Aircraft Flight Manual (AFM) procedure for Unreliable Airspeed (URA), for Challenger 604 aircraft, was mandated by AD CF-2017-01 and was effective on 20 January 2017.	*Partially - Agreed*
3-	*Bombardier*	No civil aircraft or engine is designed to continue to function under such conditions. These conditions are well outside of the certification basis of the aircraft. Therefore, Bombardier does not agree with the relevance of the second recommendation in the report: *"Take immediate actions and necessary measures to ensure that the risk of the failure of both engines on Bombardier aircraft on high level flights remains within acceptable limits for each aircraft affected by this problem."* *Knowing the circumstances of the accident, Bombardier is confident that the risk of failure of both engines on Bombardier aircraft on high-level flights remains within acceptable limits, that there is no "problem" with the engines, and that no immediate actions and/or necessary measures are required in this regard.*	*Non-agreed*
4-	*Bombardier*	*The report states : "The manufacturer did not analyze failure of airspeed indication and electric systems to support investigation on the accident accordingly."* *It would be more accurate to state that Bombardier conducted extensive analysis as part of the investigation but Bombardier was prevented from sharing this information with Iran due to Canada and U.S. export law.*	*Non-agreed*

5-	*Bombardier*	*AD CF 2017-01 references ice crystal contamination as the probable cause of two known events of unreliable airspeed, but the unreliable airspeed procedure itself must be applicable to any condition where unreliable airspeed is suspected; crew diagnose unreliable airspeed based on the behavior of the air data indications and do not necessarily suspect what is causing it; therefore, the procedure must be written so it is independent of the cause.*	*Partially - Agreed*

APPENDIX II; (Communications with UAE ATC)

Hr	Min	Sec	Station	Radio Telephony
13	01	49	TC-TRB	DAVMO TWO ROMEO DEPARTURE S.I.D. TANGO ROMEO BRAVO
13	01	52	SHJ ADC	TANGO ROMEO BRAVO, READ BACK'S CORRECT, CALL ME READY PUSH AND START.
13	01	57	TC-TRB	TANGO ROMEO BRAVO
13	05	37	TC-TRB	GROUND, TANGO CHARLIE TANGO ROMEO BRAVO REQUEST ENGINE START UP
13	05	41	SHJ ADC	TANGO ROMEO BRAVO UHH PUSH BACK AND START UP OWN DISCRETION FROM THE SERVICE APRON CALL ME AT ZULU 4 FOR TAXI
13	05	52	TC-TRB	TANGO ROMEO BRAVO.
13	11	28	TC-TRB	GROUND, TANGO CHARLIE TANGO ROMEO BRAVO ON HOLDING POINT ZED FOUR
13	11	33	SHJ ADC	TANGO ROMEO BRAVO UH TAXI RIGHT ON ALPHA, ALPHA TWO ZERO HOLDING POINT BRAVO TWO ZERO FOR RUNWAY THREE ZERO
13	11	46	TC-TRB	ALPHA, ALPHA TWO ZERO HOLDING POINT THREE ZERO, VIA BRAVO TWO ZERO TANGO ROMEO BRAVO
13	11	55	SHJ ADC	CORRECT MA'AM AND UH CALL ME ON TOWER ONE ONE EIGHT DECIMAL SIX, READY FOR DEPARTURE Q-N-H NOW IS ONE ZERO ONE ONE, INFORMATION ZULU
13	12	01	TC-TRB	INFORMATION ZULU, ONE ZERO ONE ONE, ONE ONE EIGHT DECIMAL SIX FOR TOWER, TANGO CHARLIE, TANGO CHARLIE TANGO ROMEO BRAVO
13	15	24	TC-TRB	TOWER, TANGO CHARLIE TANGO ROMEO BRAVO ON ALPHA
13	15	29	SHJ ADC	TANGO CHARLIE TANGO ROMEO BRAVO ROGER, HOLD SHORT OF THE RUNWAY AT BRAVO TWO ZERO
13	15	33	TC-TRB	HOLD SHORT OF RUNWAY AT BRAVO TWO ZERO, TANGO ROMEO BRAVO
13	15	41	DWC DEP	DUBAI DEPARTURE NORTH
13	15	43	SHJ ADC	HI DUBAI, I GOT TANGO CHARLIE TANGO ROMEO BRAVO ON DAVMO
13	15	48	DWC DEP	COPIED, UH RELEASED THANK-YOU
13	15	48	SHJ ADC	THANKS
13	15	52	SHJ ADC	TANGO ROMEO BRAVO RUNWAY THREE ZERO, BRAVO TWO ZERO LINE UP AND WAIT
13	15	56	TC-TRB	LINE UP AND WAIT RUNWAY THREE ZERO, TANGO ROMEO BRAVO
13	16	01	ABY 546	AND SHARJAH TOWER (INAUDIBLE) SIR, ARABIA SIX, UH ARABIA FIVE FOUR SIX ON THE ILS RUNWAY THREE ZERO SHH, SHARJAH
13	16	10	SHJ ADC	ARABIA FIVE FOUR SIX (INAUDIBLE) EH SHARJAH TOWER, CONTINUE APPROACH RUNWAY THREE ZERO Q-N-H ONE ZERO ONE ONE DEPARTING TRAFFIC FROM BRAVO TWO ZERO
13	16	18	ABY 546	(INAUDIBLE) CONTINUE APPROACH, ONE ZERO ONE ONE ARABIA FIVE FOUR SIX
13	16	40	SHJ ADC	TANGO ROMEO BRAVO CLEARED FOR TAKEOFF RUNWAY THREE ZERO BRAVO TWO ZERO, WIND THREE FIVE ZERO DEGREES AT SEVEN KNOTS
13	16	45	TC-TRB	CLEARED FOR TAKEOFF RUNWAY THREE ZERO FROM BRAVO TWO ZERO, TANGO ROMEO
End of Transcript				

APPENDIX *III* ; (Communications with IR of Iran ATC)

TIME (UTC) Hh/mm/ss	STATION	CONTEXT
142825	ACC	Air Canada 56, Tehran, Tehran. Hello, good afternoon
	THY757	THY757, level 340 inbound RASLA
	ACC	THY757, Tehran ,good afternoon radar contact
	THY757	THY757
142848	TCTRB	Radar, TCTRB, maintaining FL360
	ACC	TCTRB, good afternoon radar contact 360
	TCTRB	Radar contact, confirm TCTRB?
	ACC	Affirm radar contact
143217	TCTRB	Radar, TCTRB, requesting FL380
	ACC	TCTRB, climb 380
	TCTRB	Climb 380, TRB, thank you
143315	THY757	Radar THY757, request climb360 when available
	THY757	Tehran THY757
	ACC	THY757, go ahead
	THY757	Request climbing FL360, THY757
	ACC	THY757 climb 360
	THY757	Climb 360, thank you ,THY757
143411	ACC	QSM1216, stop descent 140….
	QSM1216	Stop at level 140 QSM1216
	ACC	Affirm, say again station calling
143437	TCTRB	Radar TCTRB, descending 370, due to malfunction

TIME (UTC) Hh/mm/ss	STATION	CONTEXT
	ACC	TCTRB, roger, maintain 380
143453	TCTRB	370, descending 370 TRB
	ACC	TRB, descend 370
143536	TCTRB	TCTRB, descending 340
	ACC	Continue descent 340
	IRA311	Good evening Tehran radar IRA311, maintaining FL300
	ACC	IRA311, hello, radar contact
	ETD170	Tehran radar good afternoon ETD170, FL370
	ACC	ETD170, hello radar contact
	TVP7601	Tehran hello, TVP7601, FL340 to OBTUX
	ACC	TVP7601, hello , radar contact
	QSM1216	Approaching BOPIS,QSM1216
	ACC	QSM1216, continue descent 100
	QSM1216	Continue descent 100, QSM1216
	ACC	Also, report in contact Abadan
	QSM1216	Two way communication QSM1216
	ACC	OK, released to destination, nice landing
	QSM1216	Ok, continue with destination. bye
143753	ACC	TCTRB, confirm descend flight level?
	TCTRB	*…not clear*
	ACC	Say again
143843	ACC	TCTRB, confirm situation normal?

TIME (UTC) Hh/mm/ss	STATION	CONTEXT
	ACC	TCTRB, confirm situation normal?
	ACC	TCTRB, how do you read?
	ACC	TCTRB, how do you read?
143948	ACC	THY757, can you call TRB?
	THY757	OK, we will call
	FDB754	Control good day FDB754,FL370,approaching NOTSA
	ACC	FDB754, hello radar contact, TRB how do you read Tehran
144019	THY757	TRB Do you hear me *(Turkish Language)*
	THY757	Tehran THY757
144058	ACC	THY757, can you call the traffic, we are identification lost
	ACC	THY757, the traffic is TRB, can you call them?
	THY757	Yeah, I called them many times, but they couldn't contact With us, finally, we saw them from the TCAS,6000 below
		Our altitude, THY757
	ACC	Also, you can confirm that, this traffic is…. as your
		TCAS contact?
	THY757	Now we don't have, but a couple of minutes ago, we have
		TCAS contact with them and we saw that they lost altitude
		Fastly and at 6000 feet below us we lost contact with them
	ACC	Roger, thank you for advice, yes because the traffic is behind
		You, do you have any bad weather circumstances at level 360?
	THY757	Negative, 360 is very smooth

TIME (UTC) Hh/mm/ss	STATION	CONTEXT
	ACC	Thank you
	THY757	Did you see them in your radar?
	ACC	Yes it is fail on radar
144213	THY757	Ok thank you
	THY757	I will call them a couple of more times THY757
	ACC	Thank you for advice
144346	THY757	TCTRB, THY757?

APPENDIX IV: AD CF 2017-01

Transport Canada Transports Canada

AIRWORTHINESS DIRECTIVE

This Airworthiness Directive (AD) is issued pursuant to Canadian Aviation Regulation (CAR) 521.427. No person shall conduct a take-off or permit a take-off to be conducted in an aircraft that is in their legal custody and control, unless the requirements of CAR 605.84 pertaining to ADs are met. Standard 625 - Aircraft Equipment and Maintenance Standards Appendix H provides information concerning alternative means of compliance (AMOC) to ADs.

Number:

CF-2017-01

Effective Date:

20 January 2017

ATA:

34

Type Certificate:

A-131

Subject:

Navigation – Flight Instruments – Unreliable Air Data in the Cockpit

Applicability:

Bombardier Inc. model CL-600-2B16 (604 variant) aeroplanes, serial numbers 5301 through 5665, 5701 through 5988, and 6050 through 6080.

Compliance:

Within 30 days from the effective date of this AD, unless already accomplished.

Background:

A number of in-service incidents have been reported on CL-600-2C10 aeroplanes regarding the loss of all air data system information provided to the crew. The air data system information was recovered as the aeroplane descended to lower altitudes. An investigation determined that the root cause in both events was high altitude icing (ice crystal contamination). If not recognized and addressed, this condition may affect continued safe flight and landing.

Due to similarities in the air data systems, similar events could happen on Bombardier Inc. CL-600-2B16 aeroplanes.

This AD mandates the incorporation of Aircraft Flight Manual (AFM) procedures to guide the crew to stabilize the aeroplanes airspeed and attitude for continued safe flight and landing.

Corrective Actions:

Amend the Transport Canada approved AFM by incorporating the procedure for Unreliable Airspeed as detailed in the following revisions, or later revisions of these procedure approved by Transport Canada.

Aeroplane Model	Aeroplane Serial Numbers	AFM Revision Number	AFM Revision Date
CL-600-2B16 (604 variant)	5301 to 5665	Revision 102	30 August 2016
CL-600-2B16 (604 variant) Marketing Designation – Challenger 605	5701 to 5988	Revision 40	30 August 2016
CL-600-2B16 (604 variant) Marketing Designation – Challenger 650	6050 through 6080	Revision 5	30 August 2016