



Islamic Republic Of Iran

Civil Aviation Organization

Aircraft Accident Investigation Board

Preliminary Report

Basic Information:

State File Number: A961220 TC-TRB

Type of occurrence: Accident

Date of occurrence: Mar 11th 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: 30 Sep 2018

<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”

PRELIMINARY REPORT ON AIRCRAFT ACCIDENT

CHALLENGER 604, TC-TRB

Operated by MC Aviation

Near SHAHR-E KURD IR OF IRAN



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Abbreviations

A/C	Aircraft
AAIB	Air Accident Investigation Board
ACC	Area Control Center
ADC	Air Data Reference
ADC	Air Data Reference
AFM	Aircraft Flight Manual
AIP	Aeronautical Information Publication
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
CCTV	video surveillance televisions for airports
CG	Center Of Gravity
COSPAS-SARSAT	International Satellite System For Search And Rescue
CPL	Commercial Pilot License
CVR	Cockpit Voice Recorder
DFDR	Digital Flight Data Recorder
DGCA	Directorate general Civil Aviation
DNA	Deoxyribonucleic acid
EFIS	Electronic Flight Indication System
ENG	Engine
F/O	First Officer
FCOM	Flight Crew Operating Manual
FCSSU	Flash Crash Survivable Store Unit
FIR	Flight Information Region
FL	Flight Level
KAİK	Accident Investigation Committee of Turkey
MMO	Mach Maximum Operating
MTOM	Maximum Take Off Mass
QRH	Quick Reference Handbook
STBY	Standby
TSB	Transportation safety board
ULB	underwater locator beacon
UTC	Coordinated Universal Time
VMO	Velocity Maximum Operating

Foreword:

The Civil Aviation Organization, in accordance with international obligations and domestic laws of the Islamic Republic of Iran's , 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 this regard, 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 government and the International Regulations and Regulations of the International Civil Aviation Organization (ICAO) Annex 13, have led to the investigation of the civil aviation occurrences, and after determination of the main cause and the contributing factors , will issue safety recommendations to maintain flight standards and improve the safety of flights to prevent same accidents or similar 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, administrative lawsuit proceedings associated with civil or criminal liability”.

Base on Annex 13 to the Convention on International Civil Aviation, Chapter 3, Paragraph 3.1, and Chapter 5, Paragraph 5.4.1; it is stipulated and recommended as follows;

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 accident on 11Mar 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 to the investigation as representative of State of occurrence.

According to International Law and Appendix 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, as well as the Turkish Aircraft Accident Investigation Board (KAIK) as representing state of Registry & Operator. Both states have introduced their accredited representatives accordingly. The Turkish representative, in response to the announcement of the accident, sent a team to Iran.

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.

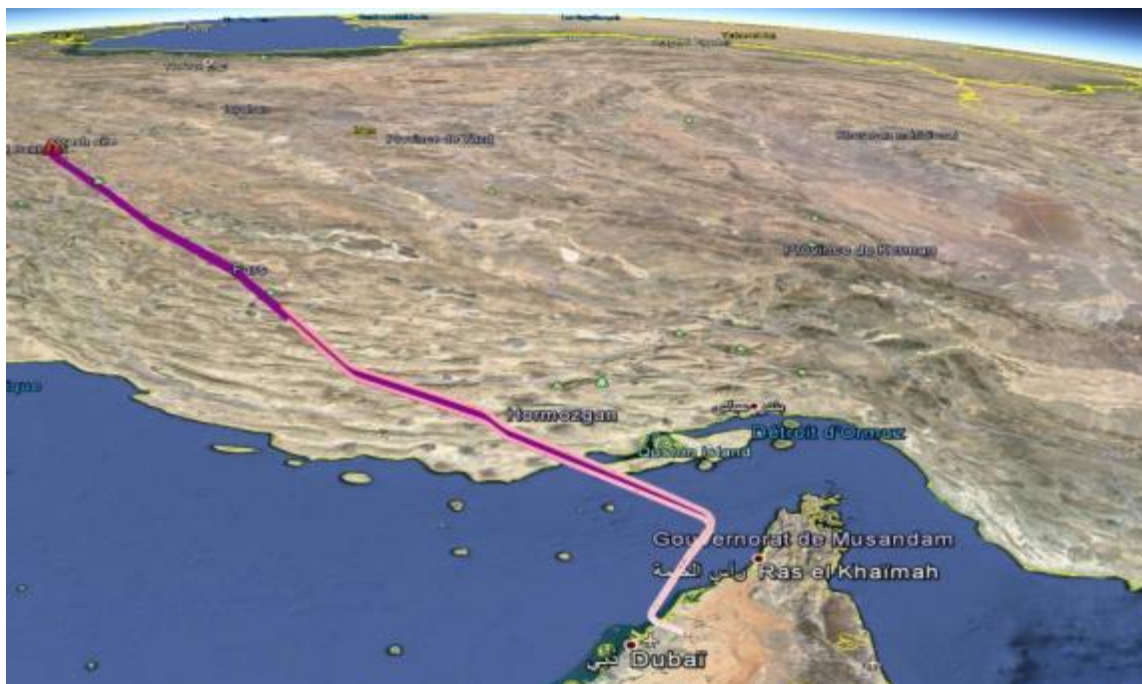
Accident Investigator in Charge

September 2018

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 and contacted with Tehran ACC and was identified by ACC controller at 13:29. 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 begun. Both engines eventually flamed out about 5 minutes later. The airplane started to descend and pilot reported malfunction and tried to control abnormal situation until the end of flight. The airplane impacted into a mountainous area southwest of Shahr-e kord in Islamic Republic of Iran.



1.2 Injures to persons:

Injuries	Crew	Passengers	Others
Fatal	3	8	-
Serious	-	-	-
Light/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 damages

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 both had Category I Medical Certificates which were valid. Furthermore, Challenger 604 aircraft type rating was endorsed to their licenses.

Research all simulator records of both pilots showed that see all abnormal procedures covered by ATO (Approved Training organization GBR.ATO.0234). Both pilots initial type rating courses done by CAE Emirates .

1.5.1.1 Captain:

Nationality	Turkish	Gender	Female
License No	TR-A 4964	Age	36
License Valid	Yes	Type Endorsed	Yes
Ratings	ATPL	Restrictions	VDL
Medical Expiry Date	21.12.2018	Previous Accidents	Incident on 2017 as training flight

Captain's Flying Experience

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

Complete type training and recurrent courses for Captain done by CAE Amsterdam by related training syllabus approved by EASA. She did her last LPC 's 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 directly related airspeed erros or unreliable indications covered,
- Stall warning system and stability augmentation devices covered,
- Early recognition and countermeasures on approaching stall (up to activation of stall warning device) in take off configuration (flap in take off 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 covered.

Also last OPC which made in aircraft on 01.03.2018, 3.4.2 and 3.4.9 was discussed and covered by TRE . during last 3 years LPC and OPC all abnormal procedures trained and covered repeatedly.

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 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 in cluded all abnormal procedures. As a summary:

- on August 29 2017 during IPT session 5, she covered IRS and ADC failure.
- 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 and sufficient trainings and all abnormal procedures covered with instructors or examiners especially pitot/static system failures which related ADC failures . also all stall indication and warning systems with proper procedures which include recognition and recovery systems 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, qualified for ACC & Radar services (License No: 1381) issued by Civil Aviation Organization of IR of Iran, holds valid medical check Class III which expires on 20 October 2019, and has passed language proficiency requirement Level IV which is valid until 15 June 2020.

1.6 Aircraft General Information:

The Challenger 604 is a sweptwing, twin-engine monoplane business jet, certified in accordance with FAR 25, FAR 36 and their amendments. Maximum ramp and takeoff weights are 48,300 and 48,200 lb respectively. The airplane 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.

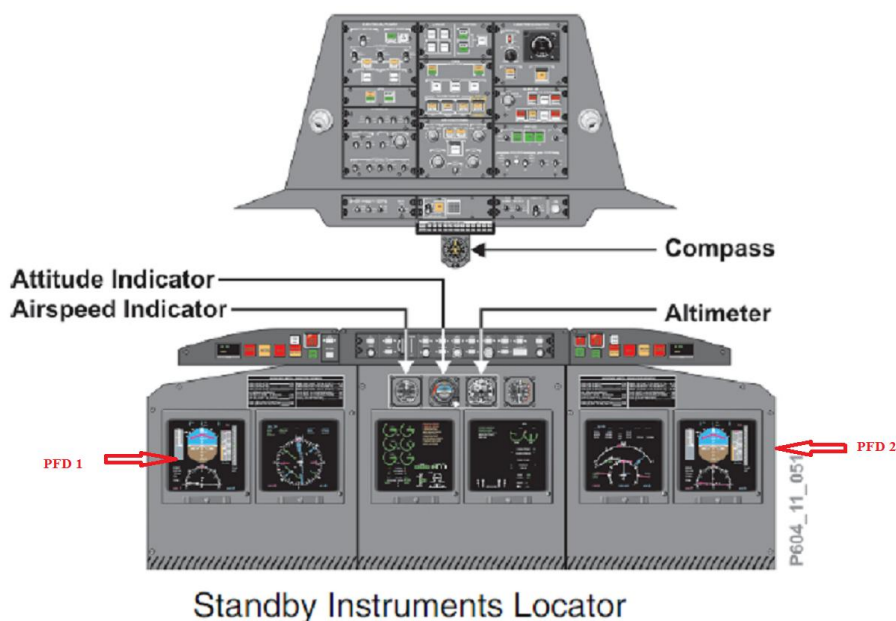
Manufacturer: Bombardier Inc. Canadair Group

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 was 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 318 KIAS. Among other things, the aircraft was equipped with two Inertial Reference Systems (IRS). The IRS provided the different aircraft systems with attitude, directional, position and three-axis rate/acceleration data.

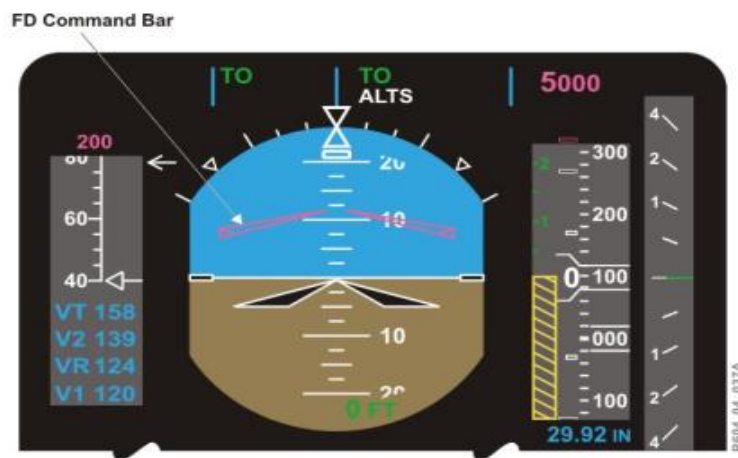


The airplane was equipped with an Electronic Flight Instrument System (EFIS). Part of the standby instruments were airspeed indicator, barometric altimeter, artificial horizon, and a magnetic compass.

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.



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 outside 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

1.6.1 Airframe:

Manufacturer	Bombardier
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 11 Mar. 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

1.6.3 Maintenance operations 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 with pitot static probes which used for airspeed indication system:

1. Functional test of pitot static probes, performed on 17 May 2017 at MCM (Maintenance Center, Malta)
2. Detailed inspection of the pitot static probes performed on 23 June 2016.

1.6.4 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 UT430 route on March 11, 2018, at 14:30 UTC, pertinent to the accident, is described as following.

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

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

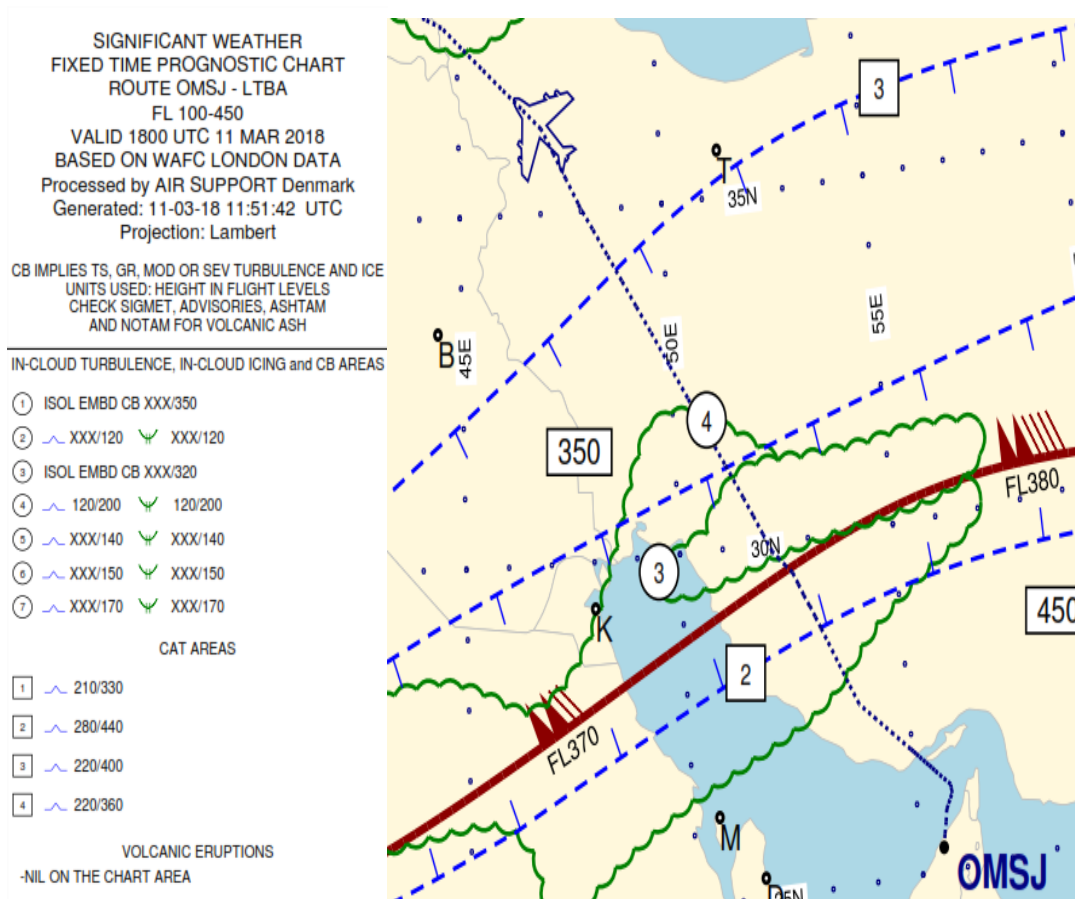
EMBD TS OBS/FCST WI N3855 E04634 -N3416 E0749- N3522 E06115

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 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 attachment I.



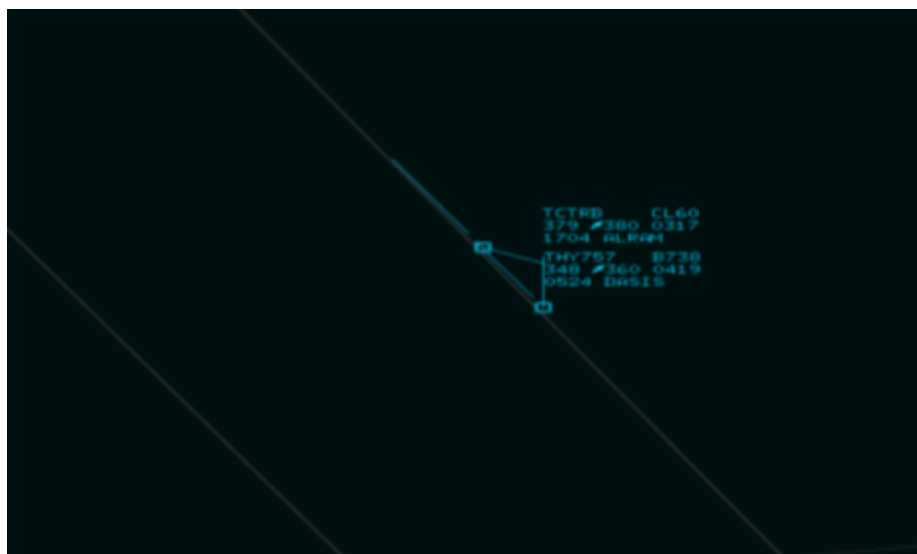
Another aircraft, a Boeing 737-800, call sign THY 757, departed at the same time from Sharjah International Airport to Istanbul Sabiha Gökçen International Airport.



TC-TRB entered Tehran FIR at 13:26 via GABCO and contacted with 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.

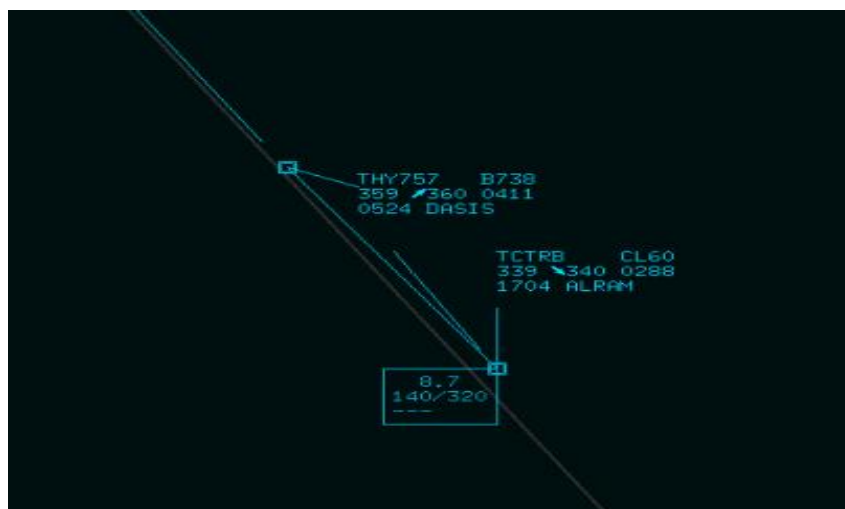


Following that, at 14:33:15, THY 575 which was flying ahead of TC-TRB at FL 340 on the same route, requested permission to climb to FL 360. Again, permission approved by the controller.

At 14:34:37 UTC, while reaching to 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 couldn't 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 again. The controller didn't 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 didn't receive any answer.

At 14:40:58, the controller shared information regarding TC-TRB with THY 757 that the aircraft was disappeared from radar scope. The controller asked pilot of THY 757 to call TC-TRB again. THY 575 tried to call it several times, again with no response. The pilot of THY 757 told radar controller that 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 was parked for three days before flight in Sharjah International Airport.





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 airplane was equipped with two flight recorders:

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

The recorder 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.

1.11.1 Flight recorder opening operations and read-out:

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 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 to 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.

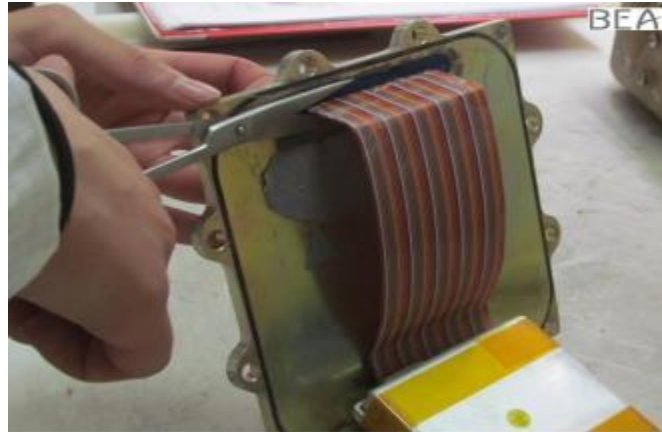
The event was recorded on the audio data.

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

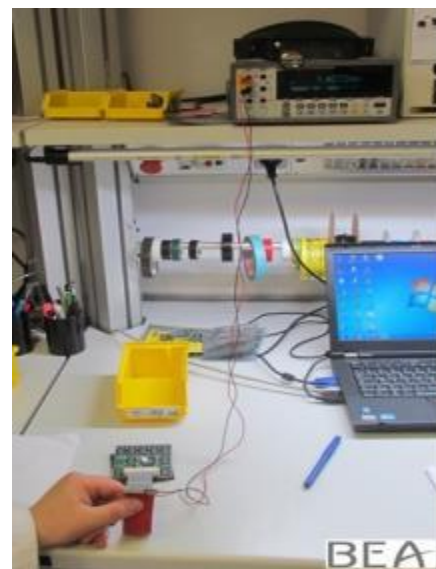
The FDR FCSSU was visually checked. The connector of the memory board was damaged.



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 50 pins 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 have been 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 some thing
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 ATTENSON [Warning message]
14h37min24	TRIPLE ATTENSON [Warning message]
14h37min27	TRIPLE ATTENSON [Warning message]
14h37min29	Synthetic Voice " <i>Engine oil</i> "
14h37min37	SINGLE ATTENSON [Caution]
14h37min49	SINGLE ATTENSON [Caution]
14h37min54	TRIPLE ATTENSON [Warning message]
14h37min56	WARBLER [Stall warning] + Stick-shaker activation [permanent sequence until the end of the CVR recording]
14h37min57	TC-TRB com to ATC [Declare an Emergency]
14h38min00	SINGLE ATTENSON [Caution]

14h38min04	SINGLE ATTENSON [Caution]
14h38min07	SINGLE ATTENSON [Caution]
14h38min08	TRIPLE ATTENSON [Warning message]
14h38min11	SINGLE ATTENSON [Caution]
14h38min13	SV "Bank angle, Bank angle" [TAWS Callout]
14h38min17	TRIPLE ATTENSON [Warning message]
14h38min21	SINGLE ATTENSON [Caution]
14h39min39	##### END OF THE CVR RECORDING #####

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

- On 14:32:48, at FL360 left and right airspeeds began to diverge, with left side steady and right side decreasing, then two minutes later aircraft started to climb. During the climb, IAS continued to diverge with Left side increasing and right side continuing to decrease future.
- Shortly after climbing through FL370, crew reduced thrust to idle and continued the climb but at reduce 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 a further approximately 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	<i>#1 Engine starting</i> <i>Passenger door closed</i>
13:10:31 13:10:33	Heading 30→34 Ground speed 0→1	<i>Taxi was begun in Sharjah</i>
13:17:59	Radio Alt 0→4 IAS=148 kt Heading = -57	<i>Take off from RWY 30</i>
13:18:02 13:18:03	L/G Down 1→0 IAS=163 kt Radio Alt=42	<i>Landing gear retracted</i>
13:45:15	Pressure Alt =36000ft IAS=236 kt	<i>Cruise Level FL360</i>
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 R/H IAS=256→ 250kt Ground speed =396→391 kt	<i>The speed begun to diverge</i> <i>Then request FL380</i>
14:32:24	Pressure Alt = 36000ft L/H IAS=256 kt R/H IAS=249 kt Ground speed =391 kt	<i>ATC: TC-TRB Climb 380</i>

UTC Time	Parameters	Remarks
14:32:36	Pressure Alt = 36000ft L/H IAS=256 kt R/H IAS=249kt Ground speed =391 k Autopilot on Vertical Speed mode	<i>Changing cruise level FL360 → FL380</i>
14:32:47	Pressure Alt = 36113ft L/H IAS=258 kt N _{1,2} =92.2-91.5 R/H IAS=247kt N _{2,2} =89.1-88.8 Ground speed =388 kt	<i>CVR: Single chime due to 10 kt difference on IAS</i>
14:33:07	Pressure Alt = 36352 ft L/H IAS=262 kt N _{1,2} =92.0 -91.28 R/H IAS=241kt N _{2,2} =88.9-88.5 Ground speed =382 kt	<i>Unreliable airspeed Reduction in ground speed CVR: single chime</i>
14:33:33 14:33:34	Pressure Alt = 37121 ft L/H IAS=270 kt R/H IAS=228kt N _{1,2} =91.5 →84, 88→80 N _{2,2} =88→84, 88→81 Ground speed =369kt	<i>CVR: sound similar to engine thrust reduction LH IAS increased and Both engines power reduced. engine power continues to decrease down to 65% N₁ by 14:33:50</i>
14:34:10	Pressure Alt = 37625 ft	<i>CVR: crew requested FL370</i>
14:34:20 14:34:30		<i>Engine power increasing back up to 78% N₁</i>
14:34:37	IAS 1=276 (About Mach 0.85) IAS 2=192	<i>CVR: CLACKER [MMO over speed] duration:20s</i>
14:34:46	Pressure Alt = 37632 ft L/H IAS=276 kt R/H IAS=189kt Ground speed =301kt Autopilot disengaged(off) Pitch Angle=7	

UTC Time	Parameters	Remarks
14:34:49	Pressure Alt = 37872 ft L/H IAS=277kt R/H IAS=187kt N1 _{1,2} =78.4 , 77.9 N2 _{1,2} =82.5 , 82 Ground speed =299 kt Pitch angle =4.8	<i>Maximum Altitude</i>
14:34:57	Pressure Alt = 37632 ft L/H IAS=276 kt R/H IAS=186kt N1 _{1,2} =78, 77 N2 _{1,2} =83, 81 Ground speed =303kt Autopilot off	<i>Stall Warning + stick shaker</i> <i>Oscillation in Acceleration+ elevator position+ pitch angle</i>
14:37:27	Pressure Alt = 32700 ft L/H IAS=203 kt R/H IAS=185kt N1 _{1,2} =87 →78, 85→77 Ground speed =277kt	<i>Reducing engine performance</i>
14:37:42	Pressure Alt = 31524 ft L/H IAS=182 kt R/H IAS=181kt N1 _{1,2} =76, 51 AOA=32.25 Ground speed =274kt	<i>Engine #2 Flame out</i>
14:37:54	Pressure Alt = 30770 ft L/H IAS=182 kt R/H IAS=178kt N1 _{1,2} =57, 23 AOA=34.93 Ground speed =252 kt	<i>Engine #1 Flame out</i>
14:38:00	Pressure Alt = 31978 ft L/H IAS=190 kt R/H IAS=0 kt Ground speed =216 kt	<i>IRS #2 failed</i>
14:38:15	Pressure Alt = 30371 ft L/H IAS=146 kt R/H IAS=9 kt N1 _{1,2} =14, 12Ground speed =148 kt	<i>End of recording</i>

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



Center fuselage and landing gear



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 remains for 10 victims of the crash site. The remains of the first officer was collected, examined and identified both morphologically as well as 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, researches for Captain Victim begun and some small broken parts of bones were found and DNA analysis showed that parts were belonged to first officer and a passenger victims.

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 victim.
- Two bodies of victim were burned by post impact fire.
- The physical characteristics of victim showed low energy impact with mountain.

1.14 Fire:


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

1.15 Survival Aspects:

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

white	A/C Colour	7
MC HAVACILIK A.C	Owner	8
3	Crew No.	9
8	PAX No.	10
UAE_ Sharjah	DEP Airport	11
Turkey – Istanbul Ataturk	DEST Airport	12
-	Alternate Airport	13
-	A/C Speed	14
ACC: 14:37	LAST ATC Contact	15
30 49 33 N 51 36 45 E	Last RADAR Contact	16
	LAST ATC Message	17
Jet A1	Fuel	18
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	Accident location	19
18:10(14:40 UTC)	Accident Time	20
16:47(13:17 UTC)	Departure time	21
17:50 UTC	Arrival Estimate time	22
Uncertainly phase <input type="checkbox"/> Alert phase <input type="checkbox"/> Distress phase <input checked="" type="checkbox"/>	Emergency phase	23
Tehran ACC	ATC unite to be informed	24

Tehran ACC	RCC	25
Red Crescent of Chahrmahal – Bakhtiari Province 	SAR Unit to be active	26
Nil	cospas-sarsat	27
Rainy	Weather on Crash site	28
Residential <input type="checkbox"/> City <input type="checkbox"/> Village <input checked="" type="checkbox"/> Military area <input type="checkbox"/>	Geographical location of site	29
Desert <input type="checkbox"/> Jungle <input type="checkbox"/> Mountain <input checked="" type="checkbox"/> Sea <input type="checkbox"/>	Topography of site	30
By Mountaineering and by Air	Access to crash site	31

– **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 arrived to 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 have been made to find the missing body with no success.



The first picture from crash site



The route of flight



The SAR operation meeting near the site with Governor



The transfer of bodies by helicopter



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 bellowed information was collected from aviation service providers and ground witness in UAE:

- The aircraft arrived from Istanbul on 08 Mar 2018 (3 days before accident time) and engines were shut down and disembarked passenger 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 some long times for coordination and towing. The pilots parked the aircraft and left.
- The residence of the pilots was in different hotel from the passengers.
- The recorded films in Terminal cameras (CCTV) showed normal condition of crew and passengers. Also presence of pilot (captain) was confirmed from terminal video recorders.
- All communications with ATC were done by first officer in arrival and departure time at Sharjah Airport.
- The flight documents same as load sheet- refueling page-flight plan; preflight inspection check list was signed by first officer for departure. (For arrival flight the documents were signed by captain and found in accident site). Two pilots were authorized to accept 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 any assessment of flight recorders data before and only the related checks were done by a German Maintenance base before.

1.17 Organizational and Management Information:

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

- a) The MC aviation as a private has a valid Operating License from Turkish authority.
- b) The company has valid certificate for continues airworthiness management for the organization CAMO for two types of aircraft (including CL604)
- c) The MC aviation had fleet two aircrafts only 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 gave data access to the Bombardier Company as aircraft manufacturer to analyze the accident. The design data of Airspeed indication system also is needed to find 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:

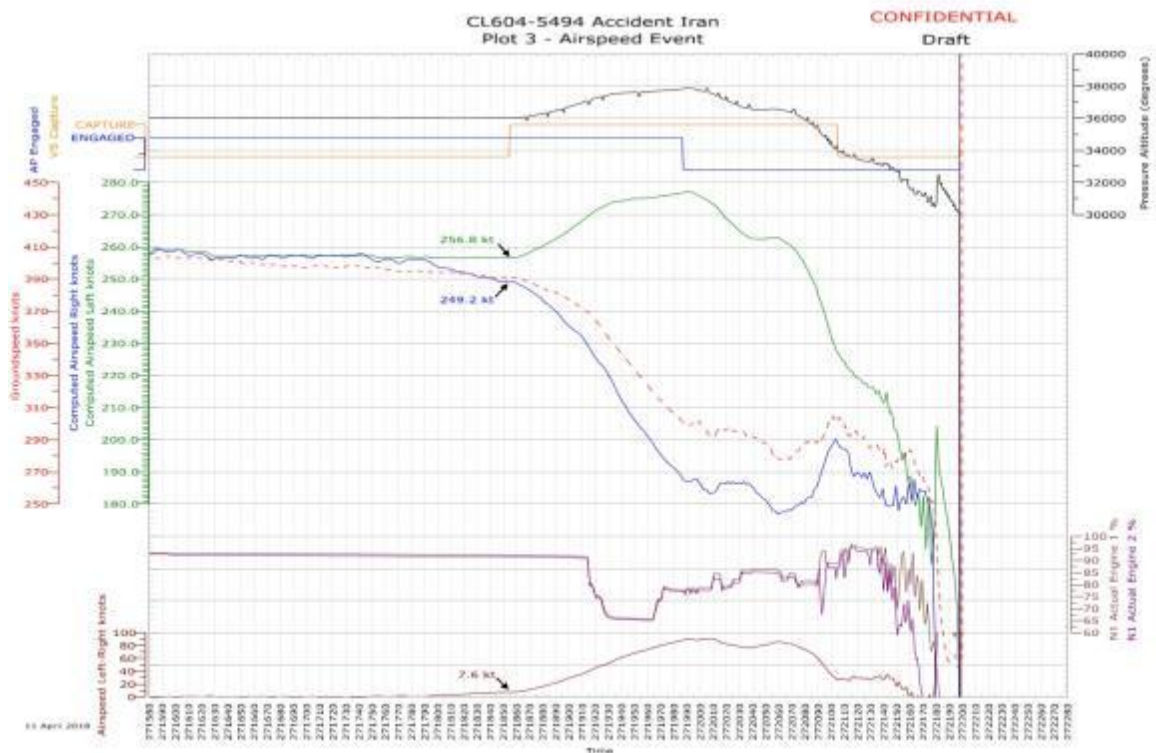
2-1 General:

- The aircraft was certificated by Turkish Civil Aviation Authority (DGCA).
- Pilots were in possession of a valid Pilot Licenses rated on the Challenger 604. At the time of the accident, the pilots were declared medically fit. The pilots were therefore appropriately qualified and experienced on the type.
- There was evidence of malfunction of Airspeed indication or other failure on computing speed of the airplane and no failure of power-plants or control surface that would have contributed to the accident
- The accident was un-survivable, and the catastrophic impact and destruction of the airplane precluded a complete inventory of components. All major structural pieces could not be recovered and examined due to rocky mountain at 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 component was not separated in flight and aircraft had integrity before impact.

2-2 Accident sequence

The Turkish Challenger 604 with register TC-TRB and a same call sign as it's register took off from Sharjah Airport (OMSJ) to Istanbul, Ataturk airport (LTBA), according It's flight plan ETD was :13:00 on 11 March 2018 , the aircraft had normal take-off and followed ATC clearance . The TC- TRB entered Tehran FIR via GABCO at time of 13:26 and contact with Tehran ACC sector 5 and climbing to FL 230 and identified by radar controller at time 13:29 the pilot requested to climb to FL 360 according its flight plan and cleared by ACC controller. At time 14:28:48, TC- TRB called Tehran ACC Sector 3 South and declared its Flight level 360 and identified by Radar controller.

Evaluation of all of the evidence obtained during the investigation of this accident indicates that the flight operational was normal until 14h32 the aircraft was in stable cruise flight at FL360 on autopilot set on ADC1 (captain side) . Flight crew initiated a climb to FL380 in vertical speed mode.



At 14:32:00 on FL360 the speeds of both side indicators began to diverge about more than 5 kt.

At 14:32:17 UTC, crew requested changing level from FL360 to FL380. The pilot selected vertical speed mode to climb and during climb acknowledged difference (10 kt) by related warning in IAS indicators.

According to FDR graphs chart a little time before 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 is heard on the CVR at about the same time as the difference between left and right airspeed reach 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 over speed 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. The accident aircraft was

flying, the initial crew action must be focused on **CROSS CHECKING** flight instruments and stand by flight instruments and set AIR DATA source selector to reliable side. The pilot did not follow bellowed abnormal procedure and directly reduce engine power to decrease IAS while hearing clacker. So the actual airspeed reached to stall condition.

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

EFIS COMP MON

EFIS COMP MON
AND

A
L
T or HDG or I
A
S or PIT or ROL or RA or LOC or GS

(PFD annunciation - flashing)

PFD	ACTION
<div style="display: flex; align-items: center;"> <div style="width: 10px; height: 20px; background-color: black; margin-right: 5px;"></div> <div style="width: 10px; height: 20px; background-color: black; margin-right: 5px;"></div> <div style="width: 10px; height: 20px; background-color: black; margin-right: 5px;"></div> </div> <p style="margin-top: 10px;">ALT and/or IAS</p>	<p>(1) Flight instruments and standby flight instruments CROSS CHECK</p> <p>(2) AIR DATA source selector.....SELECT to reliable side.</p> <p>If any of the following occurs, refer to Unreliable Airspeed (See Page EMER 13–2):</p> <ul style="list-style-type: none"> 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. <p>Refer to Aircraft Flight Manual, Chapter 6, PERFORMANCE – GENERAL, for alternate static system position error correction charts.</p>

The copilot tried to begin reading of EFIS COMP MON for three times but due to pilot interruption, she could not complete it. Not long after due to decreasing speed, stall aural warning began to sound, in addition to stick shaker and stick pusher activating repeatedly. They should refer to another emergency procedure to recover stall condition as:

Stall Recovery

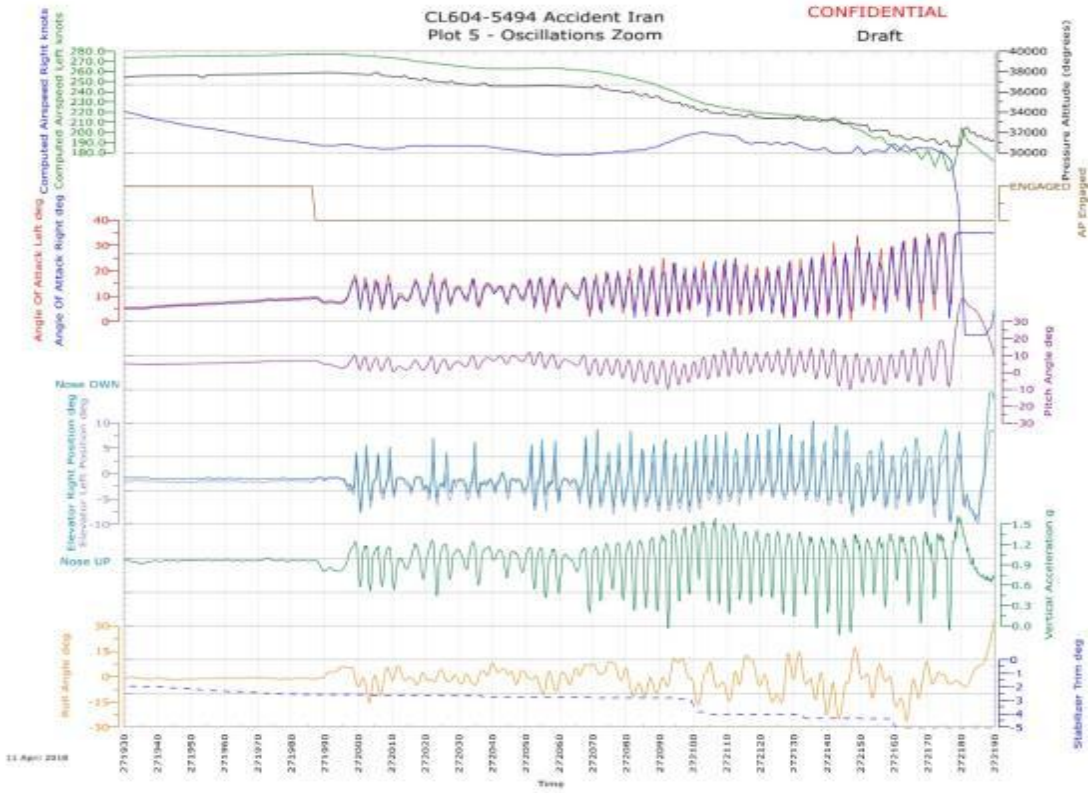
.....Aircraft buffet, uncommanded roll, stick shaker activated and/or stall warbler on.

- (1) AutopilotDISCONNECT
- (2) Pitch attitude..... LOWER NOSE
- (3) Thrust levers..... MAX POWER
- (4) Roll attitude WINGS LEVEL
- (5) FLIGHT SPOILER leverRETRACT

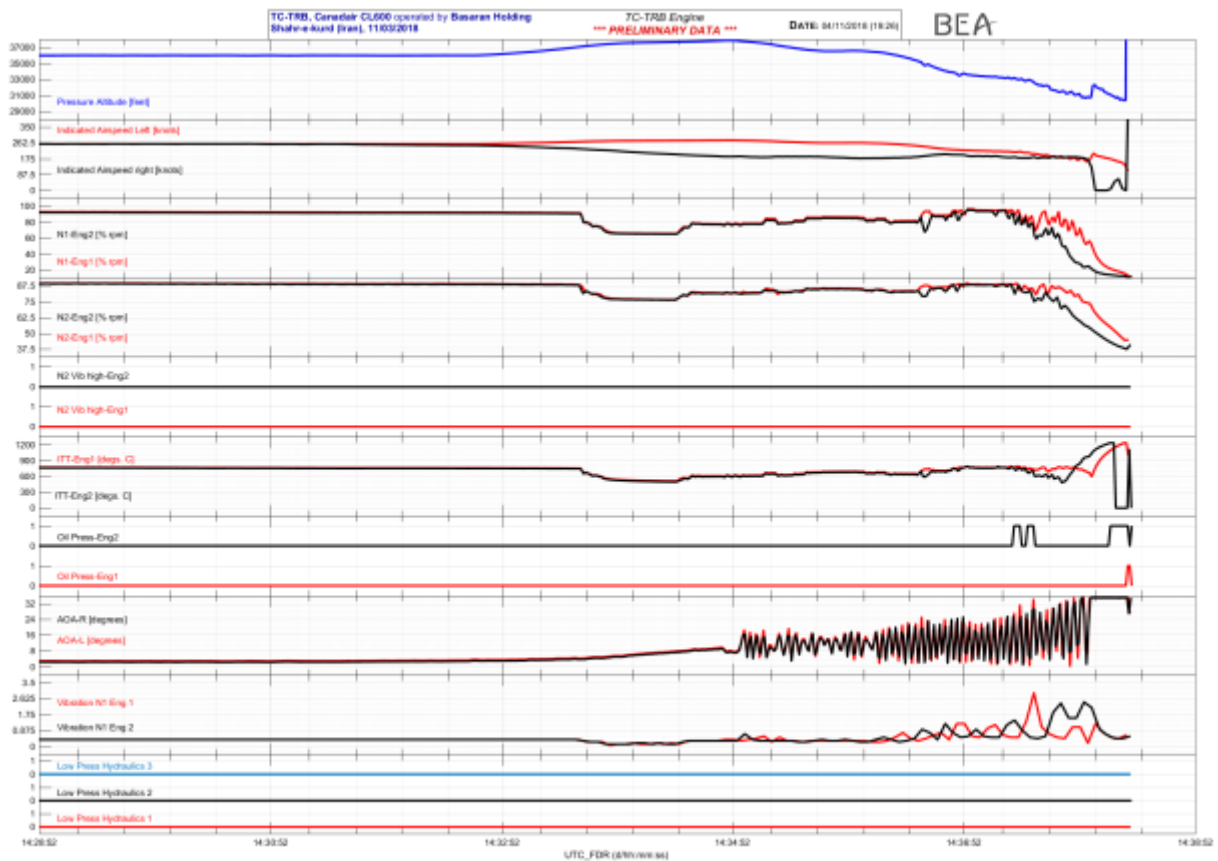
After airspeed increases and stall warning is extinguished:

- (6) Pitch attitude.....ADJUST
- (7) Thrust levers and airplane configurationADJUST

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



The autopilot was disengaged by crew before stall warning, which ended to 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 was lost at this point due to powering off aircraft electric bus which did not continue to receive power from engine generators. 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.



3. CONCLUSIONS

3.1 Findings:

These findings are based on the available information and other findings will be added or changed by gaining required cooperation by other related states.

- The pilots were licensed, medically fit, qualified for the flight.
- Both pilots were trained about abnormal and emergency procedures in Approved Training organization and passed recurrent trainings but evidences of the accident flight showed that the trainings were not effective.
- The aircraft had a valid Certificate of Airworthiness and was recorded as being serviceable before flight to Sharjah airport.
- The crew did not report any abnormality during Taxi – Take Off- Climb and Cruise prior to 14:34:37 UTC time.
- The aircraft encountered failure in Airspeed indication .The origin of Airspeed failure is not cleared now and design information of related system should be investigated.
- The crew reaction about the failure and reducing engine power caused stall situation for the flight.
- The aircraft had sufficient altitude to allow the pilot to recover from the stall situation.
- Flight crew could not perform emergency procedures both for unreliable airspeed and stall recovery completely.
- The cockpit crew coordination based on CRM principle was not enough.
- The aircraft had integrity before impact to mountain area.

3.2 Future Process on the Investigation:

Final conclusion of the accident would be possible by collaboration of TSB, Canada as state of Design and Manufacture for aircraft type by granting free access to aircraft's design and technical data with Bombardier Cooperation and receiving following information:

- Technical issue on failure of airspeed indication system based on Flight Data Recorder information.
- Supporting technical & statistic data of same failures in Bombardier Fleets and tasks for preventing further occurrences.

4. SAFETY RECOMMENDATIONS:

There is not any safety recommendation yet based on available information. Consequently, the Aircraft Accident Investigation Board of IR of Iran Civil Aviation Organization will issue required safety recommendations on the facts of Final Report.

APPENDIX I

(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 II

(Communications with IR of Iran ATC)

TIME (UTC)	STATION	CONTEXT
Hh/mm/ss		
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 descend 140....
	QSM1216	Stop at level 140 QSM1216
	ACC	Affirm, say again station calling
143437	TCTRB	Radar TCTRB, descending 370, due to malfunction

TIME (UTC)	STATION	CONTEXT
Hh/mm/ss		
	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	<i>...not clear</i>
	ACC	Say again
143843	ACC	TCTRB, confirm situation normal?

TIME (UTC)	STATION	CONTEXT
Hh/mm/ss		
	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 (<i>Turkish Language</i>)
	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 advise, 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)	STATION	CONTEXT
Hh/mm/ss		
	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 advise
144346	THY757	TCTRB, THY757?