FINAL REPORT

on

Investigation of a serious incident on 30.06.2015 with FALCON F900 aircraft, registration marks VP-CGD, and EMBRAER 170 aircraft, registration marks SP-LDK, started in the controlled air space of the Republic of Romania and realized in the controlled air space of the Republic of Bulgaria.

2016

Purpose of the Report and responsibility

In accordance with Annex 13 of the Convention on International Civil Aviation of 7 December 1944, Regulation Nr. 996/2010 of the European Parliament and the Council on the investigation and prevention of civil aviation accidents and incidents, and Ordinance 13 of 27.01.1999 of the Ministry of Transport, Information Technology and Communications, the purpose of the aviation occurrence investigation is without looking for any blame or liability to be established the causes led to its realisation in order these to be eliminated and not allowed in the future.

CONTENTS

01. LIST OF ABBREVIATIONS

A/C	-	Aircraft;
AAIU	-	Aircraft Accident Investigation Unit;
ACAS	-	Airborne Collision Avoidance System;
ACC	-	Air Control Center;
AIR POLICING	-	Peacetime NATO's mission including usage of the air space surveillance and management system, the control and management system of the military, and appropriate forces and means for air defence, including chasers, aimed at defending the sovereignty of the national air space of the NATO member states;
AO	-	Aircraft Operator;
AS	-	Air space;
ATCAS	-	Air Traffic Control Automated System
ATCO	-	Air traffic controller (officer);
ATCO-S	-	Air Traffic Controller – Supervisor;
ATS	-	Air Traffic Service;
AOM	-	Aircraft Operating Manual;
BUAF	-	Bulgarian Air Force;
BULATSA	-	Bulgarian Air Traffic Services Authority;
CAA	-	Civil Aviation Act;
CALL SIGN	-	Call-sign of the aircraft;
CNATCC	-	Common National Air Traffic Control Center;
CCUA	-	Centre for Coordination use of airspace;
CLS	-	Coast List;
AMRAIUD	-	Aircraft, Maritime and Railway Accident Investigation Unit Directorate;
DG CAA	-	Directorate General "Civil Aviation Administration";
EASA	-	European Aviation Safety Agency;
EICAS	-	Engine Instrument & Crew Alerting System;
EXE ATC	-	Radar Air Traffic Controller;
F/C	-	The flight crew;
FIR	-	Flight information region
FDR	-	Flight Data Recorder;
FHDB	-	Fault History Data Base;
FL	-	Flight level;
FS	-	Family Sectors;
GAT	-	General Air Traffic;
HMI	-	Human-Machine Interface;
ICAO	-	International Civil Aviation Organization;
IFR	-	Instrument Flight Rules ;
MCDU	-	Multifunction Control Display Unit;
MRC	-	Modular Radio Cabinet;
MTCD	-	Medium Term Conflict Detection;
MTITC	-	Ministry of Transport, Information Technology and Communications;
NIM	-	Network Interface Module;
ODS	-	Operational Display Sub-system
PFD	-	Primary Flight Display;
PLN ATC	-	Planning Air Traffic Controller;
STCA	-	Short-term conflict alert;
TCAS	-	Traffic collision avoidance system;
TCP	-	Navigation control point;
TCP	-	Transfer control point;
UTC	-	Universal coordinated time.

1. Introduction

Date and hour of the aviation event: 30.06.2015, from 11:56:19 till 12:27:58 UTC. The difference between local and universal coordinated time (UTC) is +3 h. The time applied everywhere in the Report is UTC.

Informed authorities: "Aircraft, Maritime and Railway Accident Investigation Unit" Directorate and "Civil Aircraft Administration" Directorate General at the Ministry of Transport, Information Technology and Communications of the Republic of Bulgaria, the European Commission, the International Civil Aviation Organization (ICAO), the Center of Investigation and Analysis for Safety of Civil Aviation (CIAS) and the State Commission of Aircraft Accident Investigation (SCAAI) of Poland.

On the grounds of Art. 9, par. 1 of Ordinance Nr. 13 dt. 27.01.1999 on investigation of aviation accidents, the occurrence is classified by the Aircraft Accident Investigation Unit at the "Aircraft, Maritime and Railway Accident Investigation Unit" Directorate at the Ministry of Transport, Information Technology and Communications as a serious incident. The materials on the aviation occurrence are filed in case Nr. 03/30.06.2015 to the archive of the Aircraft Accident Investigation Unit.

On the grounds of Art. 5, par. 1 of Regulation (EU) Nr. 996/2010 on the investigation and prevention of accidents and incidents in civil aviation, Art. 142. Par. 2 of the Civil Aviation Act of the Republic of Bulgaria dt. 01.12.1972 and Art. 10, par. 1 of Ordinance Nr. 13 of the Ministry of Transport dt. 27.01.1999 on the investigation of aviation occurrences, by Order Nr. РД-08-388 dt. 23.07.2015 of the Minister of Transport, Information Technology and Communications, Commission is appointed for the investigation of the serious incident.

On 30.06.2015 at 12:26 h UTC, in the controlled upper airspace of the Republic of Bulgaria, particularly in Sofia Control FS Varna East Upper airspace an infringement of the standards on the minimum radar separation between two aircraft occurred. An unidentified unknown aircraft flying without two way radio communication and without transmitting transponder (Mode A/C) passed by a controlled aircraft Falcon 900, registration marks VP-CGD, of „VOLKSWAGEN AIR SERVICE" AO, performing flight with flight number WGT62N, at a minimal horizontal distance at 0.9 nm at same FL 370. Later on the unidentified unknown aircraft established radio communication with Sofia ACC FS Varna West and it was identified as Embraer 170 aircraft, registration marks SP-LDK, performing flight with flight number LOT7293 of „LOT" AO.

Based on the grounds of the performed investigation, including the research and analysis of the available factual information, the Investigation Commission concluded that the serious incident resulted from the following main and several accompanying causes:

Main cause:

- Unintentional interruption of the Air Traffic Service in regard to LOT7293 on the side of ACC Bucharest after changing of the aircraft transponder mode of operation to STANDBY, particularly in Bucharest Control BANAP sector, during the its flight in Bucharest FIR and later on in Sofia FIR.

Accompanying causes:

- Not implemented procedures by the flight crew of Embraer 170, registration marks SP-LDK, after the momentary failure of the transponder system.

- Not provided information in timely manner on the location, direction of flight and height of the unidentified aircraft by ACC Bucharest to ACC Sofia, previously received from NATO07.

- Not implemented procedures by ACC Bucharest from the LETTER OF AGREEMENT between BULATSA SOFIA ACC and ROMATSA BUCUREŞTI ACC/CONSTANŢA APP.

    - E.1 Transfer of Control
    - E.2 Transfer of Communications;
    - F.2.5 Transfer of Aircraft Identification.

2. Factual information

2.1. Flight history

2.1.1. Flight number, type of operation, last point of departure, destination point of the involved aircraft

Aircraft	**Aircraft-1**	**Aircraft-2**
Aircraft Operator	LOT	Volkswagen Air Service
Operation type	Commercial	Commercial
Aircraft type	Embraer ERJ E170-STD	Falcon 900
Call sign	LOT7293	WGT62N
Registration	SP-LDK	VP-CGD
SSR code	6156	2140
SSR mode	S	S
Flight Rules	IFR	IFR
Type of operation	GAT	GAT
Operation phase	En-route	En-route
Last point of departure	Warsaw - EPWA	Stuttgart - EDDS
Destination point	Istanbul - LTFJ	Muscat Oman - OOMS

2.1.2. Flight preparation and description of the flight

On 30.06.2015 Falcon 900 aircraft, registration marks VP-CGD of „VOLKSWAGEN AIR SERVICE" performs a flight on the route of Stuttgart – Muscat with flight number WGT62N. According to the flight plan, the aircraft must enter the air space of the Republic of Bulgaria through TCP (navigation control point) RONBU at FL 370, fly on one-way route M859, and leave the controlled air space of Bulgaria through TCP ODERO at FL 370.

Embraer 170 aircraft, registration marks SP-LDK of „LOT" AO performs a flight after the route of Warsaw – Istanbul with flight nr. LOT7293. According to the flight plan, the aircraft must enter the controlled air space of the Republic of Bulgaria, Sofia Control, FS Varna East, through DINRO point at FL 350, fly on one-way route U 616, and leave the controlled air space of Bulgaria through RIXEN point.

On 30.06.2015, after performed rendering of instructions, a part of air traffic controllers' shift, including EXE ATC and PLN ATC, start work at 12:00 h UTC, undertaking the responsibility for the air traffic control at Sofia Control, FS Varna East Upper. At the time, the shift starts work, at FS Varna East Upper there are 5 aircraft controlled.

At 11:44:00 UTC Embraer 170 aircraft, flight number LOT7293, enters the serviced air space of ACC Bucharest at FL 370 above BUKOV point. The EXE ATC from BANAP sector identified the aircraft as LOT7293 (squawk 6156), provided it with radar servicing and instructed it to follow direct route BUKOV – DINRO at FL 370. The DCT DINRO command is given and performed by SELEX system.

At 11:56:19 UTC in conformity with the data received from FDR and CMC of Embraer aircraft, the transponder of LOT 7293 switches to STANDBY mode, as a result of which the TCAS mode TA/RA switches to OTHER mode.

Till 11:56:38 UTC the secondary target with radar tag of LOT 7293 is normally displayed on the screens of the work positions. In this moment the symbol of the target changes to a horizontal line "-" .

At 11:57:07 UTC at 10 nm westward from BCU point, the correlated target, flying as LOT 7293, disappears from the screens of all work positions of ACC Bucharest. As a result thereof, in CSL (COAST LIST) window of the work positions of the EXE ATC and the PLN ATC from BANAP sector there appears the flashing tag of LOT7293 and in the SECTOR LIST window of the work positions from BANAP and DINSI sectors the call-sign of LOT 7293 is encircled by a yellow line. At 11:57:32 UTC a conversation between the PLN ATC and the EXE ATC from BANAP sector about the appearance of LOT7293 in CSL. At 11:58:09 UTC the PLN ATC from BANAP sector tries to display the trajectory of LOT7293. At 11:58:29 UTC the PLN ATC from BANAP sector asks the PLN ATC from DINSI sector about LOT7293.

At 12:01:00 UTC, the EXE ATC from BANAP stated that LOT7293 overflew the sector an hour before. At 12:01:00 UTC in DINSI sector the PLN ATC is substituted by another one.

At 12:02:17 UTC an OLDI ACT message is automatically generated and communicated to ACC Sofia for LOT 7293 at FL 350. At 12:03:06 UTC in BANAP sector the PLN ATC is substituted by another one.

At 12:09:56 UTC the Military Air Traffic Control of Romania asked about information from the Air Traffic Controller – Supervisor of ACC Bucharest whether there is an aircraft flying without a transponder. At 12:10:30 UTC the Military Air Traffic Control from Romania Air Force called the PLN ATC from BANAP sector to obtain information about the existence of a primary target. At 12:11:21 UTC, the EXE ATC from DINSI sector checked in CSL whether they have LOT7293 aircraft.

At 12:14:36 UTC, the Air Traffic Controller-Supervisor of ACC Bucharest asks DINSI sector for the eventual disappearing of an aircraft.

At 12:15:00 UTC, a conversation about the eventual disappearing of an aircraft and a flying target in their controlled air space between the EXE ATC and the PLN ATC from DINSI sector.
At 12:17:00 UTC, a conversation about an unknown traffic at FL 400, heading to DINRO point between the EXE ATC and the PLN ATC from DINSI sector.

At 12:18:11 UTC, conversations about the line traffic at FL370, visually observed by NATO07 between the EXE ATC and the PLN ATC from DINSI sector and the Air Traffic Controller – Supervisor of ACC Bucharest and on the frequency of DINSI sector between the EXE ATC from DINSI sector and NATO07 (AWACS)

At 12:18:52 UTC, the Air Traffic Controller-Supervisor of ACC Bucharest informed the military air forces that he needed information from NATO07 on the location, height and direction of the unknown target.

At 12:21:35 UTC, multiple conversations about the direction of flight of the unidentified target between the EXE ATC and the PLN ATC from DINSI sector and the Air Traffic Controller-Supervisor of ACC Bucharest and on the frequency of DINSI sector between the EXE ATC from DINSI sector and NATO07 (AWACS) were held.
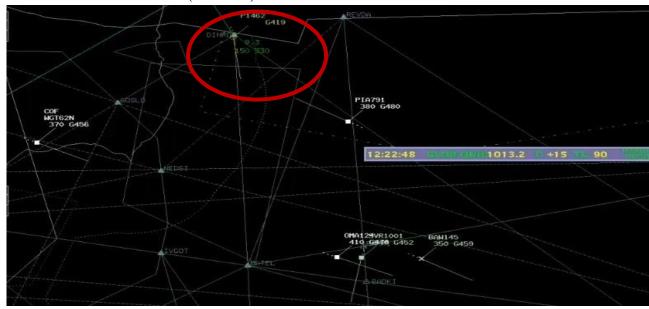

Fig. 1

At 12:22:09 UTC the Air Traffic Controller – Supervisor from ACC Bucharest notified the military air forces that NATO07 have informed them about a target at FL 370, heading 170 and speed 170 kt. At 12:22:47 UTC the military air forces informed the PLN ATC from DINSI sector that the unidentified target is found exactly above DINRO point with variable FL.

At 12:22:48 UTC an unidentified primary target entered the controlled air space of ACC Sofia overflying TCP DINRO) (see Fig.1).

At 12:23:30 UTC the EXE ATC from FS Varna East Upper requested traffic information from the flight crew of PIA791 regarding an unidentified traffic at unknown height and without a flight plan. The flight crew of PIA791 reported they observe an aircraft of TCAS flying 1000 ft lower than them. The repeated request of the EXE ATC is answered by the flight crew with the words: "we have traffic at 5 nm, 10 o'clock, crossing us".

At 12:24:19 UTC, the flight crew of LOT7293 reported to the EXE ATC of BANAP sector: "just passing DINRO FL 370".

At 12:24:59 UTC the EXE ATC of FS Varna East Upper submits traffic information to WGT62N about "an unknown" traffic with the words: "WGT62N traffic information, 10 o'clock, 13 nm, unknown level, unknown traffic, crossing left to right".

At 12:25:24 UTC, the EXE ATC from BANAP sector transfers the radio communication of LOT7293, which flies without information from the transponder at the frequency of 134.7 MHz, to FS Varna West.

At 12:25:28 UTC, the EXE ATC from FS Varna East Upper requests: "WGT62N do you see the traffic?" (Distance of 10.2 nm between WGT62N and LOT7293) The EXE ATC from FS Varna East Upper requests: "WGT62N do you see the traffic?" (Distance of 10.2 nm between WGT62N and LOT7293).

At 12:25:33 UTC the flight crew of WGT62N reports: "Yes, I have the traffic in sight…far away". (The distance between WGT62N and LOT7293 is 8,9 nm).

At 12:25:44 UTC, the EXE ATC from Varna East Upper sector again requests the flight crew of WGT62N: "Can you tell me approximate level?"

At 12:25:47 UTC the flight crew of WGT62N reports: "WGT62N estimating FL 400." (The distance between WGT62N and LOT7293 is 7,8 nm).

At 12:25:52 UTC, the EXE ATC from FS Varna East Upper requests the flight crew of WGT62N: "So it is above you?" (The distance between WGT62N and LOT7293 is 6,4 nm).

At 12:25:58 UTC, the flight crew of WGT62N responds: "It is above our flight level. We are at FL 370 but estimating they to be at FL 400."

At 12:26:00 UTC the EXE ATC of FS Varna East Upper: "Thank you!"

At 12:26:38 UTC the EXE ATC of FS Varna East Upper: "LOT 7293…."

At 12:26:45 UTC the flight crew of WGT62N: "WGT62N, I had just seen the traffic and I do not have TCAS on him and he was crossing behind me above…and there was less than FL 400.

At 12:26:50 UTC the horizontal distance between WGT62N and LOT7293 is 0,9 nm, at one and the same FL 370, determined by extrapolation of the radar plots (see Fig. 2).
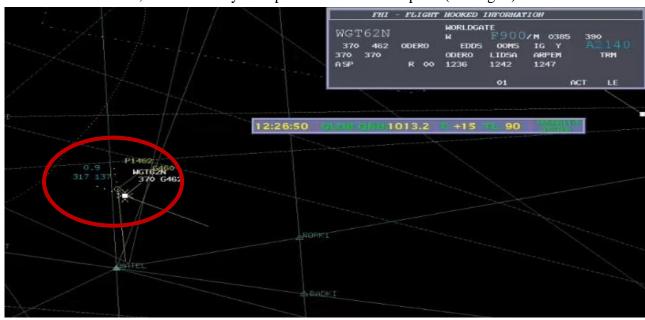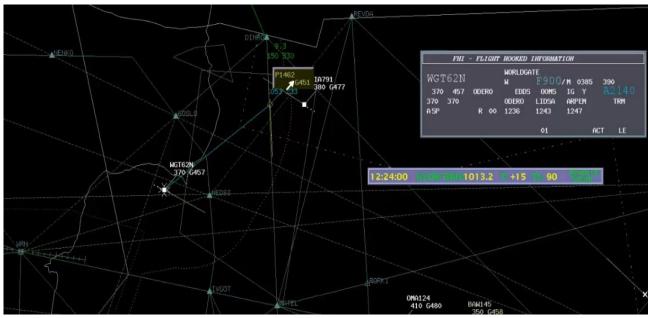

Fig. 2

At 12:27:55 UTC in the region of TCP MATEL, the transponder of LOT 7293 started to transmit information.

At 12:28:00 UTC, there appeared information from the transponder of LOT 7293, first Mode A, and then Mode C (FL 370).

During the above events, coordination is realized between the PLN ATC from Varna East Upper sector of ACC Sofia and the PLN ATC from DINSI sector of ACC Bucharest:

At 12:24:00 UTC, ACC Bucharest requested confirmation of information about the unknown aircraft: "I want to ask you if you have on the primary radar over DINRO any traffic" (see Fig. 3).

Fig. 3

At 12:24:05 UTC ACC Sofia: "Yes I have one."

At 12:24:05 UTC ACC Sofia: "Yes I have."

At 12:24:06 UTC ACC Bucharest: "And what level."

At 12:24:07 UTC ACC Sofia: "I have no level."

At 12:24:08 UTC ACC Bucharest: "No level we also, so we stand by to check what is the possibility."

At 12:24:08 UTC ACC Sofia: "Yes I'll try to call."

At 12:25:15 UTC ACC Bucharest: "So you have target over DINRO" (see Fig. 4).

Fig. 4

At 12:25:20 UTC ACC Sofia: "Not over DINRO pass DINRO Let's say again three minutes ago."
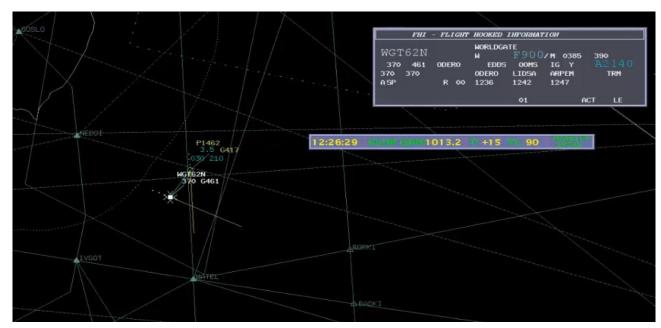
At 12:25:21 UTC ACC Bucharest: "Ok stand by."

At 12:25:26 UTC ACC Bucharest: "Ok might be traffic, which loss the transponder and squawk and stand by."

At 12:25:30 UTC ACC Bucharest: "Let's me check."

At 12:25:36 UTC ACC Bucharest: "Stand by."

At 12:26:29 UTC ACC Bucharest: "It might be LOT7293 It might have FL370, Yes, LOT7293 Flight Level 370 ok" (see Fig. 5).

Fig. 5

At 12:26:33 UTC ACC Bucharest: "But stand by we'll try to verify again the information."

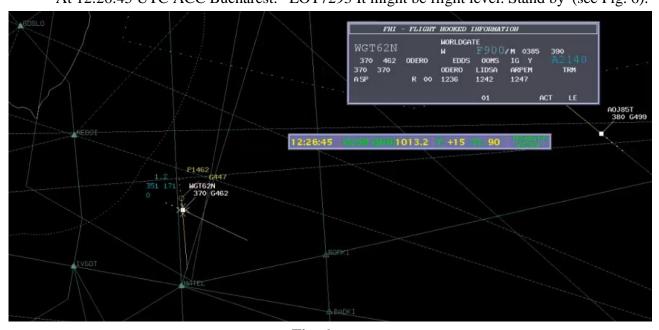At 12:26:45 UTC ACC Bucharest: "LOT7293 It might be flight level. Stand by"(see Fig. 6).

Fig. 6

At 12:27:10 UTC ACC Bucharest: "Excuse me. So did he to the call sign?"

At 12:27:12 UTC ACC Sofia: "Hold on Yes this is the traffic."

The radar identification of LOT7293 aircraft conducted by the EXE ATC of Sofia Control FS Varna West outside its controlled airspace.

At 12:25:29 UTC, the flight crew of LOT 7293 establishes initial contact with the EXE ATC of FS Varna West: "Dobar den Sofia Radar LOT 7293 maintaining level 370 to MATEL."

At 12:25:41 UTC the EXE ATC: "Station calling, say again call sign and position."

At 12:25:44 UTC LOT 7293: "LOT 7293 passing DINRO to MATEL point maintaining FL 370 squawk 6156." At this moment the aircraft is located 22 NM after DINRO point.

At 12:26:00 UTC the EXE ATC: "LOT Squawk IDENT."

At 12:26:00 UTC the EXE ATC: "LOT say again flight number."

At 12:26:55 UTC LOT 7293: "LOT 7293."

At 12:26:58 UTC the EXE ATC: "LOT 7293 report level."

At 12:27:03 UTC LOT 7293: "Level 370 LOT 7293."

At 12:27:12 UTC the EXE ATC: "LOT 7293 report exact position."

At 12:27:18 UTC LOT 7293: "Five miles before MATEL FL 370 with squawk 6156."

At 12:27:42 UTC the EXE ATC: "LOT7293 you have some problem with transponder. I don't observe your A and C Mode."

At 12:27:54 UTC LOT 7293: "We check now LOT 7293 over MATEL."

At 12:27:58 UTC the EXE ATC: "LOT 7293 I observe you identifying radar contact."

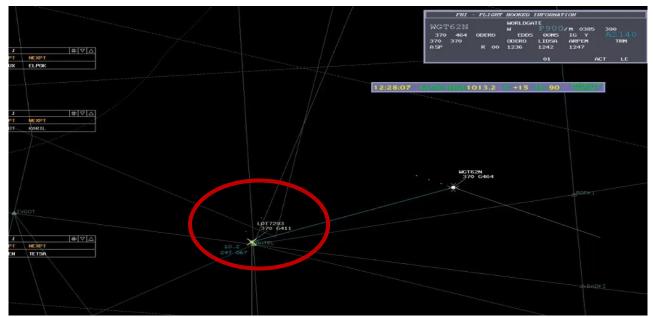At 12:28:10 UTC LOT 7293: "Thank you very much sir LOT 7293" (see Fig. 7).

Fig. 7

At 12:29:27 UTC the EXE ATC: "LOT 7293 change frequency 132.250 next sector."

At 12:29:27 UTC LOT 7293: "132.250 thank you bye, bye LOT7293."

2.1.3. Location of the aviation occurrence

The occurrence is realized during a flight of an aircraft, registration marks SP-LDK, on the route of Warsaw – Istanbul. It started in the controlled air space of the Republic of Romania, after switching of the aircraft's transponder into STANDBY Mode in the area of BCU point, and ended in the controlled air space of the Republic of Bulgaria, after identification of the aircraft as LOT7293 in the region of MATEL point.

Date and time: June 30th, 2015, from 11:56:19 till 12:27:58 UTC.

Air space classification: Class C.

2.2. Injuries to persons

As a result of the aviation occurrence there are no injuries caused to the crew members, the passengers or any other persons.

2.3. Damages to aircraft

No damages.

2.4. Other damages
No other damages.

2.5. Personnel information
Crew LOT 7293
1. Captain Pilot Flying
Gender: Male
Age: 47 Years
Employment: 18 Years at LOT
Experience: 12 100 FH total   3300 as an EMB Capt.
FCL valid: 31.12.2015
Medical Cert.   16.08.2015
Line check   29.02.2016
Type Rating   31.12.2015
Theoretical   31.12.2015
2. First Officer: PM
Gender: Male
Age: 45 Years
Employment: 14 Month at LOT
Experience   4600 FH total   1026 EMB F/O.
FCL valid: 30.04.2016
Medical Cert.   04.10.2015
Line check   31.05.2016
Type Rating   31.10.2015
Theoretical   30.04.2016

Crew WGT62T
1. Captain Pilot Flying – no available information.
2. First Officer: PM – no available information.

ROMATSA
ATS Unit:
BUCHAREST ACC - BANAP sector:
EXE ATC 1, and PLN ATC 2:
Name:
License type: ACS-RAD/OJTI
License validity: 15.05.2016
Experience: 30.09.1996
Medical validity: 14.03.2016
Work program: work program in shifts 12/24
Qualification: Main Radar Navigator Instructor
EXEATC 2:
Name:
License type: ACS-RAD
License validity: 14.04.2016
Experience: 07.12.2004
Medical validity: 25.03.2016
Work program: work program in shifts 12/24
Qualification: Main Radar Navigator
PLNATC 1:
Name:
License type: ACS-RAD
License validity: 12.10.2015
Experience: 12.06.2002

Medical validity: 07.04.2016
Work program: work program in shifts 12/24
Qualification: Radar Navigator
BUCHAREST ACC - DINSI sector:
EXEATC
Name:
License type: ACS-RAD
License validity: 10.06.2016
Experience: 01.05.1996
Medical validity: 09.12.2015
Work program: work program in shifts 12/24
Qualification: Main Radar Navigator
PLN ATC 1:
Name:
License type: ACS-RAD
License validity: 15.05.2016
Experience: 1993
Medical validity: 08.02.2016
Work program: work program in shifts 12/24
Qualification: Main Radar Navigator Instructor
PLN ATC 2:
Name:
License type: ACS-RAD
License validity: 21.10.2015
Experience: 16.06.2002
Medical validity: 10.11.2015
Work program: work program in shifts 12/24
Qualification: Main Radar Navigator
ATCO SUPERVISOR ACC BUCHAREST:
Name:
License type: ACS-RAD
License validity: 15.04.2016
Experience: 01.03.1986
Medical validity: 09.02.2016
Work program: work program in shifts 12/24
Qualification: Main Radar Navigator Instructor

BULATSA
ATS Unit:
SOFIA ACC FS Varna East Upper
EXEATC:
Gender:	Male
Year of birth:	1985, 30 years of age
ATCL BGR.ATCL	Valid till 12.10.2015
Rating	Permits FS Varna ACS – RAD, valid till 12.10.2015
ENGLISH LEVEL 5	Valid till 22.02.2017
Medical Cert.	Valid till 15.03.2016

PLNATC:
Gender:	Female
Year of birth:	1978, 37 years of age
ATCL-BGR.ATCL	Valid till 18.10.2015
Rating	Permits FS Varna ACS – RAD, valid till 18.10.2015
ENGLISH LEVEL 5	Valid till 16.12.2016
Medical Cert.	Valid till 08.03.2017

SOFIA ACC FS Varna West
EXEATC:
Gender: Male
Year of birth: 1973, 41 years of age
ATCL BGR.ATCL   Valid till 18.06.2016
Rating   Permits FS Varna ACS – RAD, valid till 18.06.2016
ENGLISH LEVEL 5   Valid till 18.12.2015
Medical Cert.   Valid till 08.10.2015

The participants in the occurrence possess the requested qualification and medical capability for the fulfilment of their functions.

2.6. Aircraft information

Due to the fact that the occurrence is connected with the functioning of the transponder system, provided here below is information only about this system.

2.6.1 Information about the XPDR (Transponder) system

Transponders play an important role in tracking an aircraft. They provide a vital link between aircraft and the ATC systems on the ground, as well as ACAS/TCAS in the air. An inoperative transponder, or one providing erroneous information, poses a potential safety risk.

Transponder is an avionic system located on board the aircraft that provides information about the aircraft identification and barometric altitude to the ATCAS on the ground and to TCAS (Traffic Alert and Collision Avoidance System) on other aircraft. It operates with the TCAS to prevent aircraft collisions. The reply from the transponder is also used by radar on the ground to determine the position of the aircraft.

Transponder operations are standardised in ICAO Annex 10 Volume IV. First the ground interrogator (or in the case of TCAS the airborne interrogator) transmits an interrogation sequence on 1030MHz (either continuously to all aircraft in the vicinity for Mode A/C or selectively to a single aircraft for Mode S). Upon receipt, the transponder on-board the aircraft immediately responds on 1090MHz. Once the return signal is received by the ground station, the data is processed and relayed on to the controller's display/used by tools and safety nets.

In accordance with AIRCRAFT MAINTENANCE MANUAL for Embraer 170 - SDS 1972 (34-52-00), on page 1-18 (Rev 24 - Feb 13/15), the transponder operates in the following modes:

Mode	Description
STANDBY	The XPDR system is energized but does not transmit.
ALT-OFF	The XPDR system transmits the reply in Mode A and Mode S, but it does not transmit the altitude data. The TCAS does not operate.
ALT-ON	The XPDR system transmits the reply in Mode A, Mode C and Mode S, and transmits the altitude data. The TCAS does not operate.
TA	The XPDR system transmits the reply in Mode A, Mode C and Mode S, and transmits the altitude data. The TCAS is in the TA (Traffic Advisory) mode.
TA/RA	The XPDR system transmits the reply in Mode A, Mode C and Mode S, and transmits the altitude data. The TCAS is in the TA/RA (Resolution Advisory) mode.

The interrogation "ground-air" for air traffic control is carried out in one of the following modes of the XPDR (Transponder) system:
-        Mode A – elicits replies of the XPDR system for identification and surveillance purposes;
- Mode C - elicits replies of the XPDR system for automatic transmission of barometric altitude and surveillance;
- Combined mode:

a) general call (Mode A/C) - elicits replies for surveillance of the transponders operating in A/C Mode, as the transponders, operating in Mode S, do not reply.

b) general call (Mode A/C/S) – for receiving of reply from transponders operating in A/C Mode, for the purposes of surveillance and identification of transponders operating in Mode S;

- Mode S:

a) "General call Mode S" - elicits replies for surveillance of transponder operating in S Mode;

b) "full-range distribution" – elicits translation to all transponders operating in Mode S, without eliciting replies;

c) "selective distribution" – for surveillance and communication with a selected transponder operating in Mode S, as replies are elicited only from transponders to which the interrogation is communicated.

- Identification mode – elicits a reply for identification of an aircraft, after request from ATCO.

The transponder system of Embraer-170 aircraft is controlled by two MCDUs (Multifunction Control Display Units) located on the Engine Start Panel (see Fig. 8).

Fig. 8

The one MCDU is located on the right side of the Captain Pilot Flying, and the other one is located on the left side of the First Officer, as seen on Fig. 9.

Fig. 9

Where the transponder is in STANDBY Mode, a "STANDBY" inscription is displayed in green on the MCDU (see Fig. 10).

Fig. 10

and a "TCAS OFF" message is displayed on both Primary Flight Displays (see Fig. 11).

Fig. 11

2.6.2 Functioning of the XPDR (Transponder) system of Embraer E170 aircraft upon display of short-term caution message NAVCOM 1 (2) FAIL.

During the occurrence the transponder of Embraer aircraft, registration marks SP-LDK, was provided with software Primus Epic Load, version 21.4.

Upon a momentary failure on the interface of the MRC (Modular Radio Cabinet), with this software version, displayed is a short-term caution message NAVCOM 1 (2) FAIL and the transponder returns to STANDBY Mode. The transponder stops transmitting signals to the ground ATCAS and the TCAS, the aircraft disappears from the screens of the Air Traffic Controllers, the safety system of the ground systems can't be used efficiently by the Air Traffic Controllers, and the TCAS does not function.

The NAVCOM FAIL message results from restarting of the NIM (the Network Interface Module). The NIM is responsible for realization of connection between the ASCB (the Avionics System Data Bus) and the MRC. Switching-off of NIM is the cause for the occurrence of NAVCOM FAIL message on EICAS. This peculiarity of the system is known by Embraer and is reviewed in Technical Newsletter O. B. Nr. 170-008/07 DATE Dec 13, 2007, published by Embraer in December, 2007.

During re-starting of NIM, in the pilot's cabin of the aircraft the following messages are displayed:

- NAVCOM 1 (2) FAIL message is displayed on EICAS for a short time, as well as the relevant warning "MASTER CAUTION";
- on PFD and on the MCDU RADIO site, pertaining to COM, NAV and transponder window, displayed are dashes in the active fields of the preliminary selected frequencies and the squawk.
- After NIM restarting:
- the EICAS message disappears;
- on PFD and on the MCDU RADIO site, the affected COM and NAV frequencies return to their previous settings;
- the previous squawk returns on the transponder and the transponder switches to STANDBY mode;
- TCAS OFF is announced and displayed in the lower left angle of the attitude indicator of each PFD.

The interruption of NIM leads to the relevant failure of NAVCOM. This is included in the NAVCOM 1 (2) FAIL message.

During the momentary switch-off of NIM, the EICAS message is announced for a short period of time. Restarting of NIM lasts for 5 seconds, and the command for the last mode of the transponder in the memory is stored just for 3 seconds and the transponder switches to STANDBY mode, after re-starting of the system.

On December 13th, 2007 Honeywell published Technical Newsletter D200711000032, to inform the operators about the transponder's behaviour associated with re-starting of NIM during flight, the measures to rectify the problem, and the recommendations to the flight crew on corrective measures upon the occurrence of such a situation.

Honeywell render the following recommendations to the flight crew, published in Technical Newsletter O. B. Nr. 170-008/07 DATE Dec 13, 2007 of Embraer:

- If a warning (a light or an audible one) has occurred, even for a moment, and the flight crew is not sure what the warning has exactly been, the status of the TCAS/Transponder system must be checked.

- If the transponder has returned to STANDBY Mode, confirmed by the inscription STANDBY in green colour on MCDU, the flight crew must select again the desired operational mode.

- If both inscriptions STANDBY and TA/RA on MCDU are displayed in white colour, a transponder swap is require before selecting the desired mode.

- In both cases, the flight crew shall check as a must whether the inscription TCAS OFF on PFD disappears or not.

These procedures are not fulfilled by the flight crew of Embraer aircraft, registration marks SP-LDK during the flight.

In January 2010, Embraer have upgraded their software with version 23.1. together with the other modifications. This software version introduces a caution CAS message called XPDR (1/2) IN STBY. The purpose of this message is to warn the flight crew that the transponder is in STANDBY mode during flight (see Appendix Nr. 1).

2.6.3. Airborne Collision Avoidance System – ACAS II

The two aircraft are equipped with ACAS/TCAS system.

ACAS is an automated system for avoidance of dangerous approach and collision of an aircraft in flight with another aircraft. In accordance with Part I, §6.18.2 of Annex 6 to the International Civil Aviation Convention, all aircraft with take-off weight of over 5700 kg shall be equipped with ACAS system of the second generation – ACAS II. In conformity with the ICAO standards, the available software applications for ACAS II (Airborne Collision Avoidance System) are TCAS II (Traffic alert and Collision Avoidance System), version 7.0 and version 7.1.

The automated system of the second generation, designated for the avoidance of dangerous approach or collision of an aircraft in flight with another aircraft, operates on the principle of the secondary radiolocation and uses data from on board transponders. Via a directed antenna, assembled on each aircraft, and data exchange between the transponders of aircraft, ACAS II monitors for the availability of aircraft flying in dangerous proximity and, where requested, the automated system for avoidance of collision on board of the two aircraft performs data exchange and synchronizes rendering of differentiated commands for manoeuvring on the vertical, aimed at avoiding of potential conflicts. No aircraft is detectable not transmitting data in Mode C and Mode S from the transponder.

ACAS II has two Modes of operation - TA (Traffic advisory) and RA (Resolution advisory).

The Traffic advisory Mode is activated in case the system detects an aircraft, which may come into conflict with the relevant aircraft in a short-term plan. After the activation of this Mode, the system displays on board a radar sign in yellow and its spatial location versus the relevant aircraft. The visual indication is accompanies by an audible warning signal for dangerous approach of an aircraft, thought the repetition of the word "Traffic".

Where the aircraft continues its movement following a conflicting trajectory or, in violation of the specified norms on normal separation, enters in a predetermined radio area

around the conflicting traffic, the system reports the dynamic parameters of the flight of the aircraft under surveillance and analyses the data received from the estimated data exchange with the opposite on board transponder. Where the analysis shows that the two aircraft move on conflicting routes, the norms on minimum separation being violated, and there is a real danger for direct collision, the system generates a command for fulfilment of vertical manoeuvring on the part of the flight crew, aimed at solving the exiting conflict and avoidance of collision with the aircraft under surveillance. The flight crew of the aircraft, found under surveillance by ACAS II, also receives a command for fulfilment of vertical manoeuvre. The two commands have differentiated instructions, as the ACAS system harmonizes the generated and rendered commands between the two aircraft, to ensure the performance of opposite manoeuvres. After switching of the system to RA Mode, the flight crews of the two aircraft receive commands for the fulfilment of a vertical manoeuvre, respectively CLIMB for the one aircraft and DESCEND for the other aircraft, or vice versa.

In case of an activated RA Mode and timely performance of the rendered commands on the part of the flight crews of the two aircraft, after solving of the conflict and avoiding of the collision, on board of the two aircraft the system announces conflict free overcoming of the dangerous approach through an audible message "Clear of traffic".

2.7. Meteorological information
The meteorological conditions at the time of the aviation occurrence have no effect for the realization of the serious incident.

2.8. Navigation
The two aircraft fulfilled the flights with standard navigation equipment for the aircraft type.

The flights of the two aircraft were carried out in the upper air space of Bulgaria, under the conditions of zonal navigation and in conformity with the Instrument Flight Rules. There is no information about technical failures of the navigation system of the Bulgarian Air Traffic Services Authority (BULATSA) which could be able to cause the occurrence .All facilities, included in the national net, have operated normally.

2.9. Communications
The two aircraft fulfilled the flights with standard communication equipment for the aircraft's type.

The bilateral radio connection at FS Varna East Upper is carried out at the frequency of 132,250 MHz. The bilateral radio connection at FS Varna West is carried out at the frequency of 134,7 MHz. The Bulgarian Air Traffic Services Authority have submitted a record from the radio-conversations of Sofia Control, FS Varna, frequencies 132,250 MHz, 134,7 MHz, as well as a telephone communication between the PLN ATC and neighbouring air traffic service sectors before, during and after the time of the aviation event. After having heard the radio conversations at the work frequency of FS Varna East Upper and Varna West, the Investigation Commission found there had been no loss of radio connection.

There had been no interruptions or disturbances during the radio exchange with no one aircraft in the sector. There is no information about technical failures of the communication system of the Bulgarian Air Traffic Services Authority (BULATSA) which could be able to cause the occurrence .All facilities, included in the national net, have operated normally.

2.10. Aerodrome information
The event is not realized at an aerodrome.

2.11. Flight data recorders
- Data is used from the flight recorders at the Common National Air Traffic Control Center (CNATCC) of the Bulgarian Air Traffic Services Authority (BULATSA) for radar picture and radio communications, as well as records from telephone connection of the Planning Air Traffic Controller with the other sectors.

- The data from FDR of Embraer 170 aircraft, registration marks SP-LDK, show that at 11:56:19 UTC the TCAS mode switched from TA/RA to OTHER. This is an indication that TCAS had not provided surveillance and control in the surrounding air space. From the data received from the CMC (Central Maintenance Computer) on Embraer aircraft, at 11:56:20 UTC there was a momentary failure in the MRC (Modular Radio Cabinet) interface, leading to the display of a short-term caution message NAVCOM 1 (2) FAIL which remained active for 6 seconds. The NAVCOM FAIL message resulted from the re-starting of the NIM (Network Interface Module). Switching-off of the NIM is the cause for the occurrence of NAVCOM FAIL message on EICAS and switching of the transponder to STANDBY mode during flight (see Appendix Nr. 2)

2.12 Wreckage and impact information
The event is not connected with wreckage and destroying of aircraft.

2.13. Medical and pathological information
Because of the nature of the aviation event, no medical or pathological studies were performed.

2.14. Fire
No fire has occurred at the time of realization of the event.

2.15. Survival aspects
The usage of emergency and rescue means was not necessitated.

2.16. Tests and research
For the purposes of investigation in connection with safety, the Investigation Commission performed:
- collection, documentation, investigation, hearing and analysis of the records from the radar picture, the radio communications, the telephone connection between the work position of Sofia Control – FS Varna East Upper and the neighbouring air traffic service sectors;
- has heard, documented and analysed the records of the communications between FS Varna East Upper from ACC Sofia and DINSI sector from ACC Bucharest.
- has held discussions with the EXE ATC, the PLN ATC, the Air Traffic Controller – Supervisor performing air traffic control during the realization of the serious incident;
- reviewed and evaluated the LETTER OF AGREEMENT between Bulgarian Civil Aviation Administration (BULATSA SOFIA ACC) and Romanian Civil Aeronautical Authority (ROMATSA BUCUREŞTI ACC/CONSTANŢA APP.
- performed analysis of the actions of the ATCO from ACC Sofia and ACC Bucharest;
- performed analysis of the actions of the flight crews of the two aircraft during the aviation event;
- a test flight with Embraer 195 of Bulgaria Air AO was carried out.
The Investigation Commission has also taken into consideration, having discussed and analysed facts from:
- SUBSEQUENT INTERNAL INVESTIGATION REPORT OF THE SAFETY OCCURRENCE FROM 30.06.2015 BY DISAPPEARENCE OF SECONDARY TARGET LOT7293 IN BANAP SECTOR – ACC BUCHAREST;
- Report of the flight crew of LOT7293;
- Information from a flight recorder of Embraer 170, performing flight with flight nr. LOT7293, registration marks SP-LDK of „LOT", submitted by the State Commission for investigation of aviation events of Poland;
- Information from decoded data from the CMC (Central Maintenance Computer) of Embraer aircraft, registration marks SP-LDK.

2.17. Information on the organization and management

For the safe and expedient performance of flights and in conformity with the requirements of Annex 11 to the International Civil Aviation Convention and Doc 4444 (PANS-ATM), between BULATSA SOFIA ACC and ROMATSA BUCUREŞTI ACC/CONSTANŢA APP a LETTER OF AGREEMENT is signed, entering into power as of 02.05.2013. The purpose of the document is to determine the procedures on coordination and transfer of control on aircraft, to be applied between Sofia ACC and Bucharest ACC/ Constanta ACC upon the provision of air traffic service for GAT (General Air Traffic).

2.18. Additional information
2.18.1. Division of the air space into Family Sectors Varna at the time of the incident
Bucharest Control – BANAP sector;
Bucharest Control – DINSI sector;
Sofia Control – FS Varna West from FL95 to FL660;
Sofia Control – FS Varna East Lower from FL95 to FL355;
Sofia Control – FS Varna East Upper from FL360 to FL660;
The division of the air space into sectors is exhibited on Fig. 12.

Fig. 12

2.18.2. Activated warning systems and warning procedure
There are no activated warnings from the ground and on board of the aircraft:
-MTCD (Medium Term Conflict Detection)
-STCA at the work position of the Air Traffic Controller.

-ACAS on board of Embraer 170 aircraft, registration marks SP-LDK and on board of Falcon 900 aircraft, registration marks VP-CGD.

2.18.3. Applied special procedures

There is no special procedure activated for the fulfilment of a task of "Air policing" for the flight of LOT7293.

2.18.4. Radar identification

ICAO Doc 4444, PANS-ATM, section

8.6.2 Identification of aircraft

8.6.2.1 ESTABLISHMENT OF IDENTIFICATION

8.6.2.1.1 Before providing an ATS surveillance service to an aircraft, identification shall be established and the pilot informed. Thereafter, identification shall be maintained until termination of the ATS surveillance service.

8.6.2.1.2 If identification is subsequently lost, the pilot shall be informed accordingly and, when applicable, appropriate instructions issued.

8.6.2.1.3 Identification shall be established by at least one of the methods specified in 8.6.2.2, 8.6.2.3, 8.6.2.4 and 8.6.2.5.

The Investigation Commission requested by e-mail from "LOT" AO to submit an Aircraft Operating Manual (OM). Because of the non-provision of OM by "LOT" AO, the Investigation Commission was unable to establish whether the flight crew of LOT7293 had acted in conformity with the provisions of AO's OM upon loss of radio communication and failure of the transponder system.

3. Analysis

Following hypotheses were addressed for establishing the causes of the serious incident:
- A probable failure of ATCAS;
- A probable failure of any one of the A/C systems on board;
- Non-fulfilment of procedures by the flight crew;
- Interruption of the Air Traffic Service.

The first hypothesis is related to failure of ATCAS. Based on the information submitted to the IC, it was concluded that the ATCAS had operated without any failures. In view of the content of par. 2.1.2, par. 2.8 and par. 2.18 above, IC rejects the possibility that the event realized resulted from a failure or malfunctioning of the ATCAS.

Under the second hypothesis, in the course of investigation the IC discovered information for malfunctioning of the XPDR/Transponder system of the Embraer 170 aircraft, registration marks SP-LDK. The contents of par. 2.6.2 shows that upon a momentary failure the transponder system on board triggers from working to STANDBY mode and that the working mode must be recovered by the flight crew following certain procedures.

The IC associates the third hypothesis with non-fulfilled procedures by the flight crew upon a momentary failure in the operation of the XPDR/Transponder system of Embraer 170 aircraft, which are recommended by the manufacturer by virtue of Technical Newsletter O. B. Nr. 170-008/07, dated Dec. 13, 2007.

According to the explanations of the flight crew of LOT7293 with Embraer 170, the flight progressed normally until the aircraft entered the air space of Romania, where it was identified and radio communication with ACC Bucharest was established. Few minutes after flying over BUKOV point the EICAS (Engine Instrument & Crew Alerting System) displayed a NAVCOM 1 FAIL message, which disappeared one or two seconds after. The presence of the message on the EICAS display was short and the crew did not realise that the transponder had switched automatically to STANDBY mode. After the establishment of radio communication with ACC Sofia, the crew was informed on the absence of any indication from the transponder. That was the moment when the crew noticed the issue related to the transponder, after which its normal operation was recovered and the flight continued without further peculiarities.

In accordance with the findings given in regards to the third hypothesis and in par. 2.6.2, the conclusion may be drawn that the crew did not establish the transponder's failure, did not report about it to the air traffic service authorities and did not fulfil the procedures required by the manufacturer through its Technical Newsletter O. B. Nr. 170-008/07 from Dec 13, 2007.

The fourth hypothesis is associated with the Air Traffic Service interruption after a failure of the transponder. In accordance with the flight plan, LOT7293 entered the Republic of Romania air space at BUKOV point. The EXE ATC of BANAP sector at ACC Bucharest recognised LOT7293 and informed it about the provision of radar service. At 10 nm, westward from TCP BCU the transponder of LOT7293 stopped transmitting data in Mode A/C. The EXE ATC did not establish the loss of radar acquaintance and did not instruct respectively the crew of LOT7293 of its recover. Moreover, the EXE ATC did not inform the neighbouring sectors about the disappearance of the secondary target of LOT7293 from the radar screens. The EXE ATC did not check the information on the flight trajectory and respectively the flight plan of the missing secondary target LOT7293 in the CSL. The EXE ATC and the PLN ATC did not use the information provided by the Romanian air force and NATO07 aircraft about a primary target flying without operating transponder. The EXE ATC did not check the frequency of the radio communication, on which the last should be transferred to, as well as the sector for controlling the LOT7293 after flying over the DINRO point towards FS Varna East-Upper after the flight crew reported of flying over the DINRO point. The transfer of the radio communication was performed incorrectly by the EXE ATC to sector Sofia Control – FS Varna West instead of FS Varna East-Upper and at a distance of 25-30 nm after DINRO point.

DINSI sector of ACC Bucharest were not informed that LOT7293 continues its flight in their area of responsibility and they did not have information about this aircraft. After receiving information from NATO 07, they did not try to establish radio communication with the flight crew on the emergency frequency. The PLN ATC did not provide timely the information received on the FL and the flight direction of the unknown aircraft to the boarder sector Sofia Control – FS Varna East.

LOT7293 entered the air space of ACC Sofia without operating transponder (without any information from Mode A/C) and without bilateral radio communication connection. The EXE ATC reacted timely requesting information about an unknown traffic with unidentified FL and started transmitting this traffic information to the aircrafts under his control. The flight crew of WGT62N was performing its flight at FL370 according to the flight plan and was following the instructions of the EXE ATC from FS Varna East-Upper. The EXE ATC warned the crew of WGT62N about the unidentified crossing traffic without radio communication and at an unknown FL. The crew of WGT62N informed the EXE ATC that TCAS did not depict any conflicting traffic, but the crew observed an aircraft flying above them at FL400 and did not ask for a change of the heading. In respond to the request of DINSI sector, PLN ATC of FS Varna East-Upper informed that he was asking for information about the unknown aircraft and its FL as well. The PLN ATC informed the Air Traffic Controller-Supervisor about the unknown aircraft who informed the Center for Coordination Use of Airspace (CCUA). Meanwhile the PLN ATC called the BUAF and communicated the same information. The EXE ATC considers the unknown aircraft to be "a Russian military aircraft" and because of the more frequent cases of such flights registered recently in the controlled air space of Sofia Control FS Varna he did not instruct the flight crew of WGT62N to change the heading after receiving information of the higher FL of the unknown aircraft.

At FS Varna East Lower, an OLDI ACT message was received about the flight of LOT 7293 at FL350. The unidentified aircraft realized radio communication with the EXE ATC of FS Varna West, who did not observe it in the controlled air space of the sector and requested additional information from the flight crew on their location, FL and squawk of the transponder. After reporting the requested information and switching to "Identification" mode, the EXE ATC established the supposed location of the aircraft and informed it about the non-operating transponder. Later the EXE ATC gave instruction for switching over of the transponder. In the region of MATEL point, the transponder of the unknown aircraft started operating, as information of Mode A appeared first and after that of Mode C. The EXE ATC identified the aircraft as LOT7293 and transferred the control and radio communication to FS Varna East Upper.

In accordance with the stated regarding the fourth hypothesis the realization of the serious incident is relevant to an unintentional interruption of air traffic service, as a result of which procedures on coordination and transfer of control over aircraft, applicable between ACC Sofia and ACC Bucharest/APP Constanta while providing air traffic servicing to GAT were not fulfilled.

Given the foregoing, it can be concluded that the serious incident was realized in result of:

1. An unintentional interruption of the Air Traffic Service to LOT7293 provided by ACC Bucharest after a change of the aircraft transponder mode of operation to STANDBY. In result, the aircraft entered the air space of the Republic of Bulgaria without operating transponder system (without transmitting information from Mode A/C), flying without two way radio communication, without transferred control over the aircraft when flying over DINRO point in accordance with the LETTER OF AGREEMENT between ACC Sofia and ACC Bucharest and later on – with transferred radio communication to "a wrong frequency".

2. Not implemented procedures by the flight crew of Embraer 170, registration marks SP-LDK, after a momentary failure of the Transponder System.

4. Conclusion
4.1   Findings
4.1.1.   Findings regarding the aircraft and its systems

-        The Embraer 170 aircraft, registration marks SP-LDK, was airworthy at the time of realization of the aviation occurrence.

-        In accordance with the FDR records and the data received from the Embraer CMC, at 11:56:20 UTC on 30 June 2015, a momentary failure of the XPDR/Transponder system was registered on Embraer 170 aircraft, registration marks SP-LDK.

-        In result from the momentary failure, the transponder switched to STANDBY mode during the flight.

-        The Embraer 170 aircraft, registration marks SP-LDK, was not equipped with the newer avionics software Primus Epic Load, version 23.1., in which it was introduced a caution CAS message „XPDR (1/2) IN STBY" that is displayed when the transponder switches to STANDBY mode during flight.

4.1.2. Findings regarding the flight crew

-        The flight crew of Embraer 170 aircraft, registration marks SP-LDK, the Captain, Pilot Flying, and the First Officer are licensed and possess the qualifications requested for performing of flights in conformity with the applicable regulations.

-        The flight crew of Embraer 170 aircraft, registration marks SP-LDK, held valid medical certificates at the time of the aviation occurrence realization.

-        The flight crew of LOT7293 did not establish the fact of switching the transponder to another mode of operation, due to the short visualisation time of notification on the EICAS display.

-        The flight crew of LOT7293 did not undertake any measures to resume the XPDR/Transponder system's normal operation in conformity with O. B. № 170-008/07 of Embraer during the flight.

-         The flight crew did not notice the current STANDBY mode of the transponder indication, as well as the inscription TCAS OFF on PFD and did not report about the improper operation of the XPDR/Transponder system to the Air Traffic Service authorities till ACC Sofia Control FS Varna West informed them about the non-operating transponder.

-        The report for overflying DINRO point from the flight crew of LOT7293 to Bucharest Control was late – 3 minutes after flying over DINRO point.

-        The WGT62N flight crew report on the estimated height of the unknown aircraft in relation to their own FL was not correct.

4.1.3. Findings regarding the airworthiness of the aircraft

-        The flight of Embraer 170 aircraft, registration marks SP-LDK, was in conformity with the flight plan from Warsaw to Istanbul - LOT7293.

- The flight of Falcon 900 aircraft, registration marks VP-CGD, was in conformity with the flight plan from Stuttgart to Muscat - WGT62N
- The aviation occurrence started in the controlled air space of the Republic of Romania, after switching of the aircraft's transponder to STANDBY mode near BCU point, and ended in the controlled air space of the Republic of Bulgaria, after identification of the aircraft as LOT7293, near MATEL point.
- The meteorological conditions at the time of realization of the aviation occurrence did not affect the serious incident.
- As a result from the momentary failure of the XPDR/Transponder system, Embraer 170 aircraft, registration marks SP-LDK, performed the flight without operating transponder in the controlled air space of the Republic of Romania for 26 min 28 s and in the controlled air space of the Republic of Bulgaria for 5 min 10 s.
- For a period of 31 min 38 s there was not positive radar identification for LOT 7293 initially from Bucharest Control and later on from Sofia Control.
- Before passing each other, the ACAS/TCAS Airborne Collision Avoidance System on board on the two aircrafts did not issue any TA/RA about the risk of conflict due to the current STANDBY mode of the Embraer 170 aircraft transponder.

4.1.4. Findings regarding the Aircraft Operator
- On December 13th, 2007 Honeywell published the Technical Newsletter D200711000032, informing the AOs on the behaviour of the transponder associated with re-starting of NIM during flight time, the measures for rectification of the problem and the procedures prescribed to the flight crew for corrective actions in such a situation.
- The IC did not succeed to establish whether the LOT7293 flight crew had acted in conformity with the procedures, specified in the Aircraft Operating Manual upon the loss of radio communication and failure of the transponder, due to lack of a copy of such a manual, which had not been provided to the moment despite requested.

4.1.5. Findings regarding Air Traffic Service
- The ATCOs of ROMATSA and BULATSA that fulfilled official obligations during the serious incident were licensed and they had the requested qualification and medical capability.
- The EXE ATC and the PLN ATC of ACC Bucharest, BANAP sector, did not detect the loss of the radar track of LOT7293 and they did not inform the flight crew of LOT7293 on stopping of the their transponder broadcast in Mode A/C, as well as on the loss of radar identification.
- The SELEX ATCAS in ACC Bucharest warned the EXE ATC and the PLN ATC from BANAP sector about LOT7293 aircraft with a lost radar track, as in the CLS (COAST LIST) window at the work positions there appeared flashing tag of LOT7293 with its call sign and SSR code.
- The BANAP sector EXE ATC at ACC Bucharest deleted LOT7293 (aircraft with a lost radar track) from the window of CLS without a reason, and the staff did not try to establish radio communication with the flight crew on the frequency based on their wrong unsupported concept on the location of LOT7293 aircraft, having not any facts in support thereof.
- The BANAP sector EXE ATC and PLN ATC at ACC Bucharest did not inform the ATCO-S and the next sector (DINSI) on the disappearance of the secondary target LOT7293. The ATCOs of DINSI sector were not familiar with the fact that LOT7293 had continued to fly in their airspace.
- The Investigation Commission did not succeed to establish what information had been provided to the new PLN ATC after changing of their shifts in BANAP sector, which had not been provided to the moment despite requested.
- The ATCO-S, the EXE ATC and the PLN ATC at ACC Bucharest did not use the information provided by the Romanian Air Forces and NATO07 for clarification of the actual situation with the unidentified aircraft and LOT7293 – they did not discover the connection between the unknown aircraft and LOT7293.

- Late transfer of radio communication of LOT7293 from ACC Bucharest to ACC Sofia at position 25-30 NM after DINRO point towards MATEL.
- Incorrect transfer of radio communication of LOT7293 by the EXE ATC from BANAP sector to frequency 134.7 MHz, which is the frequency of the Sofia Control Varna-West sector instead to the frequency of the Varna East-Upper sector.
- The ACC Bucharest did not perform transfer of control and radio communication to ACC Sofia in conformity with the LETTER OF AGREEMENT between BULATSA SOFIA ACC and ROMATSA BUCUREŞTI ACC/CONSTANŢA APP.
- The ACC Bucharest provided incorrect information via an „OLDI" message regarding FL350 for LOT7293, which went to Varna East Lower sector instead of the actual FL370 to Varna East Upper sector.
- The ACC Bucharest did not inform ACC Sofia about the aircraft flying with non-operating transponder contrary to the provisions in the LETTER OF AGREEMENT.
- The ACC Bucharest requested information on the flight level and direction of the unknown aircraft from ACC Sofia after it had already entered the controlled air space of Sofia Control and did not provide timely such an information before entering despite of already received data about it from NATO07.
- The ACC Bucharest had speculatively informed about the supposed FL370 the PLN ATC of FS Varna East-Upper of the unknown traffic and requested standby for confirmation 20 seconds before LOT7293 aircraft and WGT62N aircraft passed each other.
- The Investigation Commission did not succeed to establish the way the information on the location and FL of LOT7293 received from the flight crew after flying over DINRO point was distributed by the ATCOs in BANAP sector to the ATCOs in DINSI sector, and to the ATCO-S.
- The Investigation Commission does not have complete information about how the safety of the flight of LOT7293 was ensured in BANAP and in DINSI sectors after switching over of its transponder in STANDBY mode.
- The Investigation Commission did not succeed on the basis of provided information to establish why LOT7293 aircraft was transferred to the frequency of Sofia Control – FS Varna West, what actions were performed by the EXE ATC and the PLN ATC from BANAP sector at ACC Bucharest for the period of 1 min 5 s after the report of the flight crew for flying over DINRO point at FL370, and the causes for the non-performance of clarification of the necessary frequency by means of the information on „NDIS" display and/or though coordination with the neighbouring DINSI sector.
- The EXE ATC of Sofia Control FS Varna East Upper correctly informed the crews of other aircrafts with potentially conflicting trajectories of the unidentified aircraft and requested information of a possible visual contact with it.
- The EXE ATC from Sofia Control FS Varna East Upper considered the unidentified aircraft to be "a Russian military aircraft" because of the recently more frequent cases with such flights at the controlled air space of Sofa Control FS Varna and for this reason he did not render an instruction to WGT62N for changing of the heading.
- The flight crew of WGT62N, upon request from Sofia Control FS Varna East Upper and after a visual contact established before passing each other, informed they suppose that the unidentified aircraft flied at FL400 at a height greater than theirs fly, and confirmed FL400 for the second time. Later on and after passing each other, WGT62N informed that the aircraft was above them but was not at FL400.
- The EXE ATC of Sofia Control – FS Varna East-Upper correctly did not permit touching of the ends of the tick symbols of the unidentified aircraft with these of the other aircraft under his control in radar screen.
- The subsystem "Safety Nets" of the SELEX ATCAS did not discover any conflict and did not generate an alarm at the work positions of the Air Traffic Controllers from Sofia Control – FS Varna East about an unidentified aircraft and WGT62N because of lack of information from the transponder in Mode C of Embraer 170 aircraft, registration marks SP-LDK, and current flight information.

- The EXE ATC of Sofia Control – FS Varna West correctly requested information necessary for radar identification of the unknown aircraft, which had been incorrectly transferred to him by ACC Bucharest and was with a not functioning transponder without being informed thereof.
- The EXE ATC of Sofia Control – FS Varna West correctly transferred LOT7293 to be under the control of the EXE ATC of Sofia Control – FS Varna East Upper.

4.2 Causes

On the basis of the performed analysis the Commission finds out that the serious incident results from the following main cause and several accompanying causes.

4.2.1 Main cause

Unintentional interruption of the Air Traffic Service in regard to LOT7293 on the side of ACC Bucharest after changing of the aircraft transponder mode of operation to STANDBY, particularly in Bucharest Control BANAP sector, during the its flight in Bucharest FIR and later on in Sofia FIR.

4.2.2 Accompanying causes:

4.2.2.1 Not implemented procedures by the flight crew of Embraer 170, registration marks SP-LDK, after the momentary failure of the transponder system.

4.2.2.2 Not provided information in timely manner on the location, direction of flight and height of the unidentified aircraft by ACC Bucharest to ACC Sofia, previously received from NATO07.

4.2.2.3 Not implemented procedures by ACC Bucharest from the LETTER OF AGREEMENT between BULATSA SOFIA ACC and ROMATSA BUCUREŞTI ACC/CONSTANŢA APP.
- E.1 Transfer of Control
- E.2 Transfer of Communications;
- F.2.5 Transfer of Aircraft Identification.

5. Safety recommendations

Taking in consideration the causes for the realized serious incident and the deficiencies detected upon the investigation, the Commission recommends hereby the fulfilment of the following safety measures.

BG.SIA-2015/03/01. ROMATSA shall perform theoretical and practical training, as well as examination of ATCOs regarding actions for the provision of appropriate actions in cases of special/ emergency situations, including transponder failure during flight in ACC Bucharest.

BG.SIA-2015/03/02. ROMATSA shall perform training of ATCOs acquainting them with the requirements and provisions of the LETTER OF AGREEEMENT on collaboration between BULATSA SOFIA ACC and ROMATSA BUCUREŞTI ACC.

BG.SIA-2015/03/03. ROMATSA shall perform checking of the competence of these ATCOs at the work position of Bucharest Control who performed their official obligations during the aviation occurrence.

BG.SIA-2015/03/04. ROMATSA shall perform training of ATCOs on ODS Sub-system of the SELEX ATCAS on the work with Coast List Table (CLS) – list for de-correlated aircrafts and Sector List (SCL) – sector list upon the provision of Air Traffic Service.

BG.SIA-2015/03/05 ROMATSA shall assess the possibility and request from the ATCAS manufacturer, that upon the loss of radar information the system shall depict statically the last position of the aircraft in an appropriate colour.

BG.SIA-2015/03/06. "LOT" AO shall perform in the shortest time simulator training for actions on detection, reporting and rectification of failure of the XPDR/Transponder system to be performed by the flight crews operating Embraer 170/175/190/195 aircraft.

BG.SIA-2015/03/07. EASA to request that the AOs operating Embraer 170/175/190/195 aircraft upgrade the Primus Epic Load software with a version that can display caution CAS message XPDR (1/2) IN STBY.

BG.SIA-2015/03/08. BULATSA and ROMATSA shall supplement the LETTER OF AGREEEMENT for collaboration between BULATSA SOFIA ACC and ROMATSA BUCUREŞTI ACC as to include the necessary obligations on the timely notification under the conditions of "RENEGADE" and/or flight of an identified aircraft.

BG.SIA-2015/03/09. BULATSA and the Bulgarian Air Forces shall enhance the efficiency of the coordination between the civil Air Traffic Service authorities and the military authorities.

Appendices 1 and 2 constitute an inseparable part of the present Report.

The Investigation Commission reminds hereby to all organizations, to which safety measures have been communicated, that on the grounds of Art. 18 of Regulation 996/2010 on the investigation and prevention of accidents and incidents in civil aviation, and Art. 19, par. 7 of Ordinance Nr. 13 on the investigation of aviation events they are obliged to notify in writing the Aircraft, Maritime and Railway Accident Investigation Unit Directorate at with the Ministry of Transport, Information Technology and Communications on the status of safety measures.

Chairman of the Commission:

Hristo Hristov

Members:

Stephan Petrov

Valeri Karaliyski

Appendix 1

I - DOCUMENT EFFECTIVITY: **ALL EMBRAER 170/175/190/195 AIRPLANES**

This bulletin is issued by Embraer Flight Operations Support, as the need arises to quickly transmit technical and operational information. It is distributed to EMBRAER 170/175/190/195 operators and to any personnel who need early advice of this information.

The matter published in this bulletin may not be approved by airworthiness authorities at the time of issuance. In the event of a conflict with the approved publications (AFM, WB, MMEL, or CDL) the approved information shall prevail.

II - SUBJECT: Honeywell TNL D200711000032 - Momentary NAVCOM 1(2) FAIL caution message with Transponder reversion to STANDBY mode.

III - REASON: To emphasize system behavior during an NIM reset event, which provides a NAVCOM 1(2) FAIL message for a few seconds followed by recovery with the Transponder reverting to the STANDBY mode.

IV - BACKGROUND INFORMATION:

Honeywell Technical Newsletter TNL D200711000032 informed Operators of transponder behavior associated with NIM (Network Interface Module) resets during airplane operations.

During NIM reset, the following cues are presented in the cockpit:

- The NAVCOM 1(2) FAIL message is displayed on the EICAS for a short period of time and the Master CAUTION sounds accordingly;

- On the PFD boxes and on the MCDU RADIO page the affected COM, NAV, and transponder windows show dashes in the active and pre-select frequencies and squawking code fields.

After the NIM resets:

- The EICAS message disappears;

- The affected COM and the NAV frequencies on the PFD and on the MCDU RADIO page return to the previous setting;

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- The transponder returns with the previous squawk but in the STANDBY mode; and

- TCAS OFF annunciation is presented on the lower left corner of each PFD attitude indicator.

As informed by Honeywell in TNL D200711000032, Honeywell is currently working on a system change and will advise Operators by revising such TNL.

V - OPERATING INFORMATION:

The NIM is responsible for linking the ASCB with the MRC (Modular Radios Cabinet).

An NIM disconnection will cause the related NAVCOM failure. This triggers the NAVCOM 1 (2) FAIL message.

During a momentary NIM disconnection, the EICAS message is posted for a short period of time. As NIM resetting takes 5 seconds and the transponder last mode command memory is only stored for 3 seconds, the transponder switches to the default mode, which is STANDBY, after system reset.

The condition described in Honeywell TNL D200711000032 does not require a modification to the current NAVCOM 1 (2) FAIL procedure, as the latter directs the crew to select and use the remaining set of NAVCOM devices (VHF, VOR, DME and Transponder) when a NAVCOM 1(2) FAIL message is displayed (which leads the crew to select the intended transponder mode when switching from the previously active transponder to the other one).

If a caution light/message/aural is momentarily displayed, even if the flight crew is not sure of which message was displayed, the flight crew should verify the status of the TCAS/transponder system. If a transponder reversion to STANDBY mode is confirmed and the STANDBY label on the MCDU is displayed in green, the desired mode must be selected. If both the STANDBY and the TA/RA labels on the MCDU are displayed in white, a transponder swap is required before selecting the desired mode. In either case, the crew must check that the PFD TCAS OFF annunciation disappears.

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CREW INDICATIONS

The MCDU Radio page annunciates that the transponder system is in STANDBY mode at the left bottom of Radio Page 1/2.

On the PFD the TCAS OFF annunciation is displayed promptly every time the TCAS is set to off.

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VI - TECHNICAL PUBLICATION INFORMATION:

None.

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Appendix 2

FDE Key	Maint Msg WA	Maint Msg Key	State	Date/Time	Absolute Flight Leg	Flight Phase Number	Flight Phase Name	FDE Name	FDE Severity	Maint Msg Name	Maint Msg Code	Maint Msg Type
1000	12	0	0	INACTIVE	06.30.2015 09:56:40	17	2	PREFLIGHT	IRS ALIGNING	ADVISORY			
1000	553	0	0	INACTIVE	06.30.2015 10:12:01	17	2	PREFLIGHT	EMER LT NOT ARMED	CAUTION			
1000	104	0	0	ACTIVE	06.30.2015 10:12:05	17	2	PREFLIGHT	ENG 1 FIRE	WARNING			
1000	105	0	0	ACTIVE	06.30.2015 10:12:05	17	2	PREFLIGHT	ENG 2 FIRE	WARNING			
1000	106	0	0	ACTIVE	06.30.2015 10:12:05	17	2	PREFLIGHT	APU FIRE	WARNING			
1000	107	0	0	ACTIVE	06.30.2015 10:12:05	17	2	PREFLIGHT	CRG FWD SMOKE	WARNING			
1000	108	0	0	ACTIVE	06.30.2015 10:12:05	17	2	PREFLIGHT	CRG AFT SMOKE	WARNING			
1000	104	0	0	INACTIVE	06.30.2015 10:12:08	17	2	PREFLIGHT	ENG 1 FIRE	WARNING			
1000	105	0	0	INACTIVE	06.30.2015 10:12:08	17	2	PREFLIGHT	ENG 2 FIRE	WARNING			
1000	106	0	0	INACTIVE	06.30.2015 10:12:08	17	2	PREFLIGHT	APU FIRE	WARNING			
1000	107	0	0	INACTIVE	06.30.2015 10:12:11	17	2	PREFLIGHT	CRG FWD SMOKE	WARNING			
1000	108	0	0	INACTIVE	06.30.2015 10:12:11	17	2	PREFLIGHT	CRG AFT SMOKE	WARNING			
1000	218	0	0	INHIBITED	06.30.2015 10:13:09	17	2	PREFLIGHT	BLEED APU VLV OPEN	STATUS			
1000	218	0	0	ACTIVE	06.30.2015 10:13:11	17	2	PREFLIGHT	BLEED APU VLV OPEN	STATUS			
1000	386	0	0	INHIBITED	06.30.2015 10:24:48	17	2	PREFLIGHT	FUEL XFEED SOV OPEN	STATUS			
1000	386	0	0	ACTIVE	06.30.2015 10:24:50	17	2	PREFLIGHT	FUEL XFEED SOV OPEN	STATUS			
1000	385	0	0	INHIBITED	06.30.2015 10:24:52	17	2	PREFLIGHT	FUEL EQUAL-XFEED OPEN	ADVISORY			
1000	385	0	0	ACTIVE	06.30.2015 10:24:54	17	2	PREFLIGHT	FUEL EQUAL-XFEED OPEN	ADVISORY			
1000	218	0	0	INACTIVE	06.30.2015 10:26:53	17	2	PREFLIGHT	BLEED APU VLV OPEN	STATUS			
1000	218	0	0	INHIBITED	06.30.2015 10:27:33	17	2	PREFLIGHT	BLEED APU VLV OPEN	STATUS			
1000	218	0	0	ACTIVE	06.30.2015 10:27:35	17	2	PREFLIGHT	BLEED APU VLV OPEN	STATUS			
1000	385	0	0	INACTIVE	06.30.2015 10:33:41	17	2	PREFLIGHT	FUEL EQUAL-XFEED OPEN	ADVISORY			
1000	386	0	0	INACTIVE	06.30.2015 10:33:41	17	2	PREFLIGHT	FUEL XFEED SOV OPEN	STATUS			
1000	55	0	0	INACTIVE	06.30.2015 10:34:40	17	2	PREFLIGHT	HYD 3 PUMP A NOT ON	ADVISORY			
1000	282	0	0	INACTIVE	06.30.2015 10:34:49	17	2	PREFLIGHT	YD OFF	ADVISORY			
1000	618	0	0	INHIBITED	06.30.2015 10:36:44	17	2	PREFLIGHT	FLT CTRL TEST IN PROG	STATUS			
1000	618	0	0	ACTIVE	06.30.2015 10:36:47	17	2	PREFLIGHT	FLT CTRL TEST IN PROG	STATUS			
1000	249	0	0	INHIBITED	06.30.2015 10:37:10	17	2	PREFLIGHT	APU SHUTTING DOWN	STATUS			
1000	249	0	0	ACTIVE	06.30.2015 10:37:13	17	2	PREFLIGHT	APU SHUTTING DOWN	STATUS			
1000	297	0	0	INHIBITED	06.30.2015 10:37:22	17	2	PREFLIGHT	ENG REF ECS DISAG	CAUTION			

1000	297	0	0	ACTIVE	06.30.2015 10:37:24	17	2	PREFLIGHT	ENG REF ECS DISAG	CAUTION			
1000	297	294	2535	ACTIVE	06.30.2015 10:37:25	17	2	PREFLIGHT	ENG REF ECS DISAG	CAUTION	REFERENCE ECS DISAGREE	73217702CMC	Internal Hardware
1000	297	0	0	INACTIVE	06.30.2015 10:37:49	17	2	PREFLIGHT	ENG REF ECS DISAG	CAUTION			
1000	618	0	0	INACTIVE	06.30.2015 10:37:52	17	2	PREFLIGHT	FLT CTRL TEST IN PROG	STATUS			
1000	195	0	0	INACTIVE	06.30.2015 10:38:18	17	3	TAXI	STEER OFF	STATUS			
1000	218	0	0	INACTIVE	06.30.2015 10:38:22	17	3	TAXI	BLEED APU VLV OPEN	STATUS			
1000	249	0	0	INACTIVE	06.30.2015 10:38:40	17	3	TAXI	APU SHUTTING DOWN	STATUS			
1000	384	0	0	INHIBITED	06.30.2015 10:39:43	17	3	TAXI	APU FUEL SOV CLOSED	STATUS			
1000	384	0	0	ACTIVE	06.30.2015 10:39:45	17	3	TAXI	APU FUEL SOV CLOSED	STATUS			
1000	384	0	0	INACTIVE	06.30.2015 10:39:54	17	3	TAXI	APU FUEL SOV CLOSED	STATUS			
1000	310	0	0	INHIBITED	06.30.2015 11:01:22	18	5	CLIMB	A-I WING VLV OPEN	STATUS			
1000	310	0	0	ACTIVE	06.30.2015 11:01:24	18	5	CLIMB	A-I WING VLV OPEN	STATUS			
1000	310	0	0	INACTIVE	06.30.2015 11:01:49	18	5	CLIMB	A-I WING VLV OPEN	STATUS			
1000	600	0	0	INHIBITED	06.30.2015 11:56:15	18	6	CRUISE	AURAL WRN SYS FAULT	ADVISORY			
1000	634	0	0	INHIBITED	06.30.2015 11:56:15	18	6	CRUISE	APPR 2 NOT AVAIL	ADVISORY			
1000	648	0	0	INHIBITED	06.30.2015 11:56:15	18	6	CRUISE	AUTOLAND 1 NOT AVAIL	ADVISORY			
1000	634	0	0	ACTIVE	06.30.2015 11:56:18	18	6	CRUISE	APPR 2 NOT AVAIL	ADVISORY			
1000	648	0	0	ACTIVE	06.30.2015 11:56:18	18	6	CRUISE	AUTOLAND 1 NOT AVAIL	ADVISORY			
1000	574	0	0	INHIBITED	06.30.2015 11:56:20	18	6	CRUISE	NAVCOM 1 FAIL	CAUTION			
1000	574	63	592	INHIBITED	06.30.2015 11:56:20	18	6	CRUISE	NAVCOM 1 FAIL	CAUTION	MRC1 NAV [FN	34610115FM2	Interface
1000	574	62	159	INHIBITED	06.30.2015 11:56:20	18	6	CRUISE	NAVCOM 1 FAIL	CAUTION	MRC1 NAV [FN	34610115FM1	Interface
1000	574	0	0	ACTIVE	06.30.2015 11:56:23	18	6	CRUISE	NAVCOM 1 FAIL	CAUTION			
1000	574	63	592	ACTIVE	06.30.2015 11:56:23	18	6	CRUISE	NAVCOM 1 FAIL	CAUTION	MRC1 NAV [FN	34610115FM2	Interface
1000	574	62	159	ACTIVE	06.30.2015 11:56:23	18	6	CRUISE	NAVCOM 1 FAIL	CAUTION	MRC1 NAV [FN	34610115FM1	Interface
1000	600	0	0	INACTIVE	06.30.2015 11:56:27	18	6	CRUISE	AURAL WRN SYS FAULT	ADVISORY			
1000	574	0	0	INACTIVE	06.30.2015 11:56:29	18	6	CRUISE	NAVCOM 1 FAIL	CAUTION			
1000	634	0	0	INACTIVE	06.30.2015 11:56:29	18	6	CRUISE	APPR 2 NOT AVAIL	ADVISORY			
1000	648	0	0	INACTIVE	06.30.2015 11:56:39	18	6	CRUISE	AUTOLAND 1 NOT AVAIL	ADVISORY			
1000	195	0	0	INHIBITED	06.30.2015 13:12:49	18	2	PREFLIGHT	STEER OFF	STATUS			
1000	195	0	0	ACTIVE	06.30.2015 13:12:52	18	2	PREFLIGHT	STEER OFF	STATUS			
1000	55	0	0	INHIBITED	06.30.2015 13:13:02	18	2	PREFLIGHT	HYD 3 PUMP A NOT ON	ADVISORY			
1000	55	0	0	ACTIVE	06.30.2015 13:13:30	18	2	PREFLIGHT	HYD 3 PUMP A NOT ON	ADVISORY			
1000	562	0	0	INHIBITED	06.30.2015 13:13:32	18	2	PREFLIGHT	AT FAIL	CAUTION			

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1000	562	373	65	INHIBITED	06.30.2015 13:13:32	18	2	PREFLIGHT	AT FAIL	CAUTION	ENGINE DATA [TRSA2] FAULT	22310005TA2	Interface
1000	562	372	57	INHIBITED	06.30.2015 13:13:32	18	2	PREFLIGHT	AT FAIL	CAUTION	ENGINE DATA [TRSA1] FAULT	22310005TA1	Interface
1000	562	372	190	INHIBITED	06.30.2015 13:13:33	18	2	PREFLIGHT	AT FAIL	CAUTION	RIGHT FADEC [ATA1] FAULT	22310080TA1	Interface
1000	562	373	203	INHIBITED	06.30.2015 13:13:33	18	2	PREFLIGHT	AT FAIL	CAUTION	RIGHT FADEC [ATA2] FAULT	22310080TA2	Interface
1000	562	372	148	INHIBITED	06.30.2015 13:13:34	18	2	PREFLIGHT	AT FAIL	CAUTION	FADEC1/FADEC2 [ATA1]/WRG FAULT	22310023TA1	Interface
1000	55	0	0	INHIBITED	06.30.2015 13:13:35	18	2	PREFLIGHT	HYD 3 PUMP A NOT ON	ADVISORY			
1000	562	0	0	ACTIVE	06.30.2015 13:13:35	18	2	PREFLIGHT	AT FAIL	CAUTION			
1000	562	373	203	ACTIVE	06.30.2015 13:13:35	18	2	PREFLIGHT	AT FAIL	CAUTION	RIGHT FADEC [ATA2] FAULT	22310080TA2	Interface
1000	562	373	65	ACTIVE	06.30.2015 13:13:35	18	2	PREFLIGHT	AT FAIL	CAUTION	ENGINE DATA [TRSA2] FAULT	22310005TA2	Interface
1000	562	372	190	ACTIVE	06.30.2015 13:13:35	18	2	PREFLIGHT	AT FAIL	CAUTION	RIGHT FADEC [ATA1] FAULT	22310080TA1	Interface

1000	562	372	148	ACTIVE	06.30.2015 13:13:35	18	2	PREFLIGHT	AT FAIL		CAUTION	FADEC1/FADEC2 [ATA1]/WRG FAULT	22310023TA1	Interface
1000	562	372	57	ACTIVE	06.30.2015 13:13:35	18	2	PREFLIGHT	AT FAIL		CAUTION	ENGINE DATA [TRSA1] FAULT	22310005TA1	Interface
1000	562	0	0	INACTIVE	06.30.2015 13:13:43	18	2	PREFLIGHT	AT FAIL		CAUTION			
1000	282	0	0	INHIBITED	06.30.2015 13:14:11	18	2	PREFLIGHT	YD OFF		ADVISORY			
1000	282	0	0	ACTIVE	06.30.2015 13:14:13	18	2	PREFLIGHT	YD OFF		ADVISORY			
1000	128	0	0	INHIBITED	06.30.2015 13:20:19	18	2	PREFLIGHT	FUEL 1 LO LEVEL		WARNING			
1000	497	0	0	INHIBITED	06.30.2015 13:22:16	18	2	PREFLIGHT	FUEL 2 LO LEVEL		WARNING			