JAMAICA CIVIL AVIATION AUTHORITY

AVIATION OCCURRENCE

FINAL REPORT

Report Number: JA-2008-02

Type of Occurrence: Serious Incident

Operator Name: Air Jamaica Limited

Flight Number: AJM036

Type of Aircraft: Airbus Industrie A320-214, Serial Number 0628.

Aircraft Registration: 6Y-JAI (Jamaica, West Indies).

Occurrence Location: Norman Manley International Airport, Kingston, Jamaica, 12 NM Northwest. N18° 05′ 30″ W076° 56′ 45″

Date and Time: 07 July 2008 at approximately 00:10:00 GMT (06 July 2008, 7:10 PM Local Time.)

HISTORY OF THE FLIGHT

The aircraft was on a scheduled flight from Fort Lauderdale, Florida to Norman Manley International Airport (NMIA), Kingston, Jamaica.

The flight was cleared from TOTON for the KEYNO ONE Arrival at NMIA, ILS Runway 12, and had been cleared direct to KEYNO, the Initial Fix. However, the aircraft's weather radar was indicating weather at KEYNO, and at time 00:03:29 Greenwich Mean Time (GMT) the crew requested a deviation "to the left, almost direct CIBUG", to avoid the weather. CIBUG is 5.6 nautical miles (NM) southeast of KEYNO on the localizer for Runway 12, NMIA. Air Traffic Control (ATC) responded " … proceed direct CIBUG now.", to which the crew replied "Alright, we're cleared direct CIBUG, Jamaica Zero Three Six." At this time the aircraft was level at 5,000 feet above sea level (asl), and in Instrument Meteorological Conditions (IMC).

The ATC radar plot indicated that at about 00:02:30 GMT the aircraft changed heading to the left from a direct track towards KEYNO, to a track of 115° magnetic towards SALOC, 4.0 NM east of CIBUG on the localizer for Runway 12, NMIA. The aircraft maintained this track until the Enhanced Ground Proximity Warning System (EGPWS) event occurred. This projected track went through an area with a Minimum Vectoring Altitude (MVA) of 3,800 feet asl. At 00:07:23 GMT, after the aircraft had entered an area with an MVA of 3,500 feet asl, ATC cleared the

aircraft down to 3,500 feet asl, when the aircraft was still maintaining a track towards SALOC that would take it through the 3,800 feet asl MVA area. At that point, if the aircraft had tracked straight to CIBUG, it would have remained in the 3,500 feet asl MVA area, but the predicted track indicator on the ATC radar display went into the 3,800 feet asl MVA area. At this time the aircraft was still in IMC.

At about 00:09:45 GMT, as the aircraft, flying at 3,500 feet asl in the 3,500 feet asl MVA, approached the 3,800 feet asl MVA area, the crew noticed the radio altimeter indicators suddenly coming alive and indicating about 1,600 feet above ground level (agl), then the EGPWS warning occurred. The First Officer, who was Pilot Flying, immediately followed the evasive procedure for EGPWS warning, and the aircraft climbed rapidly through 4,000 feet asl where it entered Visual Meteorological Conditions, and the crew was able to see NMIA. The crew leveled the aircraft at about 4,100 feet asl, then descended to and maintained 4,000 feet asl. At 00:11:30 GMT the aircraft crossed the localizer for Runway 12 at SALOC and then made a right turn to intercept the localizer from the south and made a visual approach and normal landing on Runway 12 at NMIA.

INJURIES

	CREW	**PASSENGERS**	**OTHERS**	**TOTAL**
FATAL	**-**	**-**	**-**	**-**
SERIOUS	**-**	**-**	**-**	**-**
MINOR	**2**	**-**	**-**	**2**
TOTAL	**2**	**-**	**-**	**2**

Two flight attendants received minor injuries during the occurrence.

DAMAGE

There was no damage to the aircraft or other property.

PERSONNEL INFORMATION

	Captain	**First Officer**
LICENCE	ATPL	ATPL
MEDICAL EXPIRY DATE.	30 November 2008	30 April 2009
TOTAL FLYING HOURS.	6874.36	5107.14
TOTAL HOURS LAST 90 DYS	103.34	88.25
HOURS ON TYPE LAST 90 DYS	103.34	88.25
TOTAL HOURS ON TYPE	5874.36	328.60
HOURS ON DUTY PRIOR TO OCCURRENCE	3hrs 38mins	3hrs 38mins
HOURS OFF DUTY PRIOR TO OCCURRENCE	19hrs 21mins	19hrs 21mins

Both pilots were qualified for the flight. There was no evidence that either of the pilots was in a state of fatigue, suffering from any illness or otherwise indisposed.

CONTROLLER INFORMATION

CONTROLLER	
LICENCE	Air Traffic Controller License, certified as Approach Controller for Kingston Sector.
MEDICAL EXPIRY DATE	16 August 2011
EXPERIENCE AS CONTROLLER	4 Years, 28 Days
EXPERIENCE IN PRESENT UNIT	1 Year, 170 Days
HOURS ON DUTY PRIOR TO OCCURRENCE	3 Hours 45 Minutes

The Controller was qualified for the position in which he was working.

The investigation evaluated that there was no evidence that the Controller was in a state of fatigue, suffering from any illness or otherwise indisposed.

AIRCRAFT INFORMATION

YEAR OF MANUFACTURE	1997
MANUFACTURER'S SERIAL NUMBER	0628
CERTIFICATE OF AIRWORTHINESS DATE	02 AUGUST 2007
TOTAL AIRFRAME TIME/CYCLES	28,479.01 Hours/16,045
MAXIMUM ALLOWABLE TAKE OFF WEIGHT	169,750 pounds

The aircraft documentation was in order, and the aircraft was equipped for the flight.

The following items were unserviceable, and recorded under the aircraft's Minimum Equipment List (MEL) at the time of the occurrence:

1. One passenger call switch.
2. The Rudder Travel Limiter System.
3. One Coffee Maker .
4. The Captain's and First Officer's Retractable Footrests.

METEOROLOGICAL INFORMATION

The weather report at Norman Manley International Airport at 7:00 PM (00:00 GMT) was as follows: Wind from 110 degrees at 15 Knots, Visibility 10 miles, clouds few at 2,000 feet, few at 2,400 feet with cumulo-nimbus associated, broken at 20,000 feet, temperature 28 degrees Centigrade, dew point 21 degrees Centigrade, Pressure 1014 HPA.

The area forecast for Jamaica at the time of the occurrence indicated partly cloudy, with cumulo nimbus clouds associated.

The captain of a similar aircraft which was on approach into Kingston about 30 miles behind the subject aircraft reported that he observed thunderstorm activity on the aircraft's weather radar in the vicinity of KEYNO, and extending 30 miles to the west.

AIDS TO NAVIGATION

All relevant aids to navigation were functioning at the time of the occurrence.

COMMUNICATIONS

All communications were normal.

FLIGHT RECORDERS AND ENHANCED GROUND PROXIMITY WARNING SYSTEM (EGPWS)

Description	Manufacturer	Part Number	Serial Number	Model
DFDR	Honeywell	980-4700-003	2436	V
EGPWS	Honeywell	965-0976-003-206-206	21548	
FDIU	Sagem	ED43AID5	1223	
CVR	Honeywell	980-6020-001	3682	

The Air Jamaica A320 Flight Crew Operating Manual, Navigation GPWS, 1.34.70, P.4, SEQ 302, Rev 41, "Excessive Terrain Closure Rate", indicates that an EGPWS warning will occur with the aircraft not in landing configuration and not on glide slope beam if the aircraft is below 1,650 feet above ground level (agl), below 220 knots and the radar altitude rate of change is more than 5,500 feet per minute. In this case the aircraft was in cruise configuration at 209 knots, and the radio altimeter changed from 2,102 feet agl to 1,524 feet agl, i.e. 578 feet, in 4 seconds, the equivalent of 8,670 feet per minute, thus causing the EGPWS warning to activate.

The DFDR recorded a maximum nose up pitch of 20.4°, and maximum vertical acceleration of +1.9G.

The aircraft's EGPWS included a Terrain Awareness and Display (TAWS) function to warn the pilots of rising terrain. The Air Jamaica Standard Operating Procedures A320/A321, Chapter 3, Page 98, "Descent", states:

> "TERR ON ND … AS REQD In mountainous areas, consider displaying terrain on ND. If use of radar is required, consider selecting the radar display on the PF side, and TERR ON ND on the PNF side only".

REGULATORY, ORGANIZATIONAL AND MANAGEMENT INFORMATION

The Civil Aviation Regulations of Jamaica, Amendment No. 2, 2005, Nineteenth Schedule, Sub-paragraph 19.005(4) defines "Incident" as "… an occurrence other than an accident, associated with the operation of an aircraft, which affects or could affect the safety of operations, or endanger the lives of passengers or crew."

The sudden evasive maneuver in this case involved an unauthorized altitude deviation, steep deck angle and high vertical acceleration, and therefore met the definition of an Incident.

Sub-paragraph 19.035 (b), states "The operator of an aircraft involved in an … incident shall retain all records … dealing with the … incident, until authorized by the Authority to the contrary."

The Air Jamaica Flight Operations Manual, Abnormal Operations, Section 25.14, "Recording and Reporting Procedures", states in 25.14.1, "Flight Data and Voice Recorder Information":

> "The Air Regulations require the preservation and protection of Flight Data and Voice recording devices. Such devices are required to be surrendered following an accident, as

defined within the Air Regulations, to an Aviation Safety Investigator on demand. There is a further requirement that recorded information also be available along with a report from the Pilot-In-Command under other non-accident circumstances e.g. – Air Miss".

25.14.3 in the same manual states, in part,

> "… on any flight leg during which an incident/accident has occurred, pull the appropriate circuit breaker … after gate arrival. … Make a numbered entry in the aircraft Logbook indicating that the Cockpit Voice Recorder and the Flight Data Recorder circuit breakers are pulled and for Maintenance to remove same. … This will ensure that when necessary, recorder tapes are handed over to the Regulatory Representatives directly, in accordance with regulatory requirements".

The Air Jamaica Emergency Operations Manual, Publication No. 550, dated 03 November 2006, indicated on Pages 1-7 and A-8 that this occurrence required a Level Two Response, including Notification of Agencies (P. 1-9). The telephone number for the Jamaica Civil Aviation Authority (JCAA) Duty Officer was not included in this list. The Manager, Training and Standards did not call the JCAA Duty Officer, and no release of the Cockpit Voice Recorder (CVR) and Digital Flight Data Recorder (DFDR) was granted by the JCAA.

The Report of the Manager, Training and Standards stated that the Captain requested that the DFDR and the CVR be removed from the aircraft after the event, in order to preserve the flight information. The Air Jamaica Maintenance Department was asked if there were replacement DFDR and CVR units available, and responded that there were none in stock. The aircraft was scheduled to depart again immediately, and, if delayed, the subsequent flights would be cancelled.

The Manager, Training and Standards directed Maintenance to check the EGPWS, and make an entry in the Aircraft Journey Log. He then telephoned the JCAA ATC supervisor to confirm that the radar and voice information was recorded and available, and to inform them that Air Jamaica would require a copy of that data.

The Manager, Training and Standards then decided that sufficient information was available to investigate the occurrence**,** and that the aircraft would precede with the CVR and the DFDR in place, when the EGPWS had been tested. A spare DFDR was found by Maintenance shortly after this, but it was decided not to replace the one in the aircraft as that would have caused a further delay, and possibly resulted in the cancellation of the flight**.**

The DFDR recorded the information from multiple flights. The information on the CVR was only the 30 minutes before the power supply goes off.

The DFDR information was subsequently successfully recovered, but the CVR recording was lost.

ADDITIONAL INFORMATION

The Air Jamaica Manager, Training and Standards was not aware of the injuries to the flight attendants while the aircraft was on the ground at NMIA.

The DFDR and EGPWS systems were sent to the Transportation Safety Board of Canada (TSBC) for analysis, which generated TSBC Engineering Report LP095/2008 "DFDR Analysis, Airbus A320-200, 6Y-JAI".

The "snapshots" from the ATC radar system indicated that the aircraft started to climb as it crossed the boundary between the 3,500 foot MVA sector and the 3,800 foot MVA, but the track plotted by the TSBC, which overlaid the DFDR-generated track on a Google Earth representation of the terrain, showed the aircraft to be approximately 0.8 Nautical Miles back from the boundary, well within the 3,500 foot MVA sector and crossing over rising terrain, at the time of the EGPWS warning.

As the crew then immediately climbed the aircraft to 4,000 feet asl before the aircraft entered the 3,800 foot MVA sector, there was never any danger of the aircraft colliding with terrain, and the 3,800 foot MVA was not violated. The DFDR indicated that the aircraft's height above ground level (agl) went from about 3,300 feet agl just before the EGPWS event to a minimum of 1,510 feet agl as the aircraft passed over the rising terrain which triggered the EGPWS warning.

There was a discrepancy between the recorded time of the ATC recordings and that of the DFDR, the ATC time being 7.7 seconds ahead. It was determined that the ATC time was correct, as it is determined from reliable sources on the ground, and the discrepancy was not otherwise significant.

Both Captain and First Officer in their statements indicated that they believed the aircraft was tracking direct to CIBUG.

The radar plot shows the aircraft tracking to SALOC for about seven minutes prior to the occurrence.

The Captain communicated with the Purser after the EGPWS event.

The crew did not select the TERR ON ND pushbutton of the EGPWS to "ON" for the approach. The company's Standard Operating Procedures state that this should be considered.

At the time of the EGPWS event, the autopilot was in Heading and Altitude modes.

The MVA Sector boundaries and altitudes were displayed on the Controller's radar monitor.

The MVA Sector boundaries and altitudes were not published on the Jeppesen approach plates used by the crew, nor were radar vectoring altitudes on the approach plates.

The controller's radar display indicated areas of cloud, but did not define thunderstorm activity.

From the time of the aircraft being cleared down to 3,500 feet ASL, to the time of the EGPWS warning, approximately 2 minutes and 24 seconds, the Controller did not alert the crew to the fact they were approaching a 3,800 feet asl MVA area at 3,500 feet asl.

The Controller stated that he did not observe the aircraft going off course until after the event.

All the ATC equipment was working. The Controller's assistant was on a break at the time of the occurrence. The Controller considered that the traffic volume and complexity were light, and that staffing was compatible with the workload. There was no evidence of unusual disturbances or distractions.

The Controller reported that after he had cleared the aircraft direct to CIBUG, and to descend to 3,500 feet asl, he was called by NMIA Tower to advise him that an aircraft on the ramp was starting. He then briefly looked away to start this aircraft on the Flight Data Display, prepare strips for the various aircraft he was dealing with, and search for a current weather report for arriving aircraft, all of which were part of his normal duties. When he looked back at his screen AJM036 was already at 3,500 feet asl approaching the MVA 3,800 feet asl area, and then the crew climbed the aircraft to 4,000 feet asl and reported a EGPWS warning.

The Minimum Sector Altitude Warning, a system in the ATC radar which warns the Controller if an aircraft is approaching a sector below the MVA, was suppressed at the time of the occurrence. The reason for this was that it would be constantly triggered by VFR aircraft during the day flying below the MVA. However, the radar display did give the Controller a "predicted low altitude warning" in the form of a red flag flashing for a few seconds at 00:06:45 GMT.

The MVA sector altitudes provide a minimum of 1,000 feet agl clearance over the highest obstacle within the sector.

The Controller was not aware of what a EGPWS warning was, and it was not part of his training. He was therefore unable to do more than acknowledge the crew's report of an EGPWS warning.

The Controller in his report attributed the occurrence to the pilot not following instructions.

ANALYSIS

It is apparent that there was a communication breakdown between the Controller and the aircraft crew, when the crew requested a deviation from their previous clearance direct to KEYNO " … to the left, almost direct CIBUG … ", and in response the Controller cleared the flight direct to CIBUG. It was not possible for the Controller to give the crew a clearance as requested, and the clearance he gave was correct and reasonable under the circumstances. However, the crew was navigating between high terrain to the left, and cumulonimbus clouds to the right, hence the expressed need for flexibility in the track. The result was that the Controller expected the aircraft to proceed directly to CIBUG, in which case 3,500 feet asl was a safe altitude, and the crew considered that they had some leeway in the track.

Two things then went wrong: firstly, the crew did not follow their clearance, and the aircraft was on a track several degrees to the left of direct CIBUG; and secondly, the Controller did not adequately monitor the aircraft's track, and failed to notice that the aircraft was off-track for about seven minutes prior to the EGPWS warning, and heading for the 3,800 feet asl MVA at 3,500 feet asl for two minutes and 24 seconds. In any case, the crew, in requesting " … to the left, almost direct CIBUG … " implied that their intended track would take the aircraft somewhere between KEYNO and CIBUG, where 3,500 feet asl was a safe altitude, but the aircraft tracked to the left of a track direct to CIBUG, in fact directly to SALOC, towards an area where the MVA was 3,800 feet asl.

In these circumstances, there were some "safety nets" to avoid potential Controlled Flight Into Terrain (CFIT) occurrences. Firstly, the aircraft's EGPWS included a Terrain Awareness and Display (TAWS) function to warn the pilots of rising terrain, and the company's Standard Operating Procedures stated that the crew should consider activating this function by selecting the TERR on ND pushbutton to ON when flying in mountainous areas. However, the crew omitted to activate this system. Secondly, the ATC radar was equipped with a Minimum Sector Altitude Warning System to alert the Controller if an aircraft was tracking towards an MVA area below the minimum altitude. However, this had been suppressed, because it would be constantly triggered by aircraft flying on Visual Flight Rules below the MVA during daylight. Thus, these two "safety nets" in the system were discarded, one by omission and the other intentionally.

Also, the radar display did give the Controller a "predicted low altitude warning" in the form of a flashing red tag on the radar screen for a few seconds, but this did not succeed in catching the Controller's attention.

While the crew were unwittingly flying the aircraft towards the 3,800 foot MVA sector at 3,500 feet and the controller was not monitoring the track and altitude of the aircraft to ensure its safe passage, the EGPWS event occurred and caused the crew to climb the aircraft to 4,000 feet asl, thus inadvertently putting the aircraft at a safe altitude to enter the 3,800 foot MVA sector.

The requirements of The Civil Aviation Regulations of Jamaica and of the Air Jamaica Flight Operations Manual, as described in Pages 5 and 6 of this report, were not followed by the company's management, in as far as the CVR and the DFDR were not removed from the aircraft after the incident, and no release from this requirement was granted by the JCAA.

Although the DFDR information was subsequently recovered, this resulted in the CVR information being lost, as the length of the recording is only the last 30 minutes.

This decision to dispatch the aircraft with the CVR and DFDR in place was made to avoid delaying the aircraft, as no spare CVR and DFDR units were available.

CONCLUSIONS

FINDINGS

FINDINGS AS TO CAUSES AND CONTRIBUTING FACTORS

1. The aircraft crew did not follow the ATC clearance.
2. The Controller did not adequately monitor the progress of the aircraft on the radar display.
3. The ATC Minimum Sector Altitude Warning System was suppressed.
4. The Controller did not notice the Predicted Low Altitude Warning.

FINDINGS AS TO RISK.

1. The company management did not adhere to the Jamaica Civil Aviation Regulations requirements regarding the preservation of CVR and DFDR information following an Incident such as this.
2. The CVR information was lost.
3. The company Emergency Operations Manual did not contain the emergency telephone number for the JCAA Duty Officer.
4. The company's management did not consult with the JCAA Duty Officer before dispatching the aircraft on further flights.
5. The aircraft crew did not select the TERR on ND pushbutton to ON to display the terrain on ND available with the Terrain Awareness and Display function of the aircraft's EGPWS.
6. The aircraft approached the 3,800 foot MVA sector at 3,500 feet asl.

SAFETY RECOMMENDATIONS.

1. Air Jamaica reviews training regarding:

a. Following ATC clearances.
b. Hazards of Instrument Approaches in mountainous terrain.
c. Use of Terrain Awareness and Display function on the aircrafts' EGPWS.
d. The Jamaica Civil Aviation Regulations regarding the preservation of CVR and DFDR information following an Incident.

2. JCAA Air Traffic Services reviews training and Manual of Operations regarding:

a. Controller responsibilities.
b. The continuous monitoring of traffic.
c. Time and workload management.
d. EGPWS equipment and activation.

3. The JCAA ATS radar system's warning feature should not be suppressed.