

الهيئة العامة للطيران المدني
GENERAL CIVIL AVIATION AUTHORITY



United Arab Emirates

Air Accident Investigation Sector

Serious Incident - Preliminary Report - AAIS Case N° AIFN/0016/2021

Shallow Initial Climb After Take-off

Operator: Emirates
Make and Model: Boeing 777-300ER
Nationality and Registration: The United Arab Emirates, A6-EQI
Place of Occurrence: Dubai International Airport and Dubai Airspace
State of Occurrence: The United Arab Emirates
Date of Occurrence: 19 December 2021



Incident Brief

AAIS Report No.:	AIFN/0016/2021
Operator:	Emirates
Aircraft Type and Registration:	Boeing B777-300ER, A6-EQI
MSN:	42354
Number and Type of Engines:	Two, General Electric- GE90
Date and Time (UTC):	19 December 2021
Location:	Dubai International Airport
Type of Flight:	Commercial – Scheduled Passenger
People Onboard:	372
Fatalities:	None

Investigation Objective

This investigation is performed pursuant to the United Arab Emirates *Federal Act 20 of 1991*, promulgating the *Civil Aviation Law*, Chapter VII – *Aircraft Accidents*, Article 48. It is in compliance with the *Air Accident and Incident Investigation Regulation (AAIR)*, in conformity with *Annex 13 to the Convention on International Civil Aviation*, and in adherence to the *Air Accident and Incident Investigation Procedures*.

The sole objective of this investigation is to prevent aircraft accidents and incidents. It is not the intent of this activity to apportion blame or liability.

This Preliminary Report is adapted from the Final Report format contained in Annex 13 to serve the purpose of this Investigation. The information contained in this Report is derived from the data collected during the initial investigation of the occurrence.

The Final Report may contain amended information when new evidence becomes available during the ongoing investigation.

Investigation Process

The occurrence involved a Boeing B777 aircraft, registration A6-EQI, and was notified to the Air Accident Investigation Sector (AAIS) of the United Arab Emirates by phone call to the Duty Investigator (DI) Hotline Number +971 50 641 4667.

After the initial on-site investigation phase, the occurrence was classified as ‘serious incident’.

According to Annex 13 obligations, and as the United Arab Emirates being the State of Occurrence, the AAIS formed an investigation team and appointed an investigator-in-charge (IIC) and members for the different investigation areas. The AAIS notified the National Transportation Safety Board (NTSB) of the United States as of being the authority of the State of Design and Manufacture of the aircraft. The NTSB designated an accredited representative supported by advisers from the Boeing Company.



The AAIS is leading the investigation and will issue a Final Report when the Investigation is completed.

This Preliminary Report is publicly available at:

<http://www.gcaa.gov.ae/en/epublication/pages/investigationReport.aspx>

Notes:

- ¹ Whenever the following words are mentioned in this Report with the first letter Capitalized, it shall mean:
 - (Aircraft) – the aircraft involved in this serious incident
 - (Commander) – the commander of the serious incident flight
 - (Copilot) – the copilot of the serious incident flight
 - (Incident) - this investigated serious incident
 - (Investigation) - the investigation into this serious incident
 - (Operator) – Emirates
 - (Report) - this Preliminary Report.
- ² Unless otherwise mentioned, all times in this Report are in coordinated universal times (UTC).
- ³ Photos and figures used in the text of this Report are taken from different sources and are adjusted from the original for the sole purpose to improve clarity of the Report. Modifications to images used in this Report are limited to cropping, magnification, file compression, or enhancement of color, brightness, contrast or insertion of text boxes, arrows or lines.



Abbreviations and Definitions

AAIS	Air Accident Investigation Sector
AFDS	Autopilot flight director system
AIFN	Accident/incident file number
AME	Aeromedical examiner
AOC	Air operator certificate
ATPL	Air transport pilot license
°C	Celsius (degree)
FCOM	<i>Flight crew operating manual</i>
GCAA	General Civil Aviation Authority of the United Arab Emirates
ICAO	International Civil Aviation Organization
KIAD	Washington Dulles International Airport
MCP	Mode control panel
MSA	Minimum sector altitude
MSN	Manufacturer serial number
NTSB	National Transportation Safety Board of the United States
OFP	Operational flight plan
OMDB	Dubai International Airport
PF	Pilot flying
PFD	Primary flight display
PM	Pilot monitoring
SEP	Safety and emergency procedures
TOGA	Takeoff/go-around
UAE	The United Arab Emirates
UTC	Coordinated universal time



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1. Factual Information

1.1 History of the Flight

On 19 December 2021, an Emirates Boeing 777-300ER (Extended Range) Aircraft, registration A6-EQI, operating a scheduled passenger flight number EK231, departed from Dubai International Airport (OMDB), the United Arab Emirates, for Washington Dulles International Airport (KIAD), the United States.

The flight crew composed of four members divided into two sets A and B. Each set was comprised of one commander and one copilot. The Commander of set A operated as the pilot flying (PF) and the Copilot operated as the pilot monitoring (PM) for the flight.

The Commander stated that during cockpit preparation, she noticed that the altitude selector was set to 0000 feet and she selected it to 4,000 feet, which was also verified by the flight data recorder. The selection of 4,000 feet on the altitude selector was in accordance with the planned standard instrument departure (SID) of SENPA 2F¹.

At 23:10:29 UTC, the Aircraft lifted off, and at 23:10:40 the landing gears were selected to 'up' position (retracted).

The Commander stated that after lift-off, and during climb, she followed the flight director command. However, the Aircraft rate of climb reached to a maximum of approximately 800 feet per minute. The flight crew were not able to adhere to published climb gradient of the SID due to the shallow climb.

At 23:11:01, the takeoff/go-around (TOGA) switch was selected and the flight mode annunciations (FMA) were changed to TOGA/TOGA. The flight directors indicated climb attitude on the Commander's primary flight display (PFD). A flap 15 over-speed occurred as the airspeed increased towards 250 knots. The flight crew continued to their destination and landed uneventfully.

1.2 Injuries to Persons

Table 1. Injuries to persons

Injuries	Flight Crew	Cabin Crew	Other Crew Onboard	Passengers	Total Onboard	Others
Fatal	0	0	0	0	0	0
Serious	0	0	0	0	0	0
Minor	0	0	0	0	0	0
None	4	14	0	354	372	0
TOTAL	4	14	0	354	372	0

¹ SENPA 2F: is one of the standard instrument departures that are followed after takeoff from runway 30R. An initial climb clearance of 4,000 feet is part of the SID



1.3 Damage to Aircraft

There was no damage found to Aircraft during the inspection conducted at the destination airport. Further maintenance details will be discussed in the Final Report.

1.4 Other Damage

There was no other damage.

1.5 Personnel Information

Table 2 illustrates the Commander and Copilot information current at the time of the Incident.

Table 2. Crew information		
	Commander	Copilot
Age	42	26
Type of license	ATPL(A)	ATPL(A)
Valid to	7 June 2028	29 March 2025
Rating	IR/MPA/B777	IR/MPA/B777
Total flying time (hours)	1,0849:15	4,644:35
Total on type (hours)	6,567:58	3,426:15
Total on type last 90 days (hours)	196:18:00	123:01
Total on type last 7 days (hours)	22:05	0
Total last 24 hours (hours)	0	0
Last recurrent SEP training	15 July 2021	5 July 2021
Last operational proficiency check (OPC)	15 July 2021	5 July 2021
Last line check	31 August 2020	19 July 2020
Medical class	1	1
Valid to	25 August 2022	17 July 2022
Medical limitation	NIL	VDL ²

² (VDL) limitation is correction for defective distant vision whilst exercising the privileges of the license, the license holder shall wear spectacles or contact lenses that correct for defective distant vision as examined and approved by the AME (Aeromedical Examiner). According to CAR-Med Regulations: the "Distant visual acuity", with or without correction, shall be in the case of Class 1 Pilot, 6/9 or better in each eye separately and visual acuity with both eyes shall be 6/6 or better. For Class 1 Pilots: A routine eye examination can be performed by an AME at each renewal of medical certificate. However, a comprehensive eye examination by an eye specialist (Ophthalmologist) is required at the initial GCAA examination. All abnormal and doubtful cases should be referred to an ophthalmologist during renewal or when clinically indicated



1.6 Aircraft Information

1.6.1 Aircraft data

Table 3 illustrates the general Aircraft data as of the date of the Incident.

Table 3. Aircraft data		
Manufacturer:	The Boeing Company	
Model:	B777-300ER	
MSN:	42354	
Date of manufacture:	TBD	
Nationality and registration:	A6-EQI	
Name of the Owner:	Credit Agricole Corporate and Investment Bank	
Name of the Operator:	Emirates	
Certificate of Airworthiness		
	Number:	UAE-COA-0517
	Issue date:	30 November 2017
Certificate of Registration		
	Number:	UAE-COR-1038
	Issue date:	30 November 2017
Date of delivery:	30 November 2017	
Time since new (TSN) (hours):	17216:33	
Cycles since new (CSN):	2708	
Cycles since last service check:	11	

1.6.2 Autopilot flight director system (AFDS) and mode control panel (MCP)

As per the *flight crew operating manual (FCOM)*, AFDS consists of three autopilot flight director computers and the MCP. The MCP provides control of the autopilot, flight director, altitude alert, and autothrottle systems. The MCP is used to select and activate AFDS modes and establish altitudes, speeds, and climb/descent profiles.

The flight director information is displayed on the PFD. The AFDS does not have direct control of the flight control surfaces. The autopilot controls the elevators, ailerons, flaperons, and spoilers through the fly-by-wire flight control system.

1.6.3 Pitch Modes

As per the *FCOM*, there are several pitch annunciations, two of these annunciations are:

- TOGA
- ALT (active)

On the ground, TOGA annunciations are activated by either positioning the flight director switch to ON when both flight directors are OFF; or by pushing either TOGA switch while the airspeed is greater than 80 knots. The flight director PFD pitch bar indicates an initial pitch of eight degrees up. TOGA pitch guidance becomes active at lift-off.



After lift-off, the AFDS controls the pitch attitude to maintain:

- A target speed of V_2 plus 15 knots, or the airspeed³ at rotation (pitch attitude greater than two degrees) plus 15 knots, whichever is greater. If the current airspeed exceeds the target speed for 5 seconds, the target speed is reset to the lesser of the current airspeed or to V_2 plus 25 knots.
- The indicated airspeed (IAS)/MACH window speed if the window speed is changed to a speed greater than the target speed.

The Altitude (ALT) hold mode is engaged by:

- Pushing the MCP altitude HOLD switch, or
- Capturing the selected altitude from a V/S, FPA, or FLCH climb or descent.

1.7 Meteorological Information

The METAR⁴ of OMDB reported the following weather information at the time of the Incident:

OMDB 192300Z 18002KT CAVOK 21/15 Q1019 NOSIG

Wind was blowing from the south 180 degrees at a speed of 2 knots. Visibility was more than 10 kilometers. No Cumulonimbus or towering Cumulus below 5000 feet or minimum sector altitude (MSA), whichever was greater. Temperature was 21 °C. The QNH⁵ was 1019 hPa (Hectopascals), with no significant change.

1.8 Aids to Navigation

As per the operational flight plan (OFP), the SID was SENPA 2F (figure 2), which was flown by the flight crew for departure. As per the Commander's statement, the crew inserted the information of SENPA 2F SID in the Aircraft computer as planned.

³ The TO/GA pitch mode control law (1) receives V_2 speed from the Flight Management Computer and (2) takes a snapshot of the computed airspeed at the time pitch attitude exceeds 2 degrees. The applied speed target is 15 knots above the higher of those two values. In the event that V-speed are not available from the FMC, the MCP selected speed is in lieu of V_2

⁴ METAR: Metrological Aerodrome Report, used to transmit weather observation periodically via a dedicated frequency

⁵ QNH: The pressure set on the subscale of the altimeter so that the instrument indicates its height above sea level. The altimeter will read runway elevation when the aircraft is on the runway

Aids to navigation will be discussed in details in the Final Report.

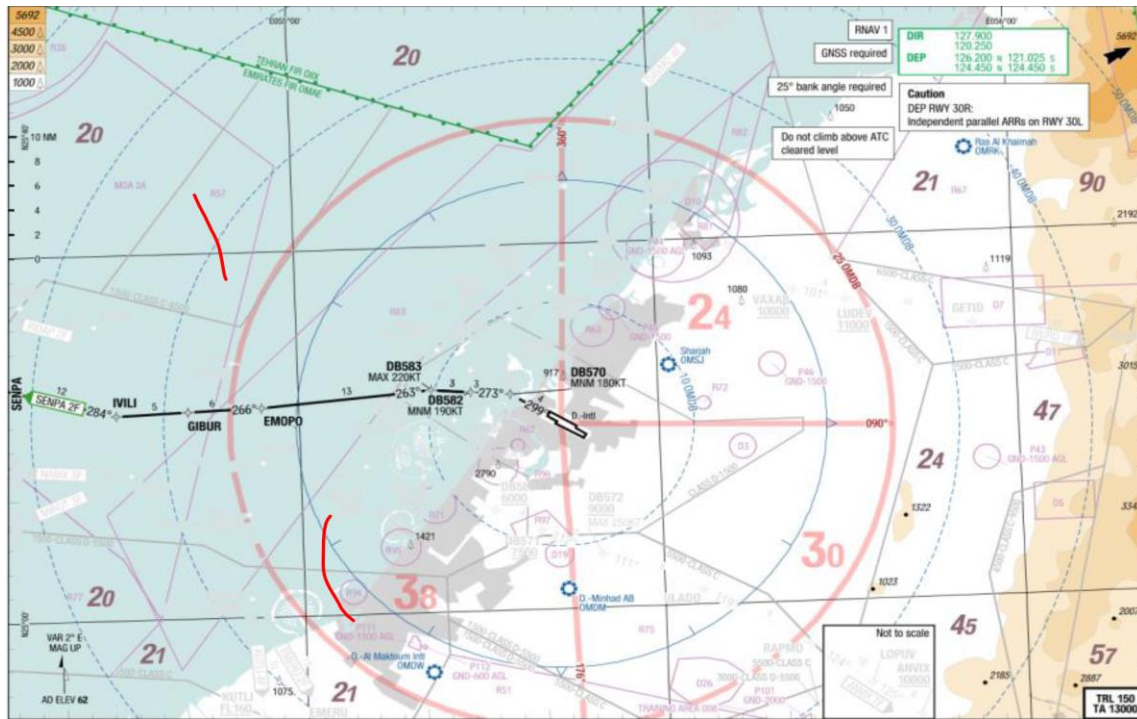


Figure 2. SENPA 2F SID

1.9 Communications

All communications between air traffic control and the flight crew were recorded by the ground based voice recording equipment and made available to the Investigation.

The details of the communications will be discussed in the Final Report.

1.10 Aerodrome Information

OMDB is the primary airport in Dubai, the United Arab Emirates. It is located 4.6 kilometres east of Dubai and has two parallel runways, 12R/30L and 12L/30R. These are 4,447 meters and 4,351 meters long, respectively.

Further details of aerodrome information will be discussed in the Final Report when required.

1.11 Flight Recorders

The Aircraft was equipped with a digital flight data recorder (DFDR) and a cockpit voice recorder (CVR) as described in table 4.



Table 4. Flight data recorder					
Recorder	Manufacturer	Part Number	Serial Number	Date Received	Date Downloaded
FDR	Honeywell	980-4750-003	06216	3 January 2022	3 January 2022
CVR	Honeywell	980-6032-003	06933	3 January 2022	3 January 2022

The DFDR was received in a good condition and the recorded data was successfully downloaded. Insight analysis of the downloaded data will be contained in the Final Report.

The CVR audio file was overwritten.

1.12 Wreckage and Impact Information

The Aircraft was intact.

1.13 Medical and Pathological Information

Post-accident blood tests did not reveal any psychoactive materials.

1.14 Fire

There was no evidence of fire.

1.15 Survival Aspects

None of the passengers or the flight and cabin crew were injured.

1.16 Tests and Research

To be discussed in the Final Report.

1.17 Organizational and Management Information

1.17.1 The Operator

Emirates was established in March 1985, and was granted air operator certificate (AOC) No. AC-0001 issued by the General Civil Aviation Authority of the United Arab Emirates.

1.17.2 The Air Navigation Services Provider

Dubai Air Navigation Services (dans) is the air navigation service provider in Dubai International Airport.

1.18 Additional Information

Additional Information will be discussed in the Final Report.

1.19 Useful or Effective Investigation Techniques

Further Investigation will be conducted in accordance with the *Civil Aviation Law* and *Air Accident and Incident Regulation (AAIR)* of the United Arab Emirates, and with the AAIS approved policies and procedures, and in accordance with the Standards and Recommended Practices of *Annex 13* to the Convention on International Civil Aviation.



2. Ongoing Investigation Activities

The Investigation is ongoing and will include further examinations and analysis of:

- The root cause of the shallow climb of the Aircraft and the crew performance.
- The related procedures and the implementation.
- Any other safety aspects that may arise during the course of this Investigation.

The Investigation will conduct an insight analysis of:

- Human factors.
- Organizational factors.

This Preliminary Report is issued by:

**The Air Accident Investigation Sector
General Civil Aviation Authority
The United Arab Emirates.**

E-mail: aai@gcaa.gov.ae