

الهيئة العامة للطيران المدني
GENERAL CIVIL AVIATION AUTHORITY



Air Accident Investigation Sector

Accident - Final Report -

AAIS Case N^o: AIFN/0008/2022

Runway Undershoot

Operator:	Private owner
Make and Model:	Cessna 208B Grand Caravan
Nationality and Registration:	The United States, N208JM
Place of Occurrence:	Al Bateen Executive Airport
State of Occurrence:	The United Arab Emirates
Date of Occurrence:	31 August 2022



This Investigation was conducted by the Air Accident Investigation Sector of the United Arab Emirates pursuant to Civil Aviation Law No. 20 of 1991, in compliance with Air Accident and Incident Investigation Regulation, and in conformance with the requirements of Annex 13 to the Convention on International Civil Aviation.

This Investigation was conducted independently and without prejudice. The sole objective of the investigation is to prevent future aircraft accidents and incidents. It is not the purpose of this activity to apportion blame or liability.

The Air Accident Investigation Sector issued this Final Report in accordance with the national and international standards and practices. Consultation with applicable stakeholders, and consideration of their comments, took place prior to the publication of this Report.

The Final Report is publicly available at:

<https://www.gcaa.gov.ae/en/departments/airaccidentinvestigation/Pages/InvestigationReports.aspx>

The Air Accident Investigation Sector The United Arab Emirates

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Occurrence Brief

AAIS Case N°:	AIFN/0008/2022
Operator:	Private owner
Aircraft make and model:	Cessna 208B Grand Caravan
Registration mark:	N208JM
Manufacturer serial number:	208B5100
Number and type of engines:	One, Pratt & Whitney Canada PT6A-140 turboprop engine
Date and time (UTC):	31 August 2022, at 1337 UTC (1737 LT)
Place:	Al Bateen Executive Airport, the United Arab Emirates
Category:	Transport (Passenger)
Persons on-board:	1
Injuries:	1

Investigation Process

The occurrence involved a private Cessna C208B Grand Caravan, registration mark N208JM. The occurrence was reported to the Air Accident Investigation Sector (AAIS) Duty Investigator by phone call to the Hotline Number +971 50 641 4667.

The AAIS opened an investigation in line with State's obligations in accordance with Annex 13 as the United Arab Emirates is the State of Occurrence. The investigation was led by an investigator-in-charge from the AAIS. The AAIS notified the National Transportation Safety Board (NTSB) of the United States being the State of Registry, Design, and Manufacture.

Because the Aircraft was destroyed, the occurrence was classified as an 'accident'.

Notes:

- ¹ Whenever the following words are mentioned in this Final Report with the first letter capitalized, they shall mean the following:
 - (Accident) – this investigated accident
 - (Aircraft) – the aircraft involved in this accident
 - (Pilot) – the pilot of the accident flight
 - (Investigation) – the investigation into this accident
 - (Owner) – the owner of the aircraft
 - (Report) – this accident investigation Final Report.
- ² Unless otherwise mentioned, all times in this Report are 24-hour clock in Coordinated Universal Time (UTC) which is the United Arab Emirates local time minus 4.
- ³ Photos and figures used in this Report are taken from different sources and are adjusted from the original for the sole purpose to improve the 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

AAIS	The Air Accident Investigation Sector of the United Arab Emirates
AD	Airworthiness directive
AED	Aerodrome emergency plan
ALT	Altitude
ALT	Alternator
AOC	Air operator certificate
ATC	Air traffic control
CAR	<i>Civil Aviation Regulations</i> of the United Arab Emirates
CAT	Category
CAVOK	Cloud and visibility OK
CPL	Commercial pilot license
CTR	Control zone
ERP	Emergency response plan
FAA	Federal Aviation Administration of the United States
FAR	Federal Aviation Regulations of the United States
FOA	Foreign Operators Affairs
FOR	<i>Foreign Operators Regulation</i>
FSDO	Flight Standards District Office (FAA)
GCAA	The General Civil Aviation Authority of the United Arab Emirates
GEN	General
ICAO	International Civil Aviation Organization
Kg	Kilogram
KIAS	Knots indicated airspeed
km	Kilometer
lb	Pound
LT	Local time
MAX	Maximum
METAR	Meteorological terminal air report
MHz	Megahertz
MIN	Minimum
MSG	Message
No.	Number
NOC	<i>No objection certificate</i>
NORM	Normal
NTSB	National Transportation Safety Board of the United States



PAPI	Precision approach path indicator
PIC	Pilot in command
PPL	Private pilot license
PROP	Propeller
PWR	Power
RPM	Revolutions per minute
SB	Service bulletin
SOC	Security operation center
STBY	Standby
UAE	The United Arab Emirates
VFR	Visual flight rules
UTC	Coordinated Universal Time
VRP	Visual reference point



Synopsis

On 31 August 2022, at 1321 UTC (1721 local time), a civil American-registered private Cessna 208B Grand Caravan departed from Sweihan to Al Bateen Executive Airport, Abu Dhabi, the United Arab Emirates, with a single pilot on-board and no passengers.

After about 15 minutes in-flight, and during descent on final to runway 31, the Pilot steepened the vertical flightpath to a low-level flight over the garden of Sheikh Zayed Grand Mosque. The Aircraft impacted tall palm trees and continued the flight path until ground impact at about one kilometer (0.54 nautical miles) from the runway threshold. The Aircraft was totally destroyed by the impact forces and consequent fire. The Pilot sustained body burns, but was able to vacate the Aircraft. He was transported to the hospital for further medical checks and treatment.

During the Investigation, no indication was found of Aircraft technical anomalies that could have contributed to the Accident.

The Air Accident Investigation Sector of the United Arab Emirates (AAIS) determines that the cause of the Accident was the non-adherence of the Pilot to the fundamental flying rules.

The AAIS issued safety recommendations addressed to the General Civil Aviation Authority of the United Arab Emirates (GCAA), Cessna, Abu Dhabi Airports, and Sheikh Zayed Air Navigation Center.



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1. Factual Information

1.1 History of the Flight

On 31 August 2022, at 1321 UTC (1721 local time), a private Cessna 208B Grand Caravan, registration marks N208JM, departed for visual flight rules (VFR) flight from Sweihan Air Base (OMAW) to Al Bateen Executive Airport (OMAD), the United Arab Emirates. The Pilot was the only person on-board.

After takeoff, the Aircraft climbed to 1,500 feet via Alpha Whiskey Four (AW4) and Alpha Delta One (AD1) VFR routes. The Aircraft levelled off at 1,500 feet altitude and continued flying for about 14 minutes until it reached the left downwind leg of OMAD runway 31 where it commenced descent.

At 1336:39, the Aircraft commenced turning left from the downwind to the base leg for runway 31. The altitude was approximately 1,100 feet while descending.

At 1336:53, the Aircraft commenced turning to the final leg while descending through 1,000 feet.

The Aircraft followed the glidepath until reaching 700 feet, thereafter, it steepened the vertical flightpath to a low-level flight over the garden of Sheikh Zayed Grand Mosque, Abu Dhabi, the United Arab Emirates. The Aircraft impacted palm trees and continued the flight path until ground impact at 1337:31, about one kilometer (0.54 nautical miles) from the runway threshold.

The Aircraft was totally destroyed by the impact forces and consequent fire. The Pilot sustained body burns, but was able to vacate the Aircraft. He was transported to the hospital for further medical checks and treatment.

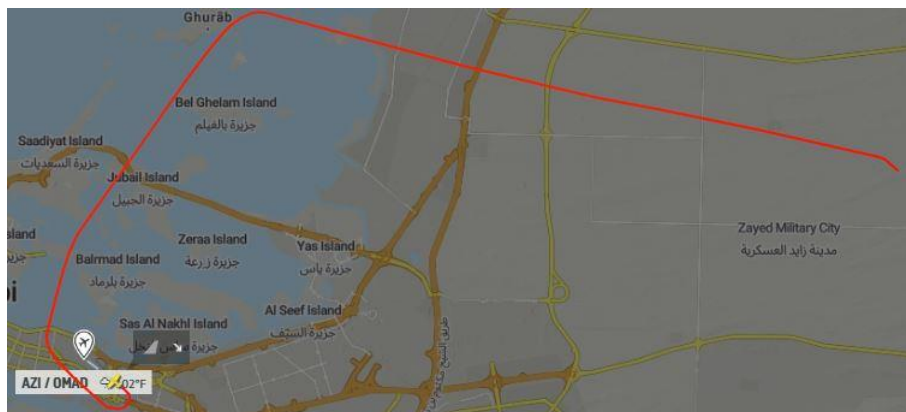


Figure 1. Aircraft flight path from OMAW to OMAD

1.2 Injuries to Persons

The Pilot sustained body burns.

1.3 Damage to Aircraft

The Aircraft was destroyed due to the impact forces and the subsequent fire.

1.4 Other Damage

Some palm trees and the garden ground surface, where the Aircraft rested, were damaged.



1.5 Personnel Information

1.5.1 The Pilot

The Pilot held a commercial pilot license (CPL) issued by the Federal Aviation Administration of the United States (FAA) on 6 June 2018.

He held a 3rd class FAA pilot medical certificate that was issued on 12 January 2020. This certificate had a validity duration of two years (24 months) for over 40 years old according to §61.23(d) of 14CFR *Federal Aviation Regulations (FAR)*. In this case, the Pilot's medical certificate had expired about seven months before the date of the Accident flight.

Although the CPL has no expiry date, its validity must be linked to the validity of the medical certificate since the Pilot flew the Aircraft in the United Arab Emirates. Flying with expired medical certificate did not comply with article (7), item (5), of the United Arab Emirates *Civil Aviation Law 20 of 1991*.

The Pilot had accumulated about 5,000 flying hours, including 600 hours on Cessna 208 Caravan, out of which about 570 hours as pilot in command (PIC).

On the day of the Accident, the Pilot had performed two flights before the Accident flight. The Accident flight was the second one, while the first flight was carried out from OMAD to OMAW with another similar type aircraft.

1.5.2 The Mechanic

The mechanic, who accomplished the inspections and maintenance tasks on the Aircraft before its departure, was a holder of a mechanic certificate with airframe and powerplant (A&P) ratings issued by the FAA on 1 November 2021. He also held an inspection authorization (IA) issued by the FAA, which was valid until 31 March 2023.

1.6 Aircraft Information

1.6.1 General type information

Cessna 208 Caravan is a single turboprop engine-powered aircraft, equipped with fixed tricycle landing gear. The aircraft type was certificated by the FAA for short-haul regional operations and utility aircraft¹ that is built in by Cessna.

The type is designed for two-pilots' operations, but it enables single-pilot operations under VFR. The cabin is configured for 9 to 14 passenger seats.

The Accident Aircraft was Cessna 208B Grand Caravan which was a stretched version of the Cessna 208 Caravan. The cockpit was equipped with Garmin G1000. (Figure 2)

1.6.2 The Aircraft – General information

The Aircraft was manufactured in March 2014 under manufacturer serial number 208B5100. It was delivered to the Owner in April 2014.

¹ A utility aircraft is a general-purpose light airplane or helicopter, usually used for transporting people, freight or other supplies, also used for other duties when more specialized aircraft are not required or available.



Figure 2. Historical photo of the Accident Aircraft

The Aircraft was fitted with a Pratt & Whitney Canada PT6A-140 turboprop engine under manufacturer serial number VA0105, and Hartzell aluminum three-blade HC-B3TN-3AF/T10890CNB-2 propeller under manufacturer serial number BUA32783.

The Aircraft was issued a standard certificate of airworthiness by the FAA on 15 March 2014, and certificate of registration on 12 April 2017. The Pilot stated that registering the Aircraft in the United Arab Emirates was “costly”, therefore he decided to operate the Aircraft with the original foreign registration.

Based on the mechanic’s statement, the Foreign Operators Affairs, in the General Civil Aviation Authority of the United Arab Emirates (GCAA), had communicated with the Owner in 2015 for basing the Aircraft in the United Arab Emirates. However, until the Accident date, the Owner was not issued a *no objection certificate* from the GCAA for basing the Aircraft. The Investigation could not find an evidence of this communication.

The insurance certificate was issued on 20 October 2020 for one-year validity and had expired about 10 months before the Accident. According to the Pilot’s statement, the insurance was not renewed because of the Covid-19 pandemic which was prevailing at that time.

1.6.3 Maintenance records

The maintenance records revealed that the scheduled maintenance tasks were accomplished in accordance with Cessna’s recommended maintenance program and *FARs*. Repairs and maintenance services were carried out as required, and the applicable airworthiness directives (ADs) and service bulletins (SBs) were executed as per the continuing airworthiness requirements.

The last scheduled maintenance was carried out on 30 August 2022 (one day before the Accident). The records indicated that two functional checks for compliance with *FAR §91.411* (for the certification checks of the pitot-static system), and *FAR §91.413* (for the transponder system) remained open and only verification checks² on these systems were completed. These open items limited the operation to only VFR flights.

There were no technical defects reported by the Pilot, and the systems were functioning normally. The Aircraft was safe to fly when it was released for the flight.

1.6.4 Aircraft performance

The Aircraft performance data indicate that the stall speed at flaps UP (retracted) and idle engine power configuration was 78 knots, whereas it was 61 knots at flaps ‘full’ (fully extended) and idle power.

² Verification check is a process of checking a system ensuring proper functioning according to the basic specifications.

The Aircraft's departed with approximately 7,687 lb (3,487 kg) gross weight, whereas the certificated maximum take-off weight was 8,807 lb (3,995 kg). The Investigation calculated the weight at ground impact to be about 7,526 lb (3,414 kg). The center of gravity was almost forward.

1.6.5 Engine and propeller controls

The engine and propeller are controlled by four separate controls that consist of:

- Power lever;
- Emergency power lever;
- Propeller controller arm; and
- Fuel condition lever. (Figure 3)

The power and fuel condition levers control the engine, whereas the propeller controller arm controls the propeller speed and feathering.

The wreckage exhibited unfeathered propeller, and propeller controller arm at the "maximum" position. However, one of the three propeller blades was found twisted due to the ground impact force. The twist angle appeared similar to a feathered blade angle.

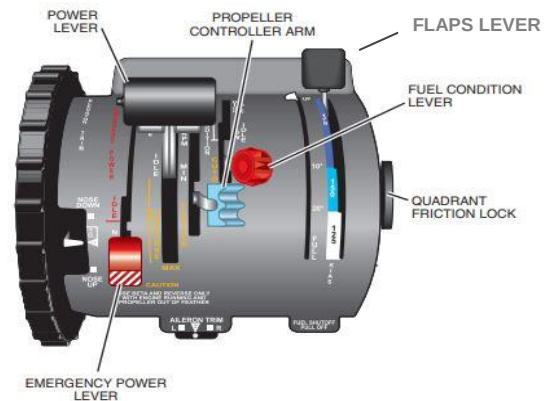


Figure 3. Example of the control pedestal of Cessna 208 Caravan

The power lever controls the engine power through the full range from maximum take-off power (MAX), backward full reverse (REVERSE) through idle (IDLE).

The range from MAX to IDLE position enables the pilot to select the desired engine power. Beta mode³ is the engine operational mode in which the pilot can control the pitch of the propeller blades from idle thrust backward to maximum reverse thrust passing through zero (no thrust) (Beta range).

As per the *pilot's operating handbook* and the FAA approved *airplane flight manual*, the Beta mode can only be used on-ground. This document also mentions in-flight retard of the power lever below idle is prohibited.

The fuel condition lever controls the minimum rotational speed (revolution per minute "RPM") of the gas generator turbine (Ng) when the power lever is at the IDLE position. This lever has CUTOFF, LOW IDLE, and HIGH IDLE positions. The CUTOFF position shuts off all fuel to the engine fuel nozzles, LOW IDLE positions the control rod stop to provide an RPM of 52% Ng, and HIGH IDLE positions the control rod stop to provide an RPM of 65% Ng.

The propeller controller arm is connected through linkage to the propeller governor mounted on top of the front section of the engine, and controls propeller governor settings from the maximum RPM (MAX) position to full feather (FEATHER) through the minimum RPM (MIN) position. The MAX position is used when high RPM is desired and governs the propeller speed at 1,900 RPM. propeller controller arm settings from the MAX position to minimum RPM (MIN) permit the pilot to select the desired engine RPM for cruise. The FEATHER position is used during normal engine shutdown to stop rotation of the power turbine and front section of the engine.

³ Beta mode is one of the engine operational modes that the power lever is placed backward the idle mode which controls the pitch of the propeller blades and produces minimum level or zero of thrust.

From the wreckage, the power lever was found at MAX position, and the fuel condition lever was at a HIGH IDLE position.

1.7 Meteorological Information

The meteorological terminal air report (METAR) of OMAD provided to the Investigation around the time of the Accident is illustrated in table 1.

Table 1. OMAD weather	
Time	1300 UTC (1700 LT)
Wind	340 degrees/10 knots
Visibility	More than 10 km
Clouds	CAVOK
Air temperature	38 degrees Celsius
Dew point	16 degrees Celsius
Pressure (altimeter)	1003 Hectopascal, no significant change
Time	1400 UTC (1800 LT)
Wind	340 degrees / 10 knots
Visibility	More than 10 km
Clouds	CAVOK
Air temperature	36 degrees Celsius
Dew point	22 degrees Celsius
Pressure (altimeter)	1003 Hectopascal, no significant change

When the Aircraft was at downwind leg while descending through 1,200 feet, the air traffic controller provided the Pilot with landing clearance and wind information. The wind speed was 9 knots with a direction of 330 degrees, which was almost identical to the METAR wind information.

The environmental conditions prevailing during the flight were normal, and the flight was performed during daytime. The sunset time was at about 1841 LT (1441 UTC).

The Pilot stated that the weather was normal and the sun position did not affect the flight on final approach.

1.8 Aids to Navigation

There were no reported defects related to on-board navigation aids or their serviceability. The navigation aids were functioning normally.

1.9 Communications

All communications between the Pilot and air traffic control (ATC) were generally clear and normal and were recorded by the ground-based voice recording equipment. The recorded communication and its transcript were made available to the Investigation.

1.10 Aerodrome Information

OMAD is located 12 kilometers southeast Abu Dhabi city center. The airport elevation is 18 feet. It is equipped with one asphalt runway 13/31 which is 3,202 meters long and 45

meters wide. Both runway sides are equipped with precision approach path indicator (PAPI) lights. The PAPI is calibrated for 3.5 degrees glideslope.

1.11 Flight Recorders

The Aircraft was not equipped with flight recorders (cockpit voice recorder and flight data recorder), and, according to the *FARs*, it was not required to be fitted with such recorders.

The recordings of ATC communication and Aircraft movement were available to the Investigation. The Investigation also used flight tracker data taken from Flightradar 24 and AirNav Radar Box.

Based on the data, the Aircraft took off from OMAW at 1321:21. It then climbed to 1,100 feet and levelled off at 1322:35.

At 1323:15, the Pilot contacted INFO on 127.500 MHz for the first time. The Pilot informed that the Aircraft took off from Sweihan to Al Bateen as the destination through Alpha Whiskey Four (AW4) and then Alpha Delta One (AD1) VFR routes.. INFO informed the Pilot that the QNH was 1003 mbar.

At 1324:45, the Aircraft commenced climb to 1,400 feet and levelled off at 1326:00.

At 1328:18, the Aircraft commenced climb to 1,500 feet and levelled off at 1328:33.

At 1333:00, INFO instructed the Pilot to contact Al Bateen Tower on 119.900 MHz.

At 1333:27, the Pilot contacted Al Bateen Tower. He informed the controller the Aircraft was at Alpha Delta One route and almost reached YIF visual reference point (VRP) inbound for landing. The controller instructed the Pilot to enter Al Bateen control zone (CTR) via Alpha Delta One route for the landing at runway 31. The wind information with a speed of 9 knots and direction of 330 degrees was given by the controller, also the QNH of 1003 mbar, which was then correctly read back by the Pilot.

At 1334:39, the controller cleared the Aircraft to cross west of the threshold of runway 13 in order to join the left downwind for the landing on runway 31, which was then correctly read back by the Pilot.

At 1335:43, the Aircraft was on the downwind at 1,500 feet abeam with the threshold of runway 13.

At 1335:55, the Aircraft commenced descent while still at the downwind leg.

At 1336:31, the controller cleared the Aircraft to land and provided the wind information with a speed of 9 knots and a direction of 330 degrees. The Pilot correctly read back.

At 1336:39, the Aircraft commenced turn to the base leg. The altitude was approximately 1,100 feet.

At 1336:53, the Aircraft commenced turn to the final leg while descending through 1,000 feet. The true airspeed was about 100 knots.

When the Aircraft reached approximately 700 feet altitude, the glide path became steeper than it should be.

At 1337:30, the Aircraft disappeared from the radar screen.

At 1337:56, the controller activated the crash alarm.

Figure 4 illustrates the Aircraft's vertical path on the final leg based on the available data. A 3.5 degrees glideslope is included as per the PAPI.

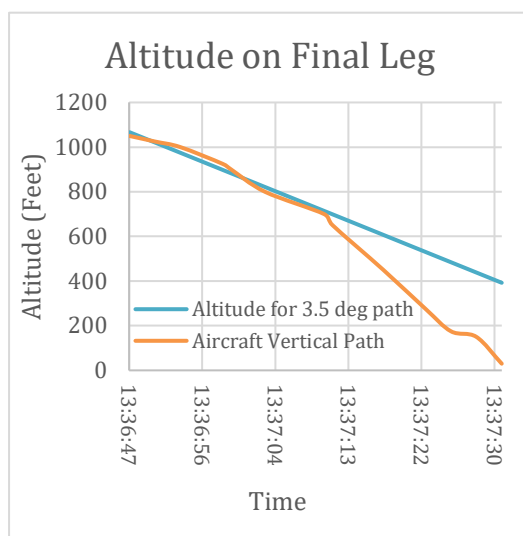


Figure 4. Vertical flight path on the final leg

1.12 Wreckage and Impact Information

The Aircraft was destroyed by the impact forces. The consequent fire consumed the majority of the aircraft's front and middle structure including the wings. The rear side exhibited damage but with less burnt composite materials.

The Aircraft rested in a position with the nose heading to 200 degrees, at about one kilometer (0.54 nautical miles) inbound from the threshold of runway 31. The elevation of the impact area was identical to the elevation of the runway.

The wing flaps were found fully retracted to clean configuration. However, the flaps handle disintegrated from the flap control panel and could not be found among the wreckage pieces. (Figure 5)





Figure 5. Wreckage distribution

1.13 Medical and Pathological Information

No medical tests were performed.

1.14 Fire

Due to the ground impact, the Aircraft's two main fuel tanks located in each wing broke, which resulted in the Aircraft catching fire.

1.15 Survival Aspects

The Pilot was able to vacate the Aircraft after the ground impact. He sustained a minor injury with body burns and was transported to the hospital.

The Accident occurred outside the perimeters of OMAD. The airport rescue and fire-fighting service was deployed to the site, and the airport emergency category was lowered to "zero" because of the degradation of the rescue and firefighting services in the airport.

The Airport Police Operations Center was notified by the Airside Operations. Abu Dhabi Police Command and Control Center was not notified by the Airport Police Operations Center.

The approved Abu Dhabi Airport Emergency Plan call-out notification chart/list includes notification and activation of Abu Dhabi Airports Police Security Operation Center (SOC) which was tasked to notify all relevant internal entities relative to the Accident and their internal escalation protocols, including Abu Dhabi Police command and control center.

1.16 Tests and Research

No tests or research were required to be conducted for the Investigation.

1.17 Organizational and Management Information

The Pilot was the Owner of the Aircraft.

The Aircraft was operated for private and non-commercial operations under *FAR Part 91*, which authorizes operators under this category to practice non-commercial operations. *Part 91* does not require an air operator certificate (AOC) to be issued for this category.

1.17.1 Regulatory, oversight, and authorizations

1.17.1.1 Chicago Convention

The international aviation is governed by the Convention on International Civil Aviation (Chicago Convention). Article (1) – *Sovereignty*, of the Convention states, "The

contracting States recognize that every State has complete and exclusive sovereignty over the airspace above its territory.” This grants the authority to the States to legislate and regulate the aviation system within their territory, whether for their locally registered aircraft or for foreign aircraft.

Foreign aircraft and operators are required to comply with the legal and regulatory requirements of the State they fly in its territory. However, a State's civil aviation law and regulations shall be in conformance with the Standards set forth by the International Civil Aviation Organization (ICAO) as embedded in the Annexes to the Convention. A State may deviate from a Standard, but this shall be filed as difference.

Paragraph 1.2.4.5 of Annex 1 to the Chicago Convention states the international Standard as:

“ Until 2 November 2022, except as provided in 1.2.5.2.6, flight crew members or air traffic controllers shall not exercise the privileges of their licence unless they hold a current Medical Assessment appropriate to the licence.

As of 3 November 2022, except as provided in 1.2.5.2.6, flight crew members, remote flight crew members or air traffic controllers shall not exercise the privileges of their licence unless they hold a current Medical Assessment appropriate to the licence.”

This international Standard link the validity of the license with a valid medical certificate. The expiry of the medical certificate will cause the license to be revoked.

1.17.1.2 Civil Aviation Law and Regulations of the United Arab Emirates

Article (6) of the United Arab Emirates *Civil Aviation Law 20 of 1991*, requires an authorization or permit for operations in the territory of the United Arab Emirates. Article (6) states:

“No aircraft shall operate in the territory of the State or in the airspace above its territory without authorization or permit being issued by the Competent Authority [the General Civil Aviation Authority “GCAA”] and in accordance with the terms thereof. The operator of such aircraft may be permitted to undertake specific operations by virtue of an international agreement to which the State is a party, or a bilateral air agreement in force between the State and another State for the regulation of air transport.

The authorization or permit as granted shall be considered personal and not transferable to other persons.”

Article (7) lists the main requirements to be met by aircraft operating in the territory of the United Arab Emirates. Item (5) of the requirements states:

“5. Members of the flight crew must hold valid licenses issued or rendered valid by the State of registry, and must be of a number equal to that specified in the certificate of airworthiness, and...”

Concerning the aircraft insurance, Item (6) of article (7) of the *Civil Aviation Law 20 of 1991* states:

“6. The aircraft must be insured for the benefit of its crew, passengers and third party on the surface, in accordance with the established rules.”

Foreign Operators Regulation of the United Arab Emirates, *CAR-FOR, GEN.003* (b) – *Definitions*, defines the terms ‘operator’ and ‘basing’ as:

“Operator. A person, organisation or enterprise authorised by a foreign State to operate an aircraft. If no person, organisation, or enterprise is designated, the GCAA will consider that the operator is the owner of the aircraft or its legal representative.”

“Basing.



An aircraft is considered to be based in UAE [United Arab Emirates] if:

- (a) It has not been in the State of the Overseeing Authority for more than 60 days; and
- (b) It has been operated from or to airports located in the UAE more than 14 days within the 60 day period.”

CAR-FOR, NOC.010 – Basing of an aircraft in the territory of the UAE, states:

“No operator shall base an aircraft in the territory of the UAE unless:

- (a) It holds a No Objection Certificate issued by the GCAA;
- (b) The aircraft is in the territory of UAE for the purpose of aircraft maintenance, and the departure flight is a non-revenue flight; or
- (c) The aircraft involved in CAT, is in the territory of the UAE for the purpose of parking or long term storage, and the departure flight if any, from UAE is a non-revenue flight.”

The Owner was not granted an authorization or permit from the GCAA to base and operate the Aircraft in the United Arab Emirates. The Investigation could not find an application or any document that reflects the intention of the Owner for obtaining such authorization.

1.17.1.3 The FAA oversight system

According to the FAA system, the FAA does not carry out scheduled oversight functions on privately owned and operated aircraft. This policy applies for general aviation aircraft operated either in the territory of the United States or outside. The FAA only performs oversight program on commercially operated aircraft and organizations.

The FAA inspectors occasionally perform ramp inspections⁴ on private and commercial aircraft located in the United States regardless its nationality. Normally, the Flight Standards District Offices (FSDO), responsible for the district in which the airport is located, is assigned for this inspection.

The FAA inspectors do not routinely perform oversea inspections on aircraft or operators unless there has been a justification for such activity.

Based on the above policies, the FAA had never performed any oversight task on the Aircraft since its delivery to the Owner in the United Arab Emirates.

1.18 Additional Information

1.18.1 Airstart procedures

The preferred airstart procedures according to the *pilot's operating handbook and FAA approved airplane flight manual* are the following:

“AIRSTART	
STARTER ASSIST (Preferred Procedure)	
1. BATTERY Switch	ON
2. AVIONICS No. 1 Switch	ON
3. Electrical Load	REDUCE
a. STBY ALT PWR Switch	OFF
b. AVIONICS Bus 2 Switch	OFF
c. IGNITION Switch	NORM
d. Left LIGHTS Panel Switches (9 total)	OFF
e. POWER OUTLET Switch	OFF
f. VENT AIR FANS	OFF
g. AIR CONDITIONING (if installed)	OFF

⁴ Ramp inspection: Surveillance of an airman, operator, or air agency during actual operations at an airport. It is a routine function for an inspector in response to notification or observation of a possible violation of the federal aviation regulations or as part of random.



h. BLEED AIR HEAT Switch	OFF
4. EMERGENCY POWER Lever	NORMAL
5. POWER Lever	IDLE
6. PROP RPM Lever	MIN RPM
7. FUEL CONDITION Lever	CUTOFF
8. FUEL SHUTOFF Knob	ON (push in)
9. FUEL TANK SELECTORS	BOTH ON
10. FUEL BOOST Switch	ON
11. Altitude	20,000 FEET MAXIMUM
12. STARTER Switch	START and OBSERVE
a. IGNITION ON CAS MSG	CHECK ON
b. Engine Oil Pressure Indication	CHECK
c. Ng	12% MINIMUM
13. FUEL CONDITION Lever	LOW IDLE and OBSERVE
a. FFLOW PPH	90-140 pph
b. ITT	MONITOR (1090°C maximum)
c. Ng	52% MINIMUM
14. STARTER Switch	OFF
WARNING	
If conditions exist such as heavy precipitation or nearly empty fuel tanks, turn the IGNITION Switch ON.	
15. FUEL BOOST Switch	NORM
(unless it cycles on and off; then leave ON)	
16. FUEL CONDITION Lever	HIGH IDLE
17. PROP RPM Lever.	SET
18. POWER Lever	SET
19. STBY ALT PWR Switch	ON
20. AVIONICS No. 2 Switch	ON
21. Electrical equipment	AS REQUIRED"

1.19 Useful or Effective Investigation Techniques

This Investigation was conducted in accordance with the *Air Accident and Incident Investigation Regulation* of the United Arab Emirates, and in adherence with the AAIS approved policies and procedures, and in conformity with the Standards and Recommended Practices of *Annex 13 to the Chicago Convention*.

2. Analysis

2.1 General

The Pilot held a valid FAA commercial pilot license (CPL), however, his 3rd class FAA pilot medical certificate was expired. As per the FAA regulatory requirements, the 3rd class medical certificate was only valid for a private pilot license (PPL). Hence, although holding a CPL, he flew the Aircraft with limitation by exercising the privileges of a PPL instead of a CPL.

The Aircraft was safe to fly when released for the flight, and the weather condition was normal and not contributory to the Accident.

2.2 The Vertical Path on the Final Leg

When the Aircraft turned to the left from the base to the final leg at 1336:53, the altitude was about 1,000 feet, while the Aircraft was on continuous descent (figure 6).

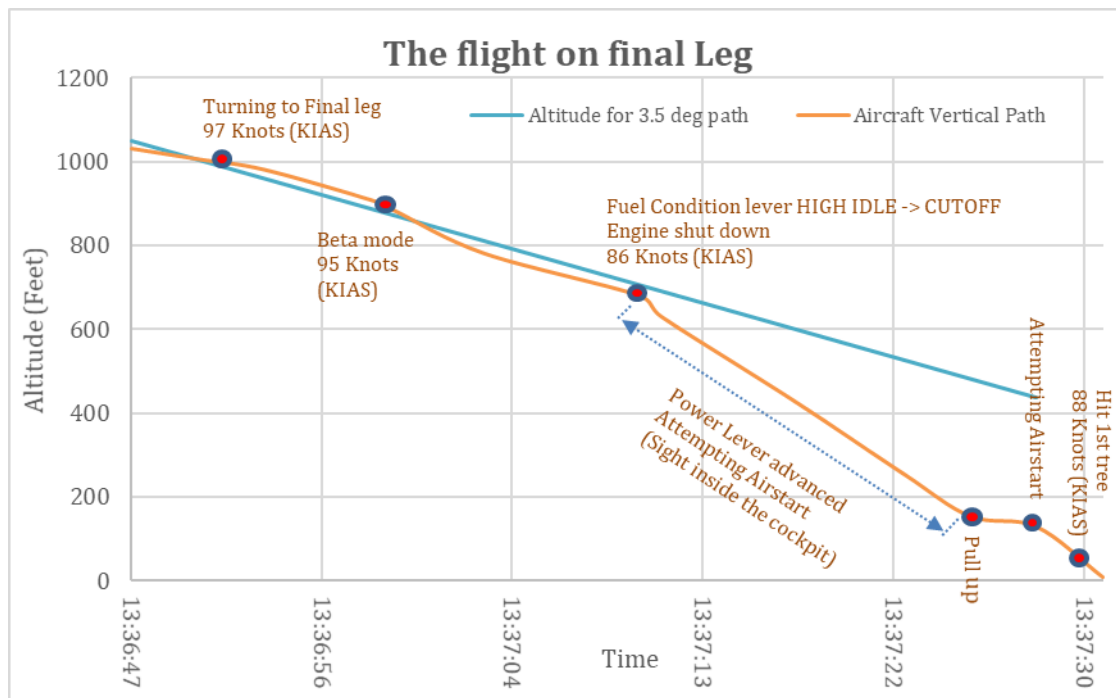


Figure 6. Events on the final leg

As per the Pilot's statement, he commanded the flaps to the 2nd setting (20 degrees) when the Aircraft was at the base leg, but that setting was not proven by the wreckage which exhibited the flaps fully retracted. Therefore, the Investigation determines that the flaps were not extended before the impact.

The true airspeed was about 100 knots at 1,000 feet altitude when the Aircraft was turning to final leg. Although the Pilot did not refer to the PAPI lights and he used his judgement instead (as per his statement), the Aircraft's vertical path was proximate to the PAPI glide path of 3.5 degrees until the Aircraft reached 700 feet. The Pilot stated that he was able to clearly see the threshold of runway 31 and his target was to land at the threshold and vacate the runway via taxiway Tango 5.

When the Aircraft was just at final leg, the Pilot assumed that the Aircraft was slightly high. As the flaps were not extended, consequently the true airspeed (approximately 98 knots) was relatively high due to the less drag. Alternatively, and as an attempt to reduce airspeed and lower the altitude, the Pilot elected to apply the beta mode which was a prohibited practice in-flight. As shown in figure 5, the Aircraft was between 900 and 1,000 feet when the Pilot



assumed the Aircraft was “slightly high”. He stated that using the beta mode is a common practice during landing to lose height, just like an airbrake, and if undershoot is exposed, the beta mode then should be taken out by moving the power lever forward to bring back the Aircraft on the profile.

Moving the power lever to beta mode in-flight might have led to loss of control or resulted in an engine overspeed condition and consequent loss of engine power. As per design, the power lever of the Cessna 208 Caravan is not provided with a detent at the IDLE position for further backward movement to the beta mode. This will allow a pilot to move lever to beta mode without any mechanical resistance.

Starting from approximately 700 feet until reaching 130 feet altitude, the Aircraft had a glideslope of 5 degrees, which exceeded the normal PAPI glideslope (3.5 degrees). As per the Pilot's statement, he perceived that the Aircraft was at a “lower side from the vertical flightpath”, which is believed by the Investigation that his observation occurred after the Aircraft reached 700 feet altitude.

As per his statement, the Pilot then attempted to extend the flaps from 20 degrees to the full down position. However, instead of moving the flaps lever, the Pilot inadvertently stowed the fuel condition lever from the HIGH IDLE to CUTOFF which caused the engine to shut down. However, since the beta mode was still active, the Aircraft's rate of descent steeped below the normal approach flightpath.

The Investigation could not exactly determine why the Pilot missed to stow the flaps lever. However, since the flaps lever was located besides the fuel condition lever on the control pedestal (as shown in figure 3), and he most probably did not give particular attention when using the lever since his sight was out of the flight deck observing the aircraft (lower) vertical path.

The Pilot then realized that there was no engine power as per his statement. He then, most probably, moved his head down to the right looking at the control pedestal and moved the power lever forward to advance the engine power. However, there was no engine response after his action. The Investigation believes that, at this point, the Pilot realized his mistaken movement of the fuel condition lever from the HIGH IDLE to the CUTOFF position.

The Pilot attempted an airstart by moving the fuel condition lever forward from CUTOFF to LOW IDLE. He then changed his eye view to down to the left at the switch and circuit breaker panel, and moved the toggle to START on the starter switch. However, the engine did not respond.

The unsuccessful engine restart might be attributed to incorrect ‘Starter Assist’ preferred procedures. The initial conditions for restart were not fulfilled by having the power lever setting more forward than the required IDLE position, the PROP RPM lever at the MAX instead of MIN, and the fuel condition lever at LOW IDLE instead of CUTOFF.

During his attempt to restart the engine, the Pilot's sight was fixated inside the cockpit. It is believed that fixation had degraded his situation awareness, and the steep rate of descent went unnoticed. It is also believed that at 130 feet altitude, the Pilot redirected his sight to peripheral external view and at that time he realized that the Aircraft flew lower than the correct vertical path. Consequently, he attempted to pitch the nose up which levelled the aircraft for a while (about two seconds) before returning to the steep descent.

Thereafter, the Pilot reattempted to restart the engine such that he moved his sight inside the cockpit since he realized that the Aircraft could not reach the threshold. Moving his sight inside the cockpit led to a loss of his situation awareness. During this attempt, he most probably moved the fuel condition lever from LOW IDLE to the HIGH IDLE position, and the power lever to MAX, as revealed from the aircraft wreckage.

After about two seconds, the Aircraft impacted few palm trees before impacting the ground.

2.3 The Airspeed

The prevailing atmosphere around OMAD was ISA+22⁵. Since the compressibility effect is negligible, and the installation and instrument error are considered negligible, the indicated airspeed can confidently be determined by true airspeed minus 3 knots⁶ for ISA+22 condition.

Based on the groundspeed extracted from the flight tracker data, and the last wind information provided by OMAD Tower control; the true airspeed was determined to be about 98 knots (95 knots indicated airspeed) at 900 feet altitude, 89 knots (86 knots indicated airspeed) at 700 feet, and 91 knots (88 knots indicated airspeed) when the Aircraft impacted the first tree.

Comparing the indicated airspeed along the final flight path with the stall speed (78 knots at flaps 'up' position), the hypothesis of stall would be eliminated. This was confirmed by the Pilot who stated that he did not hear stall warning horn before the Aircraft impacted the ground as well as the wreckage distribution pattern at the accident site.

2.4 Legality of Operations

The Aircraft was based in the United Arab Emirates since 2014 without any authorization or permit granted by the GCAA under article (6) of the *Civil Aviation Law 20 of 1991*. This fundamental article should have required the Owner to apply for the authorization/permit from the Foreign Operators Affairs (FOA) Department in the GCAA.

During his interview, the mechanic stated that FOA had communicated with the Owner in 2015 for basing the Aircraft in the United Arab Emirates. However, the Investigation was not provided with evidence of that communication, and until the accident date the Owner had never applied to the GCAA for obtaining *no objection certificate* under *CAR-FOR* provisions.

The Aircraft was based in OMAD, and since its arrival in 2014, the Aircraft was operated with no oversight records of the FAA, as being the regulatory civil aviation of the State of Registry (the United States), and the FOA as being the department responsible for granting authorization/permit (by means of *no objection certificate*) for foreign aircraft operations in the United Arab Emirates.

The FOA was not aware of the Aircraft since *no objection certificate* to base the Aircraft in the United Arab Emirates had never been applied by the Owner. The aircraft operated under a military call sign between UAE civil airports and military bases, without mentioning the aircraft registration. The GCAA regulation does not define the limits of a military call sign, hence, all airports in the UAE have considered any operation with "AF" callsign as a military (non-civil) operation, and do not report such cases to GCAA FOA. The Investigation could not find any means that was in place to detect operations of the Aircraft without approvals.

The absence of the FAA and FOA oversight roles allowed the operations to be run arbitrarily with no governing rules or operational limitations. The Pilot was practicing flying with

⁵ International standard atmosphere (ISA) is an atmospheric condition where the pressure is 1013.2 millibar, temperature of 15°C, and air density of 1.225 kg/m³ at mean sea level. ISA+22 condition means that the atmospheric condition has a temperature of 22°C higher than the ISA condition.

⁶ Indicated airspeed is 3 knots less than true airspeed for ISA+22 condition, by using equation: Indicated airspeed = true airspeed $\times (p/p_0)^{0.5}$ or true airspeed $\times (p/p_0)^{0.5}$, and $p = P/RT$ where: p is the actual pressure; p is the actual air density depends on the actual temperature (T), R is the specific gas constant.



expired medical certificate that must have consequently revoked his license as dictated by the international Standard embedded in paragraph 1.2.4.5 of Annex 1 to the Chicago Convention.

The non-compliance with the requirements of validity of pilot license (Article (7), item (5)) and aircraft insurance (Article (7), item (6)) of the *Civil Aviation Law 20 of 1991* could not be proactively detected by the FAA or the GCAA.

The expiration of the Pilot's medical certificate raised concerns about the certainty of his fitness for the flight. The Investigation did not request medical checks to be carried out on the Pilot by approved medical examiner under class 3 checklist, therefore his medical fitness for the flight could not be definitely identified. The Pilot stated during his interview that he was under impression that his medical certificate was still valid.

The Pilot stated that registering the Aircraft in the United Arab Emirates is expensive, therefore he decided to operate the Aircraft with the original American registration. He also added that he did not renew the Aircraft insurance before the due date because of the Covid-19 pandemic.

2.5 Survivability and Emergency Response to the Accident

The Accident occurred within the jurisdiction of OMAD rescue and firefighting services (about 1,000 meters from the threshold of runway 31), however, the physical Accident location was outside the airport's fence that required coordination with Abu Dhabi Police. Abu Dhabi Airport's *aerodrome emergency plan (AEP)* listed Abu Dhabi Airports Police Security Operation Center (SOC) in the emergency notification list. However, in this Accident, Abu Dhabi Police Command and Control Center was not notified by the Abu Dhabi Airports Police Security Operation Center.

3. Conclusions

3.1 General

From the evidence available, the following findings, causes, and contributing factors were made with respect to this Accident. These shall not be read as apportioning blame or liability to any particular organization or individual.

To serve the objective of this Investigation, the following sections are included in the Conclusions heading:

- **Findings.** Are statements of all significant conditions, events, or circumstances in this Accident. The findings are significant steps in this Accident sequence but they are not always causal or indicate deficiencies.
- **Causes.** Are actions, omissions, events, conditions, or a combination thereof, which led to this Accident.
- **Contributing factors.** Are actions, omissions, events, conditions, or a combination thereof, which, if eliminated, avoided, or absent, would have reduced the probability of the Accident occurring, or mitigated the severity of the consequences of the Accident. The identification of contributing factors does not imply the assignment of fault or the determination of administrative, civil, or criminal liability.

3.2 Findings

3.2.1 Findings relevant to the Aircraft

- (a) The Aircraft was registered in the United States and was issued certificate of airworthiness as per the *Federal Aviation Regulations (FARs)* of the United States.
- (b) The Aircraft was maintained in accordance with the requirements of *FARs*. The certification checks on the pitot-static and transponder systems had not been carried out, which limited the flight to be within visual flight rules (VFR).
- (c) The Aircraft was safe to fly when released for the VFR flight, and there were no technical defects that could have adversely affected its performance.
- (d) The mechanic, who was assigned for the maintenance of the Aircraft, held a valid license issued by the Federal Aviation Administration of the United States (FAA)

3.2.2 Findings relevant to the Pilot

- (a) The Pilot held a valid commercial pilot license (CPL) issued by the FAA. However, since his medical certificate had expired, his CPL should have been revoked.
- (b) The medical fitness of the Pilot for the flight could not be determined by the investigation.

3.2.3 Findings relevant to the flight

- (a) The Pilot did not refer to the PAPI lights on the final approach for landing.
- (b) The beta mode was used on the final leg to reduce the airspeed and lower the altitude, which was inconsistent with the *pilot's operating handbook and FAA approved airplane flight manual*.



- (c) The Pilot unintentionally moved the fuel condition lever from HIGH IDLE to CUTOFF which resulted in engine shutdown. The Pilot incorrectly applied the airstart checklist as an attempt to restart the engine, and the engine did not respond.
- (d) The weather prevailing during the flight was not a contributing factor to the Accident, and the flight was before sunset.
- (e) The flight was performed with expired insurance certificate which was not in compliance with article 7(6) of the *Civil Aviation Law 20 of 1991*.

3.2.4 Findings relevant to operations

- (a) The Aircraft was operated by the Owner for private and non-commercial operations, and no private operator authorization or air operator certificate (AOC) was required to be issued under *FAR Part 91*.
- (b) The Owner did not apply for *no objection certificate* from the GCAA for basing the Aircraft in the United Arab Emirates. The Owner practiced flight operations without authorization/permit that should have been granted in accordance with article (6) of the United Arab Emirates *Civil Aviation Law 20 of 1991*.
- (c) There were no oversight inspections executed on the Aircraft by the FAA since its delivery date to the Owner (April 2014) until the date of the Accident.

3.2.5 Findings relevant to the emergency response to the Accident

- (a) Abu Dhabi Airports *aerodrome emergency plan (AEP)* listed Abu Dhabi Airports Police Security Operation Center, which was tasked to notify Abu Dhabi Police Command and Control Center as one of the relevant internal entities relative to an aircraft accident.

3.3 Causes of the Accident

The Air Accident Investigation Sector determines that the causes of the Accident were:

- (a) The Pilot applied command to reduce airspeed and altitude by moving the engine power lever to beta mode. This command is limited to slow down the aircraft after landing and is prohibited in-flight.
- (b) The Pilot shut down the engine by inadvertently moving the fuel condition lever from the HIGH IDLE to CUTOFF.
- (c) After engine shutdown, the vertical flightpath went steeper than the normal glidepath as would have been indicated by monitoring the PAPI lights.
- (d) As an attempt to restart the engine, the Pilot directed his attention to airstart which was unsuccessful. During that attempt, his peripheral external view was insufficient and accordingly his situation awareness downgraded. The steep vertical flightpath went unnoticed until the Aircraft impacted the ground.

3.4 Contributing Factors to the Accident

The Air Accident Investigation Sector identifies the following contributing factors to the Accident:

- (a) Applying flying techniques that were not in accordance with the standard operating procedures published by the Aircraft manufacturer.



- (b) The Pilot currency and recency were not monitored by the FAA since there was no system in place for assigning roles for oversight functions on American-registered aircraft that operate overseas.
- (c) The arbitrary operations of the aircraft could not be detected by the GCAA Foreign Operators Affairs (FOA) Department which is responsible for issuing *no objection certificate* for foreign aircraft. FOA was not aware of the Aircraft because the Owner did not apply for the *no objection certificate* and there was no means in place that could have enabled the FOA to detect unauthorized operations.



4. Safety Recommendations

4.1 General

The safety recommendations listed in this Report are proposed according to paragraph 6.8 of *Annex 13 to the Convention on International Civil Aviation*, and are based on the conclusions listed in Part 3 of this Report; the Air Accident Investigation Sector expects that all safety issues identified by the Investigation are addressed by the concerned organizations.

4.2 Final Report Safety Recommendations

The Air Accident Investigation Sector of the United Arab Emirates recommends that:

4.2.1 Aircraft manufacturer (Cessna)

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When the Aircraft was on the final leg, and as an attempt to lower the altitude and reduce the airspeed, the Pilot applied a technique that was inconsistent with the *pilot's operating handbook* and FAA approved *airplane flight manual* by retarding the power lever to beta mode which was a prohibited command in-flight.

As per the design, the power lever was not equipped with artificial force mechanism, such as detent, that may have enhanced the sensation of the Pilot when he applied in-flight prohibited commands, or that may have resisted such command. Such unfavorable commands may be repeated anytime and cause severe consequences especially if it is applied at low altitudes.

Therefore, Cessna, and in conjunction with the Federal Aviation Administration (FAA) of the United State (as being the regulatory authority of the aircraft design organization) is recommended to carry out risk assessment for a mechanism for impeding retardation of the power lever in-flight to a position beyond the IDLE, or enhance the pilot's awareness by artificial force sensation.

4.2.2 Abu Dhabi Airports

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Abu Dhabi Airports *emergency response plan* included Abu Dhabi Airports Police Security Operation Center in the notification list, which was tasked to notify all relevant internal entities relative to the Accident and their internal escalation protocols, including Abu Dhabi Police Command and Control Center. In this Accident, Abu Dhabi Police Command and Control Center was not notified by the Abu Dhabi Airports Police Security Operation Center.

Therefore, it is recommended that Abu Dhabi Airports analyze the emergency response plan of the aerodrome operators under Abu Dhabi Airports, based on Part XI of the *Civil Aviation Regulations*, in terms of the boundary of the areas that fall under the aerodrome responsibilities and coordination with the local emirate police and civil defense departments.

4.2.3 Area Control Air Navigation Service Provider

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The Air Navigation Services (Sheikh Zayed Center), which functions as the area control center, is recommended to establish a system for identifying aircraft that remain within the United Arab Emirates territory for a specific duration after receiving



clearance to enter the flight information region (FIR). The Center can define the criteria to determine this duration, and any instances of exceeding this specified time should be promptly reported to the GCAA.

4.2.4 The General Civil Aviation Authority of the United Arab Emirates (GCAA)

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Operating a civil-registered foreign aircraft without authorization or permit issued by the GCAA in accordance with the *Foreign Operators Regulation (CAR-FOR)* of the United Arab Emirates did not comply with article (6) of the *Civil Aviation Law 20 of 1991*.

Flying with expired medical certificate did not comply with article (7), item (5), and flying an aircraft with expired insurance did not comply with the article (7), item (6).

These non-compliances were repeated, and the GCAA was unaware of them because oversight functions were not assumed since no documents or applications were submitted by the Owner of the Aircraft to the GCAA for obtaining *no objection certificate* to base the Aircraft in the United Arab Emirates. In addition, the regulation does not define the limits of a military call sign, thus all airports and ATS authorities in the UAE have considered any operation with “AF” callsign as a military (non-civil) operation, and do not report such cases/non-compliances to GCAA FOA.

Therefore, the GCAA is recommended to take necessary remedy actions to prevent these non-compliances and reinforce the law and the *Foreign Operators Regulation*.

In order to make the oversight more effective, the GCAA is recommended to circulate the requirements to all aerodrome operators and air traffic control units, and furnish them with guidance to assist operational staff in recognizing the necessary GCAA approval for foreign aircraft before granting airport or air traffic approvals, permits, or clearances, and report any deviation to the GCAA.

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Operating a general aviation foreign aircraft in the territory of the United Arab Emirates without effective roles of the State of Registry or the State which issue personnel licensing for the pilots, maintenance engineers, or mechanics, may impair the GCAA from practicing its oversight role and receiving safety or security reports relevant to safety deficiencies or security breaches.

The Investigation did not carry out a research for identifying the practices of coordination among the States for a long time or base operation of an aircraft registered in a State in the territory of another State. However, the Investigation believes that establishing an international framework for such operations will enhance the international safety and security oversight mechanisms.

Therefore, the GCAA is recommended to carry out a comprehensive review of the current international Standards and Recommended Practices and the relevant guidance material published by the International Civil Aviation Organization (ICAO) for identifying potentials for improving any current framework or developing a new one.