

الهيئة العامة للطيران المدني
GENERAL CIVIL AVIATION AUTHORITY



Air Accident Investigation Sector

Serious Incident

— Final Report —

AAIS Case N°: AIFN/0011/2017

Pilot Incapacitation

Operator:	Etihad Airways
Make and Model:	Boeing B777-200FFX
Nationality and Registration:	The United Arab Emirates, A6-DDE
State of the Operator:	The United Arab Emirates
Place of Occurrence:	Over international waters, in Bahrain airspace
Date of Occurrence:	27 September 2017



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

Occurrence Brief

Name of the Operator	:	Etihad Airways
Manufacturer	:	Boeing
Aircraft model	:	B777-200LRF
Nationality	:	The United Arab Emirates
Registration	:	A6-DDE
MSN	:	62745
State of Occurrence	:	Over international waters, in Bahrain airspace
Date and time	:	27 September 2017, at 0350 UTC

Investigation Objective

This Investigation is performed pursuant to the United Arab Emirates *Federal Act No. 20 of 1991*, promulgating the *Civil Aviation Law, Chapter VII – Aircraft Accidents, Article 48*. It complies with *Part VI Chapter 3*, of the *Civil Aviation Regulations*, and in conformity with *Annex 13* to the *Convention on International Civil Aviation*.

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

Investigation Process

The Air Accident Investigation Sector (AAIS) of the United Arab Emirates was informed about the Commander's incapacitation by the Operator's Flight Safety Department to the AAIS Duty Investigator (DI) hotline +971506414667.

The occurrence was classified as a 'Serious Incident'.

The AAIS appointed an investigator-in-charge (IIC), as being the State of Registration. The United States as the State of Manufacture and Design was notified, and assigned an accredited representative to the Investigation. The Operator assigned an adviser to the IIC. After the Investigation, this Final Report was distributed to all concerned parties.

The AAIS reports are 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 first letter capitalized, they shall mean the following:
 - (Aircraft) The aircraft involved in this serious incident.
 - (Investigation) The investigation into this serious incident.
 - (Incident) This investigated serious incident.



- (Commander) The commander of the incident flight.
 - (Copilot) The copilot of the incident flight.
 - (Report) This Final Report.
2. Coordinated Universal Time (UTC) is UAE local time minus 4 hours.
 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 addition of text boxes, arrows or lines.



Abbreviations

AAIS	The Air Accident Investigation Sector of the United Arab Emirates
AME	Aeromedical examiner
CAR	<i>Civil Aviation Regulations</i> of the United Arab Emirates
CPR	Cardiopulmonary resuscitation
CVR	Cockpit voice recorder
EASA	European Aviation Safety Agency
FAA	The Federal Aviation Administration of the United States
GCAA	The General Civil Aviation Authority of the United Arab Emirates
ICAO	The International Civil Aviation Organization
IIC	Investigator-in-charge
NTSB	The National Transportation Safety Board of the United States
OM-A	<i>Operations manual, part A</i>
OTC	Over-the-counter (medication)
SOP	Standard operating procedures
UTC	Coordinated universal time



Synopsis

Etihad Airways flight ETD 927, a scheduled cargo flight operated by a Boeing 777 freighter aircraft, departed Abu Dhabi International Airport, the United Arab Emirates, on 27 September 2017, for Amsterdam Schiphol Airport, the Netherlands. Onboard were two flight crewmembers, one loadmaster and a corporate security officer.

During the cruise, over international waters in Bahrain airspace, the Commander informed the Copilot that he would leave his seat to go to the galley.

As the Commander pulled out a meal tray from the galley, he collapsed in front of the security officer.

On being informed that the Commander was incapacitated, the Copilot declared a MAYDAY and advised Bahrain air traffic control that the flight would divert to Kuwait International Airport.

An overweight landing was conducted uneventfully, and the Aircraft was stopped on the runway. Paramedics boarded and performed cardiopulmonary resuscitation (CPR) on the Commander for approximately 15 minutes, after which time they declared that he had passed away. The Kuwait coroner later reported that the cause of death was cardiac arrest.

The Commander was well-rested when he began his duty. He had no known imminent medical condition, and had passed the annual medical licensing renewal check one day prior to the flight.

As a result of the Incident, the Aeromedical Section of the General Civil Aviation Authority (GCAA) introduced a number of initiatives to educate aeromedical examiners on blood lipid level management based on international medical information and standards.

The Operator introduced CPR training for loadmasters and corporate security officers, and amended the *operations manual* to include incapacitation procedures for freighter operations.



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1. Factual Information

1.1 History of the Flight

Etihad Airways flight ETD 927, a scheduled cargo flight operated by a Boeing 777 freighter aircraft, departed Abu Dhabi International Airport on 27 September 2018, 0302 UTC, for Amsterdam Schiphol Airport, the Netherlands. Onboard the Aircraft were two flight crewmembers, a loadmaster, and a corporate security officer. The Commander occupied the left seat and was the pilot flying,

During the cruise at flight level 320, and approximately 42 minutes into the flight, the Commander handed over control to the Copilot and left the cockpit to go to the galley.

Approximately six minutes later, the loadmaster informed the Copilot that the Commander had collapsed. The loadmaster and the security officer stated that as the Commander tried to pull out a meal tray he lost consciousness and collapsed.

The security officer attempted to revive the Commander by applying cardiopulmonary resuscitation¹ (CPR), while the loadmaster remained in communication with the Copilot. The Copilot decided to divert to Kuwait International Airport. Both the security officer and the loadmaster continued applying CPR until the Aircraft stopped on the runway following an overweight landing. Paramedics boarded the Aircraft and continued CPR. The Commander was pronounced dead after approximately 15 minutes.

Figure 1 illustrates the main events of flight ETD 927.



Figure 1. Flight path of ETD 927

¹ Cardiopulmonary resuscitation is a technique, which includes chest compressions and rescue breathing in order to keep oxygenated blood flowing to the brain and other vital organs.



1.2 Injuries to Persons

There were no injuries. The Commander became incapacitated and died.

Table 1. Injuries to persons

Injuries	Flight crew	Other persons onboard	Total onboard	Others
Fatal	0	0	0	0
Serious	0	0	0	0
Minor	0	0	0	0
None	2	2	4	0
TOTAL	2	2	4	0

1.3 Damage to Aircraft

The Aircraft was undamaged. Due to the short flight duration and the amount of fuel onboard, an overweight landing was conducted.

An overweight landing inspection was performed in accordance with the *aircraft maintenance manual* with no findings, and the Aircraft was returned to service.

1.4 Other Damage

There was no damage to property or to the environment.

1.5 Personnel Information

1.5.1 Flight crew information

Table 2. Flight crew information

	Commander	Copilot
Age	51	46
Gender	Male	Male
Type of license	Airline transport pilot license	Airline transport pilot license
Valid until	16 June 2021	19 February 2024
Rating	B777	B777
Total flying time	16,547	13,205
Total time on B777 (hours)	2,809	3,777
Total time last 90 days (hours)	170	124
Total time last 7 days (hours)	4	4
Total time last 24 hours (hours)	4	4
Last recurrent SEP ² training	11 March 2017	19 May 2017
Last proficiency check	15 May 2017	21 February 2017
Last line check	2 July 2017	4 March 2017
Medical class	Class 1 certificate	Class 1 certificate
Valid until	11 October 2018	31 March 2018
Medical limitation	VNL ³	VML ⁴

² SEP: Safety and emergency procedures

³ Correction for defective near vision.

⁴ Correction for defective distant, intermediate, and near vision.



1.5.2 Medical information relating to the Commander

The Commander's medical fitness was checked during his annual licensing medical examinations, as per the *Civil Aviation Regulations*. These examinations were carried out at the Operator's medical center, which was authorised by the General Civil Aviation Authority (GCAA) to provide the initial issue and subsequent renewals of aviation medical certificates for pilots and cabin crewmembers.

During his medical examination in October 2015, the Commander's blood lipid levels were identified as being high. Consequently, he was placed on a 3-monthly follow-up program for periodic lipid checks, and was recommended to change his diet and exercise regime. This advice and follow-up schedule was in accordance with the Operator's medical center *standard operating manual*.

The Commander's next follow-up check in January 2016 revealed an improvement in the Commander's blood lipid level, which, however, still exceeding the standard reference level. The follow-up examination in April 2016 revealed a remarkable improvement to the lipid level, and accordingly the Commander was issued with a medical certificate valid for one year.

During his annual medical examination in October 2016, the Commander's blood lipid levels were found to be high and he was scheduled again for 3-monthly follow-up checks. In March 2017, his lipid levels decreased and the follow-up condition was removed.

On the day before the Incident, 26 September 2017, the Commander renewed his medical certificate at the Operator's medical center. His blood lipid level was further reduced, although it was still outside the reference range, and the HDL (high-density lipoprotein) cholesterol to total cholesterol ratio was 3.3. His blood pressure, pulse rate, and body mass index were normal, and his electrocardiogram (ECG) was read as normal. He was 51-years old, a non-smoker, and social drinker, ate a healthy diet and observed a regular exercise program.

The Commander's 10-year risk factor for atherosclerotic cardiovascular disease⁵ had been reduced from 6.6% in 2015 to 3.2% at his latest medical check.

The aeromedical examiner renewed the Commander's aviation medical certificate to October 2018.

⁵ Atherosclerosis is a disease in which plaque builds up inside arteries.



1.6 Aircraft Information

1.6.1 Aircraft data

Table 3. Aircraft data	
Manufacturer:	Boeing Company
Model:	Boeing 777FFX
Manufacture Serial Number:	62745
Date of delivery:	February 2016
Nationality and registration mark:	United Arab Emirates, A6-DDE
Name of the owner:	UNION 34 LEASING Ltd, C/O WALKERS FIDUCIARY Ltd
Name of the operator:	Etihad Airways PJSC
Certificate of registration Number: Issuing Authority: Original Issue date: Valid until:	UAE-COR-0909 General Civil Aviation Authority, the United Arab Emirates 14 March 2016 Open
Certificate of airworthiness Number: Issuing Authority: Category: Issue date: Valid until:	UAE-COA-0384 General Civil Aviation Authority, UAE Transport Category 14 March 2016 Open
Total hours:	6382
Total cycles:	1,219
Last inspection:	Daily Check, 25 September 2017

1.7 Meteorological Information

The prevailing meteorological conditions were not a factor in the Incident. The Incident occurred during daytime, with the associated natural light conditions.

1.8 Aids to Navigation

Ground-based navigation aids, onboard navigation aids, and aerodrome navigation aids were not a factor in this Incident.

1.9 Communications

All communication between air traffic control and the flight crew was recorded by ground-based recording equipment. Additionally, communication in the cockpit was recorded by the cockpit voice recorder, and was successfully downloaded following the serious incident.

1.10 Aerodrome Information

The Commander became incapacitated while the Aircraft was over international waters in Bahrain airspace.

The Copilot diverted the flight to Kuwait International Airport, approximately 15 kilometres south of Kuwait City.

1.11 Flight Recorders

The Aircraft was equipped with a flight data recorder and a cockpit voice recorder, which were removed and transported to the flight recorder laboratory of the Air Accident Investigation Sector. The data was successfully downloaded.



1.12 Wreckage and Impact Information

The Aircraft was undamaged.

1.13 Medical and Pathological Information

An autopsy was performed on the Commander at the Kuwait City Coroner's Office.

The coroner's report stated that the Commander experienced a cardiopulmonary system collapse⁶, caused by a coronary artery stenosis⁷.

1.14 Fire

There was no fire.

1.15 Survival Aspects

The landing was uneventful and the Copilot, the loadmaster, and the security officer disembarked normally.

1.16 Tests and Research

No tests or research were conducted as part of this investigation.

1.17 Organizational and Management Information

The Operator's fleet included Airbus A320, A330, A380, Boeing B787, and B777 aircraft for the operation of commercial passenger and cargo flights.

1.17.1 The Operator's manuals

The Operator provided flight crewmember incapacitation guidance in various flight crew manuals.

The Operator's *operations manual, part A (OM-A)*, described the terms 'obvious incapacitation' and 'subtle incapacitation', including their recognition, and actions to be taken by the crew.

With reference to an "Emergency Declaration", the OM-A states "Inform ATC", "Declare an Emergency if required", and "Arrange a landing as soon as possible". The *flight crew training manual* states "Declare an Emergency to ATC" and "Land as soon as practicable after considering all pertinent factors". The procedures in both manuals were applicable for passenger aircraft operation only and required the assistance of a cabin manager. Two-pilot freighter operations were not considered in the OM-A.

Chapter 8 of the Operator's *safety and emergency procedures manual* Abnormal and Emergency Procedures – *Incapacitation of Crew Members*, contained procedures for a 'pilot incapacitation drill'. This drill was applicable for passenger aircraft only and required the assistance of a cabin manager. This manual did not provide guidance for pilot incapacitation occurring on cargo flights, where the two flight crewmembers may be the only persons onboard.

1.17.2 Operator's medical center

The Operator's medical center was established to provide employees with medical services, and organize well-being and health related initiatives. The medical center was also tasked to perform aeromedical examinations for the initial issue and the subsequent renewal

⁶ Cardiopulmonary system collapse (cardiac arrest) is a sudden loss of blood flow resulting from the failure of the heart to effectively pump. Symptoms include loss of consciousness and abnormal or absent breathing.

⁷ Coronary artery stenosis is a blockage or narrowing of the arteries that supply blood to the heart muscle.



of aviation medical certificates. This examination includes the evaluation of ECG and blood test results.

1.17.3 Operator's guidance for over-the-counter medication

The Operator provided guidelines for the use of over-the-counter medication which were reflected in chapter 6 of the *OM-A*.

Communications were circulated by the medical center to pilots and cabin crewmembers during 2015, informing them of their responsibility to declare over-the-counter or other medication that they were taking.

During 2015, the medical center focused on awareness of medication use and drug and alcohol testing. During the course of the year, the campaign included circulation of information to all crewmembers regarding medication use, poppy seed, and alcohol use.

As part of the induction training for crewmembers, information was provided by the medical center regarding the use of medication while flying.

An article was published in a newsletter for pilots regarding medication and flying, which included self-assessment for fitness to fly. This article was recirculated during 2015.

1.18 Additional Information

1.18.1 The GCAA reporting of pilot incapacitation

Table 4 illustrates the number of pilot incapacitations reported to the GCAA, in the period from 2012 to 2017, and includes all United Arab Emirates operators.

Table 4. UAE departures and pilot incapacitations between 2012 and 2017			
Year	Departures	Number of incapacitation events	Pilot incapacitation per departures in %
2012	303,695	6	0.0020
2013	352,426	7	0.0020
2014	387,944	8	0.0021
2015	446,468	7	0.0016
2016	470,920	13	0.0028
2017	463,727	7	0.0015

1.18.2 Over-the-counter medication in the possession of the Commander

The Investigation identified over-the-counter medication in the possession of the Commander. These included vitamin supplements, aspirin, painkillers and statin tablets. Statin medication is widely used to reduce the level of bad cholesterol and triglycerides in the blood, while increasing the level of good cholesterol (HDL Cholesterol).

The Investigation could not determine the origin of these supplements and medication, and whether or not these were prescribed by a medical professional.

1.18.3 Civil Aviation Regulations pertinent to over-the-counter medication

The *Civil Aviation Regulations* pertaining to medical provisions can be found under CAR Part II, Chapter 5 – *Medical Provisions*.



Within the provisions were regulations relating to pilot medical fitness for flight, the use of non-prescribed medication and seeking advice from a GCAA-approved aeromedical doctor. The following are extracts from CAR Part II, Chapter 5:

“MED.A.020 Decrease in medical fitness

(a) Licence holders shall not exercise the privileges of their licence and related ratings or certificates at any time when they:

...

2) take or use any prescribed or non-prescribed medication which is likely to interfere with the safe exercise of the privileges of the applicable licence;

...

(b) In addition, licence holders shall, without undue delay, seek aero-medical advice when they:

...

2) have commenced the regular use of any medication;

...

(c) In these cases:

1) Licence holders of medical certificates shall seek the advice of an AeMC or AME. The AeMC or AME shall assess the medical fitness of the licence holder and decide whether they are fit to resume the exercise of their privileges in accordance with the process established by the GCAA.”

The *Regulations* refers to the use of over-the-counter or non-prescribed medication. It stated:

“MED.A.028 Drug and alcohol testing program

...

i) Licence holder shall not use an over-the-counter (OTC) or non-prescribed medicine which is incompatible with aviation duties.

l) Licence holders shall not use any medication that could affect the safe performance of aviation duties unless the AME/GCAA has been informed of and has approved such use.”

CAR Part II, Chapter 5, required the applicant to disclose his/her medical history, as stated:

“MED.A.035 Application for a medical certificate

...

(b) Applicants for a medical certificate shall provide the AeMC or AME as applicable, with:

1) proof of their identity;

2) a signed declaration:

(i) of medical facts concerning their medical history;

(ii) as to whether they have previously undergone an examination for a medical certificate and, if so, by whom and with what result;

(iii) as to whether they have ever been assessed as unfit or had a medical certificate suspended or revoked.”

In regards to the lipids management and the associated cardiovascular risk the guidance material of the *Regulation* stated:

“GM1 MED.B.010 Cardiovascular system (Class 1&2)

...

1.1 Method for CVD risk assessment



(a) Test required for assessment include but are not limited to Lipid profile, check for blood pressure, random blood glucose and HBA1c⁸.

(b) The AME should use internationally recognised calculators/charts/or score cards for the estimation of CHD.

The preferred calculator for GCAA medical examination is as below; this calculator considers all the risks factors – the modifiable and non-modifiable:

<http://www.patient.co.uk/doctor/Primary-Cardiovascular-Risk-Calculator.htm>

1.2 Assessing and management of the cardiovascular risks

(a) Risk group less than 10% risk over 10 years

The licence may be issued without limitation once all modifiable risk factors have been discussed with the applicant. A management strategy should be detailed in the reports to the licensing authority.

(b) Risk group 10-20% over 10 years:

1) Modifiable risk factors should be addressed in conjunction with adjustment of current or the addition of approved prevention medications e.g. Statins

2) After the control of the modifiable risk factors, if the calculated risk remains in the intermediate zone, further cardiac evaluation by an approved cardiologist should be required.

3) If cardiac evaluation rules out significant risk of Ischemic heart events, the medical certificate may be issued with OML restriction, and annual approved cardiology follow up."

1.19 Useful or Effective Investigation Techniques

The Investigation was conducted in accordance with the legislation and *Civil Aviation Regulations* of the United Arab Emirates, and with the AAIS policies and procedures, and in accordance with the *Standards and Recommended Practices* of Annex 13 to the Convention on International Civil Aviation.

⁸ Hemoglobin A1c is a blood pigment that carries oxygen.



2. Analysis

2.1 The Incident Flight

The take-off and departure from Abu Dhabi International Airport was uneventful with the Commander as the pilot flying. Communication between the flight crewmembers was according to the standards. When the Aircraft was in the cruise at flight level 320, 42 minutes into the flight, the Commander handed over control to the Copilot. Then the Commander left his seat and went to the galley. While he was pulling a meal tray from the galley, the Commander lost consciousness and collapsed.

The corporate security officer immediately reacted by providing cardiopulmonary resuscitation (CPR). The loadmaster communicated with the Copilot on the flight deck and provided regular updates on the situation. An immediate decision was made to divert the flight to Kuwait international Airport, which was the nearest available airport. After being cleared by Kuwait ATC, the Copilot initiated the diversion from the right seat.

The Investigation believes that the professional and immediate actions of the Copilot, together with the instant and continuous attempt by the security officer to revive the Commander, provided the best opportunity for his survival. However, the medical condition of the Commander was severe and the efforts to resuscitate him were not successful.

2.2 Cardiopulmonary Resuscitation (CPR)

The security officer immediately identified the serious condition of the Commander and applied CPR in an attempt to keep his vital signals stable, until paramedics boarded the Aircraft after landing. The security officer had to rely on his memory of previous training, because the Operator did not provide loadmasters or corporate security officers with regular first aid training. Such training is provided to cabin managers on passenger flights. This was also not a requirement by the *Civil Aviation Regulations* of the United Arab Emirates.

Many freighter flights are operated by two flight crewmembers without any additional personnel onboard. In these circumstances, in-flight emergencies such as pilot incapacitations, need to be managed by the remaining flight crewmember. On flights where additional crewmembers are onboard, these crewmembers, with the correct training and equipment, could provide critical assistance in medical emergencies.

The Aircraft was not fitted with an automated external defibrillator (AED), which are standard emergency safety equipment on passenger flights. The Investigation could not determine whether the use of an AED may have saved the Commander's life.

2.3 The Commander's Medical Check

This Incident identified some limitations in the annual aviation medical examination in predicting future critical medical events. While the aeromedical examiner evaluates ECG data and assesses a person's blood count, the result is either a 'pass', a 'scheduled re-visit', or a 'failed' fitness-to-fly test.

The Commander's blood lipid level was very high two years prior to his last medical examination in October 2017. This was identified by the aeromedical examiner, who recommended a change in the Commander's lifestyle. Regular follow-ups were scheduled to monitor progress. This recommendation was in accordance with the Operator's procedures for cardiovascular risk factors.

The aeromedical examiner calculated the Commander's cardiovascular risk level at 6.6% in October 2015, which was well below the 10% limit as described in the guidance material of the relevant *Regulation*. This value resulted from utilizing the preferred calculator for GCAA medical examination, which considers modifiable and non-modifiable risk factors.



The result indicated that the risk level of the Commander's vulnerability to a stroke or a heart attack within the next 10 years was considered 'low' to 'moderate'.

The improvement in the Commander's cardiovascular risk level which reached 3.2% in October 2017 indicated to the aeromedical examiner that the Commander's lifestyle had changed and the diet that he was following was successful. Although the blood lipid level still exceeded the reference range, the constant recorded decrease over the previous two years indicated an improving situation.

The Investigation believes that, while annual medical examinations of flight crewmembers have limitations in their ability to predict serious medical episodes, the number and rate of annual pilot inflight incapacitations, as provided in table 4, indicates an overall acceptable result.

2.4 The Commander's Over-the-Counter (OTC) Medication

The Investigation became aware that the Commander had in his personal belongings vitamins, painkillers, various types of aspirin, and statins. According to the reviewed records, the use of these supplements and medications had not been declared to the aeromedical examiner.

In accordance with the Operator's procedures and the relevant *Regulations*, flight crewmembers must declare to the aeromedical examiner the use of any medication, particularly statins. The *Regulations* allowed pilots' to use statins under the supervision of an aeromedical examiner.

Had the Commander declared the use of statins at his medical examination, as required by the *Regulation*, the aeromedical examiner may have been provided with additional important information, which could have explained, or partially explained, the reduction of the Commander's 10-year vulnerability to a stroke or a heart attack. This may have provided an opportunity for the examiner to evaluate the Commander's statin medication use for a medically supported lipid reduction.

The Investigation could not determine whether the self-medicated statin use had contributed to the Commander's incapacitation.



3. Conclusions

3.1 General

From the evidence available, the following findings, causes and contributing factors were made with respect to this Serious Incident. 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.** Statements of all significant conditions, events or circumstances in this Incident. The findings are significant steps in this Incident sequence but they are not always causal or indicate deficiencies.
- **Causes.** Actions, omissions, events, conditions, or a combination thereof, which led to this Incident.

3.2 Findings

3.2.1 Findings relevant to the Aircraft

- (a) The Aircraft was certified, equipped, and maintained in accordance with the requirements of the *Civil Aviation Regulations* of the United Arab Emirates.

3.2.2 Findings relevant to the flight crew

- (a) The flight crew were licensed and qualified for the flight in accordance with the requirements of the *Civil Aviation Regulations* of the United Arab Emirates.
- (b) Both flight crewmembers held valid class 1 medical certificates.
- (c) Both flight crewmembers had accumulated four flight hours in the seven days prior to the Incident and were adequately rested to operate the flight.

3.2.3 Findings relevant to flight operations

- (a) The flight was conducted in accordance with the procedures contained in the Operator's operations manual.
- (b) During cruise at flight level 320, 42 minutes into the flight, the Commander left the cockpit.
- (c) Approximately 48 minutes after take-off, the loadmaster informed the Copilot that the Commander was incapacitated.
- (d) The security officer performed cardiopulmonary resuscitation (CPR) on the Commander.
- (e) The flight diverted to Kuwait International Airport.

3.2.4 Findings relevant to the Operator

- (a) The Operator's *operations manual part A (OM-A)* did not include pilot incapacitation procedures for freighter flights.
- (b) The Operator had guidelines for the use of over-the-counter (OTC) medication which were contained in the *OM-A*.

3.2.5 Findings relevant to the Commander's medical examination

- (a) The Commander passed his annual medical examination on the day before the Accident flight.



- (b) The Commander's 10-year vulnerability to a stroke or a heart attack had reduced from 6.6% in 2015 to 3.2% in 2017, and was considered low.
- (c) The Commander's use of OTC medication had not been declared to the aeromedical examiner.

3.3 Causes

The Air Accident Investigation Sector determines that the Commander's incapacitation and subsequent death was due to a cardiopulmonary system collapse, caused by a stenosis in the coronary artery.

The Commander's high cholesterol level caused the coronary artery disease and contributed to the stenosis in the coronary artery. The Commander's undeclared use of OTC medication likely contributed to a reduction in his lipid levels. This treatment was not managed by an aeromedical examiner.

The Air Accident Investigation Sector determines that it was not possible for the aeromedical examiner to predict the imminent incapacitation of the Commander.



4. Safety Recommendations

4.1 Safety Actions Taken

4.1.1 Safety actions taken by the GCAA

The Aeromedical Section of the General Civil Aviation Authority (GCAA) introduced the following safety actions:

- (a) The GCAA published a brochure on pilot's fitness to fly, which was disseminated amongst pilots in the UAE, and provided to aeromedical centers.
- (b) The GCAA organized a workshop for aeromedical examiners approved by the GCAA on the management of lipids in accordance with the American Heart Association.
- (c) The Aeromedical Section amended the guidelines for lipids management.

4.1.2 Safety actions taken by the Operator

After the Incident, the Operator made the following changes:

- (a) The initial and annual loadmaster recurrent courses were amended to include cardiopulmonary resuscitation (CPR) practical exercises as well as a review of pilot incapacitation knowledge.
- (b) The loadmasters' and security officers' aviation health training is aligned with the cabin crewmembers' syllabus, with the exception of the use of automated external defibrillator training, as they are not carried on B777 freighters.
- (c) Pilot incapacitation procedures on freighter aircraft are updated in the *operations manual part A (OM-A)* and in the standard operating procedures, while clearly outlining the role of loadmasters in such a scenario.
- (d) Inflight security officers are required to attend CPR practical training and assessment.

4.2 Safety Recommendations

The Investigation determines that the safety actions taken by the Aeromedical Section of the General Civil Aviation Authority and the Operator are adequate.

Providing an update to aeromedical examiners on international findings of lipid management, and amending the guidelines for lipid management provides aeromedical examiners with additional information when high lipid levels are encountered.

The actions taken by the Operator ensure that additional crewmembers, when onboard, have the training to assist in a situation where a flight crewmember, or any other crewmember, is incapacitated. This had been supported by changes to the Operator's operations manual.

Based on these actions taken, no additional safety recommendations are considered.

This Report is issued by:

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

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