

SERIOUS INCIDENT

Aircraft Type and Registration:	Reims Cessna F406, G-FIND	
No & Type of Engines:	2 Pratt & Whitney Canada PT6A-112 turboprop engines	
Year of Manufacture:	1989 (Serial no: 45)	
Date & Time (UTC):	4 April 2021 at 1125 hrs	
Location:	Near St Neots, Cambridgeshire	
Type of Flight:	Specialised Operations	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - None	Passengers - 1 (Minor)
Nature of Damage:	None	
Commander's Licence:	Commercial Pilot's Licence	
Commander's Age:	24 years	
Commander's Flying Experience:	788 hours (of which 317 were on type) Last 90 days - 88 hours Last 28 days - 29 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries by the AAIB	

Synopsis

During an unpressurised aerial photography flight at 12,000 ft the task specialist lost consciousness. The pilot commenced a rapid descent and diverted to London Luton (Luton) Airport. During the descent the task specialist regained consciousness. The aircraft landed normally.

The pilot was using supplementary oxygen during the flight whereas the task specialist was not. It could not be determined what caused the loss of consciousness.

Following the incident, the operator took safety action to require task specialists and survey operators to use supplementary oxygen for all unpressurised flights above 10,000 ft.

History of the flight

The purpose of the flight was to undertake aerial photographs over Northamptonshire. The aircraft was fitted with a camera system mounted in the cabin which took photographs through holes in the bottom of the fuselage. The flight was operated by a single pilot and a task specialist. During the flight the task specialist was sitting in the cabin and was monitoring the camera system via a laptop computer. The task required the aircraft to fly in a series of parallel straight lines at 12,000 ft.

The pilot and task specialist met at East Midlands Airport and prepared for the flight. Because the flight was intended above 10,000 ft the pilot planned to use supplementary oxygen. The pilot asked the task specialist if he would be using oxygen. The task specialist said that the advice he had been given by the operator was that he was not required to do so below 13,000 ft. The aircraft was not fitted with a built-in oxygen system so supplementary oxygen was supplied via portable oxygen bottles and nasal cannula¹.

The aircraft took off from East Midlands Airport at 0815 hrs and commenced the survey as planned. The flight proceeded normally for several hours during which the pilot and task specialist were in regular conversation. However, at approximately 1125 hrs the task specialist told the pilot he was feeling unwell. Within a few seconds he lost consciousness and fell into the aisle. The pilot declared an emergency to ATC and commenced a rapid descent. ATC initially offered Cambridge Airport as a diversion but subsequently advised this was now closed and offered Luton or Stansted Airports. The aircraft was closer to Luton Airport, so the pilot decided to divert there. As the aircraft reached approximately 6,000 ft, the task specialist started to regain consciousness and the pilot was able to shout "are you okay?", to which the task specialist was able to mouth "yes" and give a thumbs-up. By the time the aircraft was at 3,000 ft and approximately 15 - 20 nm from Luton the task specialist was able to retake his seat and was speaking normally. The aircraft landed at Luton Airport at 1145 hrs and, as a precaution, the task specialist was taken to hospital.

Hypoxia

One possible explanation for the task specialist loss of consciousness is that he was experiencing hypoxia.

Hypoxia is defined as a state of oxygen deficiency in the body sufficient to impair function of the brain and other organs². Whilst there can be a number of medical causes of hypoxia which could occur at any time, hypobaric hypoxia is altitude related. As the altitude increases and barometric pressure decreases, the partial pressure of oxygen decreases. This reduction in partial pressure means there are fewer oxygen molecules per volume of air as altitude increases. It becomes increasingly difficult for the human body to supply its oxygen needs as an aircraft climbs if supplementary oxygen is not used.

The brain is usually the first organ to suffer from the diminished oxygen supply. Even at 8,000 ft altitude, where there is a 25% reduction in the partial pressure, it is possible to detect early impairment in some mental performance tasks. However, it would be unusual for a fit and healthy individual to suffer transient loss of consciousness due to hypoxia at 12,000 ft unless there is concomitant significant hyperventilation (over-breathing).

People react differently to lack of oxygen, and some are more sensitive to hypoxia than others. This can vary from day to day. Personal factors are numerous: acclimatisation to high altitude, smoking, stress, anxiety, illness, medication, and hydration can all affect an individual's tolerance of exposure to altitude.

Footnote

¹ The operator was in the process of installing a built-in supplementary oxygen system in their aircraft when this incident occurred.

² https://www.easa.europa.eu/sites/default/files/dfu/210635_EASA_HYPOXIA_BROCHURE.pdf [accessed August 2021]

There are many other reasons why an individual may faint or briefly lose consciousness. In the absence of a medical condition that causes transient loss of consciousness, it is possible that a higher natural tendency to faint could combine with mild hypoxia to cause an individual to lose consciousness at altitude.

Personnel information

The task specialist was 25 years old and described himself as fit and healthy. He had passed a medical for the role within the last 12 months and had no history of any underlying medical conditions. He had flown unpressurised flights up to 10,000 ft in the past and had flown with supplementary oxygen above 13,000 ft, but this was the first time he had flown without oxygen at 12,000 ft.

He recalled feeling well prior to the flight and that the first few hours of the flight were uneventful. He did not think he was stressed or suffering from anxiety and he was well hydrated. After about three hours he remembered feeling dizzy and slightly sweaty. He sat back in his seat and told the pilot he felt unwell. He did not recall hyperventilating. His next memory was waking up as the aircraft descended into Luton.

After the flight he was taken to hospital but, despite extensive tests, a cause of the loss of consciousness was not found.

Operational procedures

The operator's operations were partly covered by Part-CAT³ regulations and partly by Part-SPO⁴. The requirements for the supply of and use of supplementary oxygen on unpressurised flights are slightly different in the two parts of the regulations. The operator had chosen to use the requirements in Part-CAT in all its operations. However, this part of the regulations does not specifically mention task specialists. The Part-SPO regulations include a requirement for task specialists to use supplemental oxygen whenever the cabin altitude exceeds 10,000 ft for a period of more than 30 minutes (SPO.OP.195) but this requirement was not incorporated in the operator's operations manual accepted by the CAA.

Figure 1 shows all the requirements in the operator's operations manual regarding supplementary oxygen on non-pressurised flights. Under these rules the task specialist's company considered task specialists to be 'additional crew' and therefore were not required to use oxygen below 13,000 ft.

Following this incident, the operator has updated this section of its manual to state that '*Task Specialists and Survey Operators are required to use supplementary oxygen at all times above 10,000 ft.*'

Footnote

³ Part CAT (Commercial Air Transport) applies to aircraft operation to transport passengers, cargo or mail for remuneration or other valuable consideration.

⁴ Part SPO (Specialised Operations) applies to any aircraft operation, other than commercial air transport, where the aircraft is used for specialised activities such as agriculture, construction, photography, surveying, observation, patrol or aerial advertisement.

8.8 Oxygen Requirements (SPO.OP.195)

Non-pressurised aeroplanes operated at pressure altitudes above 10 000 ft shall be equipped with supplemental oxygen equipment capable of storing and dispensing the oxygen supplies in accordance with the table below

8.8.1 Oxygen minimum requirements for non-pressurised aeroplanes.

Supply for	Duration and cabin pressure altitude
Occupants of flight crew compartment seats on flight crew compartment duty and crew members assisting flight crew in their duties	The entire flying time at pressure altitudes above 10 000 ft.
Required cabin crew members	The entire flying time at pressure altitudes above 13 000 ft and for any period exceeding 30 minutes at pressure altitudes above 10 000 ft but not exceeding 13 000 ft.
Additional crew members and 100 % of passengers (*)	The entire flying time at pressure altitudes above 13 000 ft.
10 % of passengers (*)	The entire flying time after 30 minutes at pressure altitudes above 10 000 ft but not exceeding 13 000 ft.
(*) Passenger numbers in this table refer to passengers actually carried on board, including persons younger than 24 months.	

Figure 1

Extract from the operator's Operations Manual regarding supplementary oxygen on non-pressurised flights

Analysis

During an unpressurised flight at 12,000 ft the task specialist lost consciousness. The pilot commenced a rapid descent and the task specialist regained consciousness during the descent.

The cause of the loss of consciousness could not be determined. Hypoxia was considered as a possible explanation, but it is unlikely a fit and healthy individual would suffer a transient loss of consciousness due to hypoxia at 12,000 ft. It is possible that a higher natural tendency to faint could have combined with mild hypoxia to cause the loss of consciousness. Following the incident, the operator has clarified its procedures to require task specialists to use supplementary oxygen for all unpressurised flights above 10,000 ft.

Safety action

The operator has updated its Operations Manual to require Task Specialists and Survey Operators to use supplementary oxygen at all times during unpressurised flights above 10,000 ft.