ACCIDENT

Aircraft Type and Registration:	Jetstream 4100, G-MAJC
No & Type of Engines:	2 Garrett Airesearch TPE331-14GR-807H turboprop engines
Year of Manufacture:	1992 (Serial no: 41005)
Date & Time (UTC):	16 October 2017 at 0835 hrs
Location:	Hawarden Airport, Chester
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 3 Passengers - 9
Injuries:	Crew - None Passengers - 1 (Minor)
Nature of Damage:	Damage to right propeller and right overwing emergency escape hatch
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	42 years
Commander's Flying Experience:	5,000 hours (of which 450 were on type) Last 90 days - 150 hours Last 28 days - 52 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and addtiional enquiries by the AAIB

Synopsis

During a descent into Hawarden Airport, at around FL150, the flight crew noticed a burning smell. Oxygen masks were donned, a MAYDAY was declared and an expedited approach was carried out to land on Runway 22. The crew experienced some difficulty in communication, both internal and external, while using their oxygen masks. After landing the aircraft was taxied clear of the runway, brought to a stop, and an emergency evacuation was carried out.

The burning smell was as a result of smoke and dust carried in the atmosphere from North Africa and Iberia.

The report highlights safety action taken by the operator in relation to its procedures, and other agencies in relation to the promulgation of information in unusual meteorological circumstances such as these.

History of the flight

The flight crew reported for duty at 0600 hrs at Leeds Bradford Airport. When they reported they were advised that their original schedule had been changed. Another company aircraft was unavailable due to a technical problem so the crew were to position their aircraft to Bristol International Airport and then operate a sector to Hawarden with passengers.

The aircraft had been parked overnight on the apron at Leeds. The commander reviewed the technical log and noted there were no open entries; however, when he went through the pre-flight checklist, he noticed that the standby battery charge was low. An engineer was called to the aircraft to assist, he advised that after a period with ground power attached the battery would re-charge. The crew continued to prepare the aircraft for flight. The commander reported afterwards that he had felt rushed and that there had not been time to complete a pre-flight briefing with the cabin crew member.

The co-pilot was the pilot flying (PF) for the sector to Bristol. The flight was uneventful and the aircraft landed and was shut down on the apron. The commander requested a ground power unit be connected to the aircraft, but none was available. The passengers boarded and the aircraft departed at 0800 hrs, approximately 30 minutes behind the normal schedule. The commander was the PF.

The 0820 hrs METAR at Hawarden was: surface wind from 150° at 12 kt, visibility 6,000 m, showers in the vicinity, cloud broken at 900 ft, temperature 16°C dewpoint 15°C and pressure 1008 hPa.

The descent checks and approach briefing for Runway 22 had been completed and the aircraft was descending through FL150 to the south of Hawarden when the flight crew started to notice a burning smell. It appeared to them that the smell was coming from the air vents on the flight deck. They donned their oxygen masks and attempted to verify communication between themselves, but found it difficult because of high noise levels coming through the cockpit speakers.

The co-pilot declared a MAYDAY to ATC, advising of a burning smell and their intention to continue to land at Hawarden. The commander contacted the cabin crew member on the interphone. She was hardly able to hear his message but understood that they were carrying out an emergency descent and went to check and secure the cabin. When he contacted her again she could not hear any of the message so she entered the flight deck. The commander gave her an emergency briefing, using the 'NITS' mnemonic (Nature, Intentions, Time, Special instructions), advising her that the aircraft would be landing in 10 minutes and to standby for instructions after landing. The noise levels through the cockpit speaker remained high and when the commander spoke or attempted a transmission there was a strong feedback signal.

The approach and landing on Runway 22 was completed and the commander taxied the aircraft clear of the runway, turning north onto adjacent Taxiway 'D', and brought it to a stop. He did not know if he could contact the cabin crew member and was uncertain of the conditions in the passenger cabin, so he decided an emergency evacuation should be carried out. He shut down the engines and made a PA announcement to the cabin to initiate the emergency evacuation.

After the commander made the evacuation announcement to the cabin, the engines continued to operate at idle power for 8 seconds before they started to run down; the propellers continued turning for a further 40 seconds. The forward cabin door and the two mid-cabin over wing emergency exits were opened by the passengers. The right over wing exit door was dropped

to the ground behind the wing and blown forwards by the wind into the still rotating right propeller. The aft cabin exit door was opened by the cabin crew member; it fell to the ground and was blown rearwards by the propeller wash from the right engine (Figure 1).

Figure 1

Aircraft evacuation

The passengers exited the aircraft and, once they had checked the cabin was clear, the crew followed. The RFFS were in attendance and assisted with the passenger management. There was one minor injury. A timeline of the evacuation is provided at Table 1.

Time (s)	Event
00	Aircraft turns onto Taxiway 'D'
15	Aircraft stopped
22	Over wing exits opened
49	All passengers off aircraft
63	Propellers stop turning
73	All crew off aircraft

Table 1

Evacuation timeline

Recorded information

The CVR was replayed at the AAIB and contained a record of the event. The recording indicated that both pilots were wearing their oxygen masks and had their interphones selected, which caused high noise levels during intake and exhalation of breath. Feedback whistle was also evident when the commander adjusted or removed his mask and when he attempted some transmissions.

Video recordings of the outside of the aircraft during the passenger evacuation were available for the investigation.

Aircraft information

Communication

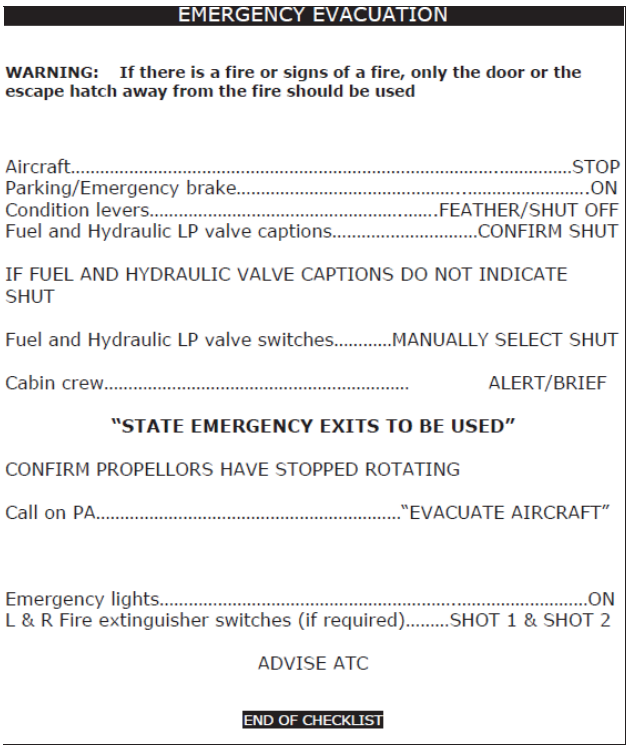
Selection and control of audio received and transmitted by each pilot is through on-side Audio Control Panels (ACP). VHF, interphone and passenger address selections are made by means of push button switches which deselect the previous selection. To select the oxygen mask microphone a MIC-MASK switch on the Audio Control Panel (ACP) is selected to MASK. When an ACP is selected to MASK audio to the cockpit speaker is activated and cannot be turned off.

A switch on each control column can be selected to TX, OFF or IC. After pressing TX the switch will spring back to OFF, whereas if 'IC' is pressed it will remain selected until a different selection is made.

Engine shut down procedures

For a normal engine shut down at the end of a flight the engine STOP buttons are pressed. This operates the fuel purging system and, when the rpm reduces to 50%, the power levers are moved to the REVERSE position.

In an emergency evacuation the engines are shut down by moving the Condition Levers to the FEATHER/FUEL SHUTOFF position, see Emergency Evacuation Checklist (Figure 2).



EMERGENCY EVACUATION

WARNING: If there is a fire or signs of a fire, only the door or the escape hatch away from the fire should be used

Aircraft.....STOP
Parking/Emergency brake.....ON
Condition levers.....FEATHER/SHUT OFF
Fuel and Hydraulic LP valve captions.....CONFIRM SHUT

IF FUEL AND HYDRAULIC VALVE CAPTIONS DO NOT INDICATE SHUT

Fuel and Hydraulic LP valve switches.....MANUALLY SELECT SHUT

Cabin crew..... ALERT/BRIEF

"STATE EMERGENCY EXITS TO BE USED"

CONFIRM PROPELLORS HAVE STOPPED ROTATING

Call on PA....."EVACUATE AIRCRAFT"

Emergency lights.....ON
L & R Fire extinguisher switches (if required).....SHOT 1 & SHOT 2

ADVISE ATC

END OF CHECKLIST

Figure 2

Emergency Evacuation Checklist

The aircraft manufacturer was not able to provide details of the time differential between the two methods for engine shut down to be achieved.

Emergency evacuation procedures

The Jetstream 41 aircraft has a single cabin entry door with integral airstairs located on the forward left side of the fuselage. Two over-wing emergency escape doors are located either side of the cabin and there is a single service door on the aft right side of the fuselage. All these can be used as exits in the event of an emergency evacuation.

The Operator's Operations Manual (OM) guidance for emergency evacuation advised that the Emergency Evacuation Checklist (Figure 2) should be performed as a memory action, the OM included the additional information:

> *'It is essential to have the engines shut down prior to the start of an evacuation. Consequently, the call on the PA to evacuate must only be made when it is considered safe to commence the procedure.'*

Aircraft examination

The aircraft was inspected at the Operator's maintenance facility and damage was found to three separate areas. The right-hand overwing emergency exit door had been struck by the right-hand propeller, causing damage to both. The right hand rear emergency exit door was damaged by contact with the taxiway surface.

Meteorology

On 13 October 2017 the UK Met Office Environment Monitoring and Response Centre (EMARC) noted on satellite imagery a quantity of dust which had lifted from the Sahara Desert and was tracking towards the UK, carried by strong southerly winds on the eastern side of ex-hurricane Ophelia. This air also picked up and carried quantities of smoke from a series of forest fires on the Iberian Peninsula. By 16 October this air reached the UK and was concentrated into a denser layer by the cold front associated with Ophelia. The Met Office forecasts for 0900 hrs 16 October 2017, separately for dust and biomass burning, are reproduced at Figures 3a and 3b.

Other information

Multiple events of smoke and fumes

During 16 and 17 October the AAIB received 32 notifications of Smoke/Fume events affecting aircraft in UK airspace and the UK CAA received in excess of 60 Mandatory Occurrence Reports (MOR). Of the 32 events reported to the AAIB, smoke/fumes were initially detected by flight and cabin crew members at altitudes from between 2,000 ft and FL200. The earliest event appears to have been around 0622 hrs on 16 October in the vicinity of Liverpool at FL130; the aircraft returned to land at Liverpool. Subsequently there were clusters of affected aircraft in the Channel Islands, Liverpool/ Manchester area and, in the afternoon of 16 October, around London Heathrow. During the afternoon of 16 October London Heathrow appended a message to their ATIS, alerting arriving and departing crews of the possibility of their encountering smoke while airborne.

The majority of the aircraft affected either returned to land at the point of departure or expedited their existing approaches, although two aircraft continued en route after initially reporting a

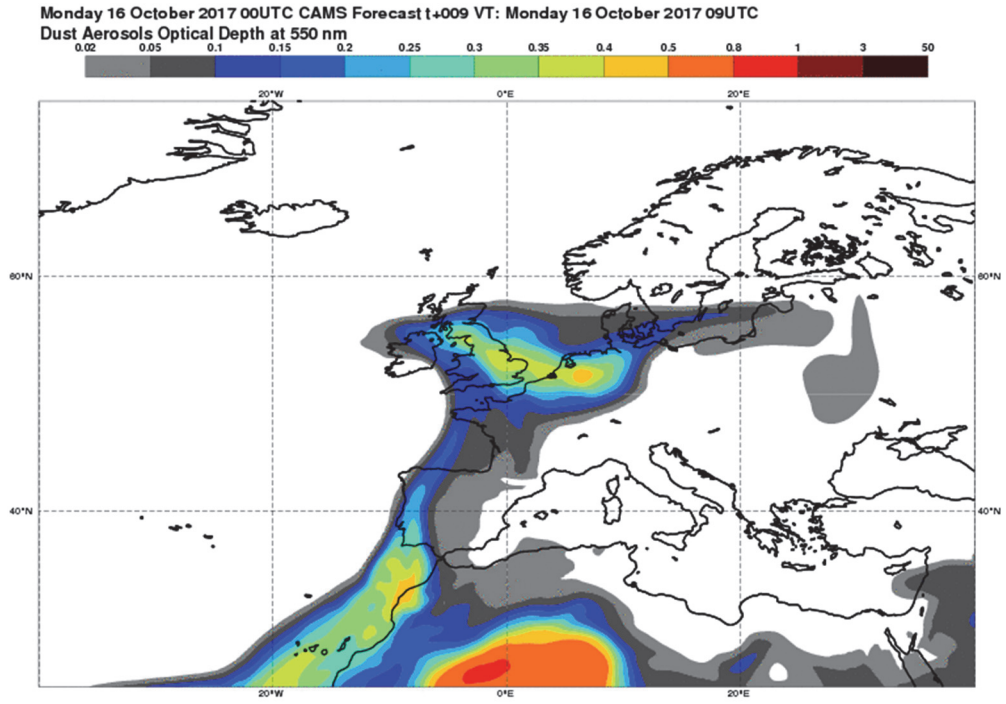


Figure 3a

16 October 2017 forecast Dust Aerosols for 0900 hrs

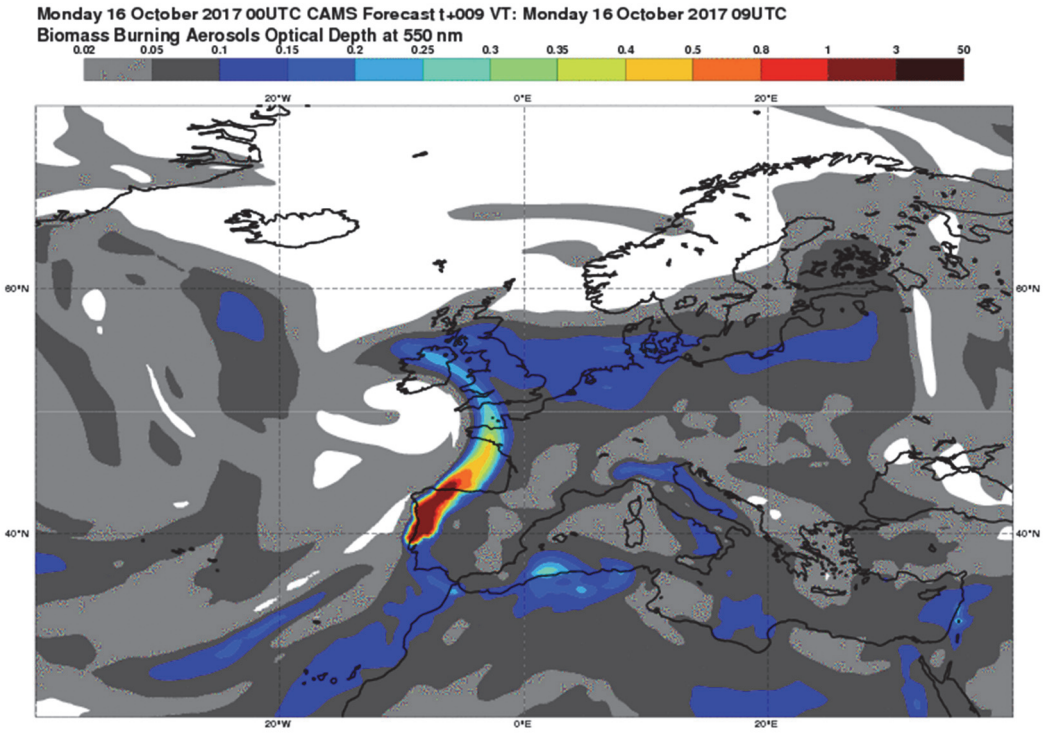


Figure 3b

16 October 2017 forecast Biomass Burning Aerosols for 0900 hrs

problem. Nearly all flight crews declared either PAN or MAYDAY and most used oxygen masks. Of these several reported experiencing difficulty when using the on board masks/goggles, some with vision through the goggles and some with interphone and radio communications.

On 16 October, different Air Navigation Service Provider (ANSP) units received multiple reports of fumes on the flight deck and of aircraft making precautionary or emergency landings. A Met Office meteorologist, based at National Air Traffic Services (NATS) headquarters, was contacted by NATS personnel when they became aware that smoke and fumes were affecting numbers of aircraft. The enquiry was passed on to the Met Office and initially a general, but not aviation specific, press report was issued. Later the report was undated to include information about the altitudes at which smoke/dust was present.

Analysis

Meteorological situation

The smoke/fume event took place on G-MAJC early on the morning of 16 October 2017, and before it was recognised that other aircraft were similarly affected. However, later in the day when there was evidence of significant numbers of aircraft reporting smoke and fumes, there was no co-ordinated dissemination of this information. Smoke and fumes on an aircraft create a high level of stress for the flight crew and any additional information is likely to be beneficial. Flight crews experiencing a smoke/fumes event would still be required to complete the abnormal procedures, but with the benefit of an understanding of the likely cause.

Communication

The flight crew had difficulty in communicating between themselves and with the cabin crew member because of high levels of breathing noise and occasional feedback whistle. This created a distraction, increased their workload and meant that the commander did not feel well informed about the conditions in the passenger cabin.

The reason for the breathing noise was the sustained selection of interphone. The reason for the feedback whistle was not determined but it appeared to be generated from the commander's side and be associated with times when he removed or adjusted his mask or attempted transmissions.

Evacuation procedure

The commander's lack of information as to the conditions prevailing in the passenger cabin led him to initiate an emergency evacuation as soon as the aircraft came to a stop. During the emergency it is likely that the flight crew were operating under high levels of stress and, as a result, the evacuation procedure was rushed and checklist actions not completed. This led to the passengers evacuating the aircraft unescorted while the propellers were still turning, with an associated risk to themselves.

Three of the four emergency exits are behind the wing and thus the possibility of walking into a propeller is reduced. However, the forward exit presents a high risk to personnel, especially when there is no crew member in attendance. The operator recognises this by requiring the engines to be shut down and the propellers confirmed to have stopped

rotation before an evacuation is initiated. The combined rundown time for the engine and the propellers, as demonstrated in this case, may be in excess of 40 seconds.

Safety action

In December 2017 a review of the smoke and fume events on 16 and 17 October was held by the UK CAA together with representatives from NATS and the Met Office.

The Met Office advised that accurate forecasting of such phenomena is problematic because it is hard to forecast the extent and height at which the smoke is likely to be present due to the difficulty in accurately locating the fires.

Met Office systems allow a SIGMET to be issued that contains smoke related information and, although it is not compliant with the ICAO format or existing templates, a test showed that it was compatible with NATS's systems. In future a SIGMET will be issued when NATS informs the Met Office there is significant smoke in the atmosphere that is affecting aircraft operations.

ANSPs are responsible for notifying the Met Office of any pilot reports of unusual phenomena affecting flight, but not at present for notifying the UK CAA.

Work is being undertaken to see whether a 'Securité' message broadcast on 121.500 MHz could be used to promulgate a safety message concerning smoke in the UK FIR.

The participants agreed to ensure that suitable escalation and inter-agency coordination procedures are put in place to improve the promulgation of such unusual events in the future.

The operator conducted its own internal investigation into the event and identified safety recommendations and actions. The operator decided to:

Provide enhanced training on use of oxygen masks including a video of mask donning procedures.

Provide a list of approved headset types shown to be compatible with the aircraft communication systems.

Review and amend the passenger emergency briefing to include a warning about the danger of rotating propellers.

Incorporate a similar type of event into the company training programme.

Bulletin Correction

The third and fifth items from the above safety actions section (commencing 'Met Office systems' and 'Work is being undertaken') were omitted from the original report prior to printing.

The items were added to the online version of the report prior to publication on 12 July 2018.