
INCIDENT

Aircraft Type and Registration:	BAE Systems Jetstream 4100, G-MAJI	
No & Type of Engines:	2 Garrett Airesearch turboprop engines	
Year of Manufacture:	1993	
Date & Time (UTC):	12 January 2007 at 0723 hrs	
Location:	After takeoff at Durham Tees Valley Airport, County Durham	
Type of Flight:	Commercial Air Transport	
Persons on Board:	Crew - 3	Passengers - 3
Injuries:	Crew - None	Passengers - None
Nature of Damage:	None	
Commander's Licence:	Air Transport Pilot's Licence	
Commander's Age:	44 years	
Commander's Flying Experience:	4,330 hours (of which 577 were on type) Last 90 days - 206 hours Last 28 days - 49 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and subsequent inquiries by the AAIB	

Synopsis

Immediately after takeoff from Durham Tees Valley Airport, the crew found difficulty in controlling the aircraft in pitch using the control yoke. They found that the pitch trim wheel and engine condition lever friction wheel had locked together, jamming both controls. The aircraft returned to the airport with the crew using engine power to assist in controlling pitch and an uneventful landing was made.

History of the flight

The aircraft was taking off from Durham Tees Valley Airport. The crew had performed all the pre-flight checks including those for full and free movement of

the flying controls and trim wheels and, as they were cleared to take off, the crew advanced the engine condition levers to FLIGHT and applied takeoff power. The engine condition lever friction lock was tightened as a precaution against 'creep-back', which could cause a configuration warning and a rejected takeoff.

The commander passed control to the co-pilot at 80 kt, the aircraft was rotated normally into the climb and the landing gear was retracted. At about 400 feet, and before the acceleration altitude of 620 feet, the co-pilot stated that he was having control difficulties and could not push the aircraft's nose down using the control column.

The commander took control and he, too, found it was difficult to control the pitch attitude, resorting to power reduction to reduce the rate of climb. A message was passed to the approach controller, advising him of their control difficulties and requesting vectors for a return to the airport. Meanwhile, the crew attempted to diagnose the problem, having climbed to 7,000 ft and returned to the overhead.

It was soon found that both the elevator manual trim wheel (see Figure 1) and the condition lever friction wheel had jammed and were immovable. The elevator electrical trim also did not work. Vectors were provided for a 10-mile final approach to the airport for an ILS landing on Runway 23 in order for the crew to assess handling. The decision was made to keep the flaps at their takeoff setting of 9° in case further

flap extension exacerbated the problem. The crew found that it was possible to control the pitch attitude satisfactorily using power variations and a safe landing was made. The aircraft taxied back to the stand and the engines were shut down with the condition levers still at the flight selection.

Investigation by the company’s engineers found that the condition lever friction wheel, which rotates about a common shaft with the elevator manual trim wheel (Figure 1), had made contact with the trim wheel such that application of nose-down elevator trim also caused rotation of the friction wheel in the ‘tighten’ sense until the two had jammed together. When the two wheels were freed, both mechanisms worked correctly. The aircraft manufacturer provided the information below

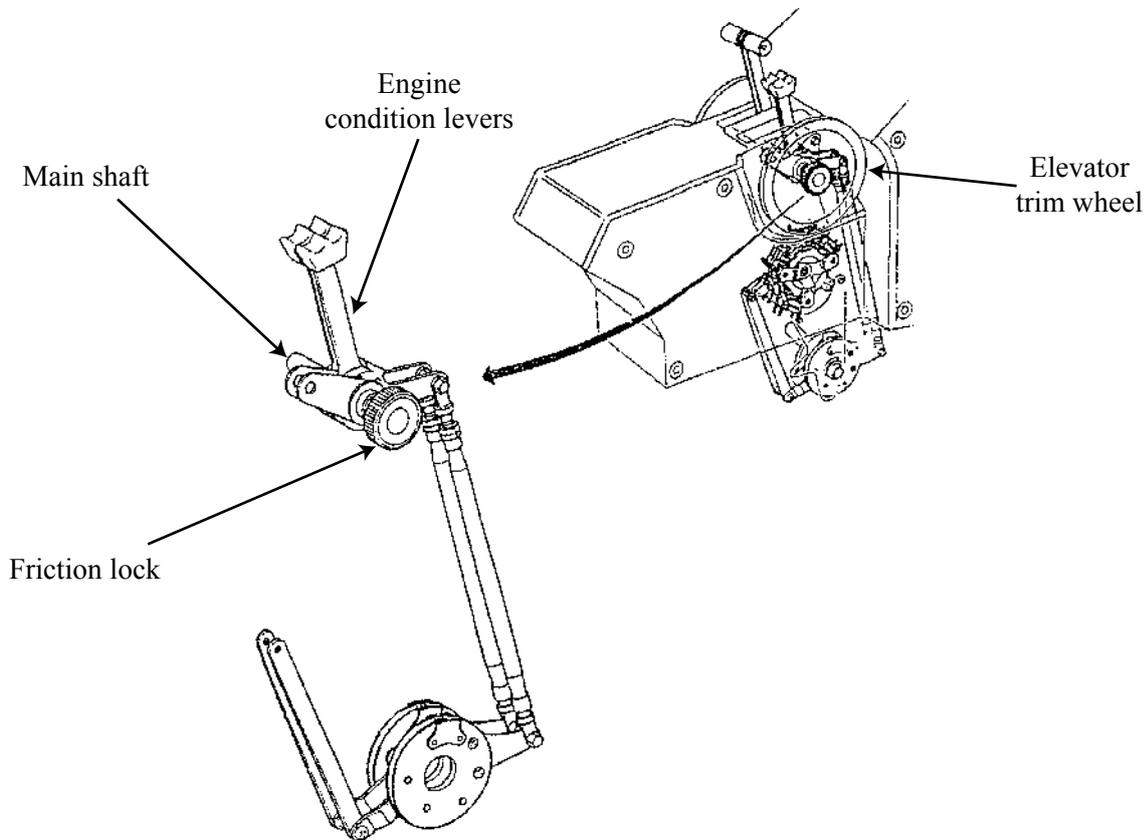


Figure 1

Jetstream 41 centre console, showing relationship between engine condition lever friction lock and elevator trim wheel

to assist the airline's investigation, but the 'displaced circlip' condition (below) described by the manufacturer was not found.

Previous incidents of a similar nature

The aircraft manufacturer supplied details of their All Operators Message (AOM) number 99/006J – issue 1 dated 9 February 1999. The AOM was issued in response to a number of reports from a particular operator in the United States of abnormally stiff elevator trim. Investigation had shown that a circlip, designed to prevent axial movement of the trim wheel along the shaft it shares with the condition levers, had become displaced from its groove (the friction wheel travels down a thread towards the trim wheel when rotated in the 'tighten' direction). As the pilots applied condition lever friction, the wheel had moved along the shaft and contacted the displaced trim wheel. The AOM recommended a 'once-off' inspection to ensure that the circlip was correctly seated and the operator of G-MAJI had introduced an additional requirement to check the circlip at 600-hour intervals.

In their response to these incidents, the FAA recommended that BAe and the CAA conduct an investigation into the causes and take action to prevent recurrence. The resulting investigation identified the cause as being the displaced circlips which, it was concluded, had been incorrectly fitted or moved during maintenance, as opposed to becoming dislodged through a design deficiency. On the basis of this, the manufacturer reasoned that no physical changes needed to be made to the assembly, as the AOM had alerted operators to the problem. The manufacturer also added a caution in the Aircraft Maintenance Manual (AMM) to ensure that the circlip was correctly seated, in response to a second FAA recommendation.

There do not appear to have been recurrences of this problem between the AOM and the incident to G-MAJI.

Discussion

In this incident, what the crew initially believed to be an abnormality in the primary pitch controls appears, in fact, to have been an out-of-trim condition. This belief led to the crew largely dismissing elevator inputs in favour of controlling pitch with power adjustments.

The commander also commented that, in hindsight, in view of the difficulties the crew were having, he should have declared a 'MAYDAY'. He also noted that ATC, while being aware of the general nature of their problems, did not ask him if he was declaring an emergency and, due to the stress and workload, he had not thought of it himself.

It is of concern that this incident, apparently a rather more extreme variation of incidents that had occurred (and which had appeared to have been resolved) about eight years ago, should not have the same root cause. The AOM described how the friction wheel is fitted with a boss which 'bottoms' on the main shaft before it can interfere with a correctly-fitted trim wheel, and therefore only a displaced trim wheel can cause contact. Despite a thorough check against the maintenance manual, no abnormalities were found in G-MAJI, and the aircraft has operated without further incident since then. The conclusion drawn by the operator is that the condition lever friction wheel had been tightened with greater than normal force to cause this incident.

However, the aircraft manufacturer has advised that, as an added precaution, it is revisiting the design review of the mechanism, carried out in response to the earlier occurrences.