Fokker F27 Mark 500 Friendship, G-JEAE

AAIB Bulletin No: 11/2003	Ref: EW/C2002/06/04	Category: 1.1
Aircraft Type and Registration:	Fokker F27 Mark 500 Friendship, G-JEAE	
No & Type of Engines:	2 Rolls-Royce Dart 532-7 turboprop engines	
Year of Manufacture:	1984	
Date & Time (UTC):	20 June 2002 at 0515 hrs	
Location:	Guernsey Airport, Guernsey	
Type of Flight:	Public Transport (Cargo)	
Persons on Board:	Crew - 2	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Damage to the tailskid, surrounding skin and back-up structure	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	52 years	
Commander's Flying Experience:	8,800 hours (of which 550 were on type)	
	Last 90 days - 80 hours	
	Last 28 days - 30 hours	
Information Source:	AAIB Field Investigation	

History of Flight

The aircraft was being flown on a cargo flight from Bournemouth to Guernsey in the early morning. The pre-flight inspection had revealed no external damage, and the aircraft departed Bournemouth at 0442 hrs. The flight proceeded uneventfully in good weather and the crew became visual with Guernsey from some distance.

At 0451 hrs the Automatic Terminal Information Service gave the Guernsey weather as; surface wind from 320° at 3 kt, visibility 28 km with fog patches, few cloud at 1,500 feet, temperature +11°C, dew point +10°C and QNH 1021 mb. The crew subsequently reported the conditions for the approach as surface wind from 270° at 3 kt, 28 km visibility and no cloud. At 15 nm from the aerodrome, having advised ATC that they were visual with the airfield, they were cleared to self-position for a visual approach to Runway 27.

The target speed for the approach was 120 kt, with a V_{REF} for landing of 100 kt. The commander stated that the aircraft was stabilised on final approach at about 2 nm at V_{REF} plus 5 kt with 40° of flap. The First Officer recalled the aircraft being steady at V_{REF} plus 10 kt by approximately 800 feet QNH (464 feet aal). He subsequently advised the commander that the speed was V_{REF} plus 5 kt and

reminded him that the aircraft was "fairly heavy". Both agreed that the speed was V_{REF} or greater as the aircraft crossed the threshold.

The aircraft was not allowed to float during the flare to minimise landing distance, although this was not a limiting factor. The crew did not regard the pitch attitude as excessively nose high or the landing as heavy, but the co-pilot did comment that the landing roll was fairly short.

By contrast, the duty Aerodrome Controller observed that the aircraft had an unusually nose high attitude during the landing, which appeared heavier than normal. The aircraft touched down at 0515 hrs.

After landing, the aircraft was taxied to the apron and shut down. During his next pre-flight inspection the commander discovered that the aircraft had suffered a tailstrike. This came as a surprise, since he had considered that a tailstrike was extremely unlikely with flap 40° selected and V_{REF} maintained beyond the threshold. However, he did consider that leaving the power on or delaying retardation of the throttles until touchdown might have prevented the accident.

Witness marks indicated that the aircraft landed on the runway 120 metres in from the threshold on a level portion of the paving.

Damage to Aircraft

The tailskid was pushed 2.5 inches into the aircraft skin. This required replacement of the skid and minor repairs to the surrounding skin and back-up structure. There was no damage to the rear pressure bulkhead.

Aircraft information

The loadsheet indicated that the landing weight was 18,715 kg, with a mid range centre of gravity. The maximum landing weight for the aircraft was 19,051 kg.

Flight recorders

The flight data recorder (FDR) contained a 25 hour time history of the aircraft's altitude, airspeed, heading, normal acceleration and flap position. Data on attitude and on engine power was not recorded and there was no requirement for this data to be recorded.

Misalignment of the flap position transducer resulted in flap position not being directly determinable from the recorded data. However, using data from previous flights the flap position transducer output corresponding to each of the flap positions was established. The recorded data showed that on the accident flight the flaps moved from 0° to 40° (full flap) in 22 seconds. 95 seconds after full flap had deployed the aircraft landed.

The aircraft was established on final approach for Runway 27 at about 2.5 miles and level at 1,000 feet aal. Seventy five seconds before touchdown the aircraft started to descend. The aircraft's rate of descent increased to about 2,300 ft/min before reducing and stabilising at 560 ft/min by 500 feet aal. In the last three seconds before touchdown there was evidence of an increased sink rate, which was then decreased just before the wheels contacted the runway.

At 500 feet aal the speed was 114 kt (V_{REF} plus14 kt). Thereafter it reduced gradually to 95.5 kt (V_{REF} minus 4.5 kt) at 50 feet aal. Over the next 4 seconds the speed reduced further to 91 kt (V_{REF} minus 9 kt), at which point the wheels contacted the runway.

A normal acceleration of 1.9 g was recorded on touchdown.

Additional information

The manufacturer advised that the normal pitch attitude during landing is 2° to 3° nose up. With the oleos compressed, a pitch attitude of 7.1° or more is required for the tailskid to contact level ground. If the oleos are extended, a 9.3° pitch attitude or greater is needed.

The operator's Operations Manual specifies the procedure to adopt for a visual approach. It states:

> *When at approx. 300 ft, and the landing is assured select flaps 40° and adjust the power levers to maintain the approach speed for the aeroplanes weight. (The final approach speed varies with flap settings. For flap 40° landings the approach speed is 120 kts. For other flap settings it is Vref + 10 kts).*
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> *During the flare smoothly retard the power levers to idle. Flare to a slightly nose up attitude and let the main wheels touch. Do not hold the aeroplane off the runway.*

The operator's Quick Reference Handbook (QRH) for the F27 Cargo gives approach speeds, threshold speeds (V_{THR}) and landing speeds (V_{REF}) for various combinations of flap setting and landing weight. V_{THR} is defined as *Vref + wind correction, where wind correction = 1/2 steady wind + full gust intensity (max 10 kts)*. For landing the speed bug is set to V_{THR}. The approach speed is calculated from a table that gives the increment to add to V_{THR}, depending on the flaps setting. For 40° of flap the approach speed is V_{THR} plus 10 kt.

For a landing weight above 18,100 kg with flap 40°, the QRH gives V_{REF} as 100 kt. On this occasion, in the light winds prevailing, V_{THR} was 101 kt and the approach speed was 111 kt, according to this formula. This is at variance with the visual approach procedure quoted from the operator's Operations Manual.

Discussion

The operator's Operations Manual and QRH gave conflicting figures for the approach speed for a landing with 40° of flap. They were 120 kt and 111 kt respectively. The landing speed, V_{REF}, was given as 100 kt in both publications.

The aircraft was established on final approach for Runway 27 at about 2.5 miles, fully configured for a visual landing with 40° of flap. Although its initial rate of descent was greater than 2,000 ft/min, by 500 feet aal it had reduced and stabilised at 560 ft/min. At that height the speed was 114 kt (V_{REF} plus 14 kt) but it appears to have been allowed to decrease steadily to 95.5 kt (V_{REF} minus 4.5 kt) at 50 feet aal. Below 50 feet the speed reduced further to 91 kt (V_{REF} minus 9 kt) at touchdown, although both pilots believed that the touchdown had been made at a speed of V_{REF} or greater.

In the final three seconds of flight the sink rate increased and then decreased just before the wheels contacted the runway. The increased sink rate was probably the result of reducing power, with the subsequent loss of slipstream induced lift. To reduce the sink rate before touchdown at a speed significantly less than V_{REF} would have required the pilot to flare the aircraft more than normal. The aircraft landed firmly with a pitch attitude of 7.1° or more.

The operator is amending his standard operating procedures to remove any inconsistencies with regard to visual approaches and flap 40° landings.