Enstrom F-28F Falcon, G-BYKF

AAIB Bulletin No: 4/2004	Ref: EW/C2004/01/01	Category: 2.3
INCIDENT		
Aircraft Type and Registration:	Enstrom F-28F Falcon, G-BYKF	
No & Type of Engines:	1 Lycoming HIO-360-F1AD piston engine	
Year of Manufacture:	1983	
Date & Time (UTC):	6 January 2004 at 1315 hrs	
Location:	Crowhurst Park, Crowhurst, East Sussex	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 2
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Damage to tail rotor drive shaft bearing and rubber bushes	
Commander's Licence:	Private Pilot's License	
Commander's Age:	44 years	
Commander's Flying Experience:	537 hours (of which 430 were on type)	
	Last 90 days - 15 hours	
	Last 28 days - 5 hours	
Information Source:	AAIB Field Investigation	

History of flight

The helicopter had taken off from a private helipad with two passengers on board. The pilot had hover-taxied from the pad to a clear area and begun a semi-towering take-off manoeuvre to avoid power lines. After a normal climb-out, at around 1,000 feet, the pilot felt a kick to the left followed by an abnormal vibration. As the helicopter transitioned into level flight and accelerated to 100 mph, the vibration increased in magnitude although the controls felt normal. There were no other abnormal indications. The pilot decided to carry out a precautionary landing; he entered a descent and carried out a successful landing back on the helipad.

After disembarking the passengers and consulting his maintenance organisation the pilot restarted the helicopter in order to diagnose the source of the vibration. He found that there were no abnormal vibrations at ground idle, however, above 1,500 RPM the vibration was noticeable and increased in magnitude. The pilot shut down the engine and observed, as the blades slowed, a misalignment of the tail rotor drive shaft.

Aircraft examination

In this type of helicopter, drive is transmitted to the tail rotor via a shaft running externally along the top of the tail boom and supported along its length by five roller bearings located within blocks. Between each block and the bearing is a rubber bush. The helicopter was examined by the AAIB in conjunction with the maintenance engineer and the pilot. The rubber bush from the No 4 bearing (numbered from the forward end of the shaft - see Figure 1) was damaged and having been released from its location, had migrated aft, although it had remained attached to the shaft (see Figure 2). Release of the bush had allowed the tail rotor drive shaft some radial movement within the bearing, thus causing the vibration. All the bearings and rubber inserts were removed for analysis.

Figure 1 & 2: Tail Rotor Drive Shaft and Photo of final location of Number 4 bearing

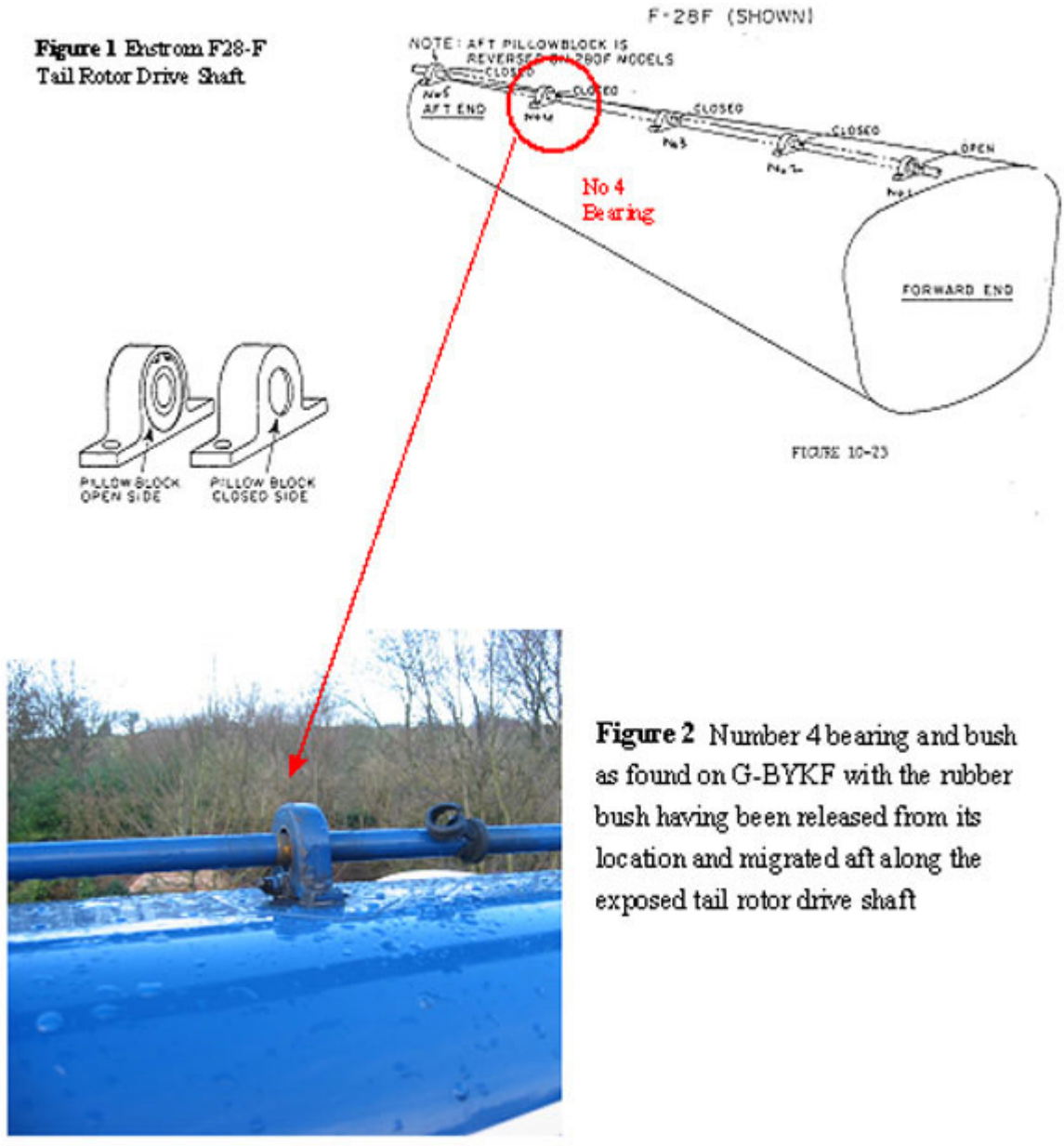

Figure 1 Enstrom F28-F Tail Rotor Drive Shaft

Figure 2 Number 4 bearing and bush as found on G-BYKF with the rubber bush having been released from its location and migrated aft along the exposed tail rotor drive shaft

The bearings and rubber inserts are maintained 'on-condition' and there is no requirement to remove the tail rotor drive shaft to inspect these components. During each pre-flight inspection the pilot checks for any play within the bearings, which are re-greased at every 50 hour inspection. This particular helicopter was over 20 years old and had originally been operated in Japan where it had lain

idle for a significant portion of the time. It had been imported to the UK and bought by the current owner in 2000. The rubber bushes had not been replaced by the current owner and were most likely those fitted during manufacture.

Examination showed that the No 4 bearing, although filled with grease, was heavily contaminated with elastomer particles from the rubber bush. The bush had become swollen from prolonged contact with grease (see Figure 3); this had resulted in wear of the bush due to contact with the block whilst the bush was rotating, thus contaminating the grease with the associated wear products. The other bushes showed similar signs of swelling. The No 4 bearing showed some evidence of corrosion, although it was probable that this had occurred as a result of moisture ingress whilst idle and it is likely that this had occurred relatively recently after the bush had been released and prior to examination by the AAIB. There is no record of any other in-flight failures of this component.

Figure 3: Comparison of rubber bush condition

Photograph courtesy of HT Consultants

1. Bush released from No 4 bearing
2. Another bush removed from G-BYKF
3. New bush

Figure 3 Comparison of rubber bush condition