AAIB Bulletin No: 6/2005 **Ref: EW/G2005/01/07** **Category: 2.1**

INCIDENT

Aircraft Type and Registration:	Aerospatiale AS332L Super Puma, G-TIGF
No & Type of Engines:	2 Makila 1A turboshaft engines
Year of Manufacture:	1982
Date & Time (UTC):	21 January 2005 at 1540 hrs
Location:	Dutch Sector, North Sea
Type of Flight:	Public Transport (Passenger)
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to main and tail rotor blades
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	56 years
Commander's Flying Experience:	17,300 hours (of which 9,000 were on type) Last 90 days - 90 hours Last 28 days - 25 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot. Further information provided by the operator's maintenance organisation

History of the flight

The aircraft was operating a passenger service from Den Helder, Holland, to an offshore platform located approximately 150 km from the Dutch coast. The commander reported that the aircraft was in the cruise at 2,000 feet, approximately 40 nm south of the platform. Whilst avoiding a cumulo-nimbus cloud, which the crew had seen from a distance and which had also been detected on the weather radar, a flash was seen in clear air to the left of the aircraft. There was no accompanying bang, static noise, electrical failure, variation in compass indication or change in vibration level. They concluded that the lightning was clear of the aircraft and therefore continued the flight to the offshore platform in accordance with their standard procedures. The remainder of the flight, including the return leg, was uneventful. The crew subsequently reported that the wind was from 300º at 45 kt with broken cloud at 3,000 feet, the indicated outside air temperature was +2ºC and the visibility was greater than 10 km in light sleet.

On arrival at base the crew briefed the engineering staff on the event. Subsequent examination revealed slight damage to the main and tail-rotor blades.

Background to the incident

The AS332 is equipped with carbon composite rotor blades and has been used extensively in both the UK and Norwegian sectors of the North Sea for many years. In 1995 an AS332, G-TIGK, was lost after a lightning strike damaged the main and tail-rotor blades. The damage to one tail rotor blade was identified as the immediate cause of that aircraft loss and a modified tail rotor blade design was developed to reduce vulnerability to lightning effects. Lightning strikes continued to occur to the type periodically, although those reported to the AAIB were restricted to main rotor blade damage. The aircraft involved completed the sectors in question and the rotor blades, gearboxes and other selected components were thereafter removed for detailed examination. In many cases the main rotor blades were damaged beyond economic repair. Examination of these blades, however, indicated that damage was generally restricted to laminate layers close to the outer skins and the immediate structural strength was estimated as having only been reduced by a small percentage. In all but one case (G-TIGK) the degree of imbalance had not lead to the need for an immediate landing.

Since the accident to G-TIGK, a number of improvements have been made to the lightning forecasting facilities for helicopters operating from Aberdeen into the North Sea. Less comprehensive facilities are available at the Den Helder base.

It was noted during the investigation of a previous lightning event, involving considerable damage on a different type of aircraft, that the pilot observed a nearby discharge during the flight yet believed his aircraft had not been affected until the damage was noted following the landing.

Assessment of damage to G-TIGF

Photographs of the main-rotor blades, together with initial verbal descriptions of the tail rotor blade condition, were supplied to the AAIB. Subsequent examination of the tail rotor blades by company personnel left in doubt the initial view that they had been affected by lightning. The photographs of the main blade damage indicated that it was very much less severe than that resulting from a number of previous strikes to AS332 main blades examined by the AAIB. All main and tail rotor blades and both gearboxes were returned to the manufacturers for examination/repair as appropriate.

Meteorology

A Sferics plot of actual lightning discharge locations for the relevant period shows extensive lightning activity over northern Germany but only a small amount of low intensity activity in the relevant area of the Dutch sector of the North Sea. A weather report from the offshore platform, timed at 1600 hrs, recorded the following conditions: wind from 300º at 46 kt, temperature +5·6ºC, broken cloud at 1,100 feet and visibility greater than 10 km with showers of heavy rain at times. The crew reported that lightning activity was not included in the forecast for the route.

It is known from previous events that the presence of an aircraft can act as a trigger for a lightning discharge when conditions conducive to lightning are present but no discharges have been observed.

Discussion

Compared with the previous lightning incidents investigated by the AAIB, this event appears to be at the lower end of the damage range in terms of airworthiness significance. It is, however, not usual for AS332 blades which suffer lightning damage beyond the capability of local repair and are returned to the manufacturer for examination, to be to be subsequently repaired and returned to service.

Gearboxes normally require strip examination and comprehensive replacement of parts to eliminate any gears or bearings which have suffered arcing damage to their working surfaces as a result of current earthing from the blades to the structure via the rotor mast and hence via the contact faces of these internal components. In addition, any gearbox components which become magnetised are also discarded, since continuing gearbox integrity relies on magnetic chip detection systems within the gearbox lubrication arrangements and their effectiveness would be negated by any other magnetic source introduced in the vicinity of the oil flow.

Although much effort has gone into improving forecasting for lightning risk in the North Sea since the G-TIGK accident, lightning strikes to AS332 aircraft continue to occur. Improvements to the tolerance of the type to such events appear, however, to have considerably reduced the risk of aircraft loss from this source.