

SERIOUS INCIDENT

Aircraft Type and Registration:	Sikorsky S-76C++, G-WIWI
No & Type of Engines:	2 x Turbomeca Arriel 2S2
Year of Manufacture:	2007
Location	Private landing site, East Sussex
Date & Time (UTC):	3 May 2012 at 2155 hrs
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 2 Passengers - 2
Injuries:	Crew - None Passengers - None
Nature of Damage:	None
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	55 years
Commander's Flying Experience:	10,250 hours (of which 4,800 were on type) Last 90 days - 11 hours Last 24 hours - 2 hours
Information Source:	AAIB Field Investigation

Synopsis

Following an event in which high torque was used, flight data was analysed on behalf of the operator using incorrect conversion information relevant to earlier variants of the helicopter. The operator was therefore unaware that total torque had exceeded a level at which maintenance action was required. The investigation

revealed the existence of the correct information and one Safety Recommendation is made to publish it in a single document.

This Special Bulletin contains facts which have been determined up to the time of issue. It is published to inform the aviation industry and the public of the general circumstances of accidents and serious incidents and should be regarded as tentative and subject to alteration or correction if additional evidence becomes available.

AAIB investigations are conducted in accordance with Annex 13 to the ICAO Convention on International Civil Aviation, EU Regulation No 996/2010 and The Civil Aviation (Investigation of Air Accidents and Incidents) Regulations 1996.

The sole objective of the investigation of an accident or incident under these Regulations is the prevention of future accidents and incidents. It is not the purpose of such an investigation to apportion blame or liability.

Accordingly, it is inappropriate that AAIB reports should be used to assign fault or blame or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

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History of the flight

The helicopter was on a commercial air transport (passenger) flight from Battersea Heliport to a private landing site in a field surrounded by trees. The commander was pilot flying (PF) and the conditions were night with low cloudbase, poor visibility, and rain. While manoeuvring, the commander became disorientated and the helicopter descended towards the tops of trees in the forested area to the south and west of the landing site. The commander executed a go-around, during which high torque was applied. The helicopter diverted to Lydd where it landed safely. The minimum radio altimeter value recorded during the go-around was two feet.

Flight recorder readout

Following the event the combined flight data and cockpit voice recorder fitted to the helicopter was downloaded by the operator. This was several weeks after the incident by which time the voice recordings for the incident had been overwritten by subsequent helicopter operations; however, flight data for the incident was available.

The operator used a third party organisation, recommended to it by Sikorsky, the helicopter manufacturer, to perform a readout service of the flight data. During this process the recorded data were converted into engineering units. These conversions were based on documentation¹ which, although supplied by Sikorsky, was written by Teledyne Controls, the flight data acquisition unit (FDAU)² manufacturer. The FDAU fitted to the helicopter had part number 2231230-10-A-1.

Footnote

¹ Teledyne Controls document - Engineering Units Conversion for Sikorsky S76-B, S76-C Helicopter - Drawing No. EUC 2231230-10-A-1 Rev. B.

² The purpose of the FDAU system is to acquire, condition, and process aircraft parameters and output them in a structured format to the crash protected flight data recorder (FDR).

The readout indicated that during the go-around manoeuvre a maximum of 114.5% and 113% torque had been recorded for engine 1 and 2 respectively.

When the AAIB was subsequently notified of the incident, a copy of the flight data was made available immediately. This was converted into engineering units by the AAIB using the same conversions detailed in the documentation supplied by Sikorsky; however, it was found that the document did not explicitly reference the C++ variant of the Sikorsky S-76, leaving doubt over the accuracy of the converted data.

Both Sikorsky and Teledyne were asked if an explicit document detailing the FDAU and FDR installation on the S-76C++ existed. Teledyne replied that such a document did exist and had been written in response to a request by Sikorsky following a configuration change to the FDAU from the -10-A-1 to the -21 version. The -21 version was designed to meet the FAA rule 2010 requirements, Part 135 Appendix C for helicopters built after April 2010 and included the requirement to record additional parameters on the FDR. To reflect these changes, the document³ detailed the altered format of the recorded parameters on the FDR together with the necessary conversions required to convert these into engineering units. Teledyne also stated that for those S-76C++ helicopters not affected by the FAA rule 2010, the -10-A-1 document was still to be used for determining how the parameters were recorded on the FDR but to use the -21 document to convert these into engineering units.

Comparison of the conversion factors of parameters common to both documents revealed that the main

Footnote

³ Teledyne Controls document – Specification Control Document for Flight Data Acquisition Unit (FDAU) Sikorsky S76C++ Helicopters P/N 2231230-21- Drawing No. SCD2231230-21 Rev. A.

difference was for engine torque⁴, increasing the linear coefficient factor by about 6%. Using this revised conversion meant that during the go-around manoeuvre of G-WIWI a maximum of 121.5% and 120% torque had actually been recorded for engine 1 and 2 respectively. Total torque was therefore greater than 240%, a level at which maintenance action was required.

A subsequent calibration check was made of the torque measurements on G-WIWI. The torque on each engine was stepped up to 100%, based on the output of the digital cockpit torque gauge. The FDR was then downloaded so that the recorded data could be compared with the gauge output to determine the correct factor needed to correlate the two outputs. The resulting factor was within 1% of the -21 conversion factor.

FDR documentation requirements

FDRs record binary data containing encoded parametric information. The binary data can then be converted to engineering units (knots, feet etc.) by referencing detailed documentation specific to the aircraft installation. The organisation most likely to possess the information and expertise required to generate such documentation is the aircraft manufacturer or the design organisation responsible for the FDR installation. The CAA, in CAP 731, and the FAA, in AC20-141B, have published guidance material to assist aircraft manufacturers or design organisations in producing such documentation.

For aircraft issued with an EASA type certificate, which includes the Sikorsky S-76C++, Commission Regulation (EC) No 1702/2003 of 24 September 2003 Part 21 requirement 21A.61 '*Instruction for continued airworthiness*' states:

'(a) The holder of the type-certificate...shall furnish at least one set of complete instructions for continued airworthiness...to each known owner of one or more aircraft...upon issue of the first certificate of airworthiness for the affected aircraft...and thereafter make those instructions available on request to any other person required to comply with any of the terms of those instructions. ...'

This regulation does not explicitly reference FDR documentation and this is not reflected in any guidance material; however, correspondence with the CAA and EASA has established that Part 21 requirement 21A.61 implicitly includes the provision of FDR documentation that will enable the conversion of the binary record to engineering units. The same is true for requirements 21A.107 and 21A.120, which are applicable to holders of Minor and Major design change approvals respectively.

The documentation available to operators of the S-76C++ (equipped with Teledyne Control FDAU part number 2231230-10-A-1) contained anomalies. A document providing the correct conversion information for the -21 version was available for use in conjunction with the -10-A-1 document, but operators were not aware of it. Moreover, the correct information did not appear in a single document providing clear guidance. There may therefore have been other instances in which operators were unaware that engines had exceeded the manufacturer's stated torque limit, and that necessary maintenance was not carried out.

Sikorsky Aircraft Corporation sent a letter⁵ dated 5 October 2012 to all S-76 operators, S-76 centres

Footnote

⁴ Other differences were identified in the engine free turbine speed (N_p).

Footnote

⁵ Sikorsky Aircraft Corporation letter – S-67C+ and S-76C++ FDR Data, Interpretation of – CCS-76-AOL-12-0005 dated 5 October 2012.

and field service representatives advising them of the issues identified in this Special Bulletin and the correct conversions to be used. However, the accuracy of FDR documentation is fundamental to air safety investigation; therefore, the following Safety Recommendation is made:

Safety Recommendation 2012-033

It is recommended that the Sikorsky Aircraft Corporation issues, in a single document, correct flight data recorder engineering unit conversion information for S-76C++ helicopters equipped with a Teledyne Control Flight Data Acquisition Unit part number 2231230-10-A-1. This document should follow the guidance given in Federal Aviation Administration Advisory Circular 20-141B and UK Civil Aviation Publication 731.

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