FINAL REPORT

AAIU Synoptic Report No: 2007-003
AAIU File No: 2006/0014
Published: 02/02/07

In accordance with the provisions of SI 205 of 1997, the Chief Inspector of Accidents, on 12/03/06, appointed Mr. John Hughes as the Investigator-in-Charge to carry out a Field Investigation into this Serious Incident and prepare a Synoptic Report.

Aircraft Type and Registration:	Schweizer 300, EI-DDI
No. and Type of Engines:	1 x Lycoming HIO-360-GIA
Aircraft Serial Number:	0156
Year of Manufacture:	2003
Date and Time (UTC):	12 March 2006 @ 12.40 hrs
Location:	Weston Airport
Type of Flight:	Training
Persons on Board	Crew - One Passengers - One
Injuries:	Crew - Nil Passengers - Nil
Nature of Damage:	No apparent damage to helicopter
Commander's Licence:	UK CPL(H)
Commander's Details:	Male, aged 44 years
Commander's Flying Experience:	3,900 hours of which 1,200 were on type
Information Source:	Pilot of EI-DDI

SYNOPSIS

The helicopter, which was on a training flight, was on approach to land when the nose yawed to the right at about 50ft above ground level (AGL). The Instructor immediately carried out an autorotation and landed with no damage and no injuries to persons on board. During the subsequent investigation it was found that the tail rotor swash plate bellcrank bearing had disintegrated in flight.

1. FACTUAL INFORMATION

1.1 History of the Flight

The Instructor was demonstrating Exercise 23 (advanced take-off and landings). Whilst making a downwind approach he gradually reduced forward speed. The airspeed indicator read zero. He started descending from 200ft AGL and pointed out the rate of descent to his student. At about 50ft AGL there was a shudder in the airframe and the helicopter quickly started to turn towards the right.

Full left pedal was applied but this had no effect. The pilot then realised that he had a loss of tail rotor control and immediately entered autorotation. The helicopter was now pointing into wind. The pilot raised the collective to cushion the landing and the helicopter slid along the grass for about 7 metres. He made an immediate shut down and both the instructor and student exited EI-DDI in the normal way. There were no reported injuries and no apparent damage to the helicopter.

1.2 Aircraft Information

The 2/3 seat Schweizer 300C, whose engineering designation is 269, first flew as the Hughes 269 in the mid-50s and was marketed by them as the model 300. Production of the 300 was transferred from Hughes to Schweizer in 1983 and the first model 300C was flown in 1984.

The aircraft involved in this incident is a two-seat Schweizer 269C-1 with a 180 hp engine and has a 3-blade fully articulated main rotor and a two-blade tail rotor system used for torque reaction and directional control. This model was first certified in 1995.

The tail rotor control system utilizes cables and pulleys in one link of its otherwise solid system of tubular push-pull rods. The tail boom assembly extends rearwards from its attachment to the centre frame section. It is a monocoque structure of aluminium and houses the tail rotor drive shaft and tail rotor control rod. At the aft end, it supports the tail rotor gearbox and tail rotor, in addition to the horizontal and vertical stabilizers. The control rod operates a tail rotor swash plate bellcrank. This bellcrank contains a bearing, which rotates about a bolt fixed to the tail rotor transmission. (See **Appendix A**)

A 25 hour inspection, in accordance with the LAMS-H-1999 Issue 1 and the manufacturers requirements, was carried out on 3 February 2006. The helicopter total hours at that time since new were 769 hrs.

1.2.1 Pilot's Flight Manual

Emergency Procedures Chapter 3-6 states:

Tail rotor failure is indicated by a sudden yawing to the right.

- *Enter autorotation*
- *Follow procedures for autorotational approach and landing.*

1.3 Investigation

Examination of the tail rotor blade pitch change mechanism showed that the double row ball bearing installed in the bellcrank had disintegrated. This allowed the bellcrank to slip through the pivot bolt including its washer and nut and separate from the tail rotor gearbox. Some corrosion was also evident on the bearing inner surface. The local servicing contractor indicated that the bolt and its bearing had not been changed since aircraft construction and that their orientation when removed from EI-DDI was correct. The bolt, nut, washers and inner face in the sequence shown in **Appendix A** were forwarded to the manufacturer for examination. Their conclusions were as follows:

"Analysis revealed that corrosion likely caused the bearing breakage. Reduction in the diameter of the bearing balls due to corrosion probably contributed to the separation. Without an identification of component location and orientation, a positive root cause cannot readily be determined."

The maintenance manual does not have a periodic lubrication interval for these bearings. It is a sealed part and they have not had any problems in the past in this area.

1.4 Preliminary Report

On 20 March 2006, the AAIU issued Preliminary Report (Ref. PR 2006/0014) in which the following Safety Recommendation was made:

"The manufacturer should modify the bell-crank assembly in order to prevent the bell-crank disconnecting from its fixed mounting in the event of bearing failure."

Copies of the Preliminary Report were sent to the FAA and NTSB. The FAA identified the Safety Recommendation under Ref. 06.072. The Robinson Helicopter Company were also informed as both the R22 and the R44 had similar installations on the tail rotor pitch change control mechanism. They replied that they had already made some design changes on the R22 in order to reduce the chance of swash-plate bearing failure. This bearing was associated with the forward leg of the bellcrank and not the pivot bearing. They were replacing the older parts as they came up for overhaul. They stated that they had received no reports of failed bearings on R44 helicopters. In February 2003, the FAA issued AD 2003-04-04 for the R22 which demands that the bearing on the tail rotor swashplate bellcrank be tested every 300 hrs time-in-service (TIS) or 12 months whichever occurs first.

As a result of the above Preliminary Report, the Manufacturers of EI-DDI on 4 October 2006 issued a Mandatory Service Bulletin C1B-019 (see **Appendix B**), which introduced a large safety washer (Part No.AN970-5) to the bellcrank bolt assembly. This new washer will prevent the bellcrank from slipping down through the pivot bolt, should the bearing disintegrate. Compliance is at the next removal of the bellcrank assembly at 600 hrs or 12 months from the issue date, whichever comes first.

2. ANALYSIS

The Service Bulletin states, "*that failure to comply with the bulletin may lead to loss of control of the helicopter and subsequently cause serious injury, death and/or property damage"*. Tail rotor control failure will cause loss of directional control that may result in damage to the helicopter following autorotation and subsequent heavy landing and as a consequence, possible injury to its occupants. In this case, a qualified instructor was flying the helicopter and he was quickly aware that the rapid lurch to the right was due to tail rotor control failure. He was also fortunate in that he had sufficient height in which to autorotate and land safely. Had the student been flying solo the consequences could have been different.

The helicopter had accumulated approximately 770 hrs in less than 3 years since construction. The bellcrank pivot bearing is a sealed bearing and is not lubricated in service. However, other helicopter manufacturers have considered it necessary to test similar exposed control system bearings at regular intervals.

3. CONCLUSIONS

(a) Findings

The Instructor experienced a loss of tail rotor control of his helicopter. He entered autorotation and landed safely.

(b) Cause

The loss of tail rotor control was due to the deterioration of the tail rotor swashplate bellcrank attachment bearing.

4. SAFETY RECOMMENDATIONS

Preliminary Report (PR) 2006/0014 made one recommendation as follows:

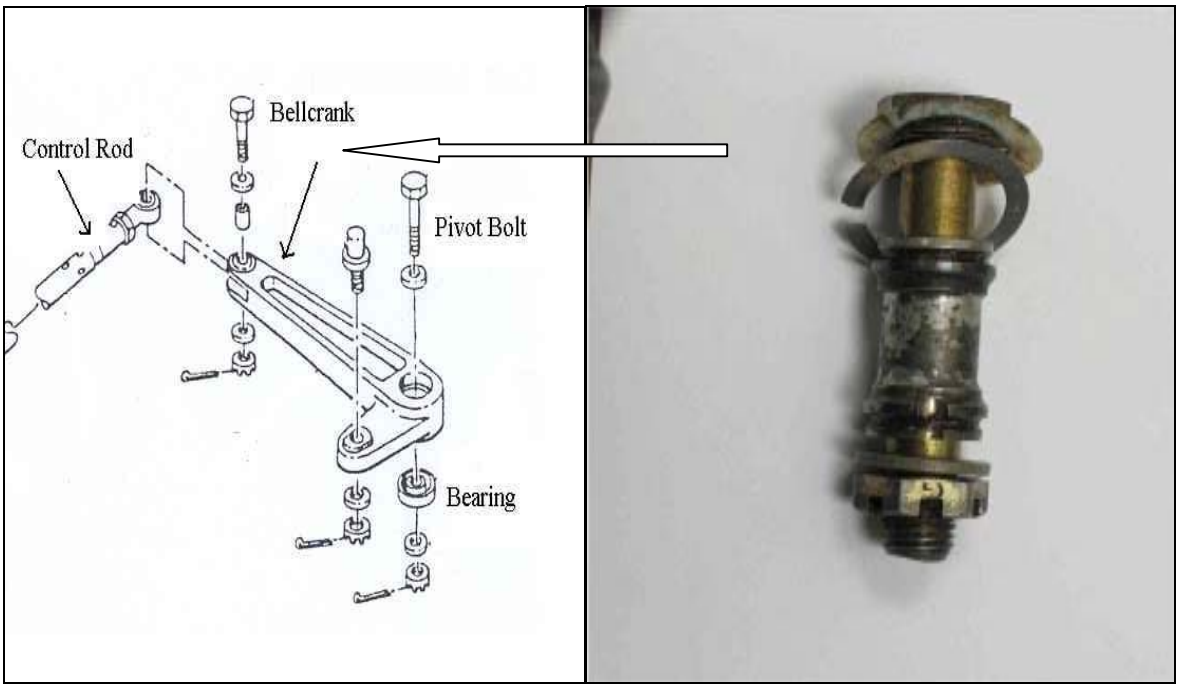
1. The manufacturer should modify the bell-crank assembly in order to prevent the bell-crank disconnecting from its fixed mounting in the event of bearing failure. **(SR 03 of 2007)**

Response/Action:

Compliance with this Recommendation has already been carried out by the helicopter manufacturer through the issue of Mandatory SB C1B-019 **(**See **Appendix B)**.

2. The Manufacturer should review the maintenance procedures in order to investigate the requirement for a periodic inspection of the tail rotor bellcrank pivot bearing integrity. **(SR 04 of 2007)**

Appendix A



The bolt NAS6205-26D as removed from EI-DDI.

Appendix B

C1B-019
04 Oct 2006

SCHWEIZER SERVICE BULLETIN

SCHWEIZER 269 SERIES

MANDATORY — MANDATORY — MANDATORY

SUBJECT: TAIL ROTOR SWASHPLATE BELLCRANK ASSEMBLY SAFETY WASHER INSTALLATION

MODELS AFFECTED: All 269C-1 Model Helicopters serial numbers 0001 thru 0260.

TIME OF COMPLIANCE: At next removal of tail rotor swashplate bellcrank assembly or 600 hour or 12 months from issue date of this Service Bulletin, whichever occurs first.

REFERENCE: 269C-1 Basic HMI

PREFACE:

- A report has been received of loss of tail rotor control due to deterioration of a tail rotor swashplate bellcrank attachment bearing. This allowed a downward displacement of the bellcrank to a point that the bellcrank pivot pin disengaged the tail rotor swashplate pivot bearing. Installation of a large area AN970-5 washer as a safety washer will prevent a bellcrank displacement that can cause pivot pin disengagement. 269C-1 Model Helicopters serial number 0261 and subsequent have been delivered with the large area washer installed.
- Failure to comply with this Service Bulletin may lead to loss of control of the helicopter and subsequently cause serious injury, death and/or property damage.

APPROVAL: Engineering aspects of this Service Bulletin are FAA approved.

PARTS REQUIRED:

AN970-5	Washer
NAS6205-26D	Bolt
AN960KD516L	Washer (alternate AN960KD516) as required
AN320-5	Nut
MS24665-151	Cotter Pin

PROCEDURE:

a. Inspect attachment bearing in tail rotor swashplate bellcrank assembly for security and condition in accordance with Basic HMI Section 9.

b. Remove tail rotor swashplate bellcrank assembly from tail rotor transmission mount and discard NAS6205-25D bolt. Install bellcrank using NAS6205-26D bolt, AN970-5 large area washer, AN320-5 nut and MS 24665-151 cotter pin. Use AN960KD516L or AN960KD516 washers as required to shim for clearance between bellcrank and transmission mount and AN970-5 washer as shown in Figure C1B-019-1.

WEIGHT AND BALANCE

Weight and Balance are not affected

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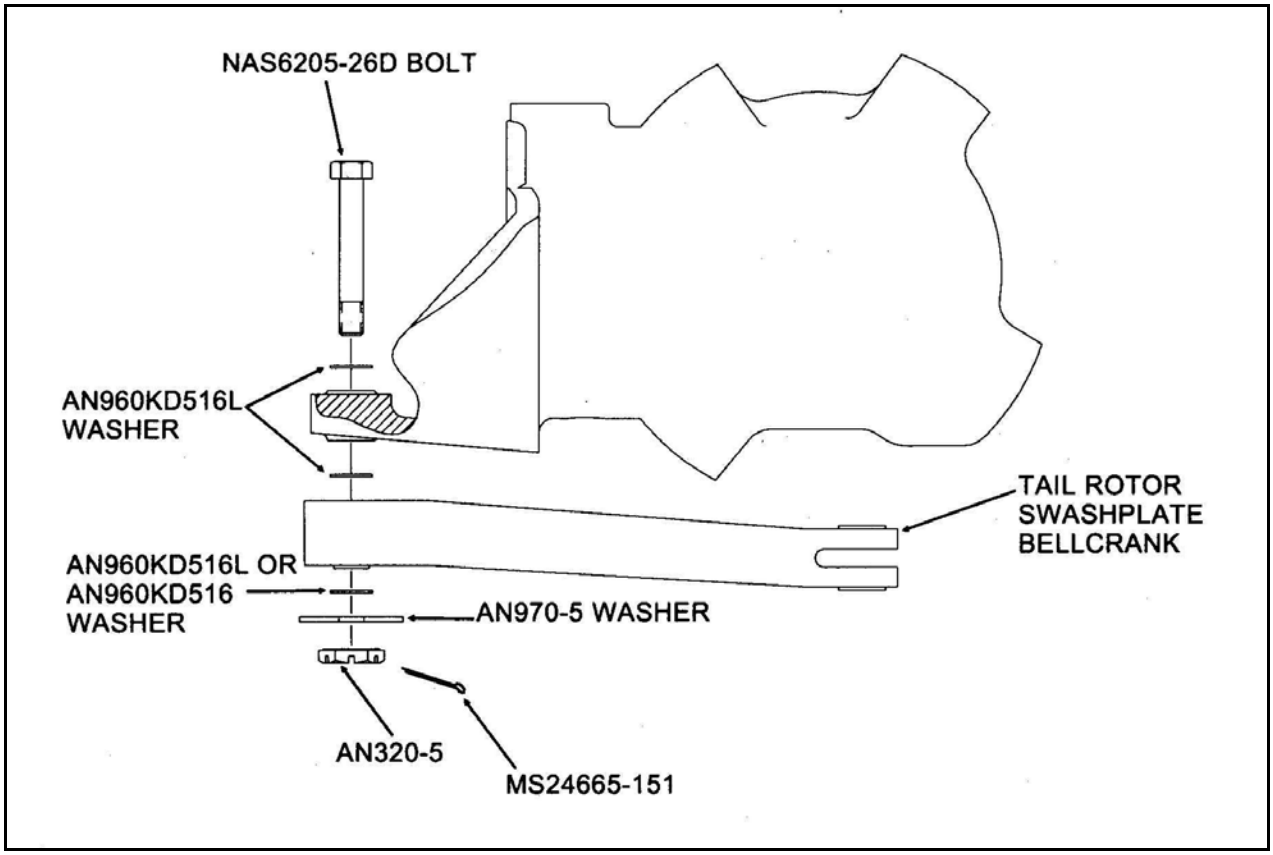
S-240 SCHWEIZER AIRCRAFT CORP. 1250 Schweizer Road Horseheads, NY 14845


NAS6205-26D BOLT
AN960KD516L
WASHER
TAIL ROTOR
SWASHPLATE
BELLCRANK
AN960KD516L OR
AN960KD516
WASHER
AN970-5 WASHER
AN320-5
MS24665-151

- END -