



Havarikommisjonen
Accident Investigation Board Denmark

BULLETIN

Serious incident

18-12-2014

involving

SIKORSKY S61N

OY-HAG



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FOREWORD

This bulletin reflects the opinion of the Danish Accident Investigation Board regarding the circumstances of the occurrence and its causes and consequences.

In accordance with the provisions of the Danish Air Navigation Act and pursuant to Annex 13 of the International Civil Aviation Convention, the investigation is of an exclusively technical and operational nature, and its objective is not the assignment of blame or liability.

The investigation was carried out without having necessarily used legal evidence procedures and with no other basic aim than preventing future accidents and serious incidents.

Consequently, any use of this bulletin for purposes other than preventing future accidents and serious incidents may lead to erroneous or misleading interpretations.

A reprint with source reference may be published without separate permit.

TABLE OF CONTENTS

SYNOPSIS	4
FACTUAL INFORMATION	5
History of the flight	5
Injuries to persons	5
Damage to the helicopter.....	6
Helicopter information	6
Meteorological information.....	11
Presence of fire.....	11
Tests and research	11
Organization and management information	12
ANALYSIS.....	12
CONCLUSION.....	13
PREVENTIVE ACTION.....	13

BULLETIN

General

File number: HCLJ510-2015-283
UTC date: 18-12-2014
UTC time: 12:30
Occurrence class: Serious incident
Location: Kangerlussuaq (BGSF)
Injury level: None

Aircraft

Aircraft registration: OY-HAG
Aircraft make/model: SIKORSKY S61N
Current flight rules: Instrument Flight Rules (IFR)
Operation type: Commercial Air Transport Revenue operations Passenger
Flight phase: Standing
Aircraft category: Rotorcraft Helicopter
Last departure point: Greenland (Denmark) BGSF (SFJ): Kangerlussuaq
Planned destination: Greenland (Denmark) BGJN (JAV): Ilulissat
Aircraft damage: Minor
Engine make/model: GENERAL ELECTRIC USA CT58 SERIES

SYNOPSIS

Notification

All times in this report is UTC.

The Aviation Unit of the Danish Accident Investigation Board (AIB) was notified of the serious incident by the Danish Transport Authority on 23-12-2014 at 08:30 hours.

The European Aviation Safety Agency (EASA), the Directorate-General for Mobility and Transport (DG MOVE), the National Transportation Safety Board (NTSB), and the International Civil Aviation Organization (ICAO) were notified on 7-1-2015.

FACTUAL INFORMATION

History of the flight

The serious incident flight was a charter flight from Kangerlussuaq, (BGSF) to Ilulissat, (BGJN)

Scheduled departure was at 13:00 hrs.

Overnight, the helicopter had been parked in the hangar.

In the morning, approximately 45 minutes prior to start-up of the engines the helicopter was towed outside.

In accordance with the procedures, the flight crew mechanic observed the start-up of the engines.

After a normal start-up of the engines and rotor engagement, the flight crew mechanic performed a walk around check. After the walk around, the flight crew mechanic went back onboard the helicopter.

Approximately 2-3 minutes after the start-up of the engines, ground personnel observed sparks from the pylon transmission area. The ground personnel signaled the flight crew, who then performed an emergency shut-down of the engines.

On the ramp, it was observed that the intermediate gear box was discolored from excessive heat around the area of the input bearing. A piece of approximately 10 by 4 centimeters of the intermediate gear box input housing had broken off.

There were no passengers onboard, and neither of the flight or other crew members suffered any injuries.

(The onboard flight crew mechanic acted as a cabin crew member as well).

The serious incident occurred in daylight and under visual meteorological conditions (VMC).

Injuries to persons

<i>Injuries</i>	<i>Crew</i>	<i>Passengers</i>	<i>Others</i>
Fatal			
Serious			
None	3		

Damage to the helicopter

The intermediate gear box installed in the forward end of the pylon was substantially damaged.

Helicopter information

The S61N amphibious transport helicopter was manufactured in 1965 in the United States of America by Sikorsky Aircraft Corporation.

The manufacturer's serial number was 61268.

The helicopter total hours since new were 42939 hours.

The helicopter total cycles since new were 76991.

The intermediate gear box:

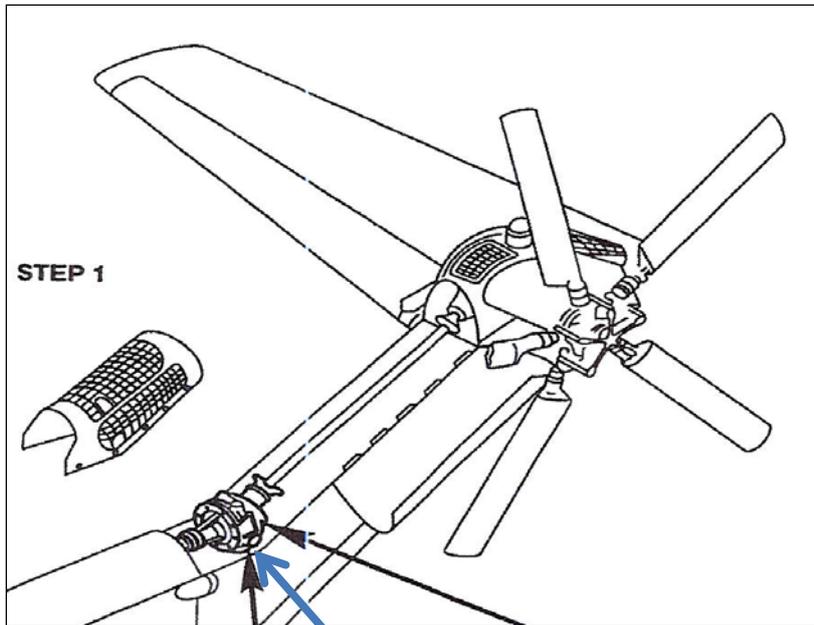
The intermediate gear box, in the forward end of the pylon, transmitted torque and changed the angle of the tail drive shaft about 44 degrees.

Input and output housings contained similar bevel gears with 1 to 1 ratio to change the angle of drive upward along the pylon.

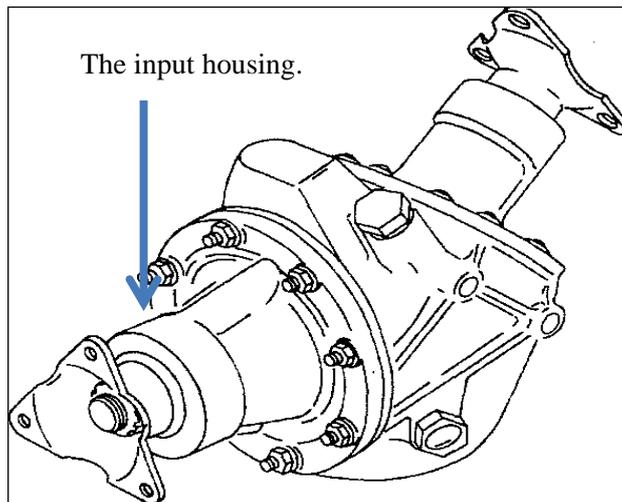
The centre housing incorporated an oil level site gage on the left side, and a filler plug at the top.

A magnetic chip detector with a high temperature sensing element replaced the plain magnetic chip detector. The magnetic chip detector in the bottom also served as a drain plug.

The intermediate gearbox was splash-lubricated and air cooled.



The intermediate gear box pylon installation



The intermediate gear box assembly

The intermediate gear box - recent maintenance history:

Part Number: S6135-66300-2
Serial Number: A-15-592

On 10-12-2012 the intermediate gear box was removed for a scheduled overhaul (O/H).

Time since new:	27673:22 hours
Time since last O/H:	4489:22 hours

On 7-8-2014, the intermediate gear box was installed in another Sikorsky S61N with the registration OY-HAF.

On 13-9-2014, the total time since last O/H was 28:33 hours.

After repeatedly intermediate gearbox chip warnings, the following maintenance was performed.

The chip detector was inspected in accordance with the maintenance manual procedures. Chips with the size of approximately 0.1 millimeter were found.

- The intermediate gear box was flushed with oil.
- Ground and hover test were performed.
- Intermediate gear box oil was replenished.

The chip detector was then re-inspected. Again chips with the size of approximately 0.1 millimeter were found.

Intermediate gear box was then removed for an unscheduled repair in the operator's component workshop.

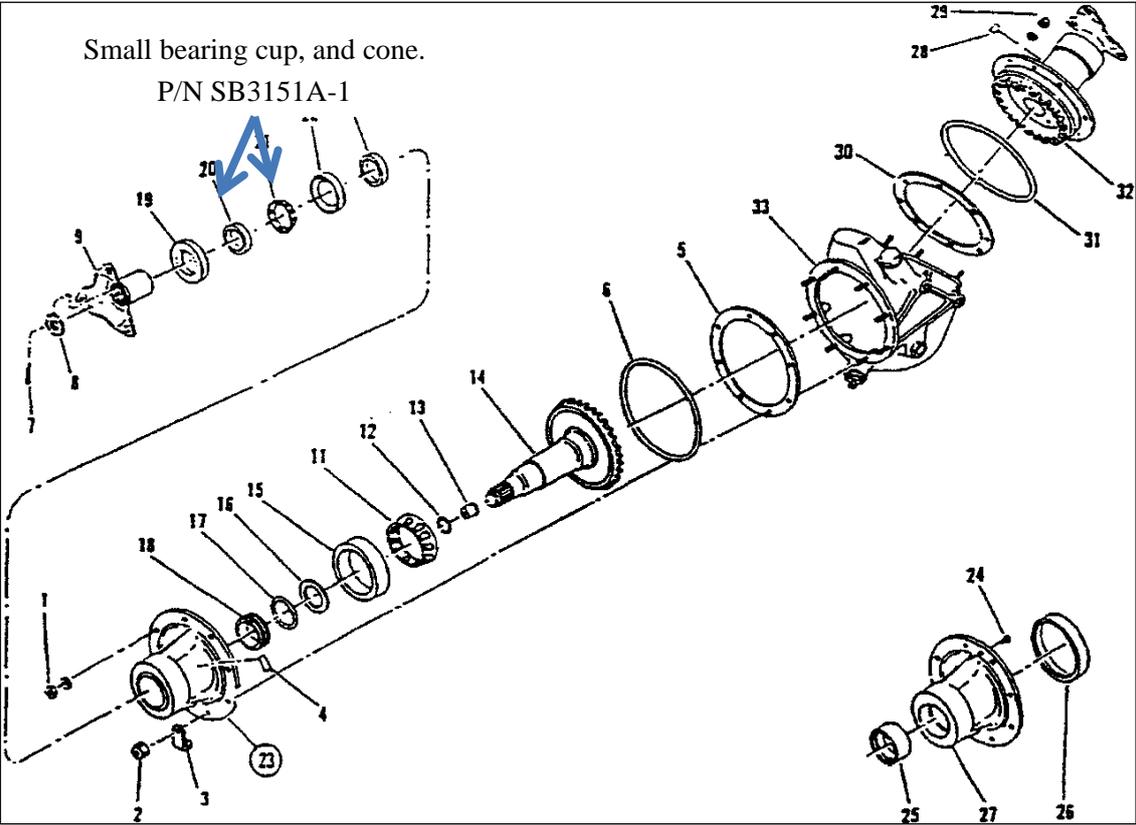
During the inspection, failure to the input gear bearing was found, and the input gear cone was overheated. Furthermore, the oil dam was found dented.

Following maintenance was performed during the repair.

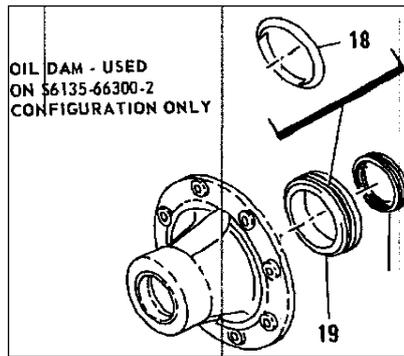
- The oil dam, all bearings, cups, cones, and packing's for the input and output seals were replaced.
- Oil lines were thoroughly checked to be clear of any contamination.

According to the workshop report, all measurements before and after the unscheduled repair were within limits.

The tapered roller small bearing cup and cone were replaced in connection with both the scheduled O/H and the unscheduled repair. The installed part number was SB3151A-1.



Forward direction



Oil dam

On 30-9-2014, the unscheduled repair was completed

On 1-10-2014 the intermediate gear box was installed in OY-HAG.

At the time of the serious incident, the total time since last repair was 30 hours.

The total time since last O/H was 58:30 hours.

According to the operator's maintenance organization, the two mechanics who performed the maintenance on the intermediate gear box were both experienced, and they had performed these tasks several times before.

The mechanics were aware of the criticality of correct assembly, especially the rigging and checking of the rotational drag and backlash.

The serious incident:

There were no chip or high oil temperature warnings indicated in the cockpit.

The function of the chip detector warning light was checked for normal function without remarks.

Light metal "fuzz" (light metal dust particles which, have been generated by normal wear) were found on the chip detector.

The oil level was normal, and the intermediate gear box had not leaked any oil.



The intermediate gear box input housing damage, and discoloring.

Meteorological information

The weather conditions reported by the flight crew were:

- The wind was calm.
- The visibility was more than 10 kilometres.
- The temperature was - 27 °C

Presence of fire

There was no presence of fire, however sparks were observed.

Tests and research

The intermediate gear box assembly and the bearing from the last unscheduled maintenance were sent to the aircraft manufacture for a full teardown.

The metallurgical laboratory (MET Lab) was initially performing the following tasks:

“Received S-61N A/C 61268 Intermediate Gear Box Assembly, P/N S6135-66300-002, S/N A15-592. That reportedly overheated at 50 hours following repair by the operator. Input housing and forward bearing, appear from external evidence, to be the most affected.”

The Met Lab expedited as-received photos, and then returned the assembly to the requester for proper processing & disassembly. Following disassembly, the parts are to be returned to the Lab for additional examination.”

The aircraft manufactures final product safety report stated the following conclusions:

“Field occurrence-Input housing overheat fracture. Due to the severely damaged condition of the components, the initial cause of the failure of the input tapered roller bearing was not evident.

However, another input tapered roller bearing that had reportedly been replaced during an overhaul ~50 hours prior to an IGB overheat incident evidenced overheating indications to the inner ring and rollers, and roller scoring damage at the large end cage pockets.

A Timken Company reference on Tapered Roller Bearing Damage Analysis lists inadequate lubrication and/or excessive preload as possibly contributing to these types of indications. Transmission engineering disposition:

The issue detailed in RFA 9101 and the related aircraft manufactures engineering investigation results do NOT present a Safety of Flight concern.

There was no history of this type of failure mode (over-heat fracture) with the subject GB (IGB: S6135-66300-002). Transmission Engineering concurs with the MET lab conclusion that the failure was potentially due to maintenance related issue, in this case excessive preload of the subject failed bearing.”

Organization and management information

The operator had more than 50 years of experience operating the Sikorsky S61.

The operator was the certificate holder of an approved maintenance organization.

The approved maintenance organization had the capability to perform O/H and repairs on the intermediate gearbox with Part Number S6135-66300-002.

ANALYSIS

The maintenance staff, which performed the O/H and the unscheduled repair, had experience with the specific tasks.

No chip or high oil temperature warnings were displayed in the cockpit.

Tapered roller bearing damage might be due to inadequate lubrication.

28:33 hours after the last scheduled O/H was performed in the operator's component workshop, technical logbook remarks on repeatedly chip warnings occurred.

30:00 hours after the unscheduled repair performed in the operator's component workshop, the serious incident occurred.

The aircraft manufactures product safety report concluded that the potentially reason for the serious incident was due to maintenance related issues. In this case, an excessive preload of the subject failed bearing (s) occurred.

Due to the similarity in the hours of operation, versus performed maintenance, the AIB finds it probable that the failure leading to the over-heat fracture might potentially have been maintenance related.

CONCLUSION

The serious incident occurred as a consequence of an intermediate gearbox input bearing failure. The failure caused the intermediate gearbox input bearing housing to overheat, and fracture.

It has not been possible for the AIB to reveal the contributing factors to the bearing failure.

PREVENTIVE ACTION

As a consequence of the serious incident and the previous remarks with repeatedly chip warnings, the operator's maintenance organization removed the affected intermediate gear box Part Number S6135-66300-002 from their component maintenance capability list.