Serious Incident

Aircraft Type and Registration:	Sikorsky S-92A, G-CIJC
No & Type of Engines:	2 General Electric Co CT7-8A turboshaft engines
Year of Manufacture:	2014 (Serial no: 920240)
Date & Time (UTC):	5 March 2026 at 1030 hrs
Location:	Aberdeen Airport
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 2 Passengers - 16
Injuries:	Crew - None Passengers - None
Nature of Damage:	Component missing from Main Rotor Damper
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	64 years
Commander's Flying Experience:	10,560 hours (of which 7,625 were on type) Last 90 days - 122 hours Last 28 days - 44 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The pilot detected higher than normal vibration during a scheduled flight and following a Health and Usage Monitoring Systems (HUMS) analysis, the helicopter was removed from service. The main rotor hub was inspected and part of the barrel nut which retained the outboard bearing of the main rotor damper to the piston was found to be missing. As the missing item, known as the cradle, was not available, no assessment could be made to determine why the part had failed. The helicopter manufacturer was aware of four other similar events in which part of the barrel nut was missing, but had previously determined, through its assessment of a more extreme failure case, that this had no effect on the continued safe flight and landing of the helicopter.

History of the flight

G-CIJC was scheduled for a routine flight from Aberdeen to the Andrew Platform in the North Sea and return on the day of the incident flight. The pilot noticed a slight abnormal vibration during main rotor engagement and ground taxi, but elected to continue the flight, and the vibration lessened in the cruise. The landing and subsequent departure from the platform was uneventful but the vibration noticeably increased on the helideck and during the cruise back to Aberdeen. The intention was for a rotors running turnaround at Aberdeen and depart for the next flight of the day. During the turnaround the HUMS card was passed to engineering to assess as per standard practice. This was accompanied with a verbal briefing from the pilot stating that the helicopter "feels very rough, especially on the ground."

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Analysis of the HUMS data highlighted elevated vibrations and following a ground track and balance test, the helicopter was shut down.

An inspection of the main rotor hub revealed the blue Main Rotor Damper (MRD) was unserviceable. The damper was replaced, the main rotor hub was inspected with no further defects found, and the helicopter was returned to service.

Recorded information

The HUMS data was reviewed in the Sikorsky Ground Based Analysis (SBGA) software and although there were several parameters which were showing increasing trends with peak values above tolerance limits, warnings are only triggered when trend values exceed the tolerance limits. From the data analysed, the parameter which triggered a warning was the 1P Pilot Lateral Ground trend value which peaked at 1.01 ips (inches per second) with the service limit of 0.5 ips.

Aircraft information

G-CIJC is a Sikorsky S-92A helicopter fitted with two General Electric CO CT7-8A engines. The main rotor hub is equipped with four main rotor blades, each identified by a colour (red, yellow, green and blue). A hydraulic damper is associated with each blade. The fixed end of the damper is attached to a lug on the damper assembly bracket of the main rotor hub and the piston end is attached to the blade retention yoke (Figure 1). As the rotor increases in speed, there is a tendency for the blades to lag and conversely as the hub slows the blades will lead. The damper ensures that the lead and lag of the blades is at a controlled rate, that the blades are equally spaced and can reduce the possibility of ground resonance.

Elastomeric bearings are included in the inboard and outboard rod ends. The outboard rod end is secured to the threaded end of the piston with a barrel nut and a circlip. The barrel nut is made up of two components – the floating self-locking nut and the semi-circular cradle. The nut is retained to the cradle by two roll pins.

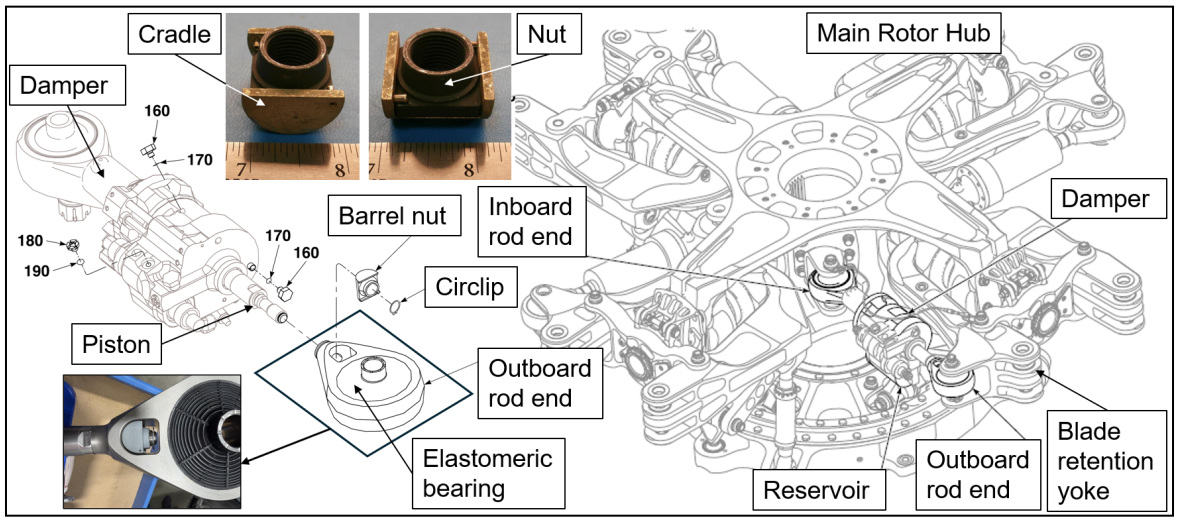


Figure 1

MRD location and component parts

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Aircraft examination

The inspection of the main rotor hub, performed following the incident flight, revealed excessive play between the piston and the outboard rod end of the blue MRD because the cradle part of the barrel nut was missing (Figure 2). However, the piston was still attached to the rod end by the self-locking nut. The MRD was sent to the manufacturer for further examination and testing.

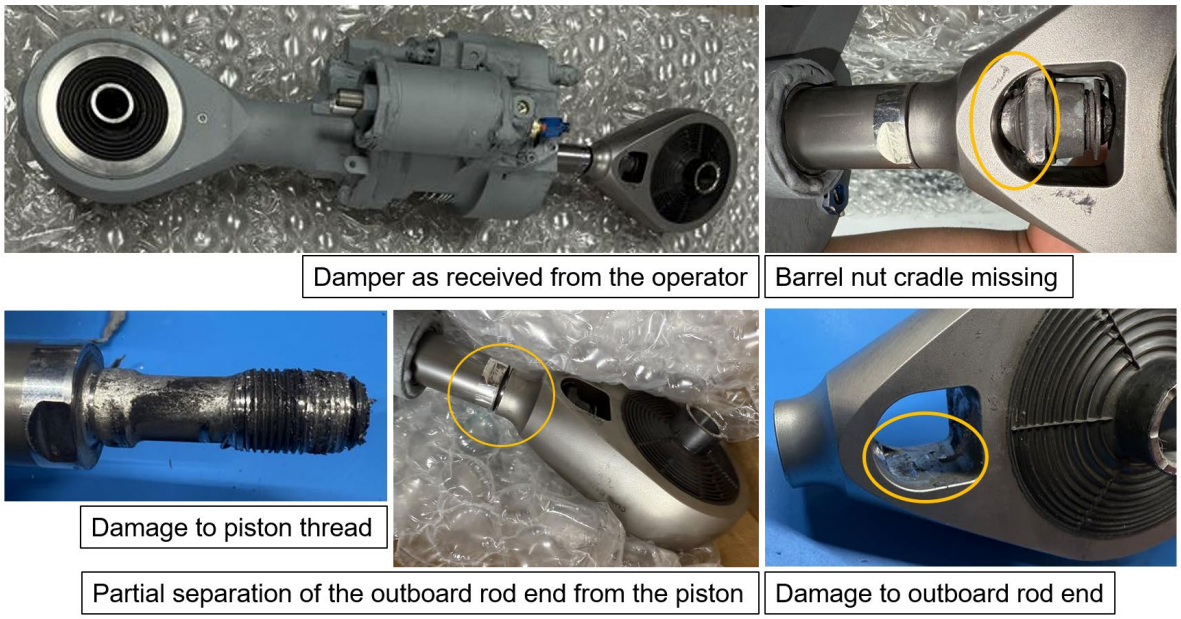


Figure 2

Details of the Main Rotor Damper inspection

Benchtop examination of the damper at the MRD manufacturer's facility confirmed that the cradle of the barrel nut was missing and had resulted in a partial separation of the outboard rod end from the piston. The circlip was in place on the end of the piston and was undamaged. A test protocol was developed based upon the production acceptance test procedure taking into account that the cradle was missing. All tests and dimensional checks were found to be within tolerance. The torque required to remove the nut from the end of the piston was considerable and once removed, it was evident that there was extensive damage to the thread on the piston. There was damage to the outboard bearing from the contact with the nut.

No analysis of the failure of the cradle was possible as it was not available to the investigation.

Other events

The helicopter manufacturer was aware of four other similar events where a part of the barrel nut was missing. They assessed the first two cases to potentially have been caused by either 'improper torque applied in assembly' or operation 'above normal flight loads' and some damage to the piston thread was noted in one of those cases. Previous assessments by the helicopter manufacturer deemed these to be the most likely causes

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but a definitive statement could not be made due to missing evidence. The third case was attributed to hydrogen embrittlement of the barrel nut. The fourth case occurred after the incident to G-CIJC and as the cradle was missing no assessment of cause could be made. The helicopter manufacturer was aware of other in-service and maintenance reports of 'looseness between the outboard rod end and piston of the MRD' but the cause(s) had not been identified.

In all cases the vibration was detectable by the pilot and the helicopter landed successfully. Qualification testing by the helicopter manufacturer had demonstrated that the helicopter could operate safely and land with one MRD not functioning. The demonstration of this failure case encompasses the loss of the cradle and as the damper and the outboard bearing are not considered primary structural elements their failure does not result in an immediate flight safety issue.

Analysis

During a scheduled return flight between Aberdeen and the Andrew Platform, abnormal vibration was detected by the pilot and verified by analysis of the HUMS data. A visual inspection of the main rotor hub revealed an unserviceable MRD. It was removed and examination at the manufacturer's facility confirmed the cradle part of a barrel nut was missing. It could not be determined why the cradle had failed as it was missing. No determination was made to the cause of the damaged piston thread. It is possible that it was cross threaded, but the damper manufacturer confirmed that the assembly of the piston to the outboard bearing is straight forward and 'quite easy.'

Analysis by the helicopter manufacturer confirmed that the loss of the cradle does not affect continued safe flight and landing of the helicopter. The condition is detectable by the flight crew and by HUMS analysis.

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