

SERIOUS INCIDENT

Aircraft Type and Registration:	Sikorsky S-92A, G-CHHF
No & Type of Engines:	2 General Electric CT7-8A turboshaft engines
Year of Manufacture:	2011 (Serial no: 920158)
Date & Time (UTC):	29 January 2018 at 1405 hrs
Location:	On approach to Scatsta Airport, Shetland
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 2 Passengers - 19
Injuries:	Crew - None Passengers - None
Nature of Damage:	None
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	46 years
Commander's Flying Experience:	8,332 hours (of which 4,439 were on type) Last 90 days - 119 hours Last 28 days - 42 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and inquiries made by the AAIB

Synopsis

During a final approach to land at Scatsta the nose landing gear (NLG) failed to extend despite being recycled and the use of the emergency blowdown system. The crew declared a PAN and the decision was taken for ground crew to lever the NLG down manually. This was successfully carried out and the helicopter landed safely. It was found that the automatic nosewheel self-centring mechanism had not operated, causing the nosewheels to jam the nose leg in its bay. The exact cause of the failure of the NLG to centre the nosewheels could not be determined. The operator has taken three safety actions.

History of the flight

The helicopter was on final approach to Runway 24 at Scatsta after having completed a routine passenger flight from the Magnus offshore platform. The crew lowered the landing gear in accordance with the approach checklist. Although the main landing gear status lights, left and right, showed green, the NLG red UNLKD caption remained. The flight crew informed ATC that there might be a technical issue and the helicopter was flown in a visual holding pattern but an emergency was not declared at that point. The crew followed the operator's '*Emergency Operations Procedure (EOP) 8/3*', recycling the landing gear and twice attempted a blowdown emergency extension, but these actions were unsuccessful. The crew then declared a PAN and sought engineering advice over the radio.

The crew flew a low-level circuit during which ATC confirmed that the nose gear had not lowered. Further engineering advice was sought and after considering various options, the decision was taken to attempt to manually release the NLG externally. The crew briefed the passengers and the helicopter was hover-taxied onto the apron with the emergency services present and under marshalling supervision. The pilot stabilised the helicopter with its mainwheels in contact with the ground and with the nose held in the air to allow the release of the NLG. The pilot then signalled one of the operator's engineering staff to approach the helicopter. The engineer observed that the nosewheels were not centred and by using a suitable length lever, he was able to re-align the wheels. The nose leg then extended with a green 'down and locked' indication and the crew settled the helicopter on the ground. A safety ground lock was fitted and the helicopter shut down without further incident.

Helicopter description

The Sikorsky S-92A is a large twin-engine utility helicopter, designed to carry up to 19 passengers and certified for dual-pilot VFR and IFR, day and night operations.

Landing gear

The helicopter is fitted with retractable landing gear consisting of double-wheel air/oil shock absorbers. The main landing gear is installed in the sponsons each side of the fuselage just aft of the cabin area, and the castering nosewheel within a wheel bay beneath the cockpit. The nose gear is non-steerable but its design allows for a 360° caster and has a damper fitted to prevent nosewheel shimmy during taxiing. Differential braking and tail rotor thrust are used to steer the helicopter during taxiing. The nose gear includes a feature which self-centres the wheels during retraction and the manufacturer comments that, when properly serviced, the nose gear should self-centre at all angles up to 180°.

The helicopter is fitted with a landing gear emergency extension system which consists of 3,000 psi nitrogen-filled bottles attached to the nose, left and right landing gear hydraulic actuators. An EMER DN switch is located on the landing gear control panel which activates a solenoid valve to release the gas charge into the extension side of the actuator. The blowdown facility works regardless of the position of the landing gear control handle.

Engineering investigation

Following this incident, the helicopter was withdrawn from service and placed on jacks to carry out fault diagnosis. Retraction checks found that the nosewheels did not initially automatically centre but after several retraction cycles the nosewheels did centre and then continued to work normally. However, the operator thought it prudent to reject the NLG. The complete NLG assembly was replaced with a serviceable item and after functional testing, the helicopter was released to service. The NLG was made safe by discharging its gas pressure and was returned to the manufacturer for examination.

The examination showed the NLG was in a good, but well used, overall condition. There was evidence of leakage around the hydraulic port and 3,250 ml of hydraulic fluid was drained out of the NLG (the correct quantity should be 3,890 ml). It was observed that the

NLG was covered in 'oily/dirty' deposits, with water and grease residue present on the lower piston tube and the lower cylinder cap not tightened to the correct torque. The exact cause of the failure of the centring mechanism could not be identified. The NLG was then rebuilt, charged and tested; it held its charge and the self-centring mechanism operated correctly.

Manufacturer's experience of previous events

The helicopter manufacturer has investigated six reports of previous events where the NLG was off-centre, jammed in the wheel well and failed to extend either by the primary or secondary means. The manufacturer attributed this to improper servicing, whereby a low oil or nitrogen charge in the strut results in the self-centring cams not interlocking correctly, allowing the wheels to remain off-centre when the aircraft weight is 'off-wheels' prior to retraction. In September 2017 the manufacturer issued a letter to operators highlighting this potential problem and the importance of correct fluid quantity and gas charge in the NLG.

Emergency operating procedures (EOPs)

On the incident flight the crew carried out '*EOP 8/3, Landing Gear Will Not Extend*'. The crew later observed that this procedure does not appear to take into account the situation where, despite the emergency blowdown actions being taken, the helicopter remains in an asymmetric landing gear configuration. However, '*EOP 8/2, Landing with the gear retracted*' directs the crew to place the aircraft in a low hover, disembark the passengers and then, after preparations to cushion the helicopter by ground staff, land as soon as practicable. It also advises using the flotation gear to assist in stabilising the helicopter. In this case the crew took these procedures into consideration but, because they were landing at a maintenance base, they had the advantage of additional expertise on hand and the time to identify and rectify the problem. They therefore opted for the action of levering the NLG down. The crew consider that '*EOP 8/3*' should cross refer to '*EOP 8/2*' as the normal action to be taken when maintenance base expertise is not available.

Analysis

Engineering

Although the operator was able initially to replicate the problem, the NLG then started to self-centre during repeated tests. However, mindful of the consequences of the same problem happening again, away from a maintenance base, the decision was taken to return the NLG to the manufacturer.

It is possible that the mechanical defect was so minor as not to leave any evidence to be found at the manufacturer. The manufacturer observed that the signs of leakage around the hydraulic port, and the oily deposits on the NLG, suggested a possible loss of oil by seepage which found its way around the NLG external surfaces. However, the reduced fluid quantity cannot be relied upon to support this notion as it is possible some of the oil was lost during the discharging process, after ground testing and prior to despatch to the manufacturer. In the absence of mechanical evidence, it is not possible to draw a conclusion as to the cause of the malfunction of the NLG self-centring.

Operations

The crew observed that 'EOP 8/3' did not lead into actions to be taken in 'EOP 8/2' if the problem with the landing gear remained after the prescribed attempts to lower the landing gear. Although the operator considered both EOPs to be correct, it was acknowledged that 'EOP 8/3' needs to direct the crew to 'EOP 8/2' more clearly. In this case the problem was solved externally using the knowledge and expertise available at the landing site. However, this could not be relied upon, showing the need to align the EOPs for use in a similar incident away from a maintenance base.

Conclusion

The exact cause of the failure of the NLG to centre the nosewheels during retraction could not be determined. However, the operator has taken steps to inform its staff of a potential cause identified in previous cases by the manufacturer. The incident has also highlighted a discontinuity in the operator's emergency procedures, which have also been addressed.

Safety actions

To reduce the risk of nosewheels not self-centring during retraction, the operator is undertaking the following safety actions:

- The manufacturer's letter, '*S92A Nose Landing Gear – Improper Servicing*', dated 19 September 2017, will be re-iterated to the operator's engineering staff.
- S-92A crews will be reminded of the need to ensure the nosewheels are not canted off-centre after taxiing prior to takeoff (although this does not appear to have been a factor in this incident).
- The operator has also reviewed the EOPs and EOPs 8/2 and 8/3 have been amended and re formatted as EOP 13/2 and 13/4. EOP 13/2 now draws the crew's attention to EOP 13/4 and the actions to be taken to ensure a safe landing with the leading gear retracted, or in an asymmetric configuration.