

Elevated SAFECOM 14-0270 [Helicopter]

Summary from SAFECOM submission:

While helicopter was enroute to a smoke report near Grantsville UT from the Pony Fire near Dugway Proving Grounds, a sound was heard in the cockpit. The pilot then saw a door light, pulled the aircraft nose left to shield airflow on the left side, and landed and shut down immediately at approximately 7500 feet on the east side of the Stansbury Mountain Range. Inspection revealed that the left sliding door was no longer attached to the aircraft. The left sliding door had been in the open and locked position, with the pilot door {left hand drive} removed. Some markings on the left cargo door were noted, as well as a small crack along the edge of the same left cargo door. The track the left sliding door slides on also had a small deformity near its aft termination. One cargo door latch was in the unlatched position. The tail, tail rotor, airframe, and main rotor were visually inspected by the pilot. No other damage was noted. The crew reported the incident to the local UAM and AFMO. The pilot elected to fly the aircraft to its base of operations nearby. The 4 helitack crewmembers walked off.

Findings

Sliding Aircraft Doors

The aircraft doors were set in an approved configuration with the flight manual. When the cockpit door is removed for greater visibility during external load/water bucket ops, the rear door on the same side must be locked in the open position. The pilot reported that the helicopter airspeed was 90 KIAS at the point when they heard the loud noise in the aircraft. This is under the 100 knots maximum airspeed specified by the flight manual for that configuration.

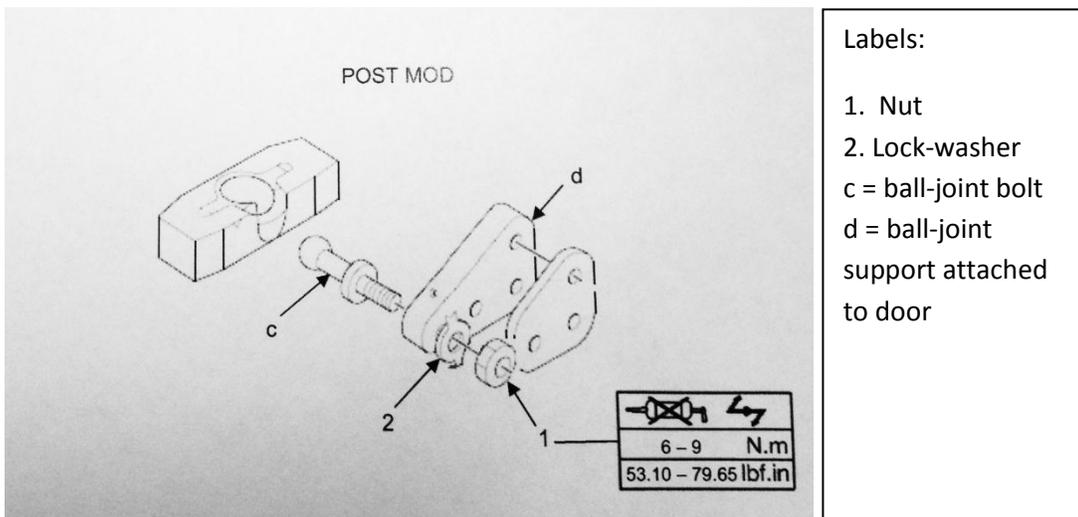
The lower ball-joint bolt assembly that retains the aft sliding door appears to have little evidence of damage. Neither the track, the rail, nor the ball-joint retaining block appears to have been pulled by excessive force.

Figure 1 Ball-Joint Bolt in lower door slide remained in place after door fell off aircraft.



There are two Airworthiness Directives (AD 2013-23-9 and AD 2013-08-19) associated with this aircraft concerning the sliding doors. Logbook entries and witness interviews support the contractor's claim that they had complied with the requirements. The AD 2013-23-9 which addressed the lower ball-joint nut and washer was completed at the factory prior to aircraft delivery. The AD was released in 11/22/2013 and the contractor verified that the modification (Modification AL 4262) was completed on the aircraft (Figure 2).

Figure 2 Post Modification Ball-Joint Assembly specified by AD 2013-23-9



Labels:

1. Nut
 2. Lock-washer
- c = ball-joint bolt
d = ball-joint support attached to door

The door had been removed and then replaced in April 2014 for the “T” inspection. This is a 24 month/600 hour inspection. This inspection was completed and signed off by the contractor’s maintenance personnel on 04/17/2014 with 656.8 flight hours. The contractor’s shop policy is that the work is completed and reviewed by an IA. There is evidence that the contractor ordered parts against this inspection to replace the disposable nuts and lock-washers for both doors. The aircraft flew approximately 24.9 hours until it entered service on the “On Call” contract at aircraft hours 681.7 on the 06/08/2014. The aircraft was inspected by an OAS Safety Inspector on 06/09/2014 with approximately 694.2 flight hours.

When the door is installed, the door is supported by the upper and rear rollers and held in place by the lower ball-joint bolt assembly. If this one nut is removed, the door can be easily removed from the aircraft.

The condition of the threads and the surrounding components points to fact that the self-locking characteristics of the nut of the ball-joint bolt were lost. The nut backed off with aircraft vibration and allowed the door to become loose and become detached from the aircraft. The ball-joint bolt showed signs of rotational scoring (Figure 3) on the shaft of the bolt that came in contract with the door flange. Maintenance manuals specify proper torque requirements to prevent the ball joint from rotating and the potential for the nut to back off..

Figure 3 Ball-Joint Bolt showing rotational scoring



The modification specified in AD 2013-08-19 was in response to an incident where a sliding door became detached and was lost in flight. It added a tabbed lock washer and a different friction type locking nut to improve the protection against the nut unscrewing. Although the modification has a lock-washer and increased friction, the bolt is able to rotate if the nut loses its specified torque value (53.10 to 79.65 in-pounds). Even with the lock-washer in place, if the compression or torque value was lost, the bolt could work its way out with the tabbed lock-washer working as a nutplate. This modification doesn't connect the nut to the bolt like a castellated nut and cotter pin, but only prevents the nut from turning on the ball-joint support.

With this one bolt as the only fastener that keeps the door attached to the aircraft, increased vigilance is in order to make sure that on daily and period inspections that the ball-joint assembly is securely attached.

The Helicopter manager, who was in the helicopter at the time of the incident, stated that the left cabin sliding door was secure in its open and locked position. Locking the door back provides additional support for the sliding door. The rear locking assembly appears to have been deformed indicating sideward force on the locking mechanism as the door was pulled left and it departed the aircraft with the failure of the ball-joint bolt.

Figure 4 Left Sliding Door Lock Assembly showing deformation



Figure 5 Right Sliding Door Lock Assembly with no deformation.



Conclusion

The primary security for the sliding door assembly on this model of helicopter rests on one fastener. Reviewing the bolt and the overall door assemblies on this helicopter, the evidence points to the failure of ball-joint bolt and nut. This fastener should receive increased focus on daily and periodic inspections to ensure that the door stays securely attached to the aircraft. It is readily visible every time the door is open and should be inspected often.

Figure 6 Ball-Joint Bolt and Nut are clearly visible when door is open



Recommendation

OAS Safety to issue Lessons Learned bulletin emphasizing the importance of proper installation of the ball-joint bolt, lock-washer, and nut; increased focus for daily and periodic inspections; ensuring the all crewmembers use CRM to ensure doors are secured in position; and to remind pilots to review airspeed limitations for open door configurations.