Australian Government
Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY REPORT
Aviation Occurrence Investigation AO-2009-073
Final

In-flight cargo door separation
28km NW Sunshine Coast Airport
1 December 2009

Australian Transport Safety Bureau
PO Box 967, Civic Square ACT 2608
Australia

1800 020 616

+61 2 6257 4150 from overseas

www.atsb.gov.au

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Abstract

On 1 December 2009 at approximately 0730 EST, the forward, left-side cargo door of a Eurocopter AS350D helicopter (registered VH-PIH) separated from the helicopter fuselage during fire-fighting operations near Maryborough, Queensland. The helicopter subsequently landed safely and there were no injuries.

It was probable that separation of the cargo door occurred as a consequence of replacement of the door seal during a recent overhaul. That replacement resulted in the door sitting proud of the mating surfaces when closed and latched. Elevated air loads acting on the door as a product of its overly proud position would subsequently have led to its fracture.

It was considered that the installation of improved door locks per Service Bulletin SB 52.00.25 and SB 52.00.26 would likely address this safety issue and significantly reduce the likelihood of a future AS350 cargo door separation event.

As a result of this occurrence the operator applied the cargo door lock modifications detailed in SB 52.00.25 and SB 52.00.26 to the new door installed on VH-PIH. In addition, the Australian Transport Safety Bureau has issued a Safety Advisory Notice to all operators of Eurocopter AS350 aircraft to consider the implications of the safety issue and take action where considered appropriate.

FACTUAL INFORMATION

History of the flight

On 1 December 2009 at approximately 0730 EST[1], the pilot of a Eurocopter AS350D helicopter, registered VH-PIH, was engaged in fire-fighting operations near Maryborough, Queensland.

The helicopter was cruising at approximately 110 kts and at an altitude of around 1,000 ft when the pilot heard two brief ‘thuds’ and noticed that the cargo door indicator light had illuminated on the failure warning panel. The pilot immediately landed the helicopter for an inspection, where it was found that the forward, left-side cargo door had separated from the airframe.

The cargo door was subsequently located and was found to have damage consistent with passage through the main rotor disk. As a result of contact with the cargo door, the main rotor blades were damaged outside of their servicability limits.

The pilot reported that there were no items stowed in the left cargo pod, all doors were securely closed and locked prior to the flight and that there were no noticable performance issues as a result of the door separation.

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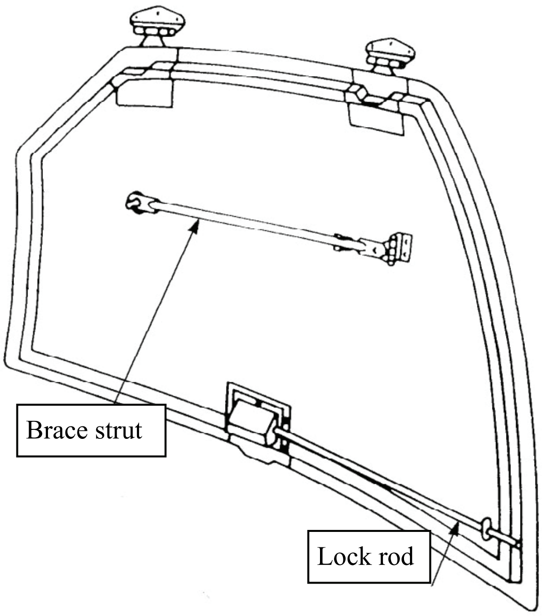
[1] The 24-hour clock is used in this report to describe the local time of day, Australian Eastern Standard Time (EST), as particular events occurred. EST was Coordinated Universal Time (UTC) +10 hours.

Cargo door examination

The cargo door was of a lightweight, composite construction, consisting of a foam core and fibreglass skins. Door hardware comprised two hinge points on the upper edge, and a locking mechanism, which consisted of a centre latch on the lower edge of the door, and a lock rod running parallel to, and securing the lower forward edge of the door (Figure 1). An internal brace strut was installed for supporting the door in the open position. Correct engagement of the latch and rod extinguished the 'cargo door' indicator light on the cockpit warning panel.

Figure 1: AS350 Left cargo door



The cargo door was received as shown in Figure 2, having sustained significant fractures in two locations. The forward fracture was consistent with passage of a main rotor blade. The blade passed through the location of the brace strut, which was not present and was not recovered with the door sections. The fracture through the centre of the door was dissimilar to the forward rotor slice and was probably the result of the door fracturing in two as it separated from the airframe.

The door had fractured around the lock mechanism during the occurrence and the mechanism was not recovered. However, two lock rod guides remained attached to the inside surface. Brittle fracture of the exterior paint adjacent to the location of the lock was indicative of a rapid failure event.

The forward door hinge was plastically deformed, and the corner section of door containing the rear hinge had fractured as the door separated from the airframe (Figure 3)

Figure 2: VH-PIH Left cargo door interior

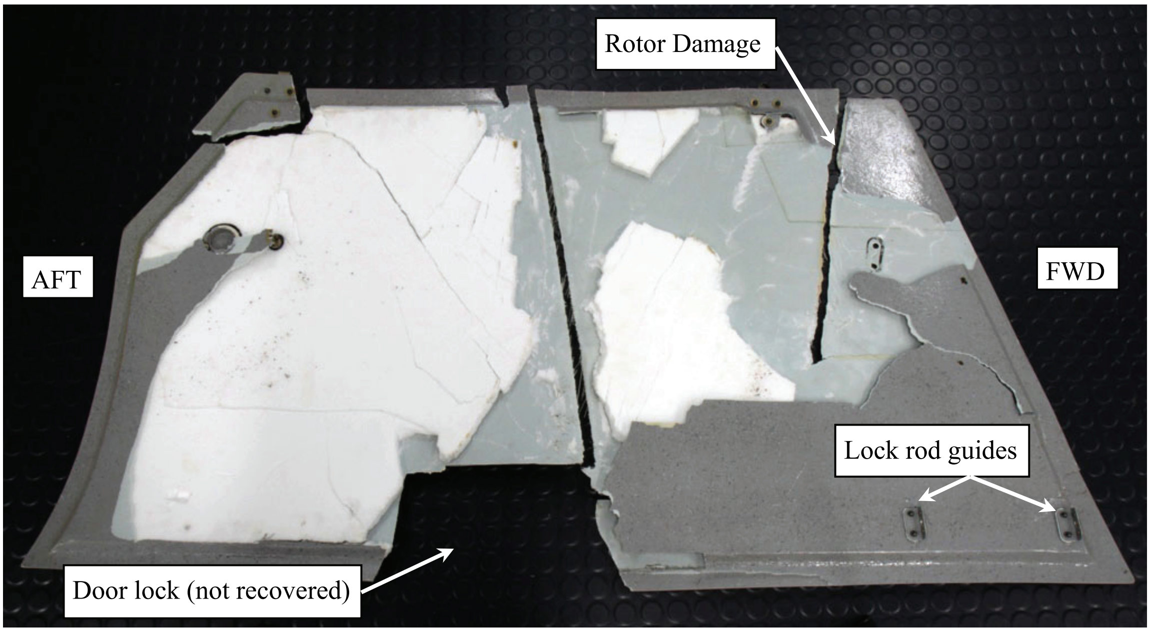
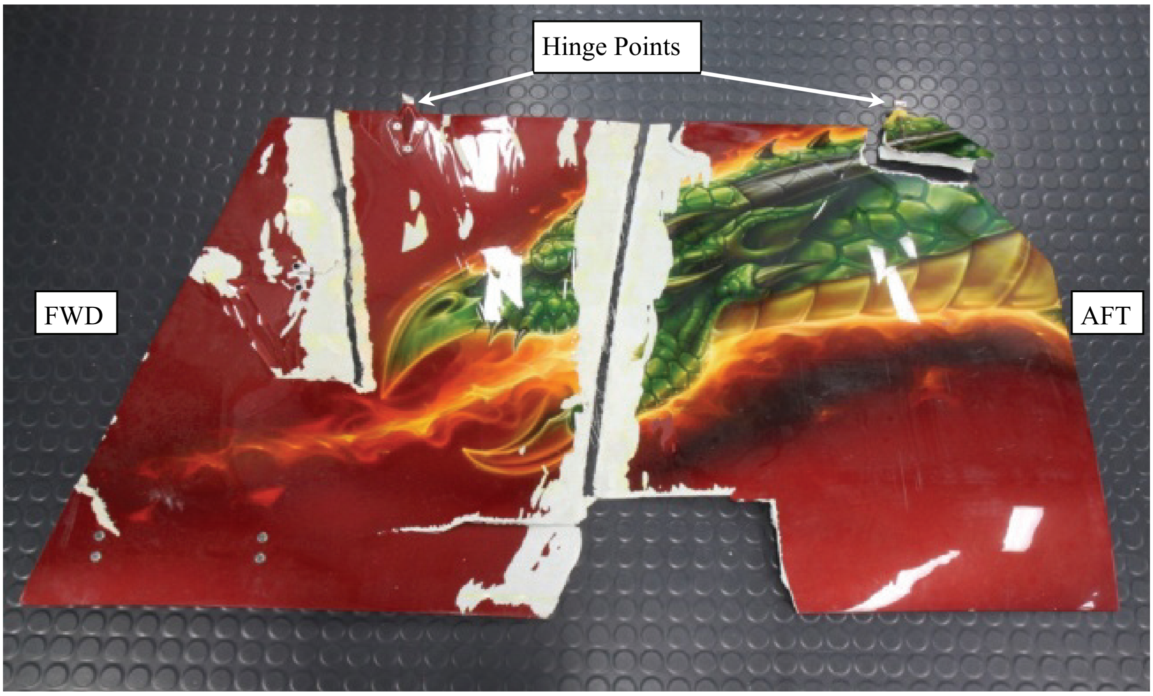


Figure 3: VH-PIH Left cargo door exterior



Maintenance history

The AS350D helicopter, Serial Number 1341, was manufactured in 1981 and had accumulated 3,308 hours total time in service (TTIS). The cargo door was refurbished during overhaul in November 2009, including replacement of the peripheral seals. The aircraft had accumulated 3,294 hours TTIS at the time of that overhaul. The door seals used were original equipment manufacturer parts.

The aircraft maintenance manual (AMM) for the removal and installation of cargo doors indicated that protrusion of the door outer edge was to be limited to within ±2 mm of the fuselage external surface. It was reported that the new door seals were less pliant than the ones they replaced - possibly due to ageing of the original seals during service. The new seals held the door approximately 3mm proud of the mating surfaces when the door was closed and locked. Despite the AMM flushness limitations, the design of the door seals was such that no adjustment was possible after seal installation.

In 2000, the helicopter manufacturer changed the design of the door lock system for new-build aircraft, and concurrently released non-mandatory (optional) service bulletins SB 52.00.25 and SB 52.00.26, providing for the installation of the improved locking mechanism and closure indicating system on existing helicopters. SB 52.00.25 (MOD 073016) removed the front lock rod and replaced the lock to secure the leading edge of the door; SB 52.00.26 (MOD 073041) added a lock to secure the aft side of the doors. The service bulletins had not been implemented on VH-PIH at the time of the occurrence.

Previous occurrences

The helicopter manufacturer advised that it was aware of a total of four occurrences involving failure of cargo doors or hardware since inception of the AS350/355 model:

- total door separation (this event and one other)
- inadvertent lock opening (one event)
- hinge failure (one event).

A risk analysis performed by the manufacturer, taking into account the excess of 20 million flight hours flown by the AS350/355 fleet, found the likelihood of subsequent events to be extremely remote, and did not warrant a reconsideration of the non-mandatory status of the improved door mechanism service bulletins

ANALYSIS

Damage to the door was consistent with the locks being engaged at the time of failure.

The most probable scenario for the door separation involved the replacement door seals holding the door proud of the airframe, as was reported. As such, the protruding door may have experienced higher than normal air loads or buffeting during cruise flight – those loads acting to pull the door out and away from its closed position. This action may have subsequently caused the front lock rod to disengage, ultimately resulting in the fracture and separation of the door from the airframe.

Considering this scenario, the installation of improved door locks per SB 52.00.25 and SB 52.00.26 would significantly reduce the likelihood of a future AS350 cargo door separation event, by reducing the protrusion of the door from the airframe and increasing the security between the door and surround.

FINDINGS

Context

From the evidence available, the following findings are made with respect to the in-flight cargo door separation from the AS350D helicopter, VH-PIH, and should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing safety factors

- Installation of new cargo door seals resulted in the door being held outside of the flushness requirement specified in the aircraft maintenance manual [Minor safety issue].
- Operation of the helicopter with a protruding cargo door probably contributed to its fracture and separation during flight.
- The improved locking mechanism for forward cargo doors, per non-mandatory service bulletins SB 52.00.25 and SB 52.00.26 was not fitted to VH-PIH.

SAFETY ACTION

The safety issues identified during this investigation are listed in the Findings and Safety Actions sections of this report. The Australian Transport Safety Bureau (ATSB) expects that all safety issues identified by the investigation should be addressed by the relevant organisation(s). In addressing those issues, the ATSB prefers to encourage relevant organisation(s) to proactively initiate safety action, rather than to issue formal safety recommendations or safety advisory notices.

All of the responsible organisations for the safety issues identified during this investigation were given a draft report and invited to provide submissions. As part of that process, each organisation was asked to communicate what safety actions, if any, they had carried out or were planning to carry out in relation to each safety issue relevant to their organisation.

Helicopter owner

Cargo door seals / flushness

Minor safety issue

Installation of new cargo door seals resulted in the cargo door being held outside of the flushness requirement specified in the aircraft maintenance manual.

Action taken by helicopter owner

As a result of this occurrence, the cargo door lock modifications detailed in SB 52.00.25 and SB 52.00.26 were applied to the new door installed on VH-PIH.

The cargo door seals were not replaced, however it was reported that the improved locking mechanisms made a significant improvement to door security and that the door now conformed to the flushness requirement of the AMM.

ATSB assessment of action taken

The ATSB considers that the safety action taken by the helicopter owner will significantly reduce the likelihood of a future door separation event.

ATSB safety advisory notice (AO-2009-073-SAN-048)

The Australian Transport Safety Bureau advises that all operators of Eurocopter AS350 aircraft should consider the implications of this safety issue and take action where considered appropriate. In particular, operators are encouraged to review the appropriate sections of the aircraft maintenance manual with regard to cargo door flushness and give consideration to the cargo door improved locking mechanism detailed in SB 52.00.25 and SB 52.00.26 to improve door security.

SOURCES AND SUBMISSIONS

Sources of Information

- pilot of VH-PIH
- operator of VH-PIH
- maintenance provider
- helicopter manufacturer

Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the Transport Safety Investigation Act 2003, the ATSB may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. Section 26 (1) (a) of the Act allows a person receiving a draft report to make submissions to the ATSB about the draft report.

A draft of this report was provided to the pilot, operator and chief engineer of VH-PIH, the Civil Aviation Safety Authority (CASA), the helicopter manufacturer and the Bureau d’Enquêtes et d’Analyses (BEA), the French civil aviation investigation authority.

Submissions were received from the chief engineer of VH-PIH and CASA. The submissions were reviewed and where considered appropriate, the text of the report was amended accordingly