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Preventing Fan Cowl Door Loss

1. Introduction

Parts Departing from Aircraft (PDA) have always represented a significant concern in aviation, and as such all events involving PDA need to be reported to Airbus, no matter the shape, material, size or weight.*

PDA may impact the aircraft and lead to structural damage, but they may also represent a danger to people on the ground.

When the part separation occurs close to an airport area, debris may fall on a runway, hence creating a risk for following aircraft.

This is particularly true for lost fan cowl doors, which are among the largest PDA, since more than 80% of the 32 reported events occurred during the take-off phase.

This article covers the published procedures and easy to implement recommendations, for both mechanics and crew members, to avoid fan cowl door losses.

* Ref OIT SE 999.0038/09 & SIL 00-097

2. Potential Heavy Damage To Aircraft

On the A320 Family, each fan cowl weights about 40 kg, hence it represents a potentially significant amount of energy, which may impact the aircraft when lost at high speed.

A fan cowl loss generally leads to twisted pylon cantilevers and/or minor damages to slats, wing leading edges, horizontal stabilizers and fuselage skins.

But the damage can also extend to skin panel perforation or serious damage to the vertical or horizontal stabilizers. This type of damage represents a major hazard in terms of handling in flight and also often requires major repair work to rectify on the ground.

Potentially, any part of the aircraft structure located aft of the engines could be affected.

The grounding time for repair can typically last for up to several weeks.

note

On other Airbus programs, occurrences of fan cowl door loss are more limited:
- 2 cases on the A330
- 3 cases on the A300/A310 Family.

Although more rare, these events also involve more severe damage, as the impact energy coud be higher than for the A320 Family (fuselage puncture leading to cabin decompression, wing skin puncture leading to fuel leak, for instance).

The higher number of occurrences on the A320 Family is mainly attributed to the lower ground clearance of the power plants.

Figure 1
Fan cowl loss event

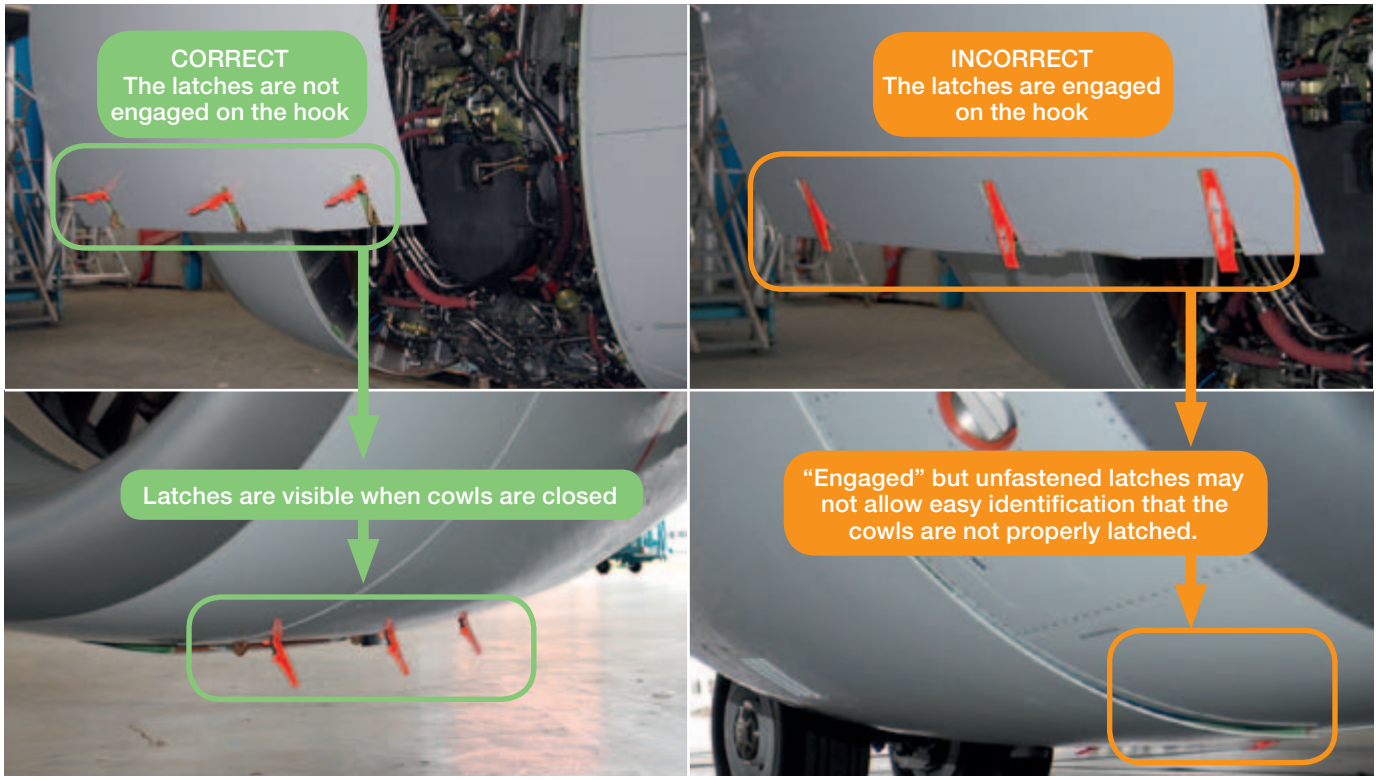


Figure 2
Latches on open doors should be left in the not engaged position

3. Incorrect Latching of Fan Cowl Doors

3.1 Recent Event

A recent fan cowl door loss event highlights some recurring factors associated to such occurrences.

The aircraft originally planned for the flight had to be rescheduled due to a technical issue.

On the day preceding the event, the replacement aircraft had been subject to a weekly IDG oil check, which called for the opening of the engine cowlings. A subsequent daily check was carried out by the same person.

The event flight was the first leg of the day. Less than one hour before the take-off, a transit check was performed. The exterior walk around was performed with time pressure and challenging weather conditions (temperature below 0°C and wind).

The engine fan cowls were lost four minutes after take-off, passing FL110 during climb. The cowls perforated the engine oil tank and the crew shut down the engine.

Post-flight inspection revealed a twisted pylon as well as multiple impacts to slats, horizontal stabilizer and the fuselage. The overall repair required assistance by a working party for three weeks.

The investigation concluded that the aircraft had departed with the fan cowls not properly latched.

3.2 Typical Scenario

For all investigated events, it was established that maintenance actions requiring opening of the fan cowls had taken place prior to the flight, and that the affected fan cowls were incorrectly latched.

Several independent risk factors were identified as the main contributors to fan cowl door losses:

- First flight of the day
- Poor weather conditions (low temperature, rain, snow, wind)
- Time constraints due to a late aircraft change
- Changes to the routine of the maintenance team during tasks involving opening of the fan cowls.

4. Maintenance Recommendations

In the chain of preventive measures, maintenance is a key factor.

Airbus insists about the need for strict adherence to the AMM 71-13-00 instructions, for proper latching and closing of the fan cowl doors.

Please note the following key recommendations:

- The fan cowl doors should always be entirely latched when they are being closed. If it is necessary to walk away from the engine prior to completing the latching, the doors should not be left unlatched, or partially unlatched.

If the aircraft walk-around is not performed in an exhaustive manner, the situation may remain unnoticed.

- Latches on open doors should always be left in a "not engaged" position, which means that they will hang down when the doors are closed and not latched (fig.2).

This ensures easy identification of an unlatched door condition.

note

In the frame of an investigation, the US National Transportation Safety Board (NTSB) has found that Airbus operators who introduced dual inspection sign-offs to their maintenance inspection procedure, to confirm latching of engine fan cowls, were successful in preventing cowl loss events.

The following cautions will be added to AMM 71-13-00 in the August 2012 revision:

CAUTION:
DO NOT LEAVE THIS JOB AFTER JUST CLOSING THE FAN COWLS, CONTINUE ON TO SECURE THE LATCHES. IF YOU ARE CALLED AWAY PRIOR TO LATCHING, THEN EITHER RE-OPEN ONE COWL DOOR OR LATCH THE LATCHES BEFORE WALKING AWAY FROM THIS ENGINE.

CAUTION:
DO NOT ENGAGE THE LATCH HANDLE HOOKS WHEN THE FAN COWL DOOR ARE OPENED

5. A320 Family Design Evolution

A number of modifications were developed to ease the detection of an unlatched cowl condition (ref. 1 & 2). In particular:

- Fluorescent paint on the latch
- Hold-Open device (IAE engines) to increase the peripheral gap
- New latch handle hook springs to ensure handle hanging down when unlatched
- Caution decal on the cowl.

The latest modification consists of the introduction of red flags, to improve the visibility of an unlatched condition of the cowls:

- On the IAE engine, a dedicated tool (P/N 98D71103002000) is included in Airbus' Tool and Equipment Manual (TEM). This new tool is called by the AMM at every Fan Cowl Door opening (Fig. 3).
- On the CFM engine, a similar tool is under development, to be finalized by end of Q4 2012.

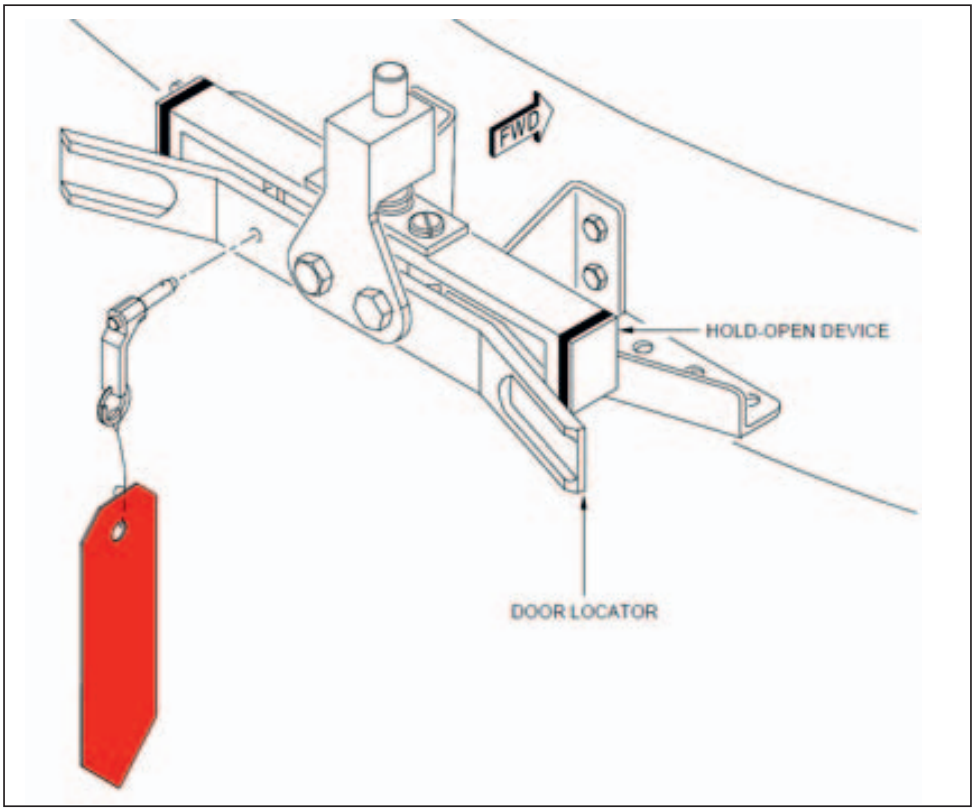


Figure 3
A320 red flag on the IAE engine Hold-Open device

6. Importance of the Pre-Flight Check

FCOM Standard Operating Procedures PRO-NOR-SOP-05 provide instructions to the crew to perform the exterior walk-around and ensure that the overall condition of the aircraft and its visible components and equipments are secure for the flight.

As part of this inspection, it is essential that a flight crew member visually inspects the fan cowl doors prior to each flight to ensure that they are closed and latched (ref. 3, fig. 4).

The effectiveness of this check relies on the correct positioning of the flight crew to visually check that all the handles are flush with the cowls and engaged in their slots.

Indeed, the crew member performing the walk-around needs to position himself **on the side of the engine** and should **crouch** to check that **all** latches are correctly latched and that there is no gap around the cowl (fig. 5).

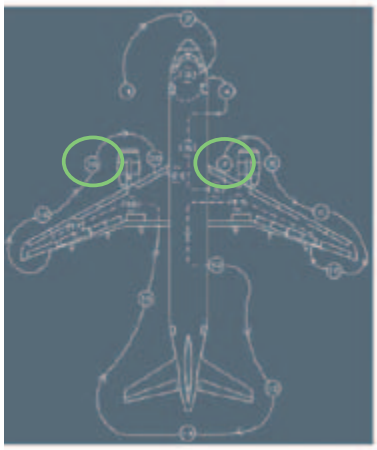
EXTERIOR WALK-AROUND

Applicable to: ALL

SCHEMATIC

ENG 1 LH SIDE

Oil fill access door.....CLOSED
* Fan cowl doors..... CLOSED/LATCHED
* Drain mast.....Condition/NO LEAK
* Engine inlet and fan blades.....CHECK



ENG 2 LH SIDE

Oil fill access door (CFM and IAE only)..... CLOSED
Master magnetic chip detector access door (IAE only)..... CLOSED
* Thrust Recovery Nozzle (PW only)..... CLOSED/LATCHED
Hydraulic filter visual access door (PW only)..... CLOSED
* Fan cowl doors..... CLOSED/LATCHED
* Drain mast..... Condition/NO LEAK
* Engine inlet and fan blades..... CHECK

Figure 4
FCOM Exterior walk-around check

Figure 5
Proper walk-around check for secured fan cowl doors

* This picture represents the worst case scenario, where the latches are engaged on the hooks, but unfastened

7. Conclusion

Fan cowl doors that are not properly latched may lead to the in-flight loss of the cowls. This may cause extensive damage to the aircraft structure and result in operational consequences such as in-flight turn back and subsequent long grounding periods for repair. They may also represent a danger to people on ground, as well as a threat to following aircraft when lost at take-off.

Specific focus on AMM maintenance instructions and SOPs, are key safety barriers to avoid such events.

The following three recommendations should be followed by maintenance personnel and crew members:

► Latches on doors in the fully open position should always be left in the horizontal (i.e. not engaged) position.

► Fan cowl doors should always be entirely latched when the cowls are being closed. Cowls must not be left in the closed position while not properly latched.

► During the exterior walk-around, the crew member has to visually check the correct closure/latching condition of the fan cowls. To do this correctly, the crew member must be positioned on the side of the engine and crouch.

References:

► Ref. 1: OIT 999.0057/07: Fan cowl door loss after take-off

► Ref. 2: Maintenance Briefing Note (MBN): Human factor – error management (case study on fan cowl loss prevention)

► Ref. 3: OIT/FOT Ref 999.0122/07 Walk-around check.