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Flight Safety

Thrust Reverser Selection Means Full-Stop

1. Introduction

When full forward thrust (TOGA) is applied after thrust reverser selection, there is a risk of non availability of maximum thrust on one or more engines, if the associated reversers do not stow.

This is exactly what happened to an A300-600 equipped with PW4158 engines, which carried out an aborted landing whilst the thrust reversers were still in transit and not fully deployed. As a result of a failure of the electrical restow circuit, the aborted landing was performed with only one engine delivering take-off thrust.

This article will describe the event and review operational recommendations on throttle handling.

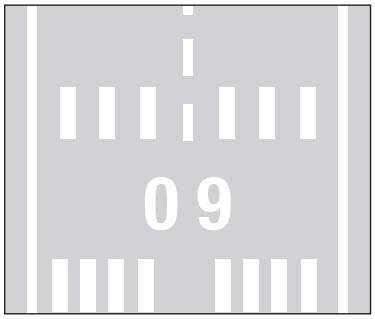
This event illustrates the necessity to strictly follow the rule specified in the FCOM: "After reverse thrust is initiated, a full-stop landing must be performed." This statement is valid for all Airbus aircraft types.

2. Event Description and Analysis

2.1 Approach

The Captain was the pilot flying. The autopilot was not engaged and the approach speed (Vapp) was 143kt. The weather report indicated rain and cross wind conditions (160°, 20kt gusting at 30kt). The flare was performed at 30ft Above Ground Level (AGL).

160°/20kt
Gusting at 30kt



2.2 Touchdown

The A300-600 touched down with an Indicated Air Speed (IAS) of 138kt and landed hard with a vertical acceleration of 1.82g.

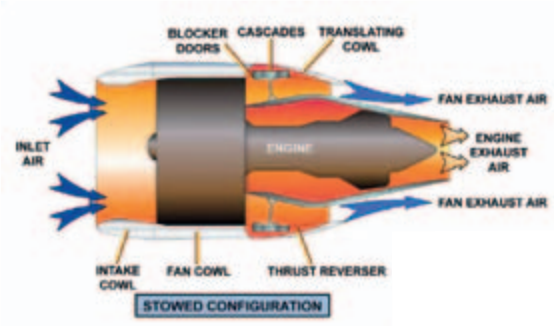
At touchdown the pilot immediately selected the thrust reverser levers to max reverse and the reversers started to deploy (refer to note 1).

The aircraft bounced, and consequently the Captain decided to abort the landing while the thrust reversers were still in transit and therefore not fully deployed.

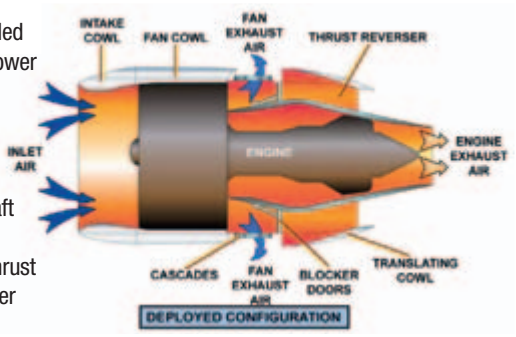
note 1

The purpose of the thrust reverser system is to direct fan air forward, to produce reverse thrust and thus to reduce aircraft speed during landing rollout.

"Stowed" is the normal flight position.



"Deployed" is selected after touchdown, producing a forward angled airflow path as engine power is increased.
This redirected airflow creates a rearward or reverse thrust effect that is used to slow the aircraft during landing rollout.
The amount of reverse thrust is varied by thrust reverser control lever movement.



2.3 Aborted Landing

While the thrust reversers were still in transit to deploy and the amber REV UNLK lights were ON, they were selected to be stowed, then TOGA was applied on both engines.

On engine 1, the thrust reverser stowed and consequently the FADEC 1 commanded engine 1 at TOGA.

On engine 2, the thrust reverser did not stow and stayed half open due to failure of the electrical restow circuit **(refer to note 2)**.

Consequently, as per design with reverser not stowed, the Auto Idle function of FADEC 2 commanded engine 2 to Idle thrust. A tail strike was experienced during rotation.The liftoff was performed in conf 30/40 (FULL), with an IAS of 125kt .

During liftoff, temporary and intermittent ENG1 REV UNLK **(refer to note 3)** and permanent ENG2 REV UNLK lights were ON **(refer to note 4)**.

2.4 Diversion

Once airborne, the pilot put the engine 2 thrust lever into the Idle position, then cycled the reverser lever to stow the reverser. The engine 2 thrust reverser remained in the partially deployed position (half open) because:

► The electrical failure of the restow circuit prevented the reverser from stowing correctly

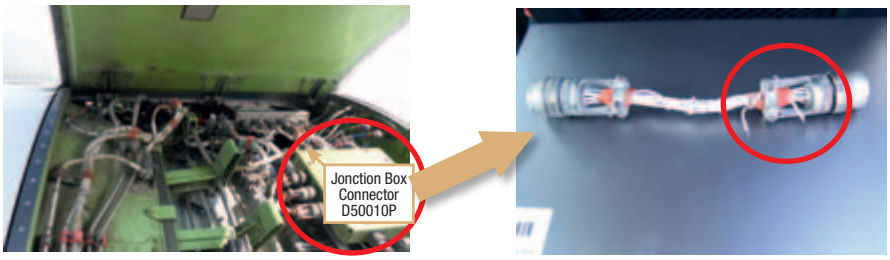
► A design protection prevents reverser movement in flight.

The pilot then advanced the engine 2 thrust lever to check for thrust response, but the thrust did not increase due to the FADEC's Auto Idle function.

The pilot then shut down engine 2 and diverted to an alternate airport where a single engine landing was performed with engine 1 thrust reverser selected.

note 2

A defective pin at connector level (junction box D5010P) was at the origin of the electrical restow circuit failure.



note 3

Reverse stowed and latched (REV UNLK light OFF) means that it is stowed within 0.125 inch of the full stow stop. At this point, the movement of the thrust reverser sleeve can only be due to vibration, aerodynamic loads (external and in the fan duct), or airplane maneuvers.

Consequently temporary intermittent unlocked indication could be considered to be due to vibration during final transit of the translating sleeve to the full stow stop position.

note 4

The thrust reverser lights indicate the operational status of the thrust reverser systems. When all lights are OFF, the translating sleeves are in the stowed position, the systems are latched.

REV UNLK LIGHTS
A light comes on amber when:
- The related thrust reverser system is unlatched,
- The translating sleeves travel between the status position and 90% of their travel.

REV LIGHTS
A light comes on green when the translating sleeves of the related thrust reverser system are beyond 90% of their travel.

3. Operational Recommendations

3.1 Throttle Handling in Flight

According to the A300-600 FCOM 2.05.70 (ENG REV UNLK procedure), the throttle of the affected engine has to be put and left in the Idle position. No movement of the thrust and reverser levers is authorized while the engine is ON.

ENG REV UNLK

THROTTLE (affected engine) ..... IDLE
DIVERSION ..... CONSIDER
MAX SPD 300
• **IF BUFFET OR BANK:**
FUEL LEVER ..... OFF
MAX SPD 240
PROC: SINGLE ENG OPERATION (12.08)..... APPLY
ENG AT IDLE
Displayed only if engine is automatically set at idle by FADEC

3.2 Throttle Handling during Aborted Landing / Touch and Go

a) The A300-600 FCOM 2.03.22 (At TOUCHDOWN) mentions:

► After reverse thrust is initiated, a full-stop landing must be performed.

This statement is valid for all Airbus aircraft types, and is also mentioned in the associated FCOM (Normal Procedure – SOP – Landing).

► Do not move reverse levers towards stow position while reverser are in transit; such action may cause system damage.

A300-600 | STANDARD OPERATING PROCEDURES | 2.03.22 | PAGE 5 | REV 33 | SEQ 070
LANDING

AT TOUCHDOWN

REVERSE LEVERS . . . . . Pull

- Immediately after touch-down of main landing gear, pull reverse levers to the idle reverse point, when REV (green) appears, apply max reverse.
- After reverse thrust is initiated, a full-stop landing must be performed.

Note 1: Maximum efficiency of the reverse is obtained at high speed

Note 2: Do not move reverse levers towards stow position while reversers are in transit; such action may cause system damage.

Note 3: If one or both REV UNLK lt remains on, apply reverse normally.

Note 4: If the use of max reverse is restricted due to noise consideration, maintain reverse idle until taxi speed is reached.

Note 5: If directional control problems are encountered, reduce thrust to reverse idle until directional control is satisfactory.

- MAX. REVERSE THRUST . . . . . Apply
- N1, EGT and IAS . . . . . .Monitor

b) The A300-600 FCOM 2.02.01 (BOUNCING AT LANDING) has been updated in June 2012 with the following additional statement:

"In any case, if reverse thrust has been selected, a full stop landing must be performed."

The FCOM of the other Airbus aircraft types will be updated accordingly in the next revisions.

A300-600 | PROCEDURES AND TECHNIQUES | 2.02.01 | PAGE 9 | REV 33 | SEQ 001
GENERAL
RECOMMENDATIONS FOR TAKE-OFF AND LANDING

BOUNCING AT LANDING

In case of light bounce (5 ft or less), maintain pitch attitude and complete the landing. Do not increase pitch attitude, as this could lead to a tailstrike.

In case of a high bounce (more than 5 ft) maintain pitch attitude and configuration, and initiate a go-around by advancing throttle levers while triggering the go-levers. This will soften the second touchdown that will most probably occur and prevent damage to the aircraft.

Retract flaps one step and landing gear only when safely established in the go-around and no risk of further touchdown exists.

A landing should not be attempted after a high bounce, as the remaining runway length might not be enough to stop the aircraft.

In any case, if reverse thrust has been selected, a full stop landing must be performed.

4. Conclusion

As a result of the crew's decision to abort the landing after they had selected reverse thrust, the aircraft took off with one engine on Idle and the aircraft's tail impacted the runway.

This occurrence illustrates that when TOGA is applied after thrust reverser selection, there is a risk of non availability of maximum thrust on one or more engines if the associated reversers do not stow. This protection is triggered by the Auto Idle function of the FADEC, which maintains the engine thrust at Idle as long as the reversers are not stowed. The consequence could be a loss of control if an aborted landing is initiated at that time.

We therefore strongly encourage all crews to adhere to the following FCOM recommendation, which is common to all Airbus aircraft types:

"After reverse thrust is initiated, a full-stop landing must be performed."

A previous article published in the first issue of this magazine: "A320 In-Flight Thrust Reverser Deployment", dated Jan 2005, describes an event where a takeoff was carried despite a REV UNLK warning.

The common key message from these two articles is that it is essential to strictly adhere to any procedure associated with the operation of thrust reversers.

Safety First

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A400M
Formation of five A400M nose to tail at Toulouse-Blagnac Airport

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