



Flight Operations Briefing Notes Landing Techniques Preventing Tailstrike at Landing

I Introduction

A tailstrike occurs when the tail of an aircraft touches the runway during takeoff or landing. It can occur with any type of aircraft, although tailstrikes occur more often with long aircraft, because tailstrike occurrence is directly related to pitch attitude versus aircraft geometry, and the status of main landing gear extension.

Tailstrikes can result in significant structural damage to the aircraft and, therefore, may jeopardize the safety of the flight and lead to considerable maintenance action.

Note:

The purpose of this Flight Operations Briefing Note is to address tailstrike occurrence at landing.

II Background Information

II.1 Statistical Data

About 25% of reported tailstrikes occur at takeoff, and 65% at landing (Source: Airbus-2004).

Note:

*Tailstrike at takeoff is addressed in the Flight Operations Briefing Note **“Preventing Tailstrike at Takeoff”**.*

Tailstrike at landing often occurs on the second touchdown, following a bounce. It is often associated with a hard landing.

Although most of landing tailstrikes are due to deviations from normal landing techniques, some are associated with external conditions, such as turbulence and wind gradient.

II.2 Operational Consequences

Tailstrikes at landing generally cause more damage than tailstrikes at takeoff because the tail may strike the runway before the main gear, and cause damage to the aft pressure bulkhead.



Figure 1

Damage Following a Tailstrike at Landing

Flight crewmembers may not always be aware that a tailstrike has occurred during landing, because the impact may not be felt. In these cases, a walk-around inspection performed by the flight crew before the next flight will ensure that the marks on the aircraft from the tailstrike are detected, and repaired, if required.

However, shallow damage that the flight crew did not detect, and that was therefore not repaired, may result in increased long-term risks (e.g. structural damage in flight, when the aircraft is pressurized).

III Operational and Human Factors Involved in Tailstrikes at Landing

Unstabilized approaches due to deviations from normal approach and landing techniques are the most common causes of tailstrikes.

The following factors increase the probability of a tailstrike during landing (**Figure 2**):

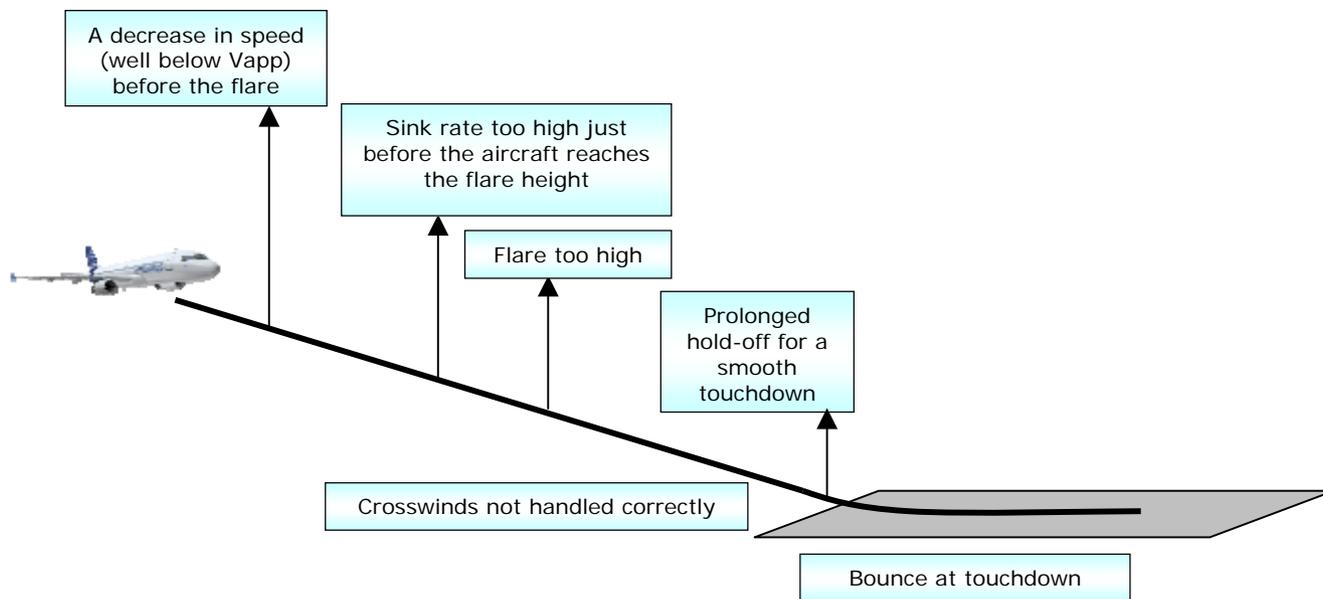


Figure 2

Operational & Human Factors Involved in Tailstrikes at Landing

Usually, no single factor will result in a tailstrike. However, the combination of several factors significantly reduce the tail clearance margin (distance between the aircraft tail and the ground).

Decrease in Speed (Well Below V_{app}) Before the Flare

Flight at too low a speed results in a high Angle-of-Attack and a high pitch attitude, and therefore, reduced ground clearance. When the aircraft reaches the flare height, the flight crew must significantly increase the pitch to reduce the sink rate. This will further reduce the ground clearance.

Sink Rate Too High Just Prior to Reaching the Flare Height

If the sink rate is too high when the aircraft is close to the ground, the flight crew may attempt to avoid a firm touchdown by commanding a high pitch rate. This action will significantly increase the pitch attitude. However, if the resulting lift increase is not sufficient to significantly reduce the sink rate, a firm touchdown may occur. In addition, the high pitch rate may be difficult to control after touchdown, particularly in the case of a bounce.

Flare Too High

A flare that is too high can result in a combination of decreased airspeed and a long float. Since both increase the aircraft's pitch attitude, the result is reduced tail clearance.

Prolonged Hold-Off for a Smooth Touchdown

As the pitch attitude increases, the flight crew must assess the aircraft's position in relation to the ground.

Bounce at Touchdown

In the case of a bounce at touchdown, the flight crew may decide to increase the pitch attitude, to ensure a smooth second touchdown. If the bounce results from a firm touchdown associated with a high pitch rate, it is important for the flight crew to control the pitch, so that it does not continue to increase.

Crosswinds Not Handled Correctly

When the aircraft is close to the ground, the wind velocity tends to decrease, and the wind direction tends to turn (direction in degrees decreasing in northern latitudes). The flight crew must be aware that during the approach phase, and especially during the flare, a crosswind effect could suddenly increase the pitch of the aircraft, and result in tailstrike.

IV Prevention Strategies and Lines of Defense

IV.1 Flying Techniques

Note:

For detailed information, refer to the Airbus operational and training documentation: The following is only an overview of some approach and landing techniques.

Approach

A stabilized approach (i.e. pitch, thrust, flight path, V_{APP}) is essential for achieving a successful landing.

Autothrust and the Flight Path Vector (FPV), if available, are effective flight crew aids.

For the approach phase, the flight crew should:

- Not chase the glide slope close to the ground: Progressively and carefully monitor the pitch attitude and sink rate
- Avoid high sink rate when close to the ground.

PNF callouts during the final approach are essential to alert the PF of any excessive deviation of flight parameters, and/or excessive pitch attitude at landing. Following a PNF flight parameter exceedance callout, the suitable PF response will be to:

- Acknowledge the PNF callout, for proper crew coordination purposes
- Take immediate corrective action to control the exceeded parameter back into the defined stabilized conditions
- **Assess whether stabilized conditions will be recovered early enough prior to landing, otherwise initiate a go-around.**

Flare

The flight crew should adapt the flare height to the aircraft inertia: It is imperative that the aircraft reaches the flare height at the appropriate airspeed and flight path angle.

The aircraft should be "in trim" at the start of the flare. For A300/A310/A300-600 aircraft, the flight crew should avoid the use of pitch trim during the flare, or after touchdown.

During the flare, the flight crew should concentrate on the pitch and roll attitude, using external visual cues.

Finally, the flight crew should set the pitch rate to zero prior touchdown.

Landing

The flight crew should avoid "holding off the aircraft" in an attempt to make an excessively smooth landing.

Immediately after main landing gear touchdown, the PF should release the back pressure on the sidestick (or control column, as applicable) and fly the nose wheel smoothly, but without delay, on to the runway.

The PNF should continue to monitor the attitude.

"PITCH, PITCH" auto callout (synthetic voice, if installed) triggers when pitch becomes excessive during flare and landing.

The Pitch Limit Indication on the PFD (if installed) can also help flight crew awareness, because it indicates the pitch limit before a tailstrike (**Figure 3**).

Bouncing at Touchdown

In case of a light bounce, the flight crew can apply the following typical recovery technique:

- Maintain a normal landing pitch attitude:
 - Do not increase pitch attitude, as this could cause a tailstrike
 - Do not allow the pitch attitude to increase, particularly following a firm touchdown with a high pitch rate.

Note: Spoiler extension may induce a pitch-up effect.

- Continue the landing
- Keep thrust at idle
- Be aware of the increased landing distance.

In case of a more severe bounce, the flight crew should not attempt to land, because the remaining runway length might not be sufficient to stop the aircraft.

For more information, refer to the Flight Operations Briefing Note **Bounce Recovery – Rejected Landing.**

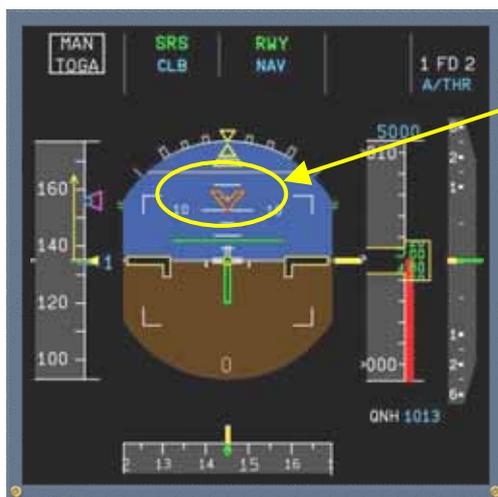


Figure 3

Typical Pitch Limitation Indication on the PFD

IV.2 Training Programs

Tailstrike prevention should be part of the recurrent training program, and Operators should provide adequate flight crew briefings.

Airbus has released a new document in electronic format called **Tailstrike Avoidance e-briefing**. This Airbus e-briefing provides several types of multimedia information in a single document, for flight crew self-education and/or instructor briefings, including: Documentation, videos, powerpoint presentations with sound.

Relevant technical data in the Flight Crew Operating Manual (FCOM), such as aircraft geometry limits (e.g. gear extended) and pitch attitude at touchdown, also provides the flight crew with an awareness of the aircraft characteristics, and helps to avoid a tailstrike.

V Summary of Key Points

The following key points will help the flight crew to reduce the risk of tailstrike at landing:

- Fly a stabilized approach (i.e. pitch, thrust, flight path angle, V_{APP})
- Do not chase the glide slope when close to the ground, and carefully monitor the pitch and sink rate
- Adapt the flare height to the aircraft inertia
- Reinforce PNF callouts during final approach to prevent excessive deviation of flight parameters (e.g. high sink rate when close to the ground, a decrease in speed below V_{APP} , etc.)
- Maintain the pitch attitude prior to touch down
- Do not hold off the aircraft to make an “extra smooth” landing
- Do not wait to bring the nose wheel to the ground just after main landing gear touchdown
- Avoid increasing the pitch, or letting the pitch increase (e.g. ground spoilers effect) after a bounce.

Perform a walk-around inspection to detect any marks that might have resulted from a tailstrike that was not noticed during the landing.

VI Associated Flight Operations Briefing Notes

The following Flight Operations Briefing Notes provide additional information on related subjects:

- **Flying Stabilized Approaches**
- **Aircraft Energy Management During Approach**
- **Crosswind Landings**
- **Bounce Recovery/Rejected Landing**

VII Airbus References

- Flight Crew Operating Manuals (FCOM) – Standard Operating Procedures and Supplementary Techniques
- A318/A319/A320/A321, A330/A340 and A380 Flight Crew Training Manuals (FCTMs) – Normal Operations – Tailstrike Avoidance
- Flight Crew Operating Manual Bulletins – Avoiding Tailstrikes
- A318/A319/A320/A321 and A330/A340 e-briefings – Tailstrike Avoidance



This FOBN is part of a set of Flight Operations Briefing Notes that provide an overview of the applicable standards, flying techniques and best practices, operational and human factors, suggested company prevention strategies and personal lines-of-defense related to major threats and hazards to flight operations safety.

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