Attachment # 3

Tail Strike Awareness Training
Information Bulletin

MD-11 Tail Strike Awareness Information

Introduction

FedEx flight standards and flight training have developed an MD-11 tail strike awareness training program. The primary objective of this program is to improve awareness of the pilot controlled factors that affect pitching tendency after touchdown and to reinforce proper sink rate and bounce recovery technique. The program consists of a 30 minute briefing followed by 1 hour of simulator training. Tail strike awareness training has been incorporated into recurrent, initial, and transition training. All FedEx pilots currently qualified on the MD-11 will receive the training during their next recurrent event, i.e. warm up, pt, or loft.

The purpose of this document is to provide FedEx MD-11 pilots immediate access to the information gathered during the development of the tail strike awareness training program.

The airline industry has logged approximately 350,000 MD-11 landings to date. MD-11 tail strike incidents/accidents have occurred at a fairly constant rate (tail strikes/total landings). Approximately 25% of the industries MD-11 tail strikes occurred on takeoff and 75% on landing.

Takeoff

The recommended rotation technique is a 3 degree per second rotation to an initial pitch attitude of approximately 15 degrees. The pilot flying (PF) should then transition to the flight director pitch bar for guidance. The flight director pitch bar is not usable until approximately five seconds after nose gear strut extension. A two step rotation is not appropriate. Two step or segmented rotations will significantly impact takeoff performance, i.e. required runway, second segment climb gradients, and obstacle clearance. It is, however, the PF's responsibility to ensure that the aircraft is accelerating properly and has become airborne passing 10 degrees of pitch attitude. If the aircraft has not become airborne, possibly due to an inaccurate flap setting, stab setting, gross weight entry, or contaminated wing, the rotation should be stopped.

Some tail strikes on takeoff have occurred as a result of early or quick rotations. One tail strike occurred as a result of the pilot initiating a rotation at V1 vs. VR. Another tail strike occurred as a result of an inaccurate gross weight entry into the FMS which resulted in inaccurate V speeds.

LANDING

- **Some of the factors that affect pitching tendency after touchdown are:**

Flap setting	**Strut servicing**	**Sink rate**
Center of gravity	**Ground spoilers**	**Pitch Attitude**
Gross weight	**Autobrakes**	**Pitch Attitude rate**
		Airspeed

- **Landing tail strikes have occurred with the following:**

  Flaps 35 and flaps 50
  Forward and aft center of gravity
  Light and heavy gross weight
  Over serviced and correctly serviced struts

One consistent factor in every landing tail strike to date has been an excessive descent rate with an increasing pitch attitude rate prior to the initial touchdown. Sink rates, pitch attitude, pitch attitude rate, and airspeed are pilot controlled factors that affect pitching tendency after touchdown and are the focus of the tail strike awareness training program.

- **The following pilot actions may result in high sink rates prior to touchdown:**

  Unstable approach
  Late or abrupt align maneuver
  Early flare

- **Stabilized approach**
  The aircraft should be fully configured, on speed (including appropriate wind and gust corrections applied to Vref) and on flight path by 1000 feet AGL. If the aircraft is not stabilized by 500 feet or if a sink rate of more than 1000 FPM develops, a missed approach should be executed.

  Several tail strikes have occurred on visual approaches without the use of an electronic glideslope. Increased crew awareness and crew coordination during these types of approaches is critical.

- **Align maneuver**

  The recommended method for a crosswind landing is to fly the final approach in a wing's level attitude with a crab into the wind. At approximately 200 feet AGL, align the fuselage with the runway by smoothly applying rudder pressure and lower the upwind wing to prevent drifting off runway centerline. In high crosswinds, consideration should be given to commencing the align maneuver prior to 200 feet, and in all cases, the align maneuver should be fully established by 100 feet AGL.

  Some tail strikes have occurred as a result of the pilot initiating a late or abrupt align maneuver. The align maneuver, commonly referred to as a forward slip, will reduce lift and if unchecked with power, will result in an increased sink rate.

- **Flare**

  The recommended flare technique is to maintain a stabilized flight path through the 50 and 40 foot CAWS callout (unless sink rate is high). At 30 feet a smooth 2.5 degree flare should be initiated so as to arrive below 10 feet in the landing attitude. Elevator back pressure should be relaxed, and a constant pitch attitude should be maintained from 10 feet radio altitude to touchdown.

  Some tail strikes have occurred as a result of the pilot initiating an early flare **and "feeling for the runway." It is critical that pilots understand the dynamics involved in this situation. The autothrottles switch to the retard mode at 50 feet radio altitude. In the retard mode, the throttles are retarded to idle at a pre-programmed rate without airspeed, vertical speed, or radio altitude bias. The pilot flying or the autopilot, if selected, must maintain the appropriate glide path to touchdown. If the aircraft is flared early and the autothrottles allowed to retard, the airspeed will decay, elevator effectiveness will be reduced, and a higher pitch attitude will be required making the pitch up tendency after touchdown more pronounced and more difficult to counteract.**

  Pilots must fully understand autothrottle retard logic. If the aircraft deviates from the appropriate glide path below 50 feet radio altitude, the PF must override the autothrottles.

HIGH SINK RATE AND BOUNCE RECOVERY TECHNIQUE

The recommended high sink rate and bounce recovery technique is to establish a 7 1/2 degree pitch attitude and arrest the sink rate with thrust. If a high bounce occurs, a go-around should be initiated. Low level go-arounds, i.e. less than 20 feet RA, are dramatically different than higher altitude go-arounds. High altitude go-arounds are initiated with pitch, while low level go-arounds must be initiated with thrust. During low level go-arounds main wheel touchdown may be unavoidable. The PF must not exceed 10 degrees of pitch or retract the landing gear until passing 20 feet RA with a positive rate of climb.

Some tail strikes have occurred as a result of the pilot attempting to arrest a high sink rate or bounce by quickly adding up elevator. This technique immediately increases both the effective weight of the aircraft and the aircraft's vertical velocity. The resulting increased attitude rate will aggravate the pitching tendency after touchdown and drive the main wheels into the ground, thus compressing the main wheel struts. The aft fuselage will contact the runway at approximately 10 degrees pitch attitude with the struts compressed.

It is imperative that pilots fully understand the correlation between an increasing attitude rate at touchdown and an increased pitch up tendency after touchdown. One degree per second of increasing attitude rate at touchdown generates as much pitch up tendency as full spoiler deployment. Elevator back pressure should be relaxed, and a constant pitch attitude should be maintained from 10 feet radio altitude to touchdown.

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