Japan Transport Safety Board

The response from the FAA to the safety recommendation

The Japan Transport Safety Board received the response from the Federal Aviation Administration (FAA) of the United States of America to the safety recommendation issued April 26, 2013 as attached regarding an accident of N526FE (McDonnell Douglas MD-) operated by Federal Express Corporation at Narita International Airport, Japan on Mar. 23, 2009.

JTSB safety recommendation to the FAA

On March 23 (Monday), 2009, about 06:49 JST (Japan Standard Time), a McDonnell Douglas MD-11F, registered N526FE, operated by Federal Express Corporation as the scheduled cargo flight FDX80, bounced repeatedly during landing on Runway 34L at Narita International Airport. During the course of bouncing, its left wing was broken and the airplane caught fire. The airplane rolled over to the left being engulfed in flames, swerved off the runway to the left and came to rest inverted in a grass area on the west side of the runway.

The airplane approached with a high sink rate, with its autothrottle “on” amid strong gusty winds and with unstable airspeed and attitudes. The late flare caused hard landing and the airplane bounced. Large nose-down elevator input just before and during the touchdown caused the second touchdown on the NLG with negative pitch attitude developing into porpoising. Upon the third touchdown, the left wing structure fractured because it surrendered to an overload transferred from the left MLG.

As a result of the investigation of this accident, the JTSB makes the following recommendations to the Federal Aviation Administration of the United States of America to take the following measures to prevent the recurrence of similar accidents.

Actions to Be Taken by the Federal Aviation Administration

a. Although the MD-11 airplane was certified to the requirement 14 CFR 25.721(a) under the interpretation at the time of certification, its design would not meet the present interpretation of the requirement since the design allows the possibilities of causing severe damage to the airplane structure in the failure mode under an overload condition where the vertical load is the primary component, resulting in the fire due to fuel spillage. As this kind of design should not be certified from now on, the airworthiness regulation rather than the guidance material should be revised to mandate the assumption of the overload condition in which the vertical load is the primary component.

b. Heat and smoke from the fire reached the cockpit at an early stage after the accident, making it difficult to initiate quick rescue activities from outside. In order to increase the crew survivability, studies about ways to separate the flight crew compartment from heat, smoke and toxic gas should be made, and if there are any effective solutions, the FAA should consider their application to in-service airplanes.

Measures to Be Taken to Supervise the Boeing Company as the Airplane Manufacturer

Past MD-11 accident investigation reports pointed out that in case of the primarily vertical overload transferred from MLG to wing structures, the gear design allows the fire hazard as a result of the destruction of wing structure followed by fuel spillage. The Boeing Company has so far focused its efforts on improving flight control programs which are effective in lessening overloads and these efforts are positively appraised to some extent; however, it's not a fundamental solution. As the occurrences of vertical overload have been reported after this accident, the measures taken so far are not considered to be satisfactory.

The JTSB recommends that the Federal Aviation Administration require the Boeing Company to study the possibility of design change for the MLG support structure and matters mentioned below in order to prevent the recurrence of similar accidents and minimize damage to be caused by such accidents.

c. In order to reduce the occurrence of MD-11 series airplanes' severe hard landing and bounce in which an overload is transferred to the MLGs and their supporting structure, the Boeing Company should improve the controllability and maneuver characteristics by improving the LSAS functions, reducing the AGS deployment delay time and other possible means.

Possible improvement on LSAS functions may include: a function to limit large nose-down elevator input during touchdown phase, which is a common phenomenon in severe hard landing cases accompanied by structural destruction for MD-11; and a function to assist bounce recovery and go-around in case of bounce.

d. In order to help pilots to conduct recovery operation from large bounces and judge the necessity of go-around, studies should be made to install a visual display and an aural warning system which show gear touchdown status on MD-11 series airplanes.

U.S. Department
of Transportation
Federal Aviation
Administration

Attachment

AUG 2 8 2013

Norihiro Goto
Chairman
Japan Transport Safety Board
2-1-2, Kasumigaseki, Chiyoda-ku
Tokyo 100-8918
Japan

Dear Chairman Goto:

This is in response to Safety Recommendations 6.1(a), 6.1(b), 6.2(c), and 6.2(d) issued by the Japan Transport Safety Board (JTSB) to the Federal Aviation Administration (FAA) on April 26, 2013. The JTSB issued these safety recommendations following its investigation of a McDonnell Douglas (now Boeing) MD-11F accident which occurred at Narita International Airport on March 23, 2009. At 06:49 local time, a FedEx Corporation MD-11F, operating as FedEx Flight 80, bounced repeatedly while landing on Runway 34L. Impact forces incurred during the landing sequence broke the left wing which separated from the fuselage attach point. The aircraft caught fire, rolled to the left, and swerved off the left side of the runway. The aircraft came to rest inverted in a grassy area. The aircraft was destroyed, and both pilots received fatal injuries. JTSB Safety Recommendations 6.1(a), 6.1(b), 6.2(c), and 6.2(d) were assigned FAA control numbers 13.060, 13.061, 13.062, and 13.063 respectively.

<u>13.060</u>. Although the MD-11 airplane was certified to the requirement 14 CFR § 25.721(a) under the interpretation at the time of certification, its design would not meet the present interpretation of the requirement since the design allows the possibilities of causing severe damage to the airplane structure in the failure mode under an overload condition where the vertical load is the primary component, resulting in the fire due to fuel spillage. As this kind of design should not be certified from now on, the airworthiness regulation rather than the guidance material should be revised to mandate the assumption of the overload condition in which the vertical load is the primary component.

<u>FAA Comment</u>. We have determined that revising 14 CFR § 25.721(a) and issuing the accompanying FAA Advisory Circular (AC) as proposed will adequately ensure that failure of the landing gear due to a primarily vertical overload will be considered in the design of future airplanes.

As noted in the JTSB accident report, the FAA is in the process of revising 14 CFR § 25.721. A Notice of Proposed Rulemaking was issued on March 1, 2013, and the comment period has since closed. Based on the comments received and our plan to harmonize with European requirements, we expect the rule to be issued as proposed with few changes. Final publication is expected by December 31, 2014.

The proposed rule states, "The landing gear system must be designed so that when it fails due to overloads during takeoff and landing, the failure mode is not likely to cause spillage of enough fuel to constitute a fire hazard. The overloads must be assumed to act in the upward and aft directions in combination with side loads acting inboard and outboard." The accompanying FAA AC will include the statement that, "Failure of the landing gear due to overload should be considered, assuming the overloads act in any reasonable combination of vertical and drag loads."

FAA Safety Recommendation 13.060 remains classified as open-acceptable action, pending the revisions to 14 CFR § 25.721.

13.061. Heat and smoke from the fire reached the cockpit at an early stage after the accident, making it difficult to initiate quick rescue activities from outside. In order to increase the crew survivability, studies about ways to separate the flight crew compartment from heat, smoke and toxic gas should be made, and if there are any effective solutions, the FAA should consider their application to in-service airplanes.

FAA Comment. The design requirements addressing fire safety associated with Class E cargo compartments are contained in 14 CFR §§ 25.851(a), 25.855, 25.857, and 25.858, which include but are not limited to:

- Material standards and design considerations for cargo compartment interiors,
- Standards for the various classes of transport category airplane cargo compartments, and
- Minimum design and certification requirements for cargo or baggage compartment fire or smoke detection systems.

Compliance with these requirements includes flight tests to demonstrate that smoke detection is achieved within one minute and to ensure that smoke penetration from cargo compartment into occupied areas is prevented. Specific guidance pertaining to these standards is provided in AC 25-7B, AC 25-9A, AC 25-17A, and AC 25-22.

Freighter airplanes are required per 14 CFR § 25.857(e)(4) to have a fire and smoke barrier located in the forward main deck to prevent flames and smoke from entering the occupied areas including the flight deck. The applicant for approval of this configuration must also show that the flame barrier meets the applicable flammability requirements of 14 CFR part 25 Appendix F. Furthermore, the applicant must conduct flight tests to demonstrate that the smoke barrier performs its function during normal operation (e.g. the environmental control system (ECS) in normal mode and fire mode) and for approved dispatch configurations with non-normal modes of ECS, if requested by the applicant. However, all of these requirements are predicated on an undamaged airplane structure and operation of the ECS. We do not require that these features continue to perform the function in the type of post-crash scenario experienced by FedEx Flight 80. The loads placed on the flame and smoke barrier as the airplane tumbled may have resulted in the barrier losing its integrity. Similarly, the ECS would have shut down and no longer been able to provide a positive pressure differential in the flight deck to prevent smoke from entering. Once the MD-11F ECS shut down and the airplane structure was compromised, it was no longer possible to keep smoke and fire from entering the flight deck.

There is very little that can be done to protect airplane occupants from an externally-fed fuel fire of the magnitude encountered by FedEx Flight 80. The latest fuselage burn-through requirements of 14 CFR § 25.856(b), issued on July 31, 2003, require that the insulation blankets resist burn-through for at least five minutes. This standard assumes the airplane is relatively intact and remains upright. This accident far exceeded the certification design requirements. Even under the best conditions, typical aluminum airplane construction cannot prevent an externally-fed fuel fire of this magnitude from entering the flight deck or cabin for the amount of time that would have been needed in this accident.

For the reasons cited above, we believe 14 CFR part 25 requirements are appropriate to address a typical post-crash fire scenario, and we do not intend to revise them to address this accident scenario. The FAA has effectively addressed the intent of Safety Recommendation 13.061, and it has been classified as closed-not adopted.

13.062. In order to reduce the occurrence of MD-11 series airplanes' severe hard landing and bounce in which an overload is transferred to the main landing gear and their supporting structure, the Boeing Company should improve the controllability and maneuver characteristics by improving the Longitudinal Stability Augmentation System (LSAS) functions, reducing the Auto Ground Spoiler (AGS) deployment delay time and other possible means. Possible improvement on LSAS functions may include: a function to limit large nose-down elevator input during touchdown phase, which is a common phenomenon in severe hard landing cases accompanied by structural destruction for MD-11; and a function to assist bounce recovery and go-around in case of bounce.

FAA Comment. The MD-11/11F Automatic Flight System (AFS) is an integral part of the automatic and manual control system of the aircraft. Manual override of the automatic flight controls and autothrottle is always available. The AFS consists of two Flight Control Computers (FCCs) with integrated autopilots (AP), Flight Directors (FD), autothrottle (AT), and engine trim controls. The AFS incorporates speed and flight path protective features that automatically override the selected speed and/or flight path commands to prevent overspeed or underspeed. The AFS includes the following features:

- LSAS with series elevator actuation;
- Speed Envelope Limiting (autothrottle and LSAS);
- Automatic Pitch Trim (autopilot and LSAS);
- Yaw Damping/Turn Coordination;
- Elevator Load Feel Control;
- Flap Limiting;
- Automatic Ground Spoiler Control;
- Altitude Alert Warning (visual and aural);
- Stall Warning with Stick Shaker and AutoSlat Extension;
- Data for Electronic Instrument System (EIS) Flight Mode Annunciation; and
- Control Wheel Steering (CWS) with Roll Attitude Hold.

We believe that no changes are needed in the LSAS design. The LSAS function is integrated with other functions in the FCC such as the Low Altitude Stability Enhancements (LASE) function. Any changes to LSAS function may result in adverse effect on the functions of the FCC and AFS. The MD-11 was originally certified and accepted with no LSAS. LSAS with LASE function was implemented on the MD-11 to make handling qualities similar enough to the DC-10 so that a pilot's type rating would be applicable to both models.

Regarding the AGS, Boeing reviewed its function and concluded that there is no "programmed delay" associated with spoiler deployment. However, there are inherent time delays (milliseconds) as part of the normal function of all actuators and control systems. The amount of time required between the mechanical part of the system fully deploying the ground spoilers and the electrical actuator being energized is not instantaneous. We believe this is acceptable.

The FAA has effectively addressed the intent of Safety Recommendation 13.062, and it has been classified as closed-not adopted.

13.063. In order to help pilots to conduct recovery operation from large bounces and judge the necessity of go-around, studies should be made to install a visual display and an aural warning system which show gear touchdown status on MD-11 series airplanes.

FAA Comment. We support proceeding with the design and certification of a visual display (bounce indicator). Detailed design of such device and procedures for its use must be evaluated to ensure it will not yield any negative outcome. Boeing has initiated the design concept and intends to certify an Off Ground Advisory System (OGAS) by January 2014 as an option for the MD-11. In May 2013, Boeing presented the OGAS information to all the MD-11 operators at the MD-11 Operator Flight Ops conference.

FAA Safety Recommendation 13.063 remains classified as open-acceptable action, pending the projected certification of OGAS in January 2014.

If you have any questions or need additional information regarding these safety recommendations, please contact (Name and Phone Number)

Sincerely,

(Original signed)

(Name)
Director, Office of Accident Investigation
And Prevention