



National Transportation Safety Board

Washington, D.C. 20594
Safety Recommendation

Date: June 29, 1993

In reply refer to: A-93-81 through 83

Mr. Joseph M. Del Balzo
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

On April 6, 1993, China Eastern Airlines flight 583, a McDonnell Douglas MD-11, in scheduled international passenger service from Shanghai, China, to Los Angeles, California, had an inadvertent deployment of the wing slats with the autopilot engaged, while in cruise flight over the Pacific Ocean at 33,000 feet. The captain disconnected the autopilot and was in manual control when the airplane went through four violent pitch oscillations and lost 5,000 feet of altitude. The flightcrew regained control, declared an emergency, and diverted to Shemya Air Force Base, Shemya, Alaska, where an uneventful landing was made. Of the 265 people aboard the airplane, 2 passengers were fatally injured, and 160 others received injuries. The airplane did not receive external damage, but the airplane's passenger cabin was extensively damaged.

The investigative responsibilities for this accident were delegated to the National Transportation Safety Board by the Civil Aviation Administration of China (CAAC), under the provisions of International Civil Aviation Organization (ICAO) Annex 13. The Federal Aviation Administration (FAA), CAAC, China Eastern Airlines, and Douglas Aircraft Company, an operating division of the McDonnell Douglas Corporation, are participating in the investigation.

The investigation of the accident is *in progress*, and the cause of the slat deployment has not been determined. However, preliminary evidence strongly suggests that the flap/slat handle became dislodged from the slat retract position and moved to a position that caused the slats to deploy. This probably occurred because of inadvertent contact with the flap/slat handle by a flightcrew member.

The Safety Board is aware of 10 other incidents of inadvertent or uncommanded in-flight slat deployments on the MD-11. Information concerning these deployments has been disseminated to operators of the airplane by Douglas via All Operators Letters (AOLs).

The first reported in-flight inadvertent slat deployment involving an MD-11 occurred on April 18, 1991. As a result of that event, Douglas issued FO-AOL-11-006 on April 19, 1991, advising MD-11 operators that if the flap/slat handle was not properly positioned, it could make an uncommanded movement out of the slat-retracted position resulting in slat extension.

On July 12, 1991, the same aircraft was involved in a second inadvertent in-flight slat deployment when a clipboard fell on the flap/slat handle.

On October 16, 1991, Douglas issued Service Bulletin 27-18, which recommended the installation of a "zero degree detent gate,"¹ intended as a mechanism to prevent unintentional slat deployments.

Following five additional reported inadvertent in-flight slat deployments, Douglas issued FO-AOL-11-046 on May 1, 1992. Information contained in the AOL summarized the incidents and noted that in one of the events, the zero degree detent gate had been installed on the airplane. The captain of that incident flight had unintentionally extended the slats in flight by depressing the zero degree detent gate.

Following an uncommanded slat deployment event in June 1992, Douglas found that the improper rigging of the slat mechanical system could cause the slats to extend without flap/slat handle contact. Douglas issued an Alert Service Bulletin (ASB) A27-29, providing procedures for the inspection of the MD-11 fleet

¹The "zero degree detent gate" consists of a spring loaded, triangular gate that prevents the flap/slat handle from moving aft if the handle is inadvertently displaced downward while in full forward (slats retracted) position.

to confirm proper slat rigging. Also included in the ASB were instructions on how to rerig out-of-rig airplanes. The FAA issued Airworthiness Directive (AD) T'92-14-51 on June 29, 1992, requiring mandatory compliance with the ASB within 10 days.

On June 25, 1992, Douglas issued FO-AOL-11-46A, which recommended an interim procedure to verify the proper flap/slat handle position in flight, until design changes could be made available. The AOL contained the following note:

CAUTION:

Do not depress the FLAP/SLAT handle, or place any object on the center pedestal which may accidentally depress the handle or rest hands or arms on the handle. Once the handle is depressed, only the Zero Degree Detent Gate locking mechanism prevents the FLAP/SLAT handle from moving aft and extending the slats. If the Zero Degree Detent Gate is subsequently depressed, a combination of control cable tension and spring forces will pull the handle aft and extend the slats.

On August 13, 1992, Douglas issued FO-AOL-11-046B regarding a July 16, 1992, occurrence of an inadvertent slat deployment during cruise flight. Information in that letter indicated that the first officer had contacted the flap/slat handle while reaching for a navigation chart, causing the slats to deploy. The letter also contained the following note:

CAUTION:

The flightcrew should exercise caution in the movement of objects or their hands in a manner which would unintentionally displace the FLAP/SLAT handle in a forward and upward motion. Sharply striking the aft side of the handle will allow the handle to move upward if a very light vertical force is applied. Normal spring and cable tensions will move the handle aft once disengaged from the FLAP UP/SLAT RET detent and allow the slats to extend.

On August 20, 1992, Douglas issued an ASB that provided for the design of a protective cover that would be installed over the zero degree detent gate

of the flap/slat handle. The FAA mandated the incorporation of the ASB in AD 92-26-03 on December 23, 1992. A 60-day compliance period was allowed.

At the time of the China Eastern Airlines in-flight slat deployment, the airplane had been modified in accordance with all Douglas service bulletins. The airplane was also in compliance with all applicable slat system ADs.

On April 28, 1993, following the China Eastern Airlines accident, Douglas issued FO-AOL-11-070, which explained the airplane flight characteristics that could be expected in the event of an inadvertent in-flight slat deployment. The AOL also described the proper crew actions to be taken to maintain control of the airplane.

Despite several attempted fixes, inadvertent deployment of the MD-11 leading edge slats, as a result of contact with the flap/slat handle, continues to occur. Douglas is aware of the continuing nature of the problem and is currently working with the FAA and MD-11 operators to redesign the airplane's flap/slat actuating system. The redesign will reportedly eliminate or greatly reduce the potential for inadvertent slat deployment and will occur in two steps.

First, several interim slat handle locking mechanisms are being evaluated to determine their functionality and their ease of installation into the MD-11 fleet. All of the designs employ some mechanism that will physically hold the slat handle in the retracted position.

The second step of the redesign involves the replacement of the current flap/slat handle and its associated cable system with an electrically operated system. The proposed new design will eliminate the cable tension forces that bias the slat system to the extend position, thus greatly reducing the possibility for an inadvertent slat extension.

Douglas reports that the redesigned electrically operated flap/slat handle system will be available in mid-1994. The design of the interim system is nearing completion and should be available to MD-11 operators within several months.

The Safety Board is concerned that the inadvertent in-flight extension of leading edge slats on MD-11 airplanes, particularly at high cruise altitudes and

airspeeds, presents a significant safety hazard, as illustrated by the China Eastern Airlines accident.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Issue an Airworthiness Directive requiring the operators of MD-11s to install an interim flap/slat handle system or device to prevent the inadvertent deployment of wing leading edge slats, when such a system or device becomes available. (Class I, Urgent Action)
(A-93-81)

Issue an Air Carrier Operations Bulletin to Principal Operations Inspectors to verify that MD-11 operators have advised flightcrews of the potential for an inadvertent in-flight slat extension if contact is made with the flap/slat handle. (Class II, Priority Action)
(A-93-82)

Require an expeditious installation of a redesigned flap/slat actuating system, when it becomes available for retrofit, that will prevent uncommanded and inadvertent deployment of the leading edge slats on MD-11 airplanes. (Class II, Priority Action)
(A-93-83)

Chairman VOGT, Vice Chairman COUGHLIN, and Members LAUBER, HART, and HAMMERSCHMIDT concurred in these recommendations.

By:



Carl W. Vogt
Chairman