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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

OPERATIONAL FACTORS GROUP CHAIRMAN'S FACTUAL REPORT ATTACHMENT 35: McDONNELL DOUGLAS/BOEING ALL OPERATORS LETTER

American Airlines flight 1420
Little Rock, Arkansas
June 1, 1999

DCA99MA060

Attachment 35

to Operational Factors Group Chairman's Factual Report

DCA99MA060

McDonnell Douglas/Boeing All Operators Letter

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AOL
ALL OPERATORS LETTER

FLIGHT OPERATIONS

February 15, 1996
FO-AOL-9-058

To: All MD-80 Operators

Subject: HANDLING CHARACTERISTICS WHEN LANDING ON WET OR SLIPPERY RUNWAYS

Applicable to: All MD-80 series Aircraft

References: Twin Jet Flight Crew Newsletter, May 1995 MD-80 Flight Crew Operating Manual

ATA Chapter No.: 60-00, Performance

Reason: To provide flight crews with additional information on MD-80 ground handling characteristics when landing on wet or slippery runways and a change to reverse thrust management techniques.

In a recent incident, an MD-80 departed the runway while landing in a heavy rainstorm. After touchdown, the thrust reversers were deployed, a skid developed and the aircraft came to a stop off the side of the runway. In situations where the runway is slippery, braking and nosewheel steering become less effective, and the crew might need reverse thrust to help decelerate, and rudder for directional control.

While the MD-80 has good handling characteristics, the "T" tail and aft mounted engine configuration do affect controllability. For example, the use of reverse thrust does affect the aerodynamic efficiency of the rudder.

In the early 1980's, flight tests were conducted to determine the causes of FOD ingestion and engine damage. The tests were successful and corrective action was taken resulting in a large decrease in FOD events. One of the actions taken was to cant the thrust reverser buckets to change the reverser efflux pattern to

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prevent debris from being picked up and placed directly in the engine path.

As a result of the reverser efflux pattern of the canted reversers, the aerodynamic forces acting on the vertical stabilizer and rudder are disrupted by an increase in reverse thrust above approximately 1.3 EPR, thus reducing the ability of the rudder and vertical stabilizer to provide optimum directional control. As reverse thrust increases above approximately 1.3 EPR, rudder and vertical stabilizer effectiveness continue to decrease until at reverse thrust greater than approximately 1.6 EPR the rudder and vertical stabilizer provide little or no directional control.

While this may not be as relevant on a dry runway, rudder effectiveness is of extreme importance when surface friction is low. This is especially applicable when crosswind or tail wind conditions are also present. Specifically, if the airplane is inadvertently landed in a crab on a slippery runway, when the thrust reverser buckets are deployed, the forces acting on the airplane will move it toward the downwind side of the runway. Directional control to compensate for this drift may only be available from the rudder.

The current Douglas MD-80 FCOM procedures recommend reverse thrust settings no greater than 1.6 EPR. If landing on wet or slippery runways the procedures recommend application of reverse thrust to idle reverse, gradually increasing as required, and reducing thrust if any difficulty in maintaining directional control is experienced during reverse thrust operations.

To further reduce the possibility of runway excursions during heavy weather operations, Douglas will revise its recommended procedures to limit reverse thrust to 1.3 EPR when landing on wet or slippery runways. Limiting reverse thrust to 1.3 EPR during heavy weather landings will avoid operations in the regime where reverse thrust decreases rudder effectivity.

Additionally, Douglas recommends the following procedures be observed:

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- A landing on a runway with a braking action of "poor" is undesirable and should not be planned unless other factors make this imperative.

- Observe the 10 knot tail wind component limitation.

- When operating on wet or slippery runways, apply sufficient down elevator after nose gear contact to increase weight on the nose wheel for improved steering effectiveness but not an excessive amount which will unload the main gear and reduce braking efficiency. Apply reverse thrust to idle reverse thrust detent. After reverse thrust is verified, gradually increase reverse thrust as required to no more than 1.3 EPR. At 80 knots (or higher if necessary), reduce reverse thrust to achieve idle reverse thrust by 60 knots. In the event of an emergency, maximum available reverse thrust may be used. If difficulty in maintaining directional control is experienced during reverse thrust operation, reduce thrust as required and select forward idle if necessary to maintain or regain control. Do not attempt to maintain directional control by using asymmetric reverse thrust.

The Douglas MD-80 FCOM Operating Procedures and Performance sections and the AFM procedures section will be revised to incorporate these procedures.

In addition, a service bulletin will be offered which will incorporate a detent in the thrust reverser control system that will provide feel at a nominal 1.3 EPR. The benefits of this added detent are:

1. rudder effectiveness is improved by limiting reverse thrust to 1.3 EPR;
2. flight crew distraction in setting reverse thrust is reduced;
3. the effects of any engine spool up asymmetry are reduced.

The Douglas Aircraft Company May 1995 Twin Jet Flight Crew Newsletter provides a comprehensive review of other factors that may exist when landing on wet or slippery runways.

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A Ground Handling Data Report (MDC K0055) for Douglas aft mounted twin jet aircraft (i.e., DC-9 & MD-80 series except MD-87) was developed to assist customer airlines and simulator operators in incorporating ground handling data in training simulators. This training aid, which was made available in 1988, has proven to provide very effective training for flight crews.

Should additional information be required, please contact your local Douglas Field Service Representative or submit your questions to Flight Operations Customer Service, Douglas Aircraft Company, 3855 Lakewood Boulevard, Mail Code: 94-26, Long Beach, California 90846-0001, fax: (310) 593-3471.

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