4. Recommendations

4.1 New Recommendations

As a result of the investigation of this accident, the National Transportation Safety Board makes the following recommendations:

To the Federal Aviation Administration:
Modify 14 *Code of Federal Regulations* Part 25 to include a certification standard that will ensure safe handling qualities in the yaw axis throughout the flight envelope, including limits for rudder pedal sensitivity. (A-04-56)

After the yaw axis certification standard recommended in Safety Recommendation A-04-56 has been established, review the designs of existing airplanes to determine if they meet the standard. For existing airplanes designs that do not meet the standard, the FAA should determine if the airplanes would be adequately protected from the adverse effects of a potential aircraft-pilot coupling (APC) after rudder inputs at all airspeeds. If adequate protection does not exist, the FAA should require modifications, as necessary, to provide the airplanes with increased protection from the adverse effects of a potential APC after rudder inputs at high airspeeds. (A-04-57)

Review the options for modifying the Airbus A300-600 and the Airbus A310 to provide increased protection from potentially hazardous rudder pedal inputs at high airspeeds and, on the basis of this review, require modifications to the A300-600 and A310 to provide increased protection from potentially hazardous rudder pedal inputs at high airspeeds. (A-04-58)

Develop and disseminate guidance to transport-category pilots that emphasizes that multiple full deflection, alternating flight control inputs should not be necessary to control a transport-category airplane and that such inputs might be indicative of an adverse aircraft-pilot coupling event and thus should be avoided. (A-04-59)

Amend all relevant regulatory and advisory materials to clarify that operating at or below maneuvering speed does not provide structural protection against multiple full control inputs in one axis or full control inputs in more than one axis at the same time. (A-04-60)

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Adopt and disseminate written guidance for use in developing and accepting upset recovery programs; such guidance could take the form of an advisory circular and should reflect the industry’s best practices and be

designed to avoid inaccurate or negative training. (A-04-61)

Along with developing the guidance recommended in Safety Recommendation A-04-61, evaluate issues concerning the level of automation appropriate to teaching upset training, and develop and disseminate guidance that will promote standardization and minimize the danger of inappropriate simulator training. (A-04-62)

To the Direction Général de l'Aviation Civile:
Review the options for modifying the Airbus A300-600 and the Airbus A310 to provide increased protection from potentially hazardous rudder pedal inputs at high airspeeds and, on the basis of this review, require modifications to the A300-600 and A310 to provide increased protection from potentially hazardous rudder pedal inputs at high airspeeds. (A-04-63)

4.2 Previously Issued Recommendations Resulting From This Accident Investigation

As a result of the investigation of this accident, the Safety Board issued the following recommendations to the Federal Aviation Administration:

Require the manufacturers and operators of transport-category airplanes to establish and implement pilot training programs that: (1) explain the structural certification requirements for the rudder and vertical stabilizer on transport-category airplanes; (2) explain that a full or nearly full rudder deflection in one direction followed by a full or nearly full rudder deflection in the opposite direction, or certain combinations of sideslip angle and opposite rudder deflection can result in potentially dangerous loads on the vertical stabilizer, even at speeds below the design maneuvering speed; and (3) explain that, on some aircraft, as speed increases, the maximum available rudder deflection can be obtained with comparatively light pedal forces and small pedal deflections. The FAA should also require revisions to airplane and pilot operating manuals that reflect and reinforce this information. In addition, the FAA should ensure that this training does not compromise the substance or effectiveness of existing training regarding proper rudder use, such as during engine failure shortly after takeoff or during strong or gusty crosswind takeoffs or landings. (A-02-01)

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Carefully review all existing and proposed guidance and training provided to pilots of transport-category airplanes concerning special maneuvers intended to address unusual or emergency situations and, if necessary, require modifications to ensure that flight crews are not trained to use the rudder in a way that could result in dangerous combinations of sideslip

angle and rudder position or other flight parameters. (A-02-02)

Require all manufacturers of transport-category airplanes to review and, if necessary, revise their maintenance manual inspection criteria for severe turbulence and extreme in-flight maneuvers to ensure that loads resulting from positive and negative vertical accelerations, as well as lateral accelerations, are adequately addressed. (A-03-41)

Require all manufacturers of transport-category airplanes to establish and validate maximum threshold values for positive and negative vertical and lateral G accelerations beyond which direct manufacturer oversight and intervention is required as a condition for returning the airplane to service. (A-03-42)

Require all operators of airplanes that have experienced accelerations exceeding the threshold values established as a result of Safety Recommendation A-03-42 (or that the operator has reason to believe might have exceeded those thresholds), as determined from FDR and other available data, to notify the FAA immediately of such high loading events and provide all related loads assessment and inspection results. (A-03-43)

Require manufacturers of transport-category airplanes to immediately notify the appropriate certification authority of any event involving accelerations exceeding the threshold values (or that the manufacturer has reason to believe might have exceeded those thresholds) necessitating the intervention of the manufacturer, and provide all related loads assessment and inspection results. (A-03-44)

Require that within 2 years, all Airbus A300-600/A310 and Boeing 747-400 airplanes and any other aircraft that may be identified as recording filtered data be retrofitted with a flight data recorder system capable of recording values that meet the accuracy requirements through the full dynamic range of each parameter at a frequency sufficient to determine a complete, accurate, and unambiguous time history of parameter activity, with emphasis on capturing each parameter's dynamic motion at the maximum rate possible, including reversals of direction at the maximum rate possible. (A-03-50)

For additional information about Safety Recommendations A-02-01 and -02, see section 1.18.4.1 of this report. For additional information about Safety Recommendations A-03-41 through -44, see section 1.18.4.2 of this report. For additional information about Safety Recommendation A-03-50, see section 1.18.7.3 of this report

4.3 Previously Issued Recommendations Classified in This Report

Safety Recommendation A-96-120 (previously classified "Open—Acceptable

Response") is classified "Open—Unacceptable Response" in section 2.6 of this report. For more information about this recommendation, see sections 1.18.6.1 and 2.6 of this report.