[4910-13-P]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 39

[Docket No. 93-NM-79-AD; Amendment 39-8789; AD 94-01-07]

Airworthiness Directives; Boeing Model 737 Series Airplanes

AGENCY: Federal Aviation Administration, DOT.

ACTION: Final rule.

SUMMARY: This amendment adopts a new airworthiness directive (AD), applicable to certain Boeing Model 737 series airplanes, that requires repetitive tests of the main rudder power control unit (PCU) to detect excessive internal leakage of hydraulic fluid, stalling, or reversal, and the eventual replacement of the main rudder PCU with an improved model. This amendment is prompted by results of an investigation which revealed that the secondary slide in the servo valve of certain PCU's can go past the intended maximum-travel position. The actions specified by this AD are intended to prevent secondary slide overtravel from occurring, which could cause the rudder actuator piston and the rudder to operate with reduced force capability or to move in a direction opposite to the intended direction; this could result in reduced controllability of the airplane.

DATES: Effective [insert date 30 days after date of publication in the Federal Register].

The incorporation by reference of certain publications listed in the regulations is approved by the Director of the Federal Register as of [insert date 30 days after date of publication in the Federal Register].

ADDRESSES: The service information referenced in this AD may be obtained from Boeing Commercial Airplane Group, P.O. Box 3707, Seattle, Washington 98124-2207. This information may be examined at the Federal Aviation Administration (FAA), Transport Airplane Directorate, Rules Docket, 1601 Lind Avenue, SW., Renton,

Washington; or at the Office of the Federal Register, 800 North Capitol Street, NW., suite 700, Washington, DC.

FOR FURTHER INFORMATION CONTACT: Kenneth W. Frey, Aerospace Engineer, Seattle Aircraft Certification Office, Systems & Equipment Branch, ANM-130S, FAA, Transport Airplane Directorate, 1601 Lind Avenue, SW., Renton, Washington 98055-4056; telephone (206) 227-2673; fax (206) 227-1181.

SUPPLEMENTARY INFORMATION: A proposal to amend part 39 of the Federal Aviation Regulations to include an airworthiness directive (AD) that is applicable to certain Boeing Model 737 series airplanes was published in the Federal Register on August 16, 1993 (58 FR 43301). That action proposed to require periodic tests of the main rudder PCU to detect excessive internal leakage of hydraulic fluid, stalling, or reversal, and the correction of discrepancies. That action also proposed to require the eventual replacement of the main rudder PCU with an improved model; such replacement would constitute terminating action for the periodic tests.

Interested persons have been afforded an opportunity to participate in the making of this amendment. Due consideration has been given to the comments received.

Several commenters request that the proposed rule be revised to require a one-time internal leakage test of the PCU, instead of the proposed repetitive tests every 750 flight hours. These commenters consider that the existing pre-flight controls check is adequate to detect rudder control anomalies that would be due to dual servo valve secondary slide overtravel; since this check is performed prior to each flight, it will verify the function of the rudder control system on a regular basis. These commenters believe that the proposed repetitive test is not appropriate or reliable, since it is sensitive to variables such as temperature and the inspecting technician’s individual technique and judgment. In addition, some of these commenters believe that the secondary slide

overtravel problems are attributable to either adverse tolerance build-up or improper assembly of the PCU during manufacture, and are not due to wear or deterioration of the valve over time; therefore, these commenters consider that repetitive tests are unnecessary. One commenter states that the proposed test has not proved to be reliable in identifying rudder PCU anomalies, and that this test could cause a rise in the number of removals of PCU's that would typically be serviceable; this would have a severe economic impact on affected operators.

The FAA does not concur with the commenters' request. First, the FAA notes that rapid rudder inputs are a factor in uncovering rudder control anomalies. During a pre-flight check, the flight crew may not cycle the rudder PCU at a rate fast enough to uncover secondary slide overtravel. For this reason, the FAA does not agree that all rudder control anomalies due to secondary slide overtravel can be detected during pre-flight checks.

Second, although the FAA agrees that the required repetitive test is not completely repeatable and could be subject to the judgment of the technician, the FAA recognizes it as a written procedure for maintenance crews to follow, which emphasizes cycling of the rudder pedals at a maximum rate. While this test cannot ensure that the secondary slide overtravel anomaly does not exist, it can detect certain conditions that contribute to secondary slide overtravel. For example, the overtravel anomaly, combined with either (1) a secondary summing arm missing its stop or (2) a primary slide jamming to the secondary slide, would be detected during the repetitive test. During bench testing on one PCU, the secondary summing arm was observed hitting its stop on some occasions and missing it on others; this intermittent condition, if combined with the secondary overtravel anomaly and rapid rudder inputs, could cause rudder control problems. For these reasons, the FAA has determined that the required repetitive tests

will contribute to flight safety because they exercise the rudder pedals at a rapid rate and they can detect high internal leakage within the servo valve.

Several commenters request that the compliance time for replacing the main rudder PCU be extended from the proposed 5 years to at least 7 years. These commenters state that such an extension is necessary to avoid the economic burden to operators that would be caused by a campaign of scheduled removals. A 7-year compliance time would correspond to a typical overhaul period for the main rudder PCU, and would avoid unscheduled removal of PCU's that exhibit no operational anomalies. Some commenters note that the design feature that allows secondary slide overtravel has existed for over 25 years and, over that time period, has accumulated 55 million flight hours in the affected fleet with no known in-flight control problems. These commenters state that it would be extremely rare for the problem condition to exist in combination with other factors so as to result in a reduction of rudder control capability. For these reasons, these commenters consider that extending the compliance time for completion of the replacement would not appreciably affect the safety of the fleet.

The FAA does not concur with the commenters' request to extend the compliance time for replacement of the PCU. Although the FAA acknowledges that no known in-flight control problems have been documented on Model 737 airplanes with regard to the subject condition, the FAA does recognize that two PCU's have been removed from Model 737 series airplanes after the pilot identified rudder control problems during the pre-flight check. In developing an appropriate compliance time for this action, the FAA considered the safety implications of incidents such as these, the availability of required parts, and the normal maintenance schedules for timely accomplishment of the replacement. Further, only the original equipment manufacturer possesses approved data allowing it to accomplish the rework of the affected PCU's; therefore, the compliance time also was based on the capability of this manufacturer to schedule and modify all of

the affected servo valves. In light of these items, the FAA has determined that 5 years for compliance is appropriate. The FAA considers that a 5-year compliance time allows ample time for all affected PCU's to be modified by the manufacturer, without creating a burden on either the operators or the manufacturer. Five years also allows ample time for the replacement to be accomplished coincidentally with scheduled major airplane inspection and maintenance activities, thereby minimizing the costs associated with special airplane scheduling. However, paragraph (c) of the final rule does provide affected operators the opportunity to apply for an adjustment of the compliance time if data is presented to justify such an adjustment.

One commenter strongly supports the proposed rule, but considers that the 5-year compliance time for replacement of the PCU's is too long. This commenter requests that replacement of all affected PCU's should begin immediately as replacement parts become available, instead of allowing operators to operate airplanes equipped with potentially defective PCU's for up to 5 years. This commenter notes that the addressed anomaly was first discovered in July 1992 and, by the time the proposed rule becomes effective and the end of the 5-year compliance period is reached, approximately 7 years will have elapsed since then. This amount of time is too long, considering the significance of the addressed unsafe condition.

The FAA does not concur with the commenter's request to shorten the compliance time for replacement of the PCU's. For the same reasons explained previously, the FAA has determined that a 5-year compliance time is appropriate. The repetitive tests of the PCU required by this AD will provide an acceptable level of safety in the interim. Additionally, the commenter should not assume that all operators will wait until the end of the compliance time before replacement the PCU's. In fact, the FAA has been advised that the PCU manufacturer has already begun rework activity and some airlines have already begun replacement procedures.

One commenter requests that paragraph (a)(2) of the proposed rule be revised to provide operators with the option of installing a serviceable, non-modified PCU, rather than only a modified PCU, if a discrepancy is detected during any test. Operators should be allowed to use this non-modified PCU, provided that it is repetitively tested until replacement of all PCU's is required in 5 years. Such a revision to the rule would prevent unnecessary grounding of an airplane if a discrepancy is detected and a modified PCU is not available. The FAA concurs and has revised the final rule accordingly.

Another commenter requests that the proposed rule be revised to address third-party repaired parts. This commenter states that at least one repair facility is producing FAA-approved replacement slide and sleeve assemblies to overhaul the Parker-Hannifin main rudder PCU dual servo valves. The commenter believes that it is the FAA's responsibility to ensure that third-party replacement parts are reworked in a controlled manner to the same level of safety as that provided by the retrofit plan developed by the original equipment manufacturer (OEM), since the replacement parts were approved solely by the FAA without support from the OEM.

The FAA does not concur that such a revision to the rule is necessary. Paragraph (c) of the final rule contains a provision that allows third-party replacement part manufacturers to submit proposed design changes to the FAA for approval as alternative methods of compliance with the AD.

One commenter suggests that the discussion of the requirements of the proposed rule be revised to clarify that the test of the main rudder PCU is necessary not only to detect excessive internal leakage of hydraulic fluid, but to detect and correct possible stalling and reversal as well. The FAA concurs. Although the test is accomplished to detect excessive internal leakage, the AD requires that any discrepancy, such as stalling and reversal, that is detected during the test must be corrected prior to further flight. The AD references Boeing Service Letter 737-SL-27-82-B for a description of the possible

discrepancies that could be found during the required test. The wording to the preamble of this final rule has been revised to include reference to the possible discrepancies of stalling and reversal; however, the wording of the AD itself needs no revision.

This same commenter suggests that the description of the unsafe condition on which this AD action is based could be worded more accurately. This commenter states that the actions specified by the AD are intended to prevent secondary slide overtravel from occurring, which could cause the rudder actuator piston and the rudder to "operate with reduced force capability or to move in a direction opposite to the intended direction." The FAA concurs with the commenter's suggestion and has revised the appropriate wording accordingly.

Two commenters suggest that the cost impact information in the preamble to the notice was not totally accurate in showing the complete costs to operators, especially those costs related to the required repetitive tests. One commenter states that each test would require approximately 8 work hours to accomplish, and that, based on the 750-flight hour repetitive test interval, most airplanes would be required to be tested between 6 and 10 times over the next 5 years (until replacement of the PCU is completed). Another commenter states that the total time required for removing and installing the PCU is 20 work hours. The FAA concurs that the economic information should be clarified. The cost impact figures, as stated in the preamble to the notice, were based on the latest data that the FAA had at that time. The cost impact information, below, has been revised to delineate the costs of the required actions, based on this latest information provided by the commenters.

Paragraphs (a)(1) and (a)(2) of the final rule have been revised to correctly reference paragraph "3.B." of Boeing Service Letter 737-SL-27-82-B for the description of possible discrepancies that could be found during the required test. The notice had incorrectly referenced paragraph "B." rather than "3.B."

After careful review of the available data, including the comments noted above, the FAA has determined that air safety and the public interest require the adoption of the rule with the changes previously described. The FAA has determined that these changes will neither significantly increase the economic burden on any operator nor increase the scope of the AD.

There are approximately 2,448 Model 737 series airplanes of the affected design in the worldwide fleet. The FAA estimates that 729 airplanes of U.S. registry will be affected by this AD.

It will take approximately 8 work hours per airplane to accomplish the required test actions, at an average labor rate of $55 per work hour. Based on these figures, the total cost impact of the tests required by this AD on U.S. operators is estimated to be $320,760, or $440 per airplane, per test.

According to information provided by commenters to the notice that preceded this rule, some airplanes may require to be tested between 6 and 10 times prior to the required replacement of the PCU (within 5 years). In the case of those airplanes requiring 6 tests, the total cost impact of the required repetitive tests would be $2,640 per airplane over 5 years; in the case of those airplanes requiring 10 tests, the total cost impact of the required repetitive tests would be $4,400 per airplane over 5 years.

The number of required work hours, as indicated above, is presented as if the tests required by this AD were to be conducted as “stand alone” actions. However, in actual practice, these tests could be accomplished coincidentally or in combination with normally scheduled airplane inspections and other maintenance program tasks. Therefore, the actual number of necessary “additional” work hours would be minimal in many instances. Additionally, any costs associated with special airplane scheduling should be minimal.

It will take approximately 20 work hours per airplane to accomplish the required replacement of the PCU (removal and installation), at an average labor rate of $55 per work hour. Required parts will be supplied by the manufacturer at no cost to operators. Based on these figures, the total cost impact of the replacement required by this AD is estimated to be $801,900, or $1,100 per airplane.

The 5-year compliance time for the replacement of the PCU, as specified in paragraph (b) of this AD, will allow ample time for the replacement to be accomplished coincidentally with scheduled major airplane inspection and maintenance activities, thereby minimizing the costs associated with special airplane scheduling.

The total cost impact figures described above are based on assumptions that no operator has yet accomplished any of the requirements of this AD action, and that no operator would accomplish those actions in the future if this AD were not adopted. However, the FAA has been advised that several operators already have accomplished at least the initial required test of the PCU's on their affected fleets, and certain operators already have replaced some PCU's. Therefore, the future economic cost impact of this rule on U.S. operators is less than that indicated above.

The regulations adopted herein will not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. Therefore, in accordance with Executive Order 12612, it is determined that this final rule does not have sufficient federalism implications to warrant the preparation of a Federalism Assessment.

For the reasons discussed above, I certify that this action (1) is not a "significant regulatory action" under Executive Order 12866; (2) is not a "significant rule" under DOT Regulatory Policies and Procedures (44 FR 11034, February 26, 1979); and (3) will not have a significant economic impact, positive or negative, on a substantial number of

small entities under the criteria of the Regulatory Flexibility Act. A final evaluation has been prepared for this action and it is contained in the Rules Docket. A copy of it may be obtained from the Rules Docket at the location provided under the caption "ADDRESSES."

List of Subjects in 14 CFR Part 39

Air transportation, Aircraft, Aviation safety, Incorporation by reference, Safety.

Adoption of the Amendment

Accordingly, pursuant to the authority delegated to me by the Administrator, the Federal Aviation Administration amends 14 CFR part 39 of the Federal Aviation Regulations as follows:

PART 39 - AIRWORTHINESS DIRECTIVES

1. The authority citation for part 39 continues to read as follows:

Authority: 49 U.S.C. App. 1354(a), 1421 and 1423; 49 U.S.C. 106(g); and 14 CFR 11.89.

§ 39.13 - [Amended]

2. Section 39.13 is amended by adding the following new airworthiness directive:

94-01-07 BOEING: Amendment 39-8789. Docket 93-NM-79-AD.

Applicability: Model 737 series airplanes; line positions 1 through 2453, inclusive; certificated in any category.

Compliance: Required as indicated, unless accomplished previously.

To prevent the rudder actuator piston and the rudder to operate with reduced force capability or to move in a direction opposite to the intended direction, which could result in reduced controllability of the airplane, accomplish the following:

(a) Within 750 flight hours after the effective date of this AD, perform a test of the main rudder power control unit (PCU), part number 65-44861-2/-3/-4/-5/-6/-7/-8/-9,

to detect internal leakage of hydraulic fluid, in accordance with Boeing Service Letter 737-SL-27-82-B, dated July 13, 1993.

(1) If no discrepancy, as described in paragraph 3.B. of the Service Letter, is detected, repeat the test at intervals not to exceed 750 flight hours.

(2) If any discrepancy, as described in paragraph 3.B. of the Service Letter, is detected during any check, prior to further flight, accomplish either paragraph (a)(2)(i) or (a)(2)(ii) of this AD:

(i) Replace the main rudder PCU with a serviceable PCU in accordance with the Model 737 Overhaul Manual. After such replacement, repeat the test at intervals not to exceed 750 flight hours.

(ii) Replace the main rudder PCU with a new main rudder PCU having part number 65-44861-11 or 65C37052-2/-3/-4/-5/-6/-7/-8/-9, in accordance with Boeing Service Bulletin 737-27-1185, dated April 15, 1993. Such replacement constitutes terminating action for the tests required by this AD.

(b) Within 5 years after the effective date of this AD, replace the main rudder PCU, part number 65-44861-(), with a new main rudder PCU having part number 65-44861-11 or 65C37052-2/-3/-4/-5/-6/-7/-8/-9, in accordance with Boeing Service Bulletin 737-27-1185, dated April 15, 1993. Such replacement constitutes terminating action for the tests required by this AD.

(c) An alternative method of compliance or adjustment of the compliance time that provides an acceptable level of safety may be used if approved by the Manager, Seattle Aircraft Certification Office (ACO), FAA, Transport Airplane Directorate. Operators shall submit their requests through an appropriate FAA Principal Maintenance Inspector, who may add comments and then send it to the Manager, Seattle ACO.

NOTE: Information concerning the existence of approved alternative methods of compliance with this AD, if any, may be obtained from the Seattle ACO.

(d) Special flight permits may be issued in accordance with FAR 21.197 and 21.199 to operate the airplane to a location where the requirements of this AD can be accomplished, provided that the airplane has not failed the internal leakage test required by this AD.

(e) The tests shall be done in accordance with Boeing Service Letter 737-SL-27-82-B, dated July 13, 1993. The replacement shall be done in accordance with Boeing Service Bulletin 737-27-1185, dated April 15, 1993. This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR Part 51. Copies may be obtained from Boeing Commercial Airplane Group, P.O. Box 3707, Seattle, Washington 98124-2207. Copies may be inspected at the FAA, Transport Airplane Directorate, 1601 Lind Avenue, SW., Renton, Washington; or at the Office of the Federal Register, 800 North Capitol Street, NW., suite 700, Washington, DC.

(f) This amendment becomes effective on [insert date 30 days after date of publication in the Federal Register].

Issued in Renton, Washington, on January 3, 1994.

Original Signed By:
Darrell M. Pederson, Acting Manager,
Transport Airplane Directorate,
Aircraft Certification Service.

AOA-1 ALERT NECESSARY?_____
ANM-100 (initial, if yes)_____

ANM-100 EXECUTIVE SUMMARY

DATE:

SUBJECT: Boeing Model 737 series airplanes; Final Rule after NPRM; Docket 93-NM-79-AD

PROJECT ENGINEER/TECH WRITER: Ken Frey, ANM-130S, x2673; Jill DeMarco, ANM-103, x2125

BACKGROUND: Boeing has advised that there have been 2 reports of rudder control anomalies on Model 737 airplanes, which were discovered during preflight controls checks. In both cases, the flight crew reported that the rudder pedals operated normally in one direction, but that pedal travel was reduced in the opposite direction while being cycled in accordance with controls checks procedures. Investigation revealed that the secondary slide in the dual servo valve on the rudder power control unit (PCU) can go past the intended maximum-travel position.

Boeing has issued appropriate service information for inspecting for the anomaly and replacing discrepant parts.

UNSAFE CONDITION: If the secondary slide in the dual servo valve on the rudder PCU overtravels, it could cause the rudder actuator piston and the rudder to operate with reduced force capability or to move in a direction opposite to the intended direction; this could result in reduced controllability of the airplane.

ACTION: On August 9, 1993, the FAA issued an NPRM proposing to require periodic tests of the main rudder PCU to detect excessive internal leakage of hydraulic fluid, and correction of discrepancies. It also proposed to require the eventual replacement of the main rudder PCU with an improved model, as terminating action for the periodic tests. Comments received included:

- Requests to extend the compliance time for replacing the PCU from 5 years to 7 years to correspond with the typical overhaul period. The FAA non-concurs. The proposed 5 years will allow ample time for replacement during regular maintenance schedules.

- A request from ALPA to shorten the compliance time for replacement of the PCU based on safety factors. The FAA non-concurs. The 5-year compliance time is based on parts availability, capability of the PCU manufacturer to modify the servo valves, and maintenance schedules. The required repetitive tests will assure safety in the interim. Additionally, many operators have already begun replacement in their fleets.

COST IMPACT: Worldwide fleet: 2,448; U.S. registered airplanes: 729

Tests:

729 airplanes x (6 work hours @ $55/hour) = $240,570
($330 per airplane per test)

PCU Replacement:

729 airplanes x [(20 work hours @ $55/hour) + (Parts free)] = $801,900
($1,100 per airplane)

AFFECTED U.S. OPERATORS: Alaska, Aloha, America West, Delta, Markair, NASA, Southwest, United, USAF, USAir,

COORDINATED WITH: Boeing, ATA

QC PROBLEM INVOLVED?: No.

CONTROVERSIAL ISSUES / MEDIA INTEREST: Related to NTSB Safety Recommendations A-92-118 and A-92-120.

AD ECONOMIC EVALUATION

Docket No. 93-NM-79-AD Airplane Model: Boeing 737

Number of airplanes (U.S. Operators): 729

The Airworthiness Directive (AD) requires repetitive testing of the main rudder power control unit (PCU)eventual replacement of all PCU's with an improved model.

Costs:

Parts per aircraft	$ Free
Labor per aircraft	
Tests: 6 work hours @ $55/hour =	$ 330
Replacement: 20 work hours @ $55/hour =	$ 1,100
Other (explain)	$
Total cost per aircraft	$ 2,430
Total fleet cost	$1,771,470

Executive Order 12866:

Could the AD be considered a "significant regulatory action?"
YES ( ) explain NO (X)

DOT Regulatory Policies and Procedures:

Is the AD significant?
YES ( ) explain NO (X)

Regulatory Flexibility Act:

Will the AD have a significant economic impact on a substantial number of small entities?
YES ( ) explain NO (X)

Project Engineer/Office Routing Symbol: Ken Frey, ANM-130S

AIR-1 _____

Date _____

ADMINISTRATOR'S AIRWORTHINESS DIRECTIVE ALERT

SUBJECT: Boeing Model 737 series airplanes; Final Rule after NPRM; Docket 93-NM-79-AD

BACKGROUND: Boeing has advised that there have been two reports of rudder control anomalies on Model 737 airplanes, which were discovered during preflight controls checks. In both cases, the flight crew reported that the rudder pedals operated normally in one direction, but that pedal travel was reduced in the opposite direction while being cycled in accordance with controls checks procedures. Investigation revealed that the secondary slide in the dual servo valve on the rudder power control unit (PCU) can go past the intended maximum-travel position.

Boeing has issued appropriate service information for inspecting for the anomaly and replacing discrepant parts.

UNSAFE CONDITION: If the secondary slide in the dual servo valve on the rudder PCU over-travels, it could cause the rudder actuator piston and the rudder to operate with reduced force capability or to move in a direction opposite to the intended direction. This could result in reduced controllability of the airplane.

ACTION: On August 9, 1993, the FAA issued an NPRM proposing to require periodic tests of the main rudder PCU to detect excessive internal leakage of hydraulic fluid, and correction of discrepancies. It also proposed to require the eventual replacement of the main rudder PCU with an improved model, as terminating action for the periodic tests. Comments addressed included:

- Requests to extend the compliance time for replacing the PCU from 5 years to 7 years to correspond with the typical overhaul period. The FAA does not concur, since 5 years will allow ample time for replacement during regular maintenance schedules without disruption of service.

- A request to shorten the compliance time for replacement of the PCU based on safety factors. The FAA does not concur, since the 5-year compliance time is based on parts availability, capability of the PCU manufacturer to modify the servo valves, and maintenance schedules. The required repetitive tests will assure safety in the interim. Additionally, many operators have already begun replacement in their fleets.

IMPACT: Worldwide fleet: 2,448; U.S. registered airplanes: 729

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($330 per airplane per test)

PCU Replacement:

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($1,100 per airplane)

AFFECTED U.S. AIRLINES: Alaska, Aloha, America West, Delta, Markair, NASA, Southwest, United, USAF, USAir,

NEWS VALUE/MEDIA INTEREST:

THIS AD WILL BE PUBLISHED IN THE FEDERAL REGISTER SUBSEQUENT TO INCORPORATION BY REFERENCE APPROVAL PROCEDURES.

cc: S-1, A-1, ADA-1, AOA-2, AXO-1, AVR-1, APA-1 (2), AGC-1, AGC-210, AFS-300, ANM-1