DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 91, 121, and 125

[Docket No.: FAA–1999–6482; Notice No. 06–12]

RIN 2120–AG87

Revisions to Digital Flight Data Recorder Regulations for Boeing 737 Airplanes and for Part 125 Operators

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Supplemental Notice of Proposed Rulemaking (SNPRM).

SUMMARY: The FAA is revising a previous proposal to increase the number of digital flight data recorder (DFDR) parameters required for all Boeing 737 series airplanes. Based on safety recommendations from the National Transportation Safety Board (NTSB) following the investigations of two accidents and other incidents involving 737s, the FAA proposed the addition of flight recorder equipment to monitor the rudder system on 737s. Since that time, the FAA has mandated significant changes to the rudder system on these airplanes. Accordingly, this new proposed rule would apply to a different set of airplanes than originally anticipated. We are requesting comment on this change in applicability and are requesting updated economic information regarding installation of the proposed monitoring equipment. The original proposed rule also sought to amend the flight data recorder (FDR) requirements of part 125 that would affect all airplanes operated under that part or under deviation from that part; we have included that same proposal in this SNPRM.

DATES: Send your comments on or before December 4, 2006.

ADDRESSES: You may send comments identified by Docket Number FAA–1999–6482 using any of the following methods:

• *DOT Docket Web site:* Go to *http://dms.dot.gov* and follow the instructions for sending your comments electronically.

• *Government-wide rulemaking Web site:* Go to *http://www.regulations.gov* and follow the instructions for sending your comments electronically.

• *Mail:* Docket Management Facility; U.S. Department of Transportation, 400 Seventh Street, SW., Nassif Building, Room PL–401, Washington, DC 20590–0001.

• *Fax:* 1–202–493–2251.

• *Hand Delivery:* Room PL–401 on the plaza level of the Nassif Building, 400 Seventh Street, SW., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

For more information on the rulemaking process, see the **SUPPLEMENTARY INFORMATION** section of this document.

Privacy: We will post all comments we receive, without change, to *http://dms.dot.gov*, including any personal information you provide. For more information, see the Privacy Act discussion in the **SUPPLEMENTARY INFORMATION** section of this document.

Docket: To read background documents or comments received, go to *http://dms.dot.gov* at any time or to Room PL–401 on the plaza level of the Nassif Building, 400 Seventh Street, SW., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: For technical issues: Timothy W. Shaver, Avionics Systems Branch, Aircraft Certification Service, AIR–130, Federal Aviation Administration, 800 Independence Avenue, SW., Washington, DC 20591; telephone (202) 385–4686; facsimile (202) 385–4651; e-mail *tim.shaver@faa.gov.* For legal issues: Karen L. Petronis, Senior Attorney, Regulations Division, AGC–200, Office of the Chief Counsel, Federal Aviation Administration, 800 Independence Ave., SW., Washington, DC 20591; telephone (202) 267–3073; facsimile (202) 267–7971; e-mail: *karen.petronis@faa.gov.*

SUPPLEMENTARY INFORMATION:

Comments Invited

The FAA invites interested persons to participate in this rulemaking by submitting written comments, data, or views. We also invite comments relating to the economic, environmental, energy, or federalism impacts that might result from adopting the proposals in this document. The most helpful comments reference a specific portion of the proposal, explain the reason for any recommended change, and include supporting data. We ask that you send us two copies of written comments.

We will file in the docket all comments we receive, as well as a report summarizing each substantive public contact with FAA personnel concerning this proposed rulemaking. The docket is available for public inspection before and after the comment closing date. If you wish to review the docket in person, go to the address in the **ADDRESSES** section of this preamble between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays. You may also review the docket using the Internet at the Web address in the **ADDRESSES** section.

Privacy Act: Using the search function of our docket Web site, anyone can find and read the comments received into any of our dockets, including the name of the individual sending the comment (or signing the comment on behalf of an association, business, labor union, etc.). You may review DOT's complete Privacy Act Statement in the **Federal Register** published on April 11, 2000 (65 FR 19477–78) or you may visit *http://dms.dot.gov.*

Before acting on this proposal, we will consider all comments we receive on or before the closing date for comments. We will consider comments filed late if it is possible to do so without incurring expense or delay. We may change this proposal in light of the comments we receive.

If you want the FAA to acknowledge receipt of your comments on this proposal, include with your comments a pre-addressed, stamped postcard on which the docket number appears. We will stamp the date on the postcard and mail it to you.

Proprietary or Confidential Business Information

Do not file in the docket information that you consider to be proprietary or confidential business information. Send or deliver this information directly to the person identified in the **FOR FURTHER INFORMATION CONTACT** section of this document. You must mark the information that you consider proprietary or confidential. If you send the information on a disk or CD–ROM, mark the outside of the disk or CD–ROM and also identify electronically within the disk or CD–ROM the specific information that is proprietary or confidential.

Under 14 CFR 11.35(b), when we are aware of proprietary information filed with a comment, we do not place it in the docket. We hold it in a separate file to which the public does not have access, and place a note in the docket that we have received it. If we receive a request to examine or copy this information, we treat it as any other request under the Freedom of Information Act (5 U.S.C. 552). We process such a request under the DOT procedures found in 49 CFR part 7.

Availability of Rulemaking Documents

You can get an electronic copy using the Internet by:

(1) Searching the Department of Transportation's electronic Docket Management System (DMS) Web page (*http://dms.dot.gov/search*);

(2) Visiting the FAA's Regulations and Polices Web page at *http://www.faa.gov/regulations_policies/;* or

(3) Accessing the Government Printing Office's Web page at *http://www.gpoaccess.gov/fr/index.html.*

You can also get a copy by sending a request to the Federal Aviation Administration, Office of Rulemaking, ARM–1, 800 Independence Avenue, SW., Washington, DC 20591, or by calling (202) 267–9680. Make sure to identify the docket number, notice number or amendment number of this rulemaking.

Anyone is able to search the electronic form of all comments received into any of our dockets by the name of the individual submitting the comment (or signing the comment, if submitted on behalf of an association, business, labor union, etc.). You may review DOT's complete Privacy Act statement in the **Federal Register** published on April 11, 2000 (Volume 65, Number 70; Pages 19477–78) or you may visit *http://dms.dot.gov.*

Small Business Regulatory Enforcement Fairness Act

The Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996 requires FAA to comply with small entity requests for information or advice about compliance with statutes and regulations within its jurisdiction. If you are a small entity and you have a question regarding this document, you may contact your local FAA official, or the person listed under **FOR FURTHER INFORMATION CONTACT**. You can find out more about SBREFA on the Internet at *http://www.faa.gov/avr/arm/sbrefa.htm,* or by e-mailing us at *-AWA-SBREFA@faa.gov. http://www.faa.gov/regulations_policies/rulemaking/sbre_act/.*

Authority for This Rulemaking

The FAA's authority to issue rules regarding aviation safety is found in Title 49 of the United States Code. Subtitle I, Section 106 describes the authority of the FAA Administrator. Subtitle VII, Aviation Programs, describes in more detail the scope of the agency's authority.

This rulemaking is promulgated under the authority described in Subtitle VII, Part A, Subpart III, Section 44701. Under that section, the FAA is charged with prescribing regulations providing minimum standards for other practices, methods and procedures necessary for safety in air commerce. This regulation is within the scope of that authority since flight data recorders are the only means available to account for aircraft movement and flight crew actions critical to finding the probable cause of incidents or accidents, including data that could prevent future incidents or accidents.

I. Background

A. Statement of the Problem

Two aviation accidents in the United States involving Boeing 737 series airplanes (737s) appear to have been caused by a rudder hardover with resultant roll and sudden descent: United Airlines flight 585, near Colorado Springs, Colorado, on March 3, 1991, and USAir flight 427, near Aliquippa, Pennsylvania, on September 8, 1994. Following lengthy investigations, the NTSB determined that the rudder on 737s may experience sudden uncommanded movement, or movement opposite the pilot's input, which may cause the airplane to roll suddenly. Other incidents of suspected uncommanded rudder movement have been reported, including a 1996 incident involving Eastwind Airlines (Eastwind) flight 517, a 737–2H5, and five incidents in 1999 involving U.S.-registered airplanes.

The 737s involved in the United Airlines and USAir accidents, and those in the more recent incidents, were equipped with the flight data recorders required by the regulations then in effect. However, these airplanes were not required to record, nor were they equipped to provide, information about the airplane's movement about its three axes or the position of flight control surfaces immediately preceding the accident or incident. While the FAA has undertaken a series of measures designed to address the suspected rudder problems, our efforts have been limited by a lack of data that focused on the control and movement of the components of the 737 rudder system. Without more data, neither the FAA nor the NTSB can definitively identify the causes of suspected uncommanded rudder events.

B. FAA Actions

Following piloted computer simulations of the USAir accident and reports of malfunctions in the yaw damper system of 737s, the FAA mandated design changes to the rudder system of 737s. First, the FAA issued Airworthiness Directive (AD) 97–14–03 (62 FR 34623, June 27, 1997), which requires installation of a newly designed rudder-limiting device and a newly designed yaw damper system, in an effort to address possible rudder hardover situations and uncommanded yaw damper movements. Second, in response to the possibility of a secondary slide jam and rudder reversal, the FAA issued AD 97–14–04 (62 FR 35068, June 30, 1997). That AD requires operators to install a new vernier control rod bolt and a new main rudder power control unit (PCU) servo valve in each airplane.

C. Safety Recommendations: 1995–1997

Between 1995 and 1997, while investigating the USAir accident, the NTSB issued 20 safety recommendations dealing with the 737; three of those (A–95–25, A–95–26, and A–95–27) dealt specifically with upgrades to the FDR for all 737s. The NTSB stated that if either the United Airlines or the USAir 737 had recorded data on the flight control surface positions, flight control inputs, and lateral acceleration, the NTSB would have been able to identify quickly any abnormal control surface movements and configuration changes or autopilot status changes that may have been involved in the loss of control.

At the time it made its recommendations, the NTSB recognized that the 737 had flown over 92 million hours since its initial certification in December 1967, and that the airplane's accident rate is comparable to that of other airplanes of a similar type. Nonetheless, the Board concluded that the design changes made to the rudder system in accordance with the issued ADs did not eliminate the possibility of other potential failure modes and malfunctions.

D. FAA Response: 1997 Regulations

In response to these safety recommendations, the FAA published revisions to the DFDR requirements for all airplanes (Revisions to Digital Flight Data Recorder Rules; Final Rule (62 FR 38362, July 17, 1997)). The revised DFDR regulations prescribe the 88 parameters that must be recorded on DFDRs, with the exact number of parameters required to be recorded determined by the date of airplane manufacture. The number of parameters that must be recorded range from 18 for a transport category airplane manufactured on or before October 11, 1991, to 88 for airplanes manufactured after August 19, 2002.

E. NTSB's 1999 Findings and Safety Recommendations

On March 24, 1999, the NTSB issued the final report of its investigation into the crash of USAir flight 427. The NTSB determined that the probable cause of the accident was a loss of control resulting from the movement of the rudder surface position to its blowdown limit. Further, the NTSB stated that

''* * * the rudder surface most likely deflected in a direction opposite to that commanded by the pilots as a result of a jam of the main rudder PCU servo valve secondary slide to the servo valve housing offset from its neutral position and overtravel of the primary slide.''

In its March 1999 report, the NTSB concluded that the 1997 regulations for upgrading DFDRs are inadequate for existing 737s, because they do not require specific flight control information to be recorded. Because several 737 rudder-related events have been associated with the yaw damper system (which moves the rudder independent of flightcrew input), the NTSB concluded that it is important that yaw damper status (parameter 89), yaw damper command (parameter 90), standby rudder status (parameter 91), and control wheel, control column, and rudder pedal forces (parameter 88) be recorded on all 737s. The NTSB also pointed out that, for optimal documentation, the indicated parameters need to be sampled more frequently than is required currently. The NTSB stated that by recording the yaw damper's operation and the resultant rudder surface movements, a yaw damper event could be distinguished quickly from a flightcrew input or a rudder anomaly. The NTSB considers this information critical to investigating 737 incidents or accidents. The NTSB stated that if pilot flight control input forces had been recorded on the United Airlines, USAir, or Eastwind FDRs, the NTSB investigations would have been resolved more quickly and actions taken to prevent similar events would have been hastened.

On April 16, 1999, the NTSB submitted the following recommendations to the FAA regarding recording additional parameters on 737 DFDRs:

Recommendation No. A–99–28. Require that all 737s operated under part 121 or part 125 that currently have a FDAU be equipped, by July 31, 2000, with a flight data recorder system that records, at a minimum, the parameters required by the 1997 DFDR regulations applicable to that airplane, plus the following parameters: Pitch trim, trailing edge flaps, leading edge flaps, thrust reverser position (each engine), yaw damper command, yaw damper status, standby rudder status, and control wheel, control column, and rudder pedal forces. Yaw damper command, yaw damper status, and control wheel, control column, and rudder pedal forces should be sampled at a minimum rate of twice per second.

Recommendation No. A–99–29. Require that all 737s operated under part 121 or part 125 that are not equipped with a FDAU be equipped, at the earliest time practicable, but no later than August 1, 2001, with a flight data recorder system that records, at a minimum, the same parameters noted in safety recommendation No. A–99–28.

The NTSB also noted in its final report on the USAir accident that 737 flightcrews continue to report anomalous rudder behavior and that the NTSB considers it possible that another catastrophic event related to 737 rudder upset could occur.

F. FAA Response: Notice No. 99–19

The FAA agreed with the intent of NTSB Safety Recommendation Nos. A–99–28 and A–99–29 and the NTSB's concerns regarding continuing reports of rudder-related incidents on 737s. On November 9, 1999, the FAA issued Notice No. 99–19 (64 FR 63140, November 18, 1999), which proposed that all 737s be required to record the parameters listed in § 121.344(a)(1) through (a)(22), (a)(88), plus three new parameters, designated as (a)(89) through (a)(91). The new parameters are yaw damper status, yaw damper command, and standby rudder status. In addition, the FAA proposed increasing the required sampling rate for the control forces listed in current paragraph (a)(88) for 737s. The FAA proposed that all 737s equipped with a FDAU of any type as of July 16, 1996, or manufactured after July 16, 1996, comply by August 18, 2000. For all 737s not equipped with a FDAU of any type as of July 16, 1996, the FAA proposed a compliance date of August 20, 2001. The FAA noted that if it received sufficient data to support an extension, the compliance period for airplanes retrofitted to include FDAUs between July 16, 1996, and November 18, 1999, would be extended to August 19, 2002.

The FAA proposed corresponding changes to part 125 for 737s operated under that part. In addition, the FAA proposed that no deviation authority from the FDR requirements of part 125 would be granted for any model airplane, and that any previously issued deviation from the DFDR requirements of part 125 would no longer be valid. The FAA also proposed that § 91.609 be amended to reflect that all airplanes operating under part 91 under deviation authority from part 125 must comply with the DFDR requirements in part 125, notwithstanding such deviation authority.

II. Continuing Need for This Rulemaking

The original NPRM, issued by the FAA in 1999, proposed that in addition to other applicable requirements, all 737 model airplanes must record certain additional parameters of flight data, including those specifically designed to monitor rudder system components. The FAA added that it planned on issuing the final rule with an immediate effective date to address the unresolved issues with the airplane as soon as possible.

In January 2001, Boeing submitted a letter to the docket requesting that the FAA delay the release of any final rule. The request was based on Boeing's 737 Rudder System Enhancement Program (RSEP), which itself was based on an NTSB recommendation to develop a ''reliably redundant rudder system'' for the 737. Boeing stated that the RSEP changes will make the 737 rudder system functionally equivalent to the 3-actuator system found on its 757 and 767 model airplanes.

Boeing's letter states that on January 16, 2001, it presented a detailed description of its 737 RSEP changes to the NTSB. While noting that the proposed rule would be applicable to the original rudder system, not the one being developed under the RSEP, it attempted to minimize the value of a final rule that applied only to airplanes with the older system installed. Boeing also questioned whether it would still be appropriate to treat the 737 different than other airplanes once the rudder system was modified.

While the redesigned rudder control system meets the latest FAA system requirements, it remains a system unique to the 737 model airplane. In Boeing 757/767/777 model airplanes, the rudder control system has three separate actuators in separate power control units (PCU) that are always powered. The original design of the 737 rudder control system had a single input into a valve that controlled two installed actuators in the PCU. In the redesigned 737 system, there are three actuators, but they are housed in two PCUs rather than the three present in the other Boeing model airplanes. The main PCU has two actuators, each with its own valve that accepts input. The third actuator is in a standby PCU that is not normally powered unless the main PCU fails. Thus, the 737 rudder control system effectively still has only two actuators during normal flight operations, and a single actuator when the main PCU is inoperative.

Several events have occurred since the NPRM was issued in 1999, including Boeing's RSEP. One of the recommendations issued by the NTSB included the formation of an engineering test and evaluation board (ETEB) to conduct a failure analysis of the rudder actuation control system of the 737. The 737 ETEB was formed in May 1999 and issued its final report in July 2000.

Among the key findings of the 737 ETEB are the following:

(1) The 737 rudder control system is susceptible to a number of failures and jams. These failures and jams can affect the operation of the rudder power control units and can result in uncommanded rudder motion.

(2) A number of failures and jams of the 737 rudder control system were detected in configurations on which the FAA later issued corrective action under one or more Airworthiness Directives (ADs). More than two dozen of these failures and jams (alone or in combination) have what are considered catastrophic failure effects.

(3) Even when 737s were in compliance with the ADs issued at the time, rudder control system failures and jams were still present.

(4) Most of the failure modes were discernable on both the older (classic) models and the newer (next generation) models of the 737.

(5) There were no catastrophic failure modes identified at cruise speed and altitude. One change to the hydraulic pressure system mandated by AD reduced the time an airplane was exposed to catastrophic failure modes, but exposure was not eliminated during takeoffs and landings.

Among its recommended long-term actions, the ETEB recommended that the 737 rudder system be modified to ensure that no single failure or single jam of the rudder control system would cause an uncommanded rudder motion that has catastrophic results.

The NTSB did not withdraw or change its recommendation regarding further monitoring of the rudder system on 737s, and indicated in a February 2001 letter to the FAA that it had not changed its position regarding the need for installation of the new FDR equipment ''at the earliest possible opportunity regardless of any rudder system modification.''

In November 2001, the FAA published a proposed AD that would require the installation of a new rudder control system (and accompanying changes to nearby systems) (66 FR 56783, November 13, 2001). The FAA determined that the inherent failure modes in the 737 rudder system, verified by the ETEB, result in a design system architecture that is unsafe. The FAA also determined that the rudder system design architecture led to a need for non-normal operational procedures, which had also been implemented by AD. The FAA concluded that the combination of the inherent failure modes and the non-normal operational procedures, considered together, present an unsafe condition that warranted the incorporation of a newly designed rudder control system.

The final rule AD was published on October 7, 2002 (67 FR 62341), with an effective date of November 12, 2002, and gives all operators of 737 model airplanes 6 years to install a new rudder control system.

Boeing has been installing the newly designed rudder control system on 737 model airplanes manufactured since January 2003. Boeing is also installing the additional sensors that were proposed in the NPRM on these newly manufactured 737s, and those parameters are being recorded.

When we began drafting a final rule, we realized that the 737 fleet that would be affected by the proposed rule—those airplanes with the original rudder system—had already begun to shrink in number. The promulgation of several Airworthiness Directives means that by the 2008 compliance date for those ADs, no 737 aircraft left in the U.S. fleet would have the old rudder system. Therefore, we no longer find it appropriate to require the installation of flight recorder equipment to monitor those parts of the aircraft which became life-limited by these ADs and will be eliminated by 2008.

This SNPRM attempts to address the changes in circumstances introduced by the RSEP, the findings by the ETEB, and the ADs issued by the FAA by revising the fleet of airplanes affected by the proposed rule, and by changing the proposed compliance time to coincide with the modifications required by the ADs.

The FAA does not have convincing evidence that the redesigned rudder control system obviates the need for the additional flight recorder parameters. The newly designed rudder system is unique in that the third actuator is only activated upon the failure of the main PCU, at which point the two main actuators are no longer performing. Thus, the FAA has tentatively concluded that the information that would be gathered by the addition of the proposed parameters could provide meaningful information in the event of a rudder control failure. While the ETEB conducted considerable testing of the 737 aircraft and its rudder system, those tests cannot duplicate the actual flight experience of either the original or the new rudder system as it would be recorded using the parameters proposed. The only way to get this data is by installation of equipment that will record the movement of the rudder surface and the companion actions of the yaw dampers. The ETEB did not have this information because the equipment to record it was not mandatory. Since the additional parameters have yet to be installed, investigators of an accident or incident remain similarly limited today.

Boeing has indicated that there have been no reports of rudder hardover incidents on 737s with the redesigned rudder system. However, since the system has only been installed as original equipment on airplanes since 2003, and since compliance with the retrofit is not required until 2008, only limited historical data on the function and reliability of this redesigned system is available.

Additionally, as discussed above, the redesigned rudder system does not actively power three actuators. Rather, the third actuator only powers up in the event of a power failure to the two primary actuators. Thus, while the new design incorporates three actuators, similar to the design of Boeing's 757/767/777 model airplanes, a functional difference remains between the new 737 rudder system and that installed on other Boeing airplanes.

We note that the rudder control system enhancement can be split into three separate tasks and are not normally accomplished at once. The first two changes can be accomplished with the old rudder control system still in place. As of August 2004, Boeing had shipped 2,957 kits needed for the first part of the installation, but only 728 kits for the third part. The FAA assumes these numbers have gone up; however, since there is no reporting requirement for compliance with the AD, we have no way of knowing how many new components or complete rudder control systems have been installed. However, the FAA understands that the wiring kit provided by Boeing for the first part of the redesigned rudder system includes the wiring required for the proposed additional sensors, making the installation of the parameters less burdensome than originally anticipated. Compliance with this rule, if adopted, would require the installation of the sensors and their connection to the DFDR system. These circumstances argue for either the issuance of this rule (to take advantage of the work yet to be accomplished on the majority of the 737 fleet) or withdrawal, as soon as possible.

We continue to believe that unless the proposed additional flight recorder sensors are installed and the function of the new system components are monitored, there will never be any means to eliminate the rudder system as a possible cause of any future incident or accident, or to identify the particular component or action as a source of the problem if the rudder control system is involved. These are the circumstances that spurred the original NTSB recommendations on the 737, but we are cognizant of the significant changes in circumstances that have occurred in the last five years, including the mandated changes to the original rudder system, and the decline in reported incidence of rudder hardover events.

We are also aware that we now need new information on the costs and benefits of requiring these enhancements on a fleet of aircraft that did not exist when we originally proposed the rule, those with the new rudder system installed.

The FAA originally evaluated the cost data associated with this SNPRM nearly five years ago, shortly after the close of the comment period for the NPRM. Since then, some 737s may have been retrofitted with the new rudder, and may be partially equipped to record the additional flight data parameters. Further, with the introduction of the new Boeing 737 rudder, there is a new class of airplane that will incur retrofitting costs that may be different from those costs reported by the industry and used in the Supplemental Preliminary Regulatory Evaluation (Supplemental PRE) that accompanies this rulemaking document. Because the FAA does not have the data necessary to evaluate the impact of, and need for, a rule requiring the additional parameters for those 737s equipped with the new rudder control system, the agency requests more current information for the following specific questions as well as any additional data that the public believes needs to be incorporated into the economic analysis.

1. How many 737s are in your fleet?

2. How many 737s do not record the flight parameters that we are proposing be recorded? How many 737s currently record these parameters?

3. How many 737s have been retrofitted with the new Boeing rudder? How many of those airplanes do not record the flight data parameters that we propose to be recorded?

4. How many 737s are expected to be retrofitted with the new Boeing rudder in each of the years 2006, 2007, and 2008?

5. How many 737s are expected to be retired in each of the years 2006, 2007, and 2008?

6. For those 737s that have already been retrofitted under the AD but do not record the additional flight data parameters, how much would it cost to install the equipment to record the additional flight data parameters? How many days would it take to install the equipment to record those additional flight data parameters on those airplanes if the work were done: during a major maintenance session; an overnight maintenance session?

7. Are the assumptions and estimates made in Table 1 of this notice and the accompanying Supplemental PRE, and throughout that report, accurate? If you are able to provide more current data, please submit it.

8. Please provide an update on the status of the various design changes that would still need to be accomplished to provide the information necessary to install the proposed flight recorder parameters on the fleet expected to be retrofitted with the new rudder design.

We are issuing this SNPRM to gather information on the need for flight recorder parameters that monitor the new rudder system. This proposal represents a shift in the scope of the rule. When the DFDR enhancements were proposed, work was still in progress in diagnosing the functions and perceived weaknesses of the original rudder system. We have modified the original proposed regulatory text to require that the flight recorder parameters proposed in 1999 be installed concurrent with the new rudder system; we have redrafted the rule to state that compliance would be required no later than November 12, 2008, the date that compliance is required with the Airworthiness Directives mandating the installation of the redesigned rudder system. We have made other changes to the proposed regulatory text based on comments to the NPRM. These changes, which are explained later in the document, will not be revisited. Accordingly, we request interested parties to direct their attention to our requests for data, the need for additional parameters for the redesigned 737 rudder control system, and the proposed November 2008 compliance date.

In summary, the FAA finds this supplemental proposal necessary in order to update the status of the number and configuration of 737s in the current fleet. Since we do not track operator compliance with ADs, the information requested here will tell us how many airplanes have been retrofitted with the new rudder system and the estimated costs for installing the DFDR parameters if the new rudder system has already been installed. We expect to receive information on the number of retirements expected, as well as the number of aircraft that are already in compliance because they are new or because the proposed DFDR rudder parameters may have been installed voluntarily.

III. Summary of Comments

The FAA received 17 comments on the proposed rule. Of the 17 comments, the Air Transport Association of America, Inc. (ATA), submitted three separate comments; one of the ATA submissions included seven comments from member airlines. Only one commenter, the Air Line Pilots Association (ALPA), supports the proposed rule as published. Specifically, ALPA agreed that a potentially unsafe condition has been identified and concurs with the proposed amendments. The other commenters generally supported the intent of the proposed rule; however, these commenters expressed concern about:

(1) The time frame for compliance proposed in the Notice of Proposed Rulemaking (NPRM),

(2) the availability of installation instructions,

(3) the unavailability of parts, and

(4) the probability of considerable airplane out-of-service time.

The amount of time that has elapsed since comment was invited, and the events that have occurred since comment was invited, has caused most of the comments to become outdated. The proposed compliance times are no longer applicable, nor are the costs that were applied to them. Accordingly, we are not including a discussion of comments concerning compliance time, parts availability, or out of service time since these issues no longer exist under current circumstances.

Comments on Specific Proposed Requirements

The following disposition of comments addresses those comments that were not overtaken by intervening events and actions. Some of the questions and information submitted with them remain relevant to the actions contemplated under this modified proposal.

Boeing stated that it typically does not develop or commit to design changes until the release of a final rule. However, because of the proposed short time frame for compliance, Boeing had already implemented production design changes in an attempt to accommodate the expected compliance schedule. Boeing noted that a typical design change of this magnitude would require a minimum of 18 months to allow time to develop the design and to work with parts suppliers, operators, and the FAA.

A. Compliance Issues for Rudder Pedal Forces

Proposal: The FAA stated in Notice No. 99–19 that it had received inquiries from the NTSB and Boeing concerning an acceptable means of recording the rudder pedal control input forces required by paragraph (a)(88) of § 121.344; the requirement was added in the 1997 amendment to the DFDR regulations.

To meet the 1997 regulations, Boeing developed a rudder pedal force transducer that is placed ''midstream'' in the rudder control system. The transducer is designed to identify whether the input was coming from the cockpit or from the rudder assembly.

The NTSB indicated informally that it would prefer a system that measures the rudder input force at the individual rudder pedals. This would require the addition of four transducers (one on each rudder pedal) rather than the single one designed by Boeing. The FAA noted that the NTSB believes that only the installation of four rudder pedal force sensors would meet the intent of its April 16, 1999 recommendation to record rudder input force.

The FAA acknowledged the difference between the data acquired using Boeing's already approved single transducer system and the NTSB's suggested four-pedal sensor retrofit. The FAA requested comment on the necessity and feasibility of instrumenting all four rudder pedals on 737s with force sensors as a means of complying with paragraph (a)(88). The FAA also requested comment on whether Boeing's single force transducer should remain an accepted means of compliance with parameter 88 for all 737s that do not have the transducer installed or had not yet otherwise complied with paragraph (a)(88). In addition, the FAA requested cost data for the four-pedal retrofit to determine whether the incremental increase in benefits that would be provided by that configuration would be offset by the additional time and costs involved if such a requirement were mandated.

Comments: The FAA received two comments on recording rudder control inputs, one from the NTSB and one from Boeing.

The NTSB stated that the rudder pedal force exerted by each crewmember is critical to its understanding the loss of control problems experienced in the 737. The NTSB added that in its investigation of a 1999 rudder incident involving Metrojet, not knowing the amount of rudder pedal force exerted has made it impossible to separate pilot actions from (possible) rudder system anomalies. The Board argued that a single sensor placed midstream in the rudder control system, as introduced by Boeing, would not identify whether the flightcrew inputs are in opposition to each other or whether the nose wheel steering (NWS) or some other system anomaly forward of the sensor causes the inputs. In addition, any jams in the controls between the pedals and the sensor may go undetected, because the amount of force exerted by the flightcrew would not be registered by the sensor. The NTSB stated that, if the upgrade required only a single force sensor in the rudder system, the possibility would remain that the information would not be sufficient to identify some future flight control problems even after the proposed retrofit.

Boeing commented that neither the existing rule nor the proposed rule includes specific requirements that support a change to the current design to measure individual rudder pedal force. Boeing stated that the 1997 rule contained no requirement to measure any disagreement between pilot inputs. According to Boeing, the NTSB recommendations and the proposed rule suggested that the only issue is the ability to quickly distinguish a yaw damper event from a flightcrew input or a rudder anomaly. Boeing believed the current single transducer design meets this intent.

Boeing claimed the current 737 NG airplane rudder pedal design satisfies the parameter 88 requirements defined in the existing rule. Boeing added that the rudder design on 737–100 through –500 series airplanes delivered since August 1998 is identical to that on the 737 NG airplanes, and retrofit kits are available for this installation in airplanes delivered before then. Boeing noted that any change to the requirements to which this installation complies would require additional retrofit.

Boeing further stated that the proposed addition of four individual rudder pedal force sensors would require a significant number of design changes in the rudder control mechanism and to the structure of the cockpit floor. The 737 has severely limited space in the area these would be placed, which limits design options. At the time the NPRM was issued, Boeing and its suppliers had not yet been able to identify a design solution that could be implemented without significant structural and system changes that would make retrofit complex, lengthy, and costly. Boeing added that it expected the design definition and implementation of four transducers would take much longer than the implementation dates proposed.

Boeing also argued that four transducers would provide no major incremental gain in information. According to Boeing, a single transducer allows investigators to determine why the rudder moved, by pilot action or system input, but that a single transducer will not show whether a pedal jammed. The four transducers would enable Boeing to determine whether the rudder moved and may allow determination of which pedal was jammed or restricted. However, the four transducers, like the single transducer, would not permit determination of why a rudder pedal was jammed or restricted, because the jam or restriction is also ''upstream'' of the transducers.

FAA reply: Although specifically requested, the FAA did not receive any cost data or time estimates for a four-rudder-pedal sensor retrofit as described in the NPRM. While the FAA understands the NTSB's desire for the information that such rudder pedal sensors might provide, general comments from Boeing indicate that such a retrofit would be both time-consuming and costly. The FAA is unaware of a sensor currently in production that could meet the design requirements that would be necessitated by the NTSB's request. Even if such a sensor does exist, Boeing also indicated (in its comment and in discussions with the FAA) that major redesign of the aircraft might be necessary, including moving a floor beam, since there is so little space available under the rudder pedals of the 737. Such modifications would take several years to design and incorporate into the production line; the engineering for in-service airplanes would be more complicated, since changes to major structural components would mean a change to the airplane's original type design and the airworthiness certification of every affected airplane. The time that such design and retrofit would take far exceeds any recommendation of the NTSB, and argues against the NTSB's own characterization of the modification as time-sensitive.

Further, the FAA is unable to say with any certainty that the information that might be gathered by the NTSB's proposed pedal force sensors would lead to a solution to the rudder problem. The rudder pedal force sensors may well be able to identify the amount of force an individual pilot is placing on a pedal, but the amount of force does not seem to have been an issue in the noted accidents or incidents. If there is a problem in the rudder system, then the amount of force exerted in an attempt to overcome it is less important than finding where the malfunction is occurring. If pilots are fighting each other for control using the rudder pedals, then the issue is not with the airplane itself. It is a suspected problem with the airplane itself that is the reason for proposing this rule, and the FAA has determined that continuing to allow compliance with parameter 88 using a single midstream transducer reflects the best balance of cost and information to be gained in an attempt to locate the source of the problem in a timely fashion.

Accordingly, the FAA has decided against promulgating a four-pedal sensor requirement. The agency has no basis for concluding that a retrofit of individual rudder pedal sensors would be cost beneficial when the costs themselves cannot readily be estimated without a significant investment of time and energy. Moreover, since the FAA is unable to quantify the requirements either for the equipment or the recording rate and sensitivity, any information on estimated costs becomes that much less reliable and certainly falls short of the legal requirements for imposing the eventual cost on operators.

B. Compliance Issues for the Control Column and Control Wheel

Proposal: Parameter (a)(88) requires that control wheel and control column input forces be measured and recorded. The current rule requires that airplanes with breakaway capability record both left and right side control wheel forces. The FAA noted in the preamble to the NPRM that there also are issues of acceptable means of measuring control column and control wheel forces. The FAA specifically requested comment on the means and costs of measuring these control forces under the requirements proposed in this rulemaking.

Comments: The FAA received comments from Boeing, Alaska, United Airlines, ATA, and the NTSB on the control column and control wheel systems.

Boeing stated that to comply with the existing rule for parameter (a)(88), Boeing intended to modify the control column and control wheel force transducers for DFDR application to achieve the increased force range. Boeing would also install new flight control computer hardware and software to interface with the new transducers.

Boeing stated that the retrofit for the 737–100 through –500 series airplanes is basically the same as that for the 737 NG airplanes. However, it noted the 737–100 through –500 series airplanes include two control column force transducers in the same location as the 737 NG airplanes, but that the force applied by individual pilots cannot be determined because the elevator control systems of the 737–100 through –500 series airplanes do not have a jam override device between columns.

Boeing also described the FAA-approved single-wheel force transducer design for parameter (a)(88), and stated that it meets the intent of the existing rule provided that the left and right control wheel positions also are recorded. Boeing stated that the aileron system measures both cockpit control positions, but only the left side's force. Each pilot's control inputs go through the left side force transducer, except in the event of a failure. Boeing added that because the FAA does not typically consider dual failures a likely event, the proposed configuration should be acceptable.

Boeing noted that to comply with the existing requirements for parameter (a)(88), the control wheel force transducer would have to be modified specifically for DFDR application to achieve the increased force range. New flight control computer hardware and software would have to be installed to interface with the new transducer and the force transducer stops would have to be modified to allow the additional range.

Boeing further stated the control wheel retrofit of the 737–100 through –500 series airplanes is basically the same as that of the 737 NG airplanes, except that Boeing would add a (new) second control wheel position transducer to the first officer's control wheel to allow the 737–100 through –500 series airplanes' configurations to be identical with that of the 737 NG airplanes.

The NTSB stated that although it is concerned that the current control force sensors will not meet the range and accuracy requirements of the proposed rule, suitable control force sensors were likely to be available by the then proposed compliance dates. The NTSB contended that separate sensors to measure the pilot and copilot flight control input forces must be used when breakaway features are employed (breakaway capability allows either pilot to operate the airplane independently).

Two operators of 737s and the ATA commented that as of the date of the NPRM, the required sensors had not yet been developed.

FAA reply: The primary objection raised by the commenters was that the regulation would force early compliance with parameter (a)(88) for control wheel and control column forces, and that the sensors required to record to Appendix M specifications were not available and had not yet been designed. Sensor design and availability are no longer issues since all aircraft manufactured after August 19, 2002 have been required to meet Appendix M standards for parameter (a)(88). Nor is there any need to provide for more than one sensor type since a sensor that records to Appendix M standards now exists for use in a retrofit. Accordingly, the FAA intends to adopt the rule as originally proposed, with the Appendix M standards applicable to all 737s recording all functions required by parameter (a)(88) (±70 pounds control wheel force and ±85 pounds control column force).

The FAA understands that the lateral control system on the 737 has an override device between the two control wheels that allows either pilot to operate the control wheel independently, but that the primary control path for both pilots is through the left cable control path. The right control is not usually connected and is used only in the event of a failure. A single control wheel force transducer in the left cable path records the inputs from both pilots. The FAA agrees that the single control wheel force transducer is acceptable, provided the left and right control wheel positions are also recorded. The use of a single force transducer with two position sensors is acceptable because comparison of the two position sensors allows detection of a breakout of the override between the control wheels; this breakout allows the right cable control path to become active.

C. Compliance Issues; Other Parameters

1. Standby Rudder Status

Proposal: In the NPRM, the FAA proposed to add recording of the standby rudder status. The standby rudder system is an alternative source of hydraulic power to the rudder that is used when primary hydraulic power is lost. The intent of the proposed requirement was to record whether the standby rudder system switch is in the on or off position.

Comment: Boeing believed the intent of recording the standby rudder status was to determine the actual status of the standby rudder system and not the position of any particular switch. Boeing indicated that the system should record the state of the standby hydraulic rudder shutoff valve, which also is controlled by both of the standby rudder system switches. Boeing maintained this would provide a clearer indication of the actual status of the standby rudder system than recording whether the standby rudder switch is in the on or off position. The ATA stated that the sensors for the standby rudder status parameter have not been designed for any 737.

FAA reply: The FAA agrees with the comments and we have revised the proposed language in paragraph (a)(91) to indicate that it is the valve position that needs to be recorded for standby rudder status, not the position of the switch, as initially proposed.

2. Thrust Reverser

Proposal: Under the 1997 DFDR regulations, instrumentation of the thrust reversers (§ 121.344(a)(22)) was not required until the year 2001 for some airplanes and is not required at all for older airplanes. The proposal would require all 737s regardless of age to record the thrust reverser position.

Comment: Boeing stated that the requirement for recording thrust reverser positions would require modifications to the engine accessory unit (EAU) to monitor the thrust reverser. According to Boeing, approximately 937 737–100 and –200 airplanes will require two new PC cards and associated connectors and wiring, and approximately 250 737–300 and –400 airplanes will require four new PC cards and associated connectors and wiring if the proposal is adopted. Boeing requested that the FAA not require instrumentation of the thrust reversers for the older 737–100 through –500 series airplanes. The 737 NG airplanes would be retrofitted to record thrust reverser position. Boeing suggested specific language that could be used to codify its request.

FAA reply: The SNPRM does not incorporate Boeing's suggested change. Under § 121.344(b)(1), adopted in 1997, the only airplanes not required to record thrust reverser position, parameter (a)(22), are airplanes manufactured on or before October 11, 1991, that were not equipped with a FDAU as of July 16, 1996. All other airplanes must either be retrofitted to record, or record at manufacture, thrust reverser position.

The distinction made in § 121.344(b)(1) was introduced to prevent the oldest airplanes from having to be retrofitted with a FDAU to meet the 1997 rule, not because thrust reverser data is not important. Under this SNPRM, the other recording requirements for 737s necessitate the installation of a FDAU, eliminating the distinction made in the 1997 rule. Further, the FAA cannot accept Boeing's suggested language because it is general and would relieve not only 737s but certain other airplanes from the 1997 requirement to record parameter (a)(22). This proposal would require all 737s to record parameter (a)(22).

3. Yaw Damper Status and Yaw Damper Command

Proposal: Proposed paragraph (a)(89) would add the recordation of yaw damper status. The intent of the requirement is to determine whether the yaw damper is on or off. Proposed paragraph (a)(90) would add the recordation of yaw damper command. The intent of this requirement is to record the amount of voltage being received by the yaw damper system. This determines how much rudder movement is being commanded.

Comment: For the 737–100 through –500 series airplanes, Boeing proposed to record the yaw damper linear variable displacement transducer (LVDT) position feedback from the new yaw damper coupler through an ARINC 429 interface, and, if the DFDR capacity allows, the yaw damper command from the yaw damper coupler through an ARINC 429 interface. Boeing noted that the 737 NG airplanes record both the yaw damper command from the stall management yaw damper and the yaw damper LVDT position feedback through an ARINC 429 interface. The ATA stated that sensors for yaw damper status and yaw damper command parameters are not addressed in a retrofit service bulletin.

FAA reply: Sensors for the yaw damper status and yaw damper command parameters have been developed and have been installed in 737s manufactured since August 18, 2000. The sensors exist and the FAA continues to believe that the parameters should be required.

4. Other Issues

Proposal: The current DFDR regulation allows single-source recording for control input and control surface positions, parameters (a)(12) through (a)(14) or (a)(12) through (a)(17), depending on the date of airplane manufacture. The proposed rule eliminated the allowance to record these from a single source.

Comments: Boeing stated that § 121.344(b) and (c), as proposed, removes the allowance to permit recording parameters (a)(12) through (a)(17) from a single source and applies the full requirement of appendix M to part 121 to recording these parameters. However, paragraph (d) still permits recording parameters (a)(12) through (a)(17) from a single source.

FAA reply: Removing the allowance for recording control and surface positions from a single source was an error in the proposed rule. This SNPRM includes the single-source recording as provided in the 1997 rule. A sentence has been added in § 121.344(m) indicating that single-source recording would remain available to airplanes otherwise subject to § 121.344(b)(1), (c)(1), or (d)(1).

Proposal: The proposal removes 737s from the requirements of § 121.344(b) and (c), adds specific 737 requirements to § 121.344(d), (e), and (f), and adds new § 121.344(m).

Comments: Boeing indicated that § 121.344(d), (e), and (f), as proposed, state that all 737s must comply with the requirements in paragraphs (m)(1) and (m)(2). Boeing contended this language overlooks the requirements of paragraph (m). Boeing also did not understand why paragraphs (d), (e), and (f) were not revised as paragraphs (b) and (c) to except the 737. Boeing stated that the addition of paragraph (m) makes it unclear as to what is required for 737s and that it would be much clearer to include the additional 737 requirements in the existing applicable paragraphs. Boeing further stated that § 121.344(m), as proposed, is inconsistent with paragraphs (b), (c), and (d) in that it requires recording parameters (a)(88) through (a)(91), while paragraphs (b), (c), and (d) do not.

FAA reply: The modifications to the compliance schedule for installation of the additional parameters have removed the issue of compliance time; compliance time is no longer determined by the date of FDAU installation.

For consistency, § 121.344(b), (c), (d), (e), and (f) are similarly revised to reference the 737 requirements in § 121.344(m). The FAA has decided against putting the 737 requirements in each subparagraph because it would be cumbersome, unnecessarily repetitive, and introduce more possibilities for error.

Proposal: The note to parameter (a)(88) in current Appendix M to part 121 requires airplanes that have a flight control breakaway capability (which allows either pilot to operate controls independently) to record both control force inputs; the note also discusses sampling rates.

Comments: Boeing pointed out that the note to parameter 88 in appendix M to part 121 and appendix E to part 125 indicates that all the comments in the remarks column do not apply to the 737. Boeing believed that the note is meant to indicate that it is only the sampling interval remarks that do not apply to the 737s. The NTSB also stated that the remarks section covers, in addition to the sampling rate requirements, a requirement to record both control force inputs for those airplanes that have a flight control breakaway capability that allows either pilot to independently operate the airplane, which still would apply to 737s.

FAA reply: The FAA agrees with Boeing, and has revised footnote 18 to clarify application of the parameter for 737s. The requirement to record both control force inputs for systems with breakaway capabilities does apply to the 737, but as discussed above, the FAA has approved the use of a single control wheel force transducer provided that both control wheel positions are recorded (although both pilot's inputs go through the left side force transducer, except in the event of a failure). Because the FAA historically has not considered a dual failure a likely event, this configuration is acceptable.

Proposal: The FAA proposed the same changes to the digital flight data recorder regulations in § 125.226 as those proposed in § 121.344. In addition, the FAA proposed the same changes to Appendix E to part 125 as those proposed to Appendix M to part 121. The FAA also proposed that airplanes operating under deviation authority from part 125 must comply with the flight data recorder requirements of part 125 for the particular aircraft. The FAA specified that this deviation requirement would apply to all aircraft and not only the 737. The FAA specifically sought comments on why the flight data recorder requirements of part 125 should not be made applicable to aircraft operated under deviation authority. In addition, the FAA sought comments from affected persons operating aircraft under deviation authority from part 125 concerning the proposed compliance schedule.

Comments: The FAA received no comments on the proposed changes to part 125. Accordingly, the changes to part 91, applicable to part 125 airplanes operated under deviation authority, and the changes to part 125 and Appendix E are proposed again here without change from the original proposal.

IV. Changes Adopted in This SNPRM

When the FAA proposed the recordation of new flight data recorder parameters in November 1999, the ETEB was still in the process of conducting its failure analysis, and other action by the agency was not yet contemplated. The ETEB's finding and the FAA's subsequent decision to issue the AD requiring replacement of the rudder system mandate that this rule be modified to account for those actions.

This proposed rule, if adopted, would require the installation of the flight recorder parameters proposed in the NPRM with the following modifications. The installation would be accomplished simultaneously with the installation of the redesigned rudder system in order to minimize the costs and out-of-service time required. The regulatory evaluation for this proposed rule has been significantly revised to include this extended compliance time. This extension of the compliance time also addresses the majority of the comments received in response to the proposed rule. Specifically, this SNPRM incorporates the following changes:

- Sections 121.344(b), (c), (d), (e), and (f) and § 125.226(b), (c), (d), (e), and (f) would be amended to indicate that all 737 model airplanes also must comply with the requirements in § 121.344(m) or § 125.226(m), respectively. Sections 121.344(m) and 125.226(m) would be added to indicate that in addition to other applicable requirements, all 737 model airplanes must record the parameters listed in paragraphs (a)(1) through (a)(22) and (a)(88) through (a)(91) in accordance with the ranges, accuracies, resolutions, and recording intervals specified in Appendix M to part 121 or Appendix E to part 125, respectively. The proposed compliance times have been changed to state that the installation of the equipment required to record these parameters must be accomplished during the installation of the modified rudder system required by AD or no later than November 2008. These sections would also reinstate the language allowing single-source recording, as discussed in the disposition of comments. The parameters that may be recorded from a single source would be determined by the age of the airplane and its applicable regulations.
- Footnote 18 would be added to parameter 88 in Appendix M to part 121 and Appendix E to part 125 and would read "For all 737 model airplanes: The seconds per sampling interval is 0.5 per control input; the remarks regarding the sampling rate do not apply; a single control wheel force transducer installed on the left cable control is acceptable provided the left and right control wheel positions also are recorded." Footnote 19 would be added to parameter 88 in Appendix M to part 121 and Appendix E to part 125 and would read "For all 737 model airplanes manufactured on or before January 31, 2001, Range values are: Full Range; Control wheel ± 15 lbs.; Control column ± 40 lbs.; and Rudder pedal ± 165 lbs."
- Sections 121.344 (a)(91) and 125.226(a)(91) would be revised to read "standby rudder valve status" and in appendix M to part 121 and appendix E to part 125, the range for parameter 91 would be revised to read "Discrete."
- The range for the rudder pedal in parameter 88 in appendix M to part 121 would be corrected to read "Rudder pedal ± 165 lbs."

No 737s are exempt from this rulemaking. Airplanes that have been manufactured since January 2003 would already be incompliance with this rule because the rudder parameters proposed here would have been installed at manufacture.

V. Chronology

The following is a list of selected events relevant to 737 rudder control issues and FAA rulemaking actions:

Date	Event
December, 1967	The Boeing 737 is type certificated.
March 3, 1991	United Airlines flight 585 crashes near Colorado Springs, CO; loss of rudder control implicated, but the flight recorder was rudimentary (5 parameters recorded as required by regulation).
1993	NTSB Recommendation on the 737 rudder system.
September 8, 1994	Crash of USAir flight 427 near Aliquippa, PA.
June 9, 1996	Rudder hardover reported on Eastwind flight.
1996	FAA issues AD on flight crew procedures to overcome potential system failures.
1995–1997	NTSB issues 20 safety recommendations on the 737, three in 1995 recommending upgrades to the DFDRs.
June, 1997	FAA issues two ADs on 737 rudder system components.
February 23, 1999	USAir flight 2710 reports uncommanded rudder hardover at cruise.
March 24, 1999	NTSB final report on USAir 427 indicates loss of control from uncommended rudder hardover as probable cause; says 1997 DFDR rule changes by FAA not adequate for 737.
May, 1999	ETEB formed to conduct failure analysis on rudder control actuation system of the 737.

Date	Event
November 18, 1999	FAA NPRM proposing three new DFDR parameters for 737s, proposing compliance in 2000 or 2001 based on installed equipment.
December 20, 1999	Comment period for NPRM closes.
1999	Five rudder hardover incidents reported on 737s during the year.
July, 2000	ETEB final report finds numerous failure modes on 737 rudders, recommends modification of the entire rudder system.
September, 2000	Boeing begins its Rudder System Enhancement Program (RSEP).
January 16, 2001	Boeing makes a presentation to the NTSB on its RSEP findings.
January, 2001	Boeing submits letter to FAA rule docket requesting delay of any final rule in anticipation of final RSEP findings expected later that year.
February, 2001	In a letter to the FAA, the NTSB maintains its position on installation of new DFDR parameters on 737s as soon as possible, and regardless of rudder system modification.
February, 2001	Boeing applies for a change in type design based on its RSEP.
November 13, 2001	FAA publishes NPRM AD on modified rudder system.
October 7, 2002	FAA publishes final rule AD to install modified rudder system; compliance is due in 6 years (11/11/2008); special flight crew procedures in effect since 1996 are superseded as of installation.
January, 2003	New Boeing 737s are delivered with the new rudder system and the three DFDR rudder parameters as original equipment.

VI. Paperwork Reduction Act

This SNPRM proposes to amend the regulations to add a requirement for all 737s to record additional flight data parameters. These additional parameters are not required by the current regulations and would provide the only currently available means of gathering information that the FAA and the NTSB anticipate will help assess the cause of incidents that appear to be related to rudder anomalies on 737 airplanes.

The respondents are all U.S. certificate holders operating 737 airplanes under parts 91, 121, 125, and 129.

The required information would be electronically recorded on the DFDR each time the airplane begins its takeoff roll until it has completed its landing roll and kept until the airplane has been operated for 25 hours. The recorded data would be overwritten on a continuing basis and accessed only following an accident. This requirement would be a nominal addition to a passive information collection activity and therefore does not contain a measurable additional hour burden.

As required by the Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)), the U.S. Department of Transportation submitted the information collection requirements to the Office of Management and Budget (OMB) for its review and assignment of an OMB control number and one was assigned. However, when the control number came up for reauthorization, we decided not to renew it. If this proposed requirement is made final, we will reapply for the authorization.

VII. International Compatibility

In keeping with U.S. obligations under the Convention on International Civil Aviation, FAA policy is to comply with International Civil Aviation Organization (ICAO) Standards and Recommended Practices to the maximum extent practicable. The FAA has determined that there are no ICAO Standards and Recommended Practices that correspond to these regulations.

VIII. Economic Evaluation, Regulatory Flexibility Determination, International Trade Impact Assessment, and Unfunded Mandates Assessment

Changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs each Federal agency to propose or adopt a regulation only if the agency makes a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreements Act (19 U.S.C. 2531–2533) prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the United States. In developing U.S. standards, the Trade Act requires agencies to consider international standards. Where appropriate, agencies are directed to use those international standards as the basis of U.S. standards. Fourth, the Unfunded Mandates Reform Act of 1995 requires agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules. This requirement applies only to rules that include a Federal mandate on State, local, or tribal governments or on the private sector, likely to result in a total expenditure of $100 million or more in any one year (adjusted for inflation).

Based on the available information, the FAA believes that this proposed rule:

(1) Would have benefits that justify its costs and would be a ''significant regulatory action'' as defined in the Executive Order and as defined in DOT's Regulatory Policies and Procedures;

(2) Would have a significant impact on a substantial number of small entities;

(3) Would have minimal effects on international trade; and

(4) Would not impose an unfunded mandate on state, local or tribal governments or on the private sector.

The FAA has placed these analyses in the docket and summarizes them as follows.

Data Sources

The principal data sources used are the public comments from the ATA and six airlines, as well as discussions with representatives from Boeing and several airlines that operate 737s, an ATA survey of its members, avionics vendors, and repair stations that will perform some of the FDR system retrofits. In this section, the FAA addresses the public comments concerning the Preliminary Regulatory Evaluation and the economic effects of the proposed rule.

Affected Airplanes and Industries

In the November 1999 NPRM, the FAA estimated the proposed rule would affect 1,306 737s projected to be in service in the year 2000, and 2,144 737s that will be manufactured between 2001 and 2020.

In the Supplemental PRE, the FAA estimates that this proposed rule would affect 1,171 current 737s projected to be active in 2008. The FAA believes this proposal would not affect 737s in production because Boeing voluntarily manufacturers these airplanes to the rule's requirements. Currently, eight airlines (Southwest Airlines, Continental Airlines, United Airlines, Delta Airlines, U.S. Airways, American

Airlines, America West Airlines, and Alaska Airlines) operate 80 percent of the affected airplanes. One major airline (Southwest Airlines) and two national airlines (Aloha Airlines and Sun Country Airlines) operate 737s exclusively.

Benefits

The principal benefit from increasing the number of recorded flight data parameters is the increased probability that the information gathered can be used to determine more precisely the causes of future 737 rudder-related accidents. Once these causes are known, regulatory agencies and the aviation industry could effect corrective actions (*e.g.*, an airplane design modification or changes in operating procedures) that could prevent such future accidents.

In the NPRM, the FAA estimated the number of these future 737 accidents based on the assumption the historical accident rate would remain constant. The ATA and Continental Airlines disagreed by noting that the FAA issued several ADs on the 737 rudder system since 1995, and no rudder-associated accidents had happened since then. (These comments, made in 2000, do not include the 2002 AD (Number 2002–20–07) that requires 737 rudders to be retrofitted to prevent an uncommanded rudder hardover event.) Continental Airlines believed that, to the extent that the ADs have mitigated this unknown problem, an accident rate based on the pre-AD 737 historical rate will overestimate the future accident rate. The FAA agrees the historical 737 accident rate is not appropriate for this analysis. Given the recent ADs, there is insufficient information to specify the future 737 accident rate and how much this rulemaking will reduce it. As a result, the FAA has changed the approach used in the NPRM in analyzing benefits in this SNPRM analysis. Rather than predicting a number of future accidents, as was done for the NPRM, the Supplemental PRE estimates the potential quantified benefits that would occur if recording these flight data parameters would lead to the prevention of an accident. Should the FAA receive sufficient data in response to this rulemaking notice to permit it to predict a number of future accidents, it may revert to the methodology used in the preliminary regulatory evaluation supporting the NPRM.

In the NPRM, the FAA used the following values to quantify the potential benefits from a prevented 737 accident: $2.7 million for each prevented fatality, an average of 96 passengers and crew on a 737, for a resulting total of $259.2 million an airplane; $20 million for a destroyed 737; $5 million for ancillary damage to ground structures; and $31 million for the resultant government and industry accident investigation. Thus, the average potential benefit from preventing a 737 in-flight accident was estimated to be $315.2 million in 1999 dollars. There were no comments on this estimate.

In the Supplemental PRE, the FAA uses the following updated values and average 737 size to quantify the potential benefits from a prevented 737 accident: $3 million for each prevented fatality; an average of 113 passengers and crew on a 737, for a resulting total of $339 million an airplane; $17 million for a destroyed 737; $6 million for ancillary damage to ground structures; and $33 million for the resultant government and industry accident investigation. These changes are the result of increased costs, as well as an increase in the average number of passengers aboard a 737. Thus, the average potential benefit from preventing a 737 in-flight accident is about $395 million in 2003 dollars.

Significant Differences in the Economic Models Used in the Preliminary Regulatory Evaluation and the Supplemental Preliminary Regulatory Evaluation

Table 1 lists the significant differences in assumptions and values between those used in the NPRM and those in this analysis. The specific impact that each value has on the revised compliance costs is discussed in the individual compliance cost sections. Although there are other differences that have changed the calculated costs, the differences listed in Table 1 are the most significant ones.

TABLE 1.—SIGNIFICANT DIFFERENCES IN ASSUMPTIONS AND VALUES BETWEEN THE PRELIMINARY REGULATORY EVALUATION AND THE SUPPLEMENTAL PRELIMINARY REGULATORY EVALUATION

Assumption or value	Preliminary regulatory analysis	Supplemental preliminary regulatory analysis
Number of Airplanes	1,306 (in Year 2000)	1,567 (in Year 2004).
Number of Retrofitted Airplanes	1,306 (by Year 2001)	1,171 (by Year 2008).
Annual Increase in Flight Hours & Fuel Burn	4.1 percent	Varies depending on number of airplanes.
Year of First Retrofits	2000	2005.
Number of years to retrofit	18 months	4 years.
How scheduled retirements are handled	All airplanes active on the final rule date are retrofitted.	No airplane scheduled for retirement before 2008 is retrofitted.
Who does initial engineering redesign	All individual STC holders	Boeing.
Hourly Labor Rates: Engineers; Mechanics	$100; $70	$125; $85.
How recorders are affected	Newer recorders in 737 "Classic" airplanes can be reprogrammed at a unit cost of $10,000..	All recorders in 737 "Classic" airplanes must be replaced at a unit cost of $20,000.
How FDAUs are affected	Existing FDAUs in 737 "Classic" airplanes can be reprogrammed at a unit cost of $20,000.	All FDAUs must be replaced in 737 "Classic" airplanes at a unit cost of $50,000.
How FCCs are affected	No impact—no cost	Must be reprogrammed at a cost of $10,000 per airplane.
How many airplanes retrofitted during a "C" or "D" maintenance check.	33 percent	100 percent.
How many out-of-service days for a retrofit not done during a "C" or "D" maintenance check.	4–9	2–8.[1]
How many out-of-service days for a retrofit done during a "C" maintenance check.	2–7	0–6.
Per gallon price of aviation fuel	$0.61	$0.75.

TABLE 1.—SIGNIFICANT DIFFERENCES IN ASSUMPTIONS AND VALUES BETWEEN THE PRELIMINARY REGULATORY EVALUATION AND THE SUPPLEMENTAL PRELIMINARY REGULATORY EVALUATION—Continued

Assumption or value	Preliminary regulatory analysis	Supplemental preliminary regulatory analysis
Future production 737s	All affected at a per airplane cost of $38,900	No cost because parameters 89–91 would have been installed in the absence of the final rule.

[1] In the event we receive information that some airplanes cannot be retrofitted during a ''C'' or ''D'' check, we will use an out of service time of 2 to 8 days for FDR equipment installation. We specifically request that this estimate be verified by affected operators.

Compliance Costs for the Supplemental Rule

As summarized in Table 2, the FAA estimated in the NPRM that the cost to retrofit a 737 would vary between $41,800 and $221,950 per airplane, depending upon the 737 model, its FDR system equipment, and whether the retrofit would be completed during a ''D'' check, a ''C'' check, or would require a separate dedicated scheduled maintenance session. *See also the footnote to Table 1.*

TABLE 2.—PER AIRPLANE COMPLIANCE COST BY 737 SERIES AND FDR SYSTEM ESTIMATED IN THE PRELIMINARY REGULATORY EVALUATION

[All values in 1999 $]

737 Series	Equipment and labor costs	Out-of-service days	Out-of-service lost net revenue	Total costs and lost net revenue
200	$160,200–176,400	4–7	$250–800	$160,450–177,200
200-Advanced (No FDAU)	160,200–176,400	4–7	4,900–8,600	160,690–185,000
200-Advanced (FDAU)	68,800–90,000	2–4	2,450–4,900	71,250–94,900
300 (No FDAU)	175,200–191,400	6–9	20,375–30,550	195,575–221,950
300 (FDAU)	35,100–90,000	2–4	6,800–21,550	41,900–111,550
400 (No FDAU)	160,200–176,400	6–9	17,350–30,350	177,550–206,750
400 (FDAU)	35,100–90,000	2–4	8,675–25,250	43,775–107,350
500 (No FDAU)	175,200–191,400	6–9	20,150–30,200	195,350–221,600
500 (FDAU)	35,100–90,000	2–4	6,700–19,100	41,800–109,100
600	35,100	2–4	15,375–30,750	50,475–65,850
700	35,100	2–4	17,350–34,675	52,450–69,775
800	35,100	2–4	20,800–41,575	55,900–76,675
900	35,100	2–4	21,950–43,875	57,050–76,975

The FAA estimated in the NPRM the total costs of compliance with the proposed rule between 2000 and 2020 would be about $255 million, which had a present value of $205.4 million. Of the $255 million total costs, the one-time costs to retrofit the existing 737 fleet (engineering plus retrofitting plus losses from out-of-service time) would have been $158.7 million. If the rule had been issued on January 1, 2000, the $158.7 million would have been spent within 20 months or the airplanes would have been grounded. The increased costs to manufacture future 737s from 2000 through 2019 would have been $86 million. Finally, the increased annual costs of the additional fuel burn due to the increased weight of the airplane and the additional maintenance of the FDR system from 2000 through 2019 would have been $10.3 million.

In the Supplemental PRE, after incorporating data from the comments and updating the fleet and unit cost data, the FAA has determined that the cost per 737 will be between $189,320 and $201,320 for a 737–200, between $189,320 and $209,320 for a 737–300/400/500 that does not have a FDAU, between $142,120 and $167,120 for a 737–300/400/500 that has a FDAU, between $49,410 and $63,410 for a 737 NG that does not record parameters 89–91, and $9,475 for a 737 NG that records parameters 89–91.

The FAA has tentatively determined the total cost to comply with this SNPRM would be about $143 million between 2004 and 2014, which has a present value of about $126.5 million. Of the $143 million, about $140 million will be expended during the first 4 years for engineering costs, retrofitting costs, and out-of-service costs, $2 million will be for increased fuel consumption, and $0.7 million will be for additional FDR system maintenance. There will be minimal compliance costs for production 737s because Boeing has been voluntarily installing the capability to record the additional data required by the proposed rule since August 2000.

Summary of Factors Creating the Significant Differences Between the Estimates

There are 4 major factors that create the differences between the NPRM and SNPRM estimates.

The first factor, which increases one-time retrofitting compliance costs, is the FAA's assumption that some of the existing solid-state recorders and existing FDAUs could be reprogrammed. However, the ATA, Alaska, Aloha Airlines, Continental Airlines, Southwest Airlines, and United Airlines commented that retrofitting the FDR systems in the 737-''Classic'' series requires purchasing new recorders and new FDAUs; they cannot be reprogrammed. Boeing, American, and Aloha Airlines reported that their 737-''NG'' series recorders and FDAUs could be reprogrammed. The FAA accepts both these positions. As a new recorder costs between $10,000 and $15,000 more than a reprogrammed recorder, and a new FDAU costs $30,000 more than a reprogrammed FDAU, the impact on the total retrofitting cost is considerable.

A second factor, which lowers compliance costs, is that 135 fewer 737s will be retrofitted under the SNPRM than would have been retrofitted under the originally proposed rule.

A third factor, which lowers compliance costs, is that the FAA significantly reduces its estimated number of labor hours to retrofit FDR systems to record flight data parameters (a)(19) through (a)(22) in 737s with FDAUs. In the NPRM, the FAA estimated it would take 400 hours while the FAA now estimates that it takes 100 hours.

A final factor that lowers compliance costs is that the Supplemental PRE analysis contemplates that the flight data parameter retrofit will be performed when a 737 is retrofitted with a new rudder rather than within the 20 months originally proposed in the NPRM. Since the publication of the proposed rule, more 737s have been retired, reducing those estimated costs.

Commenters' Retrofit Cost Estimates

In the NPRM, the FAA used retrofitting costs largely provided by the industry. In the comments to the NPRM estimates, Aloha Airlines estimated a cost of $165,100 to $185,000 to retrofit its 737–200 Advanced airplanes that did not have a FDAU, $71,250 to $94,900 to retrofit its 737–200 Advanced airplanes that have a FDAU, and $52,450 to $69,775 to retrofit its 737–700 airplanes. American Airlines estimated a cost of $47,250 plus lost revenue for 2+ days out-of-service for each of its 737–800 airplanes. Continental Airlines did not report a total cost, but was in general agreement with the FAA estimates, if the FAA adjusted its costs to recognize that existing recorders and FDAUs in 737-''Classic'' airplanes cannot be reprogrammed and must be replaced. United Airlines estimated a total retrofitting cost of $24,100,000 and for its fleet of 158 737-''Classics'', for an average airplane cost of $152,500. The FAA has tentatively determined the retrofitting cost of a 737-''Classic'' ranges from $142,000 to $189,000 while the retrofitting cost of a 737-''NG'' ranges from $9,475 to $49,410.

Time to Engineer New Designs for the Retrofitted FDR Systems

In the NPRM, the FAA assumed that each STC holder would independently do all the engineering redesign. Boeing, the ATA, Alaska, Continental Airlines, Southwest Airlines, and United Airlines commented that such an approach would be inefficient and lead to duplication of effort. Industry expects Boeing to do the initial engineering work, which the STC holders would then modify for their various FDR systems. The FAA accepts those comments and has adjusted its analysis accordingly.

In the NPRM, the FAA estimated that airlines and repair stations would redesign 40 FDR systems and it would take 16 to 26 weeks and cost each FDR system holder $200,000 to complete the first FDR system redesign. As engineering data from one STC can be used in other STCs, the FAA assumed that after five such FAA approvals, an STC holder could use commonality demonstrations to reduce this cost from $200,000 to $25,000 per STC. Thus, the FAA estimated a total one-time cost of $2.95 million for the initial engineering redesign.

Boeing indicated that the FAA significantly underestimated the engineering hours required for each individual engineering analysis. Although Boeing did not provide specific estimates in its comments, the FAA has assessed the engineering analyses for the 737 series as a one-time cost of $6.6 million, which consists of 30 engineering years.

In the NPRM, the FAA assumed that three engineers working full-time for four months (one engineer year) would be needed for an FDR system redesign STC approval, at a cost of $200,000 per STC application. The FAA further estimated that 32 applications would be made for a one-time engineering cost of $7.5 million.

Aloha Airlines, Continental Airlines, Southwest Airlines, United, and U.S. Airways commented that it would take from six months to one year after Boeing completes the initial engineering analysis for them to complete their design modifications and obtain FAA approvals. They did not, however, provide an estimate of their engineering time or costs to complete these applications. In the Supplemental PRE, the FAA estimates that 15 STC applications will require one engineer year (at a cost of $250,000) to complete, while 25 of the STCs will require 250 engineer hours (at a cost of $31,250) to complete. On that basis, the calculated total STC engineering cost is $4.6 million.

Aloha Airlines stated the FAA underestimated the number of engineering analyses because each airplane ''configuration'' within a 737 series would need a separate engineering analysis. They commented that 13 of their 18 airplanes will need a $200,000 analysis. The FAA agrees that an adjustment in the cost calculations needs to be made for the different configurations. However, because much of the engineering is identical for each configuration within a 737 series, the FAA has tentatively determined that it will take half of the engineering time for a commonality demonstration STC (125 hours) for a configuration STC. The FAA has calculated a per configuration cost of $16,125. Finally, the FAA has tentatively determined that 60 of these ''configuration'' STCs will be performed because most airlines' fleets have fewer configurations than the Aloha Airlines fleet. The FAA estimates a total cost of $967,500 for this engineering.

Alaska also noted that two of the sensors had not been developed for any airplane and several other sensors had not been approved for use in many of the 737-''Classic'' airplanes. Thus, as well as the design STC approval, the FAA would also need to issue Parts Manufacturing Authorizations (PMAs) to the new sensors manufacturers. Alaska posited that although the vendors will incur most of these development costs, these costs should be included in Boeing's initial engineering costs because Boeing will be the kit supplier.

In the NPRM, the FAA estimated the total one-time engineering costs to modify the FDR system STCs and obtain FAA approval would have been $9.15 million. The FAA now calculates the total costs to modify the FDR system STCs and obtain FAA approvals are $15 million.

Equipment and Labor Costs to Retrofit FDR Systems

In the NPRM, the FAA estimated the equipment and labor costs to retrofit FDR systems for compliance with the proposed rule would be $124.3 million. Based on the comments and the revised fleet, the FAA has reduced the anticipated equipment and labor cost to comply with the final rule, if adopted, to $111.8 million.

In the NPRM, the FAA estimated that 156 737s would have their recorders replaced, while the remaining 1,150 737s would have their recorders upgraded with additional memory. The FAA estimated that: a new recorder would cost $25,000; upgrading the memory of a recorder that records 18 flight data parameters would cost $10,000; upgrading the memory of a recorder that records 22 flight data parameters would cost $5,000; and upgrading the memory of a recorder that records more than 22 parameters would cost $1,900.

ATA, Aloha Airlines, Continental Airlines, Southwest Airlines, and United Airlines commented that all of their 737-''Classics'' would have their recorders replaced because they cannot be reprogrammed.

Accepting and incorporating industry comments, and with the increased numbers of retirements, the FAA has tentatively determined that 605 737s will need their recorders replaced and 279 737s will need their recorders reprogrammed by 2008.

Finally, Continental Airlines reported new recorder costs of $13,000 while Aloha Airlines reported a recorder cost of $25,000. In the Supplemental PRE, the FAA has assessed a cost of $20,000 per recorder, the average of these two estimates and estimates provided by avionics manufacturers.

In the NPRM, the FAA estimated that installing a new recorder would require 32 labor hours to remove the old recorder and to install and test a new recorder. Upgrading an FDR would require 16 labor hours to remove, reprogram, reinstall, and test. The FAA received no comments on this estimate and uses it in the Supplemental PRE.

In the NPRM, the FAA estimated the cost of replaced or upgraded recorders would be $17.2 million. Based on the increased recorder cost estimate and the fewer retrofitted 737s, the FAA now calculates that the total cost of replaced or upgraded recorders in this is $14.6 million, which has a present value of $12.8 million.

In the NPRM, the FAA estimated that a FDAU would be retrofitted into 496 737s that did not have one, while the existing FDAUs in 810 737s would be reprogrammed. The same commenters who addressed the issue of the recorder all agreed that, whereas the FDAUs in their 737-''NGs'' can be reprogrammed, every FDAU in their 737-''Classics'' would have to be replaced—those units cannot be reprogrammed. The FAA agrees with these comments. In the Supplemental PRE, the FAA has tentatively determined that by 2004 operators of 198 737–200s will have introduced FDAUs into their airplanes; that operators of 407 737–300/400/500s with a FDAU will have installed new FDAUs in their airplanes; and that operators of 279 737–700/800/900s will have reprogrammed their existing FDAUs.

Continental Airlines and Aloha Airlines reported a $50,000 cost for a new FDAU and a cost to reprogram a FDAU of between $7,500 and $10,000. In the Supplemental PRE, the FAA uses a cost of $50,000 for a new FDAU and an average of the two estimates ($8,750) as the cost to reprogram a FDAU.

In the NPRM, the FAA noted that retrofitting a 737 with a FDAU would require rerouting the FDR system wiring because the recorder (where the wires formerly terminated) is located aft, while the new FDAU would be in the front. Relying on estimates from Southwest Airlines and United, the FAA estimated that retrofitting a FDAU would take 200 labor hours, which includes the associated labor hours to rewire the existing FDR system. Aloha Airlines submitted the only specific comment on this issue and it agreed with the FAA estimate. Thus, the FAA continues to assume 200 labor hours to retrofit a FDAU.

In the NPRM, the FAA estimated that it would take 48 hours for a FDAU on a 737-''Classic'' airplane and 40 hours for a FDAU on a 737-''NG'' airplane to be removed, shipped to the manufacturer, reprogrammed, reinstalled, and tested. Three airlines filed comments on these estimates. Aloha Airlines reported that it will take the same number of labor hours (200) to replace an existing FDAU as it will to retrofit a FDAU in an FDR system that did not previously have one. The FAA disagrees. The effort to retrofit a FDAU is greater than the effort to install one in an airplane that did not have it. Continental Airlines estimated a cost of $71,500 for the equipment and labor costs to replace a FDAU. However, that estimate also included the cost to record the additional flight data parameters and the increased sampling rate for flight data parameter (a)(88). United Airlines similarly estimated a total labor cost of $33,000 for the entire retrofit. The numbers submitted by Continental Airlines and United Airlines do not allow the FAA to distinguish the number of labor hours to replace a FDAU from the total labor hours for the retrofit. After reviewing the comments, the FAA has increased the estimated number of labor hours to replace a 737-''Classic's'' FDAU from 48 hours to 80 hours and reduced the number of labor hours from 40 hours to 20 hours for a 737-''NG's'' FDAU.

Accordingly, the FAA calculates that the labor costs to install a FDAU in an FDR system that did not have one is $17,000; the labor costs to replace a FDAU is $6,800; and the labor costs to install a reprogrammed FDAU is $1,700.

In the NPRM, the FAA estimated the total FDAU equipment and labor costs to retrofit FDAUs would be $37.6 million. In the Supplemental PRE, the FAA calculates the total equipment and a labor cost to retrofit FDAUs at $40.9 million, which has a present value of $35.8 million.

In the NPRM, the FAA divided the equipment and labor costs for the additional wiring for adding the sensors into three components: (1) The costs to record flight data parameters (a)(19) through (a)(22); (2) the costs to record flight data parameters found in (a)(88) at the greater ranges and increased sampling rates; and (3) the costs to record flight data parameters (a)(89) through (a)(91). That division is continued in this analysis.

In the NPRM, the FAA estimated the costs of the sensors and wiring for a 737 FDR system to record parameters (a)(19) through (a)(22) were $20,000. The only specific comment received on this estimate was from Aloha Airlines, which agreed with the estimate. As a result, the FAA uses this value in the Supplemental PRE.

In the NPRM, the FAA estimated that the installation of the sensors and wiring to record flight data parameters (a)(19) through (a)(22) would take 200 labor hours for a 737–200, a 737–200 Advanced, or a 737–400 airplane. It would take 400 labor hours for a 737–300 or a 737–500 series airplane.

Boeing commented that the FAA misclassified the labor costs for the 737–400 because the avionics in that series are essentially the same as the avionics in the 737–300 and 737–500 series airplanes. These airplanes employ ARINC 700 systems, while the 737–200 and 737–200 Advanced are, basically, ''all analog'' airplanes. Boeing contended the labor time (and cost) to rewire a 737–400 airplane is similar to the labor hours (and costs) for a 737–300 or a 737–500 airplane. The FAA accepts Boeing's comment and has assigned the same number of labor hours for all the 737–300/400/500 airplanes.

As Aloha Airlines uses the same 200 labor hour estimate for its 737–200 retrofits, the FAA continues to use the 200 labor hours in the NPRM to retrofit 737–200s in the Supplemental PRE. Boeing noted that there are minor differences in the amount of wiring among all of its 737- ''Classics''. The FAA agrees and has revised its estimate for the 737–300/400/500 series retrofit to record flight data parameters from 400 labor hours to 200 labor hours. Thus, the FAA calculates the sensor and labor cost to record flight data parameters (a)(19) through (a)(22) of $17,000 for a 737-''Classic''. The total anticipated cost to record flight data parameters (a)(19) through (a)(22) is $37,000. Boeing also commented that the FAA had not specifically estimated the costs for the individual sensors and other equipment required to record flight data parameters (a)(19) through (a)(22). The FAA agrees; however, the FAA notes that the airline cost estimates were not provided on an individual sensor basis. Consequently, the FAA could not establish individual sensor cost estimates.

In the NPRM, the FAA used preliminary industry estimates that it would cost $12,000 to add the necessary sensors and wiring to record flight data parameter (a)(88) in a 737 FDR system that does not currently record it or that does not record it at the proposed range. American Airlines commented that it will cost $8,000 for the sensors to record this flight data parameter at the proposed range. The FAA accepts the American Airlines estimate and has assumed a cost of $8,000.

In the NPRM, the FAA assumed that it would cost $12,000 to replace all sensors currently recording flight data parameter (a)(88) in order to comply with the higher sampling rate requirement. Boeing, however, reported that the existing sensors can be reprogrammed to transmit information at the increased sampling rate. The FAA agrees with Boeing and has tentatively determined there will be no sensor costs to comply with the higher sampling rates for flight data parameter (a)(88).

In the NPRM, the FAA estimated that it would take 160 labor hours to install the sensors in a 737-''Classic'' FDR system that was either not recording flight data parameter (a)(88) or not recording it at the proposed range. Aloha Airlines reported a total of 360 labor hours to record flight data parameters (a)(88) through (a)(91). As three of the six flight data parameters to be recorded are found in (a)(88), the FAA has assumed that half of the labor hours reported by Aloha Airlines (180) hours will be used to install flight data parameter (a)(88) for a labor cost of $15,300 per airplane.

In the NPRM, the FAA estimated that it would take 160 labor hours to replace the sensor in a 737–''NG'' that was recording flight data parameter (a)(88) at the lower sampling rate. The FAA believes that it takes fewer labor hours to reprogram the sensor to record flight data parameter (a)(88) than it will take to introduce new sensors and wiring into a FDR system that had not previously recorded it. In the Supplemental PRE, the FAA has tentatively determined that it will take 80 labor hours (at a cost of $6,800) to install new sensors for flight data parameter (a)(88).

Boeing did not provide a labor hour estimate to install reprogrammed sensors to record at the higher sampling rate. In the Supplemental PRE, the FAA estimates that it takes one-half (40) hours to reprogram the sensors than it does to install new sensors at a labor cost of $3,400 per airplane.

The FAA also estimates that the retrofit costs to install new sensors to record flight data parameter (a)(88) are $23,300 for a 737-''Classic'' and $14,800 in a 737-''NG''. The cost to install reprogrammed sensors in a 737-''NG'' is $3,400.

Aloha Airlines and American Airlines provided sensor costs or the number of labor hours to retrofit FDR systems to record flight data parameters (a)(89), (a)(90), and (a)(91). The American Airlines comment provided aggregated data and the FAA could not disaggregate some of their costs. Aloha Airlines reported a total wiring and sensor cost of $12,000 to record flight data parameters (a)(88) through (a)(91). The FAA agrees with this estimate. As the FAA has also determined that the wiring and sensor cost to retrofit flight data parameter (a)(88) is approximately $8,000, the FAA concludes that the wiring and sensor costs to retrofit flight data parameters (a)(89) through (a)(91) should be approximately $4,000.

As noted, the FAA has determined that half of the labor time reported by Aloha Airlines is to install flight data parameter (a)(88) and half the time is to install flight data parameters (a)(89), (a)(90), and (a)(91). Thus, the FAA calculates that 180 labor hours (at a cost of $15,300) will be required to install flight data parameters (a)(89), (a)(90), and (a)(91) in a 737-''Classic''. The FAA has also assumed that 80 labor hours (at a cost of $6,800) will be required to install flight data parameters (a)(89), (a)(90), and (a)(91) in a 737-''NG''. The FAA calculates that the retrofitting costs to record flight data parameters (a)(89), (a)(90), and (a)(91) is $27,300 for a 737-''Classic'' and $10,800 for a 737-''NG''.

In the NPRM, the FAA estimated the total retrofitting sensor and wiring costs to have been: $84,000 for a 737–200 or a 737–400 airplane without a FDAU; $100,000 for a 737–300 or a 737–500 airplane without a FDAU; $49,000 for an older 737 airplane with a FDAU; and $24,000 and for a newer 737 airplane with a FDAU.

In the Supplemental PRE, the FAA estimates that the retrofitting sensor and wiring costs, per 737, are: $89,600 for a 737-''Classic'' that records 18 flight data parameters; $52,600 for a 737-''Classic'' that records 22 flight data parameters; $25,600 for a 737-''NG'' manufactured before August 2000: and $10,800 for a 737-''NG'' manufactured after August 2000.

In the NPRM, the FAA estimated that the total sensor and wiring costs to retrofit all 737 FDR systems by the compliance date would be $69 million. The FAA now calculates that the total sensor and wiring costs to retrofit all 737 FDR systems by the compliance date is $48 million, which has a present value of $42 million.

In the NPRM, the FAA did not consider (and did not estimate) any cost for reprogramming the flight control computers (FCCs). Boeing and American Airlines commented that recording the additional flight data parameters would require reprogramming the FCCs. Boeing provided no cost estimates for FCC reprogramming, but American Airlines reported that it will cost $5,000 per FCC to reprogram the 2 FCCs (for a total cost of $10,000 per airplane). The FAA accepts the American Airlines estimate and applies it to all 737s. The FAA now calculates a total cost to reprogram the FCCs of $8.8 million, which has a present value of $7.7 million.

In the NPRM, the FAA estimated that the equipment and labor costs to retrofit the existing 737 fleet were $17.2 million for recorders, $37.7 million for FDAUs, and $69.4 million for wiring and sensors, for a total cost of $124.3 million. In the Supplemental PRE, the FAA calculates that the equipment and labor costs to retrofit the existing 737 fleet are $14.7 million for recorders, $40.9 million for FDAUs, $47.2 million for wiring and sensors, and $8.8 million for FCCs, for a total cost of $111.6 million, which has a present value of $92.6 million.

Total One-Time FDR System Retrofitting Costs

In the NPRM, the FAA estimated the total one-time compliance costs and losses from out-of-service time would have been $149.6 million. Based on the comments and updated data, the FAA now calculates that the total one-time compliance costs and losses from out-of-service time would be $125.2 million, which has a present value of $109.5 million.

Annual Costs Resulting From Retrofitting 737 FDR Systems

The Supplemental PRE also contemplates annual compliance costs from: (1) Additional airplane weight due to retrofitted FDR system; and (2) additional maintenance costs to annually validate the FDAU.

In the NPRM, the FAA estimated that the proposed rule would add 40 pounds to a 737 that does not have a FDAU and records 18 flight data parameters and add 10 pounds to a 737 that has a FDAU and records at least 22 flight data parameters. In calculating the estimated additional fuel cost, the FAA assumed a per-airplane average of 2,750 flight hours per year, a price of $0.61 per gallon of aviation fuel, and 0.23 additional gallons consumed per additional pound per flight hour. These assumptions resulted in per-airplane annual costs of $400 for a 737 that adds 40 pounds and $100 for a 737 that adds 10 pounds. On that basis, the FAA estimated the total cost from the increased fuel consumption during 2001 and 2020 would have been $6.1 million, which has a present value of $3.6 million. There were no comments on this estimate.

In the Supplemental PRE, the underlying NPRM methodology is maintained but certain parameters are updated (from 2,750 to 3,360 flight hours per year and from $0.61 to $0.75 per gallon cost of aviation fuel). However, the FAA has revised the weight added by the retrofitted sensors and wiring for 737–300/400/500s from 10 pounds to 20 pounds. On that basis, the FAA now calculates that adding 40 pounds to a 737 would increase its annual fuel costs by $584, adding 20 pounds would increase its annual fuel costs by $292, and adding 10 pounds would increase its annual fuel costs by $146. These revised calculations result in a total fuel cost increase of $2 million between 2005–2014, which has a present value of $1.4 million.

In the NPRM, the FAA estimated that the incremental annual inspection and validation of a FDAU would cost $750. On that basis, the FAA estimated the total cost from the increased maintenance during 2001 and 2020 would have been $4.2 million, which has a present value of $2.7 million. As there were no comments on this estimate, the FAA has decided to retain it. Based on the number of 737s that would have had FDAUs introduced into the airplane and on the number that would have been retired between 2005 to 2014, the FAA calculates a total maintenance cost increase of $700,000, which has a present value of $535,000.

In the NPRM, the FAA estimated that the increased annual operational and maintenance costs between 2001 and 2020 would have been $10.3 million, which has a present value of $6.3 million. In the Supplemental PRE, the FAA calculates that the increased annual operational and maintenance costs between 2005 and 2014 are $2.7 million, which has a present value of $1.9 million.

Compliance Costs for Production 737s

In the NPRM, the FAA estimated a total cost for 737s manufactured between 2000 and 2020 of $86 million, which has a present value of $40.4 million, to install the equipment to record proposed flight data parameters (a)(89), (a)(90), and (a)(91). As previously discussed, the Supplemental PRE has taken into account Boeing's voluntary installation of this equipment on all its 737s since August 2000, indicating that the SNPRM would impose no compliance costs on production 737s.

Benefit-Cost Comments

In the NPRM, the FAA estimated that the expected present value of the benefits ($156 million) would have been less than the present value of the quantifiable total compliance costs ($214 million). However, the FAA noted there is considerable uncertainty about the potential number of future accidents. As a result, the FAA concluded that it was in general agreement with the NTSB recommendations that this information is needed.

Boeing disagreed with an aggregated benefit-cost approach and commented that an appropriate analysis should be based on an individual provision-by-provision (or, in this case, flight data parameter by flight data parameter) evaluation. In principle, the FAA agrees with the Boeing comment. However, the FAA has no data that can support a parameter-by-parameter cost calculation. All of the submitted retrofitting cost data were block costs in which no individual flight data parameter costs were provided. In practice, such a detailed benefits analysis presupposes the existence of an objective probability function based on an engineering analysis for each flight data parameter of the potential for the additional information to lead accident investigators to the cause of an accident. It is precisely because engineering analyses have been unable to determine the causes of these accidents that such individual probabilities cannot be determined. At best, current engineering analyses have established that one of this group of several flight data parameters, if recorded, may help to determine the causes of future accidents. As a result, the FAA has decided against reevaluating its benefit-cost analysis in the Supplemental PRE based on the individual flight data parameters.

Finally, Boeing commented that the FAA should analyze the proposed rule for individual airplanes based on their expected remaining service life with a possible view of exempting older 737s. The justification is that the potential benefits to any individual 737 airplane would be lower the shorter its remaining service life while the costs would not be similarly reduced. Although the FAA agrees that, for an individual 737, the incremental benefits received from a dollar of cost are lower for older airplanes, the FAA disagrees that this is an appropriate framework to analyze the recording requirements. The primary benefits attributable to this proposed rule do not accrue to the 737 that would have an accident, but, rather, to every other 737 that would not have a similar accident because engineering or operational changes that would prevent such future accidents would be developed from the flight data recorded from the accident or incident. The FAA is not able to correlate the potential probability of such an accident to the age of a 737. Accordingly, in any year, the FAA assumes that all 737s face an equal probability that an accident may occur to any one of them. If some 737s were exempted from the rule and if an uncontrolled rudder movement accident were to happen to one of those exempted airplanes, then no such future accident would be prevented for the 737 fleet because the necessary flight data would not have been recorded and no appropriate engineering or operational changes could have been made. However, in recognition of the potential economic impact, the FAA agrees with Boeing's suggestion that it is appropriate to limit the applicability of this rule to not include those 737s that have a limited remaining service life. Thus, this proposed rule would apply only to 737s that would be in service 4 years after the promulgation of the final rule.

Regulatory Flexibility Determination

The Regulatory Flexibility Act of 19805 U.S.C. 601–612, directs the FAA to fit regulatory requirements to the scale of the businesses, organizations, and governmental jurisdictions subject to the regulation. The FAA is required to determine whether a proposed or final action will have a ''significant economic impact on a substantial number of small entities'' as defined in the ACT. If the FAA finds that the action will have a significant impact, the FAA must perform a ''regulatory flexibility analysis.'' However, if an agency determines that a proposed or final rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the Act provides that the head of the agency may so certify, and a regulatory flexibility analysis is not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear.

In the NPRM, the FAA prepared a Preliminary Regulatory Flexibility Analysis because the proposed rule might have had a significant economic impact upon a substantial number of small entities. The FAA had concluded, after that preliminary analysis, that the proposed rule may not have met that criterion, but it reported its analysis and requested public comments. The FAA received no comments about the Preliminary Regulatory Flexibility Analysis.

However, subsequent to publication of the NPRM, the Office of Advocacy of the Small Business Administration published new guidelines that defined a small airline as one that has fewer than 1,500 employees. In 2003, the FAA performed a new Regulatory Flexibility Analysis for this SNPRM. In that analysis, of the 20 airlines that would be affected by the SNPRM, 12 have fewer than 1,500 employees and are small entities. Of these 12 airlines, one had a positive net operating income, seven had negative net operating income, and net operating income data were not available for four airlines. Twelve airlines is a substantial number of airlines and the cost per airplane is significant—particularly when the airline has negative net operating income.

Therefore, based on that information available at that time and the definition of a small business, the FAA Administrator has determined that the proposed rule could have a significant economic effect on a substantial number of small entities. Under the new definition, our preliminary conclusion is that it will have a significant economic impact.

This determination is explained in more detail in the Regulatory Flexibility Section of the Supplemental PRE. However, since the results of that evaluation are based on data that are not current, we are requesting that affected operators provide us with more current data to be used to update the Regulatory Flexibility Evaluation before any final rule is issued.

Trade Impact Assessment

The Trade Agreement Act of 1979 prohibits Federal agencies from establishing any standards or engaging in related activities that create unnecessary obstacles to the foreign commerce of the United States. Legitimate domestic objectives, such as safety, are not considered unnecessary obstacles. The statute also requires consideration of international standards and, where appropriate, that they be the basis for U.S. standards. The FAA has assessed the potential effect of this rulemaking and determined that it would have only a domestic impact and, therefore, no affect on any trade-sensitive activity.

Unfunded Mandates Assessment

The Unfunded Mandates Reform Act of 1995 (the Act) is intended, among other things, to curb the practice of imposing unfunded Federal mandates on State, local, and tribal governments or on the private sector.

Section 202(a) (2 U.S.C. 1532) of Title II of the Act requires that each Federal agency, to the extent permitted by law, prepare a written statement assessing the effects of any Federal mandate in a proposed or final agency rule that may result in the expenditure by State, local, and tribal governments, in the aggregate, or by the private sector, of $100 million or more (adjusted annually for inflation) in any one year; such a mandate is deemed to be a ''significant regulatory action.'' The FAA currently uses an inflation-adjusted value of $128.1 million in lieu of $100 million. Section 203(a) of the Act (2 U.S.C. 1533) provides that before establishing any regulatory requirements that might significantly or uniquely affect small governments, an agency shall have developed a plan under which the agency shall:

(1) Provide notice of the requirements to potentially affected small governments, if any;

(2) Enable officials of affected small governments to provide meaningful and timely input in the development of regulatory proposals containing significant Federal intergovernmental mandates; and,

(3) Inform, educate, and advise small governments on compliance with the requirements.

With respect to (2), Section 204(a) of the Act (2 U.S.C. 1534) requires the Federal agency to develop an effective process to permit elected officers of State, local, and tribal governments (or their designees) to provide the input described.

This rulemaking does not contain a significant Federal intergovernmental or private sector mandate because the compliance costs to the private sector would be about $48 million in each of the years 2005, 2006, and 2007, and no more than $3 million in any following year. Therefore, the requirements of Title II do not apply.

Executive Order 13132, Federalism

The FAA has analyzed this rulemaking under the principles and criteria of Executive Order 13132, Federalism. We determined that this action will not have a substantial direct effect on the States, or the relationship between the national Government and the States, or on the distribution of power and responsibilities among the various levels of government, and therefore does not have federalism implications.

IX. Environmental Analysis

FAA Order 1050.1E identifies FAA actions that are categorically excluded from preparation of an environmental assessment or environmental impact statement under the National Environmental Policy Act in the absence of extraordinary circumstances. The FAA has determined this rulemaking action qualifies for the categorical exclusion identified in paragraph 312d and involves no extraordinary circumstances.

X. Regulations That Significantly Affect Energy Supply, Distribution, or Use

The FAA has analyzed this SNPRM under Executive Order 13211, Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use (May 18, 2001). We have determined that it is not a ''significant energy action'' under the executive order because it is not a ''significant regulatory action'' under Executive Order 12866, and it is not likely to have a significant adverse effect on the supply, distribution, or use of energy.

List of Subjects

14 CFR Part 91

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

14 CFR Part 121

Air carriers, Aircraft, Aviation safety, Reporting and recordkeeping requirements, Safety, Transportation.

14 CFR Part 125

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

The Amendment

In consideration of the foregoing, the Federal Aviation Administration proposes amending Chapter I of Title 14, Code of Federal Regulations as follows:

PART 91—GENERAL OPERATING AND FLIGHT RULES

1. The authority citation for part 91 continues to read as follows:

Authority: 49 U.S.C. 106(g), 1155, 40103, 40113, 40120, 44101, 44111, 44701, 44709, 44711, 44712, 44715, 44716, 44717, 44722, 46306, 46315, 46316, 46504, 46506–46507, 47122, 47508, 47528–47531, articles 12 and 29 of the Convention on International Civil Aviation (61 stat. 1180).

2. Amend § 91.609 by adding a new paragraph (h) as follows:

§ 91.609 Flight recorders and cockpit voice recorders.

* * * * *

(h) An aircraft operated under this part under deviation authority from part 125 of this chapter must comply with all of the applicable flight data recorder requirements of part 125 applicable to the aircraft, notwithstanding such deviation authority.

PART 121—OPERATING REQUIREMENTS: DOMESTIC, FLAG, AND SUPPLEMENTAL OPERATIONS

3. The authority citation for part 121 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 40119, 41706, 44101, 44701–44702, 44705, 44709–44711, 44713, 44716–44717, 44722, 44901, 44903–44904, 44912, 45101–45105, 46105, 46301.

4. Amend § 121.344 by removing the word ''and'' after paragraph (a)(87); by removing the period after paragraph (a)(88) and adding a semicolon in its place; by adding new paragraphs (a)(89), (90) and (91), (b)(4), (c)(4), (d)(3), (e)(3) and (m); and by revising paragraph (f) to read as follows:

§ 121.344 Digital flight data recorders for transport category airplanes.

(a) * * *

(89) Yaw damper status;

(90) Yaw damper command; and

(91) Standby rudder valve status.

(b) * * *

(4) In addition to the requirements of paragraphs (b)(1) through (b)(3) of this section, all Boeing 737 model airplanes must comply with the requirements of paragraph (m) of this section, as applicable.

(c) * * *

(4) In addition to the requirements of paragraphs (c)(1) through (c)(3) of this section, all Boeing 737 model airplanes must comply with the requirements of paragraph (m) of this section, as applicable.

(d) * * *

(3) In addition to the requirements of paragraphs (d)(1) and (d)(2) of this section, all Boeing 737 model airplanes also must comply with the requirements of paragraph (m) of this section, as applicable.

(e) * * *

(3) In addition to the requirements of paragraphs (e)(1) and (e)(2) of this section, all Boeing 737 model airplanes, also must comply with the requirements of paragraph (m) of this section, as applicable.

(f) For all turbine-engine-powered transport category airplanes manufactured after August 19, 2002—

(1) The parameters listed in paragraphs (a)(1) through (a)(88) of this section must be recorded within the ranges, accuracies, resolutions, and recording intervals specified in appendix M to this part.

(2) In addition to the requirements of paragraphs (f)(1) of this section, all Boeing 737 model airplanes must also comply with the requirements of paragraph (m) of this section.

* * * * *

(m) In addition to all other applicable requirements of this section, all Boeing 737 model airplanes must record the parameters listed in paragraph (a)(1) through (a)(22) and (a)(88) through (a)(91) of this section within the ranges, accuracies, resolutions, and recording intervals specified in Appendix M to this part. The approved recorder and all equipment necessary to record the parameters required by this paragraph must be installed no later than the installation of the redesigned rudder system required by one or more Airworthiness Directives issued under part 39 of this chapter. The single-source recording provisions of paragraphs (b)(1)(ii), (c)(1), and (d)(1) of this section may be used for airplanes otherwise subject to those paragraphs.

5. Amend Appendix M to part 121 by revising item 88 and adding items 89 through 91 to read as follows:

Appendix M to Part 121—Airplane Flight Recorder Specifications—Continued

* * * * *

Parameter	Range	Accuracy (sensor input)	Seconds per sampling interval	Resolution	Remarks
88. All cockpit flight control input forces (control wheel, control column, rudder pedal).[18 19]	Full range Control wheel ±70 lbs. Control column ±85 lbs. Rudder pedal ±165 lbs.	±5%	1	0.2% of full range	For fly-by-wire flight control systems, where flight control surface position is a function of the control input device only, it is not necessary to record this parameter. For airplanes that have a flight control break away capability that allows either pilot to operate the control independently, record both control force inputs. The control force inputs may be sampled alternately once per 2 seconds to produce the sampling interval of 1.
89. Yaw damper status.	Discrete (on/off)		0.5		
90. Yaw damper command.	Full range	As installed	0.5	1% of full range.	
91. Standby rudder valve status.	Discrete		0.5		

[18] For all 737 model airplanes: the seconds per sampling interval is 0.5 per control input; the remarks regarding the sampling rate do not apply; a single control wheel force transducer installed on the left cable control is acceptable provided the left and right control wheel positions also are recorded.

[19] For all 737 model airplanes manufactured on or before January 31, 2001, Range values are: Full Range; Control wheel ±15 lbs.; Control column ±40 lbs.; and Rudder pedal ±165 lbs.

PART 125—CERTIFICATION AND OPERATIONS: AIRPLANES HAVING A SEATING CAPACITY OF 20 OR MORE PASSENGERS OR A MAXIMUM PAYLOAD CAPACITY OF 6,000 POUNDS OR MORE

6. The authority citation for part 125 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701–44702, 44705, 44710–44711, 44713, 44716–44717, 44722.

7. Amend § 125.3 by adding a new paragraph (d) to read as follows:

§ 125.3 Deviation authority.

* * * * *

(d) No deviation authority from the flight data recorder requirements of this part will be granted. Any previously issued deviation from the flight data recorder requirements of this part is no longer valid.

8. Amend § 125.226 by removing the word ''and'' after paragraph (a)(87); by removing the period after paragraph (a)(88) and adding a semicolon in its place; by adding new paragraphs (a)(89), (90), and (91), (b)(4), (d)(3), (e)(3), and (m); and by revising paragraph (f) to read as follows:

§ 125.226 Digital flight data recorders.

(a) * * *

(89) Yaw damper status;

(90) Yaw damper command; and

(91) Standby rudder valve status.

(b) * * *

(4) In addition to the requirements of paragraphs (b)(1) through (b)(3) of this section, all Boeing 737 model airplanes also must comply with the requirements of paragraph (m) of this section.

(c) * * *

(4) In addition to the requirements of paragraphs (c)(1) through (c)(3) of this section, all Boeing 737 model airplanes must comply with the requirements of paragraph (m) of this section, as applicable.

(d) * * *

(3) In addition to the requirements of paragraphs (d)(1) and (d)(2) of this section, all Boeing 737 model airplanes also must comply with the requirements of paragraph (m) of this section, as applicable.

(e) * * *

(3) In addition to the requirements of paragraphs (e)(1) and (e)(2) of this section, all Boeing 737 model airplanes, also must comply with the requirements of paragraph (m) of this section, as applicable.

(f) For all turbine-engine-powered transport category airplanes manufactured after August 19, 2002—

(1) The parameters listed in paragraphs (a)(1) through (a)(88) of this section must be recorded within the ranges, accuracies, resolutions and recording intervals specified in appendix E to this part.

(2) In addition to the requirements of paragraph (f)(1) of this section, all Boeing 737 model airplanes must also comply with the requirements of paragraph (m) of this section.

* * * * *

(m) In addition to all other applicable requirements of this section, all Boeing 737 model airplanes must record the parameters listed in paragraph (a)(1) through (a)(22) and (a)(88) through (a)(91) of this section within the ranges, accuracies, resolutions, and recording intervals specified in Appendix E to this part. The approved recorder and all equipment necessary to record the parameters required by this paragraph must be installed no later than the installation of the redesigned rudder system required by one or more Airworthiness Directives issued under part 39 of this chapter. The single-source recording provisions of paragraphs (b)(1)(ii), (c)(1), and (d)(1) of this section may be used for airplanes otherwise subject to those paragraphs.

9. Amend Appendix E to part 125 by revising item 88, and adding items 89 through 91 to read as follows:

Appendix E to Part 125—Airplane Flight Recorder Specifications—Continued

* * * * *

Parameter	Range	Accuracy (sensor input)	Seconds per sampling interval	Resolution	Remarks
88. All cockpit flight control input forces (control wheel, control column, rudder pedal).[18] [19]	Full range Control wheel ±70 lbs. Control column ±85 lbs. Rudder pedal ±65 lbs.	±5%	1	0.2% of full range	For fly-by-wire flight control systems, where flight control surface position is a function of the displacement of the control input device only, it is not necessary to record this parameter. For airplanes that have a flight control break away capability that allows either pilot to operate the control independently, record both control force inputs. The control force inputs may be sampled alternately once per 2 seconds to produce the sampling interval of 1.
89. Yaw damper status.	Discrete (on/off)		0.5		
90. Yaw damper command.	Full range	As installed	0.5	1% of full range.	
91. Standby rudder valve status.	Discrete		0.5		

[18] For all 737 model airplanes: the seconds per sampling interval is 0.5 per control input; the remarks regarding the sampling rate do not apply; a single control wheel force transducer installed on the left cable control is acceptable provided the left and right control wheel positions also are recorded.

[19] For all 737 model airplanes manufactured on or before January 31, 2001, Range values are: Full Range; Control wheel ±15 lbs.; Control column ±40 lbs.; and Rudder pedal ±165 lbs.

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Issued in Washington, DC, on August 25, 2006.

John J. Hickey,

Director, Aircraft Certification Service.

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