DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 91, 121, and 125

[Docket No. FAA–1999–6482; Notice No. 99–19]

RIN 2120–AG87

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

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of proposed rulemaking (NPRM).

SUMMARY: The FAA proposes to amend the digital flight data recorder (DFDR) regulations for transport category airplanes to add a requirement for all Boeing 737 (B–737) series airplanes to record additional flight data parameters. This proposal is based on safety recommendations issued by the National Transportation Safety Board (NTSB) following the investigations of two accidents and other incidents involving B–737 aircraft. The additional parameters that would be recorded would provide the only currently available means of gathering information that the FAA and the NTSB anticipate will help assess the reasons for continuing incidents that appear related to rudder anomalies on B–737 airplanes. In addition, the FAA is proposing a change to the flight data recorder requirements of part 125 that would affect all aircraft operated under that part or under deviation from that part.

DATES: Comments must be received on or before December 20, 1999.

ADDRESSES: Comments on this document should be mailed or delivered, in duplicate, to: U.S. Department of Transportation Dockets, Docket No. [FAA–1999–6482], 400 Seventh Street SW., Room Plaza 401, Washington, DC 20590. Comments also may be sent electronically to the following Internet address: 9–NPRM–CMTS@faa.gov. Comments may be filed and examined in Room Plaza 401 between 10 a.m. and 5 p.m. weekdays, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: George Kaseote, Aircraft Certification Service, AIR–130, Federal Aviation Administration, 800 Independence Avenue SW., Washington, DC 20591; telephone (202) 267–8541; facsimile (202) 493–5173.

SUPPLEMENTARY INFORMATION:

Comments Invited

Interested persons are invited to participate in the making of the proposed action by submitting such written data, views, or arguments as they may desire. Comments relating to the environmental, energy, federalism, or economic impact that might result from adopting the proposals in this document also are invited. Substantive comments should be accompanied by cost estimates. Comments must identify the regulatory docket or notice number and be submitted in duplicate to the DOT Rules Docket address specified above.

All comments received, as well as a report summarizing each substantive public contact with FAA personnel concerning this proposed rulemaking, will be filed in the docket. The docket is available for public inspection before and after the comment closing date.

All comments received on or before the closing date will be considered by the Administrator before taking action on this proposed rulemaking. Comments filed late will be considered as far as possible without incurring expense or delay. The proposals in this document may be changed in light of the comments received.

Commenters wishing the FAA to acknowledge receipt of their comments submitted in response to this document must include a pre-addressed, stamped postcard with those comments on which the following statement is made: ''Comments to Docket No. FAA–1999–6482.'' The postcard will be date stamped and mailed to the commenter.

Availability of NPRMs

An electronic copy of this document may be downloaded using a modem and suitable communications software from the FAA regulations section of the FedWorld electronic bulletin board service (telephone: (703) 321–3339) and the Government Printing Office (GPO)'s electronic bulletin board service (telephone: (202) 512–1661).

Internet users may reach the FAA's web page at http://www.faa.gov/avr/arm/nprm/nprm.htm or the GPO's web page at http://www.access.gpo.gov/nara for access to recently published rulemaking documents.

Any person may obtain a copy of this document by submitting 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. Communications must identify the notice number or docket number of this NPRM.

Persons interested in being placed on the mailing list for future rulemaking documents should request from the above office a copy of Advisory Circular No. 11–2A, Notice of Proposed Rulemaking Distribution System, which describes the application procedure.

Background

Statement of the Problem

Two aviation accidents in the United States involving Boeing 737 (B–737) model airplanes appear to have been caused by a rudder hardover with resultant roll and sudden descent: United Airlines (United) flight 585, near Colorado Springs, Colorado, on March 3, 1991, and USAir flight 427, near Aliquippa, Pennsylvania, on September 8, 1994. The NTSB has determined that the rudder on B–737 airplanes may experience sudden uncommanded movement or movement opposite the pilot's input, which may cause the airplane to roll suddenly. Incidents of suspected uncommanded rudder movement continue to be reported, including five incidents in 1999 involving U.S.-registered airplanes.[1]

The B–737 airplanes involved in the United and USAir accidents and in the recent rudder incidents were equipped with the required flight data recorders (FDRs), but none of the recorders provided information about the airplanes' movement about their three axes or the positions of the flight control surfaces immediately preceding the accidents or incidents. To date, corrective measures taken to resolve the suspected problem have been limited by the lack of data being recorded. More data is needed to help identify events occurring during suspected uncommanded or hardover rudder events.

The FAA has issued 17 airworthiness directives (ADs) for the B–737 airplane as a result of the investigation into the USAir accident, including one that addresses an upgraded rudder power control unit (PCU) designed to remedy one element of the rudder upset problem, a rudder reversal. Suspected rudder upsets continue to occur, however, and some of the B–737 airplanes that recently experienced

[1] On February 23, 1999, a USAirways Metrojet B–737–200 experience a roll to the left with no change in heading. This incident is further described later in this NPRM. On February 23, 1999, A USAirways B–737–200 experienced an uncommanded rudder movement shortly after departure. On March 12, 1999, a Delta Air Lines B–737–247 experienced a 2-second uncommanded yaw to the right during cruise flight. On April 13, 1999, a United B–737–300 experienced an uncommanded 20 to 30 degree roll to the left during level cruise flight described as a ''sharp quick uncommanded kick to the left.'' On April 10, 1999, a United B–737–300 aborted its takeoff roll because of an uncommanded yaw event as the airplane passed through 120 to 130 knots.

suspected uncommanded rudder movements (not reversals) had been modified with the upgraded rudder PCU, suggesting that other events are still occurring in the rudder system.

The FAA agrees with the NTSB's conclusion that the collection of additional rudder system and flight control data are necessary to more effectively assess the cause of the continued uncommanded rudder movements and to possibly design a solution. The NTSB stated in its safety recommendations that all B–737 airplanes should record pitch trim, trailing and leading edge flaps, thrust reverser position, yaw damper command, yaw damper status (on/off), standby rudder status (on/off), and control wheel, control column, and rudder pedal forces.

Summary of B–737 Accidents

United Flight 585

On March 3, 1991, United flight 585, a B–737–291, was on a scheduled passenger flight from Denver to Colorado Springs, Colorado. As the airplane was completing its turn to final approach, it rolled rapidly to the right and pitched down, reaching a nearly vertical attitude before it struck the ground. The airplane was destroyed and none of the 5 crewmembers or 20 passengers survived. The FDR recorded five flight data parameters (altitude, airspeed, heading, vertical acceleration, and microphone keying) in accordance with the applicable regulations for an airplane its age. The FDR was not required to record other parameters that the NTSB later perceived as critical to its accident investigation, including airplane pitch and roll attitude, engine thrust, lateral and longitudinal acceleration, control wheel position, rudder pedal position, and the position of the control surfaces (rudder, aileron, and spoiler). The NTSB was unable to make a determination of the probable cause of the accident.

USAir Flight 427

On September 8, 1994, USAir flight 427, a B–737–3B7, was on a scheduled passenger flight from Chicago, Illinois, to Pittsburgh, Pennsylvania, when, during the approach to Pittsburgh, the airplane suddenly rolled to the left and pitched down until it reached a nearly vertical attitude and struck the ground near Aliquippa, Pennsylvania. The airplane was destroyed and none of the 5 crewmembers or 127 passengers survived. The FDR was equipped to record the following 13 parameters: altitude, airspeed, heading, pitch attitude, roll attitude, vertical acceleration, longitudinal acceleration, microphone keying, low pressure compressor speed, high pressure compressor speed, exhaust gas temperature, fuel flow, and control column position.

NTSB Investigation of USAir Flight 427

Early in the investigation of the USAir accident, the NTSB noticed that the airplane experienced a high rate of change in its heading, an indication that the initial upset of the airplane may have been caused by uncommanded rudder movement. This situation had been considered in the 1991 United flight 585 accident investigation, and the NTSB reviewed the information it had collected from the United accident as the USAir investigation continued. Another rudder upset incident occurred on an Eastwind Airlines[2] B–737 while the USAir investigation continued, and a concurrent investigation was opened. The Eastwind investigation concluded that unlike the B–737s involved in the United and USAir accidents, the Eastwind flight was moving at well over the crossover airspeed,[3] and thus maintained sufficient roll control authority to overcome the effects of full rudder deflection.

FAA Actions

Following piloted computer simulations of the USAir accident and reports of malfunctions in the yaw damper system of B–737s, the FAA issued two ADs requiring design changes to the rudder system on B–737 airplanes. To address possible rudder hardover scenarios and uncommanded yaw damper movements, the FAA first issued AD 97–14–03 (62 FR 34623, June 27, 1997). That AD requires installation of a newly designed rudder-limiting device to reduce rudder authority at flight conditions where full rudder authority is not required; and installation of a newly designed yaw damper system to improve system reliability and fault monitoring capability. In response to the possibility of a secondary slide jam and rudder reversal, the FAA next issued AD 97–14–04 (62 FR 35068, June 30, 1997), which requires installation of a new vernier control rod bolt and a new main rudder PCU servo valve. The new servo valve is similar to the servo valve used on B–737 Next Generation (NG) series airplanes (B–737–600, –700, –800, and –900) and is designed to eliminate the possibility of a rudder reversal.

Incident Investigation: 1991–1995

The NTSB investigated 28 B–737 incidents involving anomalous rudder activity or uncommanded rolls between 1991 and 1995. Because all of the airplanes involved were manufactured before May 26, 1989, under § 121.343(b) they were required to record only five parameters of flight data. As a result, the NTSB lacked certain definitive investigative criteria and had little more than the flightcrews' subjective recollections to aid in determining a probable cause.

Safety Recommendations: 1995–1997

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

FAA Response: 1997 Regulations

In response to these safety recommendations, the FAA promulgated 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 a maximum of 88 parameters to be recorded on flight data recorders, with the exact number of parameters required to be recorded depending on the date of airplane manufacture. For turbine-powered

[2] On June 9, 1996, Eastwind fight 517, a B–737–2H5, was on a regularly scheduled passenger flight from Trenton, New Jersey, to Richmond, Virginia. While on approach to Richmond, the airplane yawed abruptly to the right and then rolled to the right. The captain immediately applied opposite rudder and left aileron. The yaw/roll event slowed but the airplane was still attempting to roll so the captain advanced the right throttle to compensate for the roll with differential power. The airplane then appeared to move back toward neutral for 1 or 2 seconds before abruptly returning to a right bank. The flightcrew then disengaged the yaw damper system and several seconds later the upset event stopped. The airplane flew normally for the remainder of the flight. There were no injuries to the 48 passengers or 5 crewmembers nor any damage to the airplane. The FDR recorded the following 11 parameters: time, altitude, airspeed, magnetic heading, engine pressure ratio (both engines), microphone keying, roll attitude, control column position, and longitudinal and vertical acceleration.

[3] The crossover airspeed is the airspeed above which the lateral control system (ailerons) of the B–737 can overcome the aerodynamic forces caused by a rudder that has gone to a full hardover position (full travel in one direction).

transport category airplanes manufactured on or before October 11, 1991, and not equipped with a flight data acquisition unit (FDAU),[4] 14 CFR 121.344 and 125.226 require the recordation of 18 specified parameters by August 20, 2001. For airplanes manufactured on or before October 11, 1991, that were equipped with a FDAU, the regulations require the recordation of 22 parameters by August 20, 2001. Airplanes manufactured after October 11, 1991, are required to record 34 parameters by August 20, 2001. In some situations, compliance may require the addition of sensors and wiring capable of recording the specified parameters or a reprogramming of the current recorder to accommodate the specified parameters. The 1997 DFDR regulations also added a requirement for newly manufactured airplanes. Airplanes manufactured after August 18, 2000, are required to record 57 parameters, and airplanes manufactured after August 19, 2002, are required to record 88 parameters of flight data.

Further NTSB Findings

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.[5] Furthermore, 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.

Continuing Concerns

On February 23, 1999, USAirways Metrojet flight 2710, a B–737–2B7, experienced an unexplained rudder hardover at cruise altitude. The flightcrew reported that the airplane began to roll to the left although the heading did not change. After the flightcrew disconnected the autopilot, they noticed the right rudder pedal was forward of neutral and that pressure on the left rudder pedal would not move the rudder. The flightcrew regained normal rudder control only after the standby rudder system was activated under prescribed USAirways' procedures. The airplane made a successful emergency landing. The preliminary results of kinematic analysis and computer simulations using the Metrojet's FDR data indicate that the rudder traveled slowly to its blowdown limit. To date, examinations of the Metrojet rudder system have not revealed evidence of a failure or a jam of the servo valve or other problem, such as a blockage in the rudder system feedback loop, that would explain the uncommanded rudder hardover.

The NTSB recognized that the B–737 airplane has 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 NTSB has concluded that the redesigned rudder system does not eliminate the possibility of other potential failure modes and malfunctions.

NTSB Recommendations

The NTSB concluded in its March 1999 report that the current regulations for upgrading the DFDRs on existing airplanes are inadequate because they do not require the recordation of specific flight control information. Because several B–737 airplane 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 command (proposed parameter 90), yaw damper status (proposed parameter 89), standby rudder status (proposed parameter 91), and control wheel, control column, and rudder pedal forces (current parameter 88) all be recorded on all B–737 airplanes. The NTSB also indicated that for optimal documentation, the indicated parameters need to be sampled more frequently than is currently required. The NTSB stated that by documenting 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 in the case of B–737 airplanes. The NTSB stated that if pilot flight control input forces had been recorded on the United, USAir, or Eastwind FDRs, the NTSB investigations would have been resolved more promptly 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 the recordation of additional parameters on B–737 DFDRs:

Recommendation No. A–99–28. Require that all B–737 airplanes 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 B–737 airplanes 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 B–737 flightcrews continue to report anomalous rudder behavior and the NTSB considers it possible that another catastrophic event related to the B–737 rudder upset could occur.

FAA Response

The FAA agrees with the intent of NTSB Safety Recommendation Nos. A–99–28 and A–99–29. The agency shares the concern of the NTSB regarding continuing reports of rudder-related incidents on B–737 airplanes and has initiated this rulemaking action.

The Proposed Regulations

The FAA is proposing that all B–737 model airplanes be required to record the parameters listed in § 121.344(a)(1) through (a)(22), and (a)(88), plus three new parameters, to be designated as (a)(89) through (a)(91), that would be added by this rulemaking. The new parameters include yaw damper status, yaw damper command, and standby rudder status. In addition, the sampling rate for the control forces listed in current paragraph (a)(88) would be increased for B–737 airplanes.

Compliance Date Determinations

In its recommendation, the NTSB proposed that B–737 aircraft with FDAUs be retrofitted to record the listed parameters by July 31, 2000, and those

[4] The flight data acquisition unit (FDAU) is an electronic device that acquires data from sensors of various types (analog, digital, pneumatic, etc.), translates the data into a digital format, and transmits the data to the flight data recorder.

[5] The rudder's blowdown limit is the maximum rudder deflection available for an airplane at a given flight condition/configuration and occurs when the aerodynamic forces acting on the rudder become equal to the output force of the rudder's powered control actuator, which is a function of the system hydraulic pressure.

without FDAUs be retrofitted by August 1, 2001.

The FAA is proposing dates of August 18, 2000, and August 20, 2001, respectively. The FAA notes that the compliance date for the 1997 DFDR requirements is August 20, 2001. In an effort to streamline compliance and facilitate planning by operators with mixed fleets, the dates in this proposed regulation are the same (or comparable to) the date in the 1997 regulations. These dates represent a change of less than three weeks from the date recommended by the NTSB. The FAA has determined that this brief delay is warranted in order to facilitate consistency and efficiency in the regulations.

The FAA is aware that operators that have already upgraded their airplanes to meet the 1997 regulations may have incurred out-of-service costs from the additional downtime needed for installation. The FAA does not have data indicating how many airplanes may already have been retrofitted and thus would have to undergo another unscheduled maintenance visit to comply with these proposed regulations. Accordingly, the FAA is willing to consider an extension of the compliance period, up to one year beyond the 2001 compliance date, for those airplanes that installed a FDAU between July 16, 1996, and November 18, 1999. The FAA seeks comment from those operators who would benefit from such an extension, including specific information regarding the number of airplanes that would be affected by this change and the costs savings that would result from decreased downtime, as opposed to complying by August 20, 2001. The FAA understands that airplanes may have recently undergone an extended heavy maintenance visit to install equipment to meet the 1997 regulations, and seeks to mitigate the impact of this proposed rule if the savings would be significant without undermining the intent of the regulations proposed here. More detailed economic data is necessary to justify this further extension.

Compliance Status Determination

The NTSB recommendations concerning the date for retrofit of B–737 airplanes is based on whether the airplane was equipped with a FDAU as of the date of its recommendation, April 16, 1999. The 1997 DFDR regulations use the date July 16, 1996 (the date of the NPRM for those regulations), as the date for determining whether an airplane was equipped with a FDAU. The FAA has determined that the 1996 date is more appropriate for the requirements proposed here. The FAA is aware that some operators, in an attempt to comply with the 1997 DFDR regulations early, have already retrofitted B–737s in their fleets and have installed FDAUs in airplanes that were not equipped with them in July 1996. Because airplanes with FDAUs would have to comply with these proposed regulations 1 year earlier than non-FDAU airplanes, these operators would be penalized by their early compliance with the 1997 DFDR upgrades. Accordingly, the FAA has determined that it is more appropriate to use the July 16, 1996, date in this proposed regulation. That date already is familiar to operators, will facilitate consistent planning by affected operators, and will not penalize those operators that chose to complete the 1997 DFDR upgrades before they were required to do so.

In addition, as proposed above, the FAA is considering extending the compliance date an additional year for those airplanes that were upgraded with FDAUs between July 16, 1996 and November 18, 1999.

Accordingly, B–737 airplanes that were equipped with a FDAU on July 16, 1996, would be required to comply with the requirements proposed here by August 18, 2000. Those B–737 airplanes that were not equipped with a FDAU as of July 16, 1996, would have to comply by August 20, 2001. If the FAA receives sufficient data supporting such a change, airplanes that were retrofitted to include a FDAU between July 16, 1996, and November 18, 1999, would have to comply by August 19, 2002.

Proposed Rule Changes

The FAA is concerned that the promulgation of new regulations applicable only to B–737 airplanes may cause confusion since they overlap the DFDR upgrade regulations promulgated in 1997 for all airplanes operated under part 121 and part 125.

Proposed changes to the affected sections of part 121 are summarized as follows:

Paragraph 121.344(b) applies to airplanes that were manufactured before October 11, 1991, and requires the recordation of either 18 or 22 parameters of flight data, depending on whether the airplane had a FDAU on July 16, 1996. Paragraph (b) would be amended by adding language that excepts B–737 airplanes from this paragraph; all B–737 airplanes would instead be subject to the requirements listed in new paragraph 121.344(m), discussed below.

Paragraph 121.344(c) applies to airplanes that were manufactured before October 11, 1991, and were equipped with digital data buses and certain FDAU equipment as of July 16, 1996. That paragraph requires the recordation of 22 parameters of flight data. Paragraph (c) would be amended by adding the same exception language for the B–737 that was proposed for paragraph (b). All B–737 airplanes would instead be subject to the requirements listed in new paragraph 121.344(m), discussed below.

Paragraph 121.344(d) applies to airplanes that were manufactured after October 11, 1991. That paragraph requires the recordation of 34 parameters of flight data, plus all other parameters that the airplane is equipped to record. Language would be added to paragraph (d) indicating that in addition to the requirements of (d), all B–737 airplanes must comply with paragraph 121.344(m). Because the requirements of paragraphs (d) and (m) do not overlap completely, compliance with both would be required. The compliance dates for the two paragraphs remain separate. Essentially, a B–737 airplane covered by paragraphs (d) and (m) would have to install the parameters listed in paragraphs (a)(1) through (a)(22), plus paragraphs (a)(88) through (a)(91) by August 18, 2000, since they already have FDAUs. The parameters listed in paragraphs (a)(23) through (a)(34) would not have to be installed before August 20, 2001, under the requirements of paragraph (d). This is the only category of B–737s for which a dual compliance date would exist. The FAA anticipates that most operators of B–737s would choose to install all of the required equipment at the same time.

Paragraph 121.344(e) applies to airplanes that will be manufactured after August 18, 2000. Paragraph (e) requires the recordation of 57 parameters of flight data, plus all other parameters that the airplane is equipped to record. Similar to paragraph (d), language would be added to paragraph (e) indicating that in addition to the requirements of (e), all B–737 airplanes must comply with paragraph 121.344(m). Because the requirements of paragraphs (e) and (m) do not overlap completely, compliance with both would be required. In order to comply with both paragraphs, a B–737 airplane manufactured after August 18, 2000, must go into service recording the parameters listed in paragraphs (a)(1) through (a)(57) and (a)(88) through (a)(91), plus all other parameters that the airplane is equipped to record.

Paragraph 121.344(f) applies to airplanes that will be manufactured after August 19, 2002. That paragraph requires the recordation of 88 parameters of flight data, plus all others parameters that the airplane is equipped to record. Similar to paragraph (e), language would be added to paragraph (f) indicating that in addition to the requirements of paragraph (f), all B–737 airplanes must comply with paragraph 121.344(m). Because the requirements of paragraphs (f) and (m) do not overlap completely, compliance with both would be required. In order to comply with both paragraphs, a B–737 airplane manufactured after August 19, 2002, must go into service recording the parameters listed in paragraphs (a)(1) through (a)(91), plus all other parameters that the airplane is equipped to record.

All paragraphs of current § 121.344 not specifically amended by this rulemaking would continue to apply to all B–737 airplanes.

New Paragraph 121.344(m)

The proposed rule contains a new paragraph 121.344(m) that would apply to all B–737 airplanes operated under part 121. The parameters required to be recorded under paragraph (m) would be either an alternative or an addition to the other recording requirements of § 121.344 for an airplane of a particular age and having particular equipment installed, as explained above.

The introductory text of proposed paragraph (m) states that all B–737 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. This language introduces two requirements that were not included in the 1997 DFDR upgrade regulations.

First, under the 1997 DFDR regulations, B–737 airplanes that were not equipped with FDAUs did not have to have FDAUs installed to meet those regulations. However, the FAA anticipates that FDAUs will, in many cases, be necessary in order to meet the recording requirements established in paragraph (m) and appendix M.[6] Second, B–737 airplanes that were covered under § 121.344(b) had to record the designated parameters in accordance with the rates, ranges, and accuracies specified in appendix B to part 121. Under this proposal, those airplanes would have to record the parameters listed in paragraph (m) in accordance with appendix M rather than appendix B. Appendix M contains more stringent requirements than appendix B for recording rates and accuracies, and may require equipment upgrades.

The proposed compliance dates for the requirements of paragraph (m) are in given in paragraphs (m)(1) and (m)(2). Paragraph (m)(1) provides that all B–737 model airplanes equipped with a FDAU of any type as of July 16, 1996, must comply with the requirements of paragraph (m) by August 18, 2000. Paragraph (m)(1) also provides that B–737 airplanes manufactured after July 16, 1996, must comply with the requirements of paragraph (m) by August 18, 2000. Without the manufacturing date provision, airplanes manufactured after the date specified (July 16, 1996) would have no specified compliance date. This requirement presumes that B–737s manufactured after July 16, 1996, are equipped with FDAUs and thus would be subject to the August 18, 2000, compliance date.

Paragraph (m)(2) states that all B–737 model airplanes that were not equipped with a FDAU of any type as of July 16, 1996, must comply with the requirements of paragraph (m) by August 20, 2001.

FDAU Equipment

A FDAU is an electronic device that acquires data from sensors of various types, translates the data into a digital format, and transmits the data to a flight recorder. The FAA has received numerous questions regarding the meaning of a ''FDAU of any type,'' as used in the regulations. In some cases, operators have sought to delay compliance with the 1997 DFDR regulations or change the applicability of the regulations based on the equipment installed in their airplanes. The term FDAU is intended to refer to any piece of equipment installed on an airplane that functions as a data acquisition unit. A particular piece of equipment need not have a nameplate designating it as, or be marketed or sold as, a ''flight data acquisition unit'' in order to be considered a FDAU for purposes of these regulations if it functions as described. Further, a combination unit that is capable of FDAU functions would be considered a FDAU for purposes of both current and proposed regulations.

Compliance Dates

With some minor variation, as described above, the FAA has agreed to the compliance schedule recommended by the NTSB for retrofit of B–737s to record the flight data proposed in this rulemaking. The FAA agrees with the NTSB that operators have less to accomplish in a retrofit of airplanes that had FDAUs installed as of July 16, 1996, than they do for airplanes that have never had FDAUs. Accordingly, a B–737 that had a FDAU installed on July 16, 1996, must comply with the requirements of paragraph (m) by August 18, 2000. A B–737 airplane that did not have a FDAU installed as of July 16, 1996, and does not have a FDAU installed as of the date of this NPRM must comply with the requirements of paragraph (m) by August 20, 2001. A B–737 airplane not equipped with a FDAU on July 16, 1996, but equipped with a FDAU as of the date of this NPRM, must comply with paragraph (m) by August 19, 2002.

The reasons for the change to the NTSB's recommended dates for compliance and for determining FDAU status were discussed above.

The New Parameters

Flight Control Input Forces

The parameter listed in paragraph (a)(88) is described as ''[a]ll cockpit flight control input forces (control wheel, control column, rudder pedal).'' These control input forces are the center of the NTSB's recommendation and comprise data that the NTSB has stated is critical to a more complete investigation of accidents and incidents concerning loss of control of airplanes.

This parameter was added in the 1997 amendment to the DFDR regulations, but within the last few months has become a source of disagreement as to where these forces must be measured. The FAA has received inquiries from the NTSB and Boeing concerning an acceptable means of recording rudder pedal forces. These are discussed below.

Actions by Boeing

In 1996, in response to the proposed DFDR upgrade regulations, Boeing began to develop the equipment and instructions necessary to comply with paragraph (a)(88). In designing a rudder pedal force transducer (a specific type of sensor), Boeing's primary concern was to identify whether the input was coming from the forward or the aft end of the system; that is, whether the input was coming from the cockpit or the rudder assembly itself.

Boeing developed a transducer that is placed ''midstream'' in the rudder control system. This specific transducer and its location were driven by the need for the equipment to be retrofitted or installed (on the assembly line) on every design in the Boeing fleet. Boeing's research indicated that a force transducer placed on the rudder pedals themselves could require significant structural redesign of existing airplanes.

[6] If an operator chooses instead to add a second flight data recorder, a FDAU may not be necessary because sufficient recording capacity would exist.

Finally, Boeing was looking for a design and installation that it could develop quickly to meet the needs of operators for compliance with the 1997 DFDR regulations, and that would require the least amount of structural disassembly to install.

The first rudder force transducer was designed for the B–737 NG series airplanes. Although the NPRM for the 1997 regulations (published in July 1996) drove the initial design and timing, Boeing realized that whatever design it settled on would have to work on all of its airplane models.

Boeing currently has available two service bulletins addressing the installation of the rudder force transducer on in-service B–737s. The service bulletin for the B–737–300, –400, and –500 series was released April 15, 1999; the bulletin for the B–737–600, –700, and –800 series was released May 20, 1999. The bulletin for the B–737–100 and –200 series airplanes is in development. In mid-June 1999, Boeing reported that it had approximately 1,000 rudder transducer retrofit kits available, and that for the time being, they were being offered free of charge in order to encourage installation. Boeing stated that few kits had been requested at that time.

NTSB Opinion

The NTSB's April 1999 recommendation indicated only that it wanted the control forces recorded, without specifying a means for doing so. In conversations with NTSB staff in May 1999, it became evident to the FAA that the NTSB would prefer a system that measured the rudder input force at the pedals themselves, an addition of four transducers rather than the one already designed by Boeing. Subsequent discussions between the FAA and the NTSB indicated that the Board is of the opinion 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.

FAA Response

In response to the NTSB's expressed preference, the FAA requested that Boeing estimate the amount of time and cost involved in placing force sensors on each of the four rudder pedals of all B–737 airplanes. By letter dated May 26, 1999, Boeing estimated that it would take approximately 18 to 24 months to develop a service bulletin for the installation of four rudder pedal force transducers. In addition, Boeing estimates that it would take an additional 6 months before retrofit kits to install the transducers would be available.

Boeing also indicated that it does not currently have a viable design solution for the four rudder pedal transducer option that does not involve ''major under floor structural modification,'' that would affect the entire fleet of B–737 airplanes. In conversations with Boeing staff, it was thought that as little as one inch of clearance was available under the rudder pedals, and that additional equipment installed at that location could require that one of the floor beams be moved. Boeing was not immediately able to indicate the estimated costs of such a modification, but the description implies that the cost would be substantial.

The time estimated by Boeing to reengineer the B–737 for four rudder pedal transducers is well beyond the installation dates recommended by the NTSB. Moreover, the fact that the four rudder pedal transducer option might require significant redesign of the airplane structure suggests that the cost of such a modification would be extraordinary.

In a presentation to the FAA and the NTSB in May 1999, Boeing indicated that the rudder transducer data, alone or in combination with other flight recorder data, will satisfy almost all of the concerns expressed by the NTSB for flight control data. The FAA acknowledges that choices have to be made when deciding what equipment is feasible for installation and the level of data that can be provided by different installations.

The FAA acknowledges that there is a difference in the exact nature of the data acquired using Boeing's approved single transducer system and the NTSB's preferred four-pedal sensor retrofit. However, without a better understanding of the incremental benefits the particular data that the four-pedal sensor option would provide and a better estimate of the time and cost that would be required for installation, the FAA cannot decide which option provides the most overall benefit.

The FAA specifically requests comment on the necessity and feasibility of instrumenting all four rudder pedals on B–737 airplanes with force sensors as a means of compliance with paragraph (a)(88). While the FAA has found Boeing's single force transducer to be acceptable for monitoring rudder pedal force, it requests comment on whether this should remain an accepted means of compliance for all B–737 airplanes that have not yet installed the single transducer or otherwise complied with paragraph (a)(88).

If the FAA finds, in light of the comments received, that the four-pedal sensor retrofit is the only way available to determine the source of suspected uncommanded rudder movement, and that any incremental increase in cost and time required to accomplish this retrofit will provide a justifiable benefit, the FAA will propose it as an alternative for B–737 airplanes that have not otherwise complied with paragraph (a)(88) as of November 18, 1999. Any proposal would include an analysis of the costs and benefits of that configuration.

The FAA notes that for the purpose of determining an estimated cost of these proposed regulations, the data for the single Boeing transducer was used for compliance with paragraph (a)(88) because it was the only information available. Those estimates are presented in detail in the regulatory evaluation section of this document. The FAA requests cost data for the four-pedal retrofit, described above, in order to determine whether the incremental increase in benefits that would be provided by that configuration are offset by the additional time and cost that would be needed for compliance.

Measuring Other Control Forces

Paragraph (a)(88) also requires the measurement and recordation of control wheel and control column input forces. While these two measurements have not received the level of attention focused on rudder pedal forces, the FAA understands that there are issues of acceptable means of measuring these forces as well. The FAA specifically requests comment on the means and costs of measuring these control forces under the requirements proposed in this rulemaking.

Change to Current Parameter 88

The NTSB also recommended that control input forces be measured more frequently for B–737 airplanes. This recommendation is being proposed as a change to the sampling interval that would apply to the B–737 only, and would require that control forces be sampled twice per second. This requirement would be added in appendix M, parameter 88, by means of a footnote specifying a shorter interval for B–737 airplanes only. The sampling interval for that parameter would remain unchanged for all other aircraft. Similarly, the text in the ''Remarks'' column for parameter 88 would remain applicable to other aircraft, but would not apply to B–737 airplanes.

Yaw Damper Status

Proposed paragraph (a)(89) would add the recordation of yaw damper status. The intent of this requirement is to record whether the yaw damper is on or off. As described previously, the yaw damper system moves the rudder independent of flightcrew input, and has become a concern in the continuing occurrence of rudder-related incidents.

Yaw Damper Command

Proposed paragraph (a)(90) would add the recordation of yaw damper command. The intent of this is to record the amount of voltage being received by the yaw damper system, which determines how much rudder movement is being commanded. This is an automatic system that is not controlled by cockpit commands, except to turn the system on or off. The flightcrew does not necessarily know what the system is doing since the rudder movement does not feed back through the rudder pedals.

Standby Rudder Status

Proposed paragraph (a)(91) would add the recordation of 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 this requirement is to record whether the standby rudder system switch is in the on or off position.

Changes to Part 125

The changes proposed for part 121 are also proposed for the corresponding sections of part 125. Specifically, the changes made to § 121.344 also would be made to § 125.226. The changes made to appendix M to part 121 would also be made to appendix E to part 125.

One additional change would be made to part 125. The FAA has determined that for purposes of flight data recordation, there is no difference between a large airplane operated under part 121 and one operated under part 125, *or operated under part 91 under deviation authority from part 125.* Accordingly, the FAA has determined that aircraft that are operating under deviation authority from part 125 must still comply with the flight data recorder requirements of part 125 for the particular aircraft. This requirement would apply to *all* aircraft, not just the B–737.

This requirement is proposed as a new paragraph 125.3(d), which indicates that no deviation authority from the flight data recorder requirements would be granted, and that any previously issued deviation from the FDR requirements of part 125 would no longer be valid. Section 91.609 also will be amended to reflect this requirement.

Any person who operates under deviation authority from part 125 would be subject to the FDR requirements of part 125 applicable to the particular aircraft as of the date of the final rule adopting these proposed regulations. For B–737s, compliance would be required as described in this proposed rule. For all other aircraft, compliance would be required as specified in the applicable subsections of §§ 125.225 or 125.226. An aircraft subject to § 125.226 would have to upgrade its FDR system to meet the requirements of that paragraph by the date specified in the applicable paragraph of that regulation.

For persons operating using deviation authority from part 125, this would be a retrofit requirement, and no current holders of letters of deviation would be ‘‘grandfathered.’’ This NPRM serves as notice to current holders of letters of deviation that their deviation authority would be amended pursuant to paragraph 125.3(b).

The FAA specifically requests comments addressing why the flight data recorder requirements of part 125 should not be made applicable to aircraft operated under deviation authority. The FAA also specifically requests comments from affected persons operating their aircraft under deviation authority from part 125 concerning the compliance dates proposed above. If the proposed compliance dates cannot be met, reasons why they cannot be met and acceptable alternatives should be submitted as part of the comment.

TABLE 1.—RULE CHANGES AND COMPLIANCE DATES

Current rule paragraph	Manufacture date/FDAU status in 1996	Number of parameters required in the 1997 rule	1997 rule compliance date	Number of parameters proposed for B–737s
121.344(b)	Before 1991/no FDAU	18	8/1999 through 8/2001	26 by 8/2001, FDAU necessary.
121.344(b)	Before 1991/FDAU	22	8/1999 through 8/2001	26 by 8/2000.
121.344(c)	Before 1991/FDAU plus data bus.	22 plus any capable	8/2001	26 by 8/2000.
121.344(d)	After 1991/with FDAU	34 plus any capable	8/2001	38 by 8/2000.
121.344(e)	After 2000/with FDAU	57 plus any capable	8/2000	61 at manufacture.
121.344(f)	After 2002/with FDAU	88	8/2002	91 at manufacture.

Paperwork Reduction Act

This proposal contains information collection requirements. As required by the Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)), the Department of Transportation has submitted the information collection requirements associated with this proposal to the Office of Management and Budget for its review.

Title: Revisions to Digital Flight Data Recorder Regulations for Boeing 737 Airplanes and for Part 125 Operations.

This notice proposes to amend the regulations to add a requirement for all B–737 series airplanes to record additional flight data parameters. The additional parameters to be recorded 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 continuing incidents that appear to be related to rudder anomalies on B'737 airplanes.

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

The required information is electronically recorded on the FDR each time the airplane begins its takeoff roll until it has completed its landing roll and must be kept until the airplane has been operated for 25 hours. The recorded data are overwritten on a continuing basis and are only accessed following an accident. This requirement is a nominal addition to a passive information collection activity and therefore does not contain a measurable hour burden. However, for purposes of the submission to OMB, the FAA has assigned a one hour burden to the request. The measurable burden associated with this NPRM is the cost to the respondents. The breakdown associated with the cost can be found in the regulatory evaluation summary below.

The agency is soliciting comments to: (1) Evaluate whether the proposed collection of information is necessary for the proper performance of the functions of the agency, including whether the information will have practical utility; (2) evaluate the accuracy of the agency's estimate of the burden; (3) enhance the quality, utility, and clarity of the information to be collected; and (4) minimize the burden of the collection of information on those who are to respond, including through the use of appropriate automated, electronic, mechanical, or other technological collection techniques or other forms of information technology (for example, permitting electronic submission of responses).

Individuals and organizations may submit comments on the information collection requirement by December 20, 1999, to the address listed in the **ADDRESSES** section of this document.

According to the regulations implementing the Paperwork Reduction Act of 1995 (5 CFR 1320.8(b)(2)(vi)), an agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless an agency displays a current valid OMB control number. The OMB control number for this information collection will be published in the **Federal Register** after it is approved by the Office of Management and Budget. It should be noted that OMB approval for the activity described above would be for a modification of the existing collection of information for digital flight data recorders under OMB control number 2120–0616.

Compatibility With ICAO Standards

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

Regulatory Evaluation

Proposed changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs that each Federal agency shall propose or adopt a regulation only upon 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 Office of Management and Budget directs agencies to assess the effects of regulatory changes on international trade. Fourth, the Unfunded Mandates Reform Act of 1995 (Public Law 104–4) requires agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local, or tribal governments, in the aggregate, or by the private sector, of $100 million or more annually (adjusted for inflation). In conducting these analyses, the FAA has determined that this proposed rulemaking: (1) Would be a ''significant regulatory action'' as defined in Executive Order 12866 or as defined in DOT's Regulatory Policies and Procedures; (2) would have a significant economic impact on a substantial number of small entities; (3) would have minimal effects on international trade; and (4) would not contain a significant intergovernmental mandate but would contain a significant private sector mandate. These analyses, contained in the document *Initial Regulatory Evaluation of the Revisions to Digital Flight Data Recorder Rules for Boeing 737 Airplanes and for Part 125 Operations,* which has been placed in the docket, are summarized as follows.

Request for Comments

The FAA requests comments on any and all of its assumptions, methodology, and data used in its economic analyses. The FAA also requests that commenters provide supporting data for their comments.

Data Sources

The principal means of obtaining data for this analysis has been discussions with representatives from Boeing, several airlines that operate Boeing 737s, manufacturers of FDRs and FDAUs, and repair stations that would perform FDR system retrofits. In addition, the Air Transport Association surveyed its members and provided the FAA with data concerning potential compliance costs and out-of-service time that would be associated with the proposed rule. As may be expected, there were some differences in the various estimates. In choosing among these estimates, the FAA has generally selected the median estimates.

Affected Industries

The FAA has estimated that the proposed rule would require that 1,306 U.S.-registered B–737s have their FDR systems retrofitted to record additional flight data parameters. It would further require these additional flight data parameters to be recorded in an estimated 2,144 newly manufactured U.S.-registered B–737s during the 20 years following the promulgation of the proposed rule. Twenty-four U.S. air carriers, 3 foreign U.S. air carriers, and 16 non-air carrier private owners currently operate U.S.-registered B–737s. The proposed rule would also affect transport category airplanes other than B–737s that are operating under part 91 on a deviation authority from part 125. However, as those costs and benefits for this latter group were included in the regulatory evaluation for the FAA's 1997 Digital Flight Data Recorder Rulemaking, they are not again evaluated in this proposed rule. Finally, the proposed rule would affect Boeing's future production B–737s.

Benefits

The principal benefit from increasing the number of flight data parameters recorded would be the increased probability that a future B–737 accident or incident investigation would uncover a previously unknown cause that would not have been discovered in the absence of these additional parameters being recorded. The discovery of this cause, in turn, could lead to corrective actions (for example, an airplane design modification or changes in operating procedures) that would help to prevent similar accidents. As there have been few B–737 accidents whose causes could not be determined (two such accidents in about 92 million B–737 flight hours), the FAA has evaluated the benefits and costs of the proposed rule over a 20-year time period.

In order to quantify the potential benefits of a prevented B–737 accident, the FAA has used the following values: $2.7 million for each prevented fatality and an average of 96 passengers and crew on a B–737, for a resulting total of $259.2 million per airplane; $20 million for a destroyed B–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 B–737 in-flight accident would be about $315.2 million.

Compliance Costs

Summary

B–737 operators would incur nearly all of the costs imposed by the proposed rule. These costs would be comprised of both one-time first-year costs and recurring annual costs. As described in the following paragraphs, the FAA has estimated that the present value of the total costs of compliance with the proposed rule would be about $205.3 million. Of that expenditure, about $158.6. million would be first-year costs to retrofit the current B–737 fleet that would be spent by August 20, 2001. The present value of the increased costs of manufacturing future B–737s over the next 20 years would be about $40.4 million and the present value of the increased annual costs of additional fuel and maintenance of B–737s during the next 20 years would be $6.3 million.

As previously discussed, the FAA revised the flight data recorder rules for many airplanes, including B–737s, in 1997. In the Final Regulatory Evaluation for that final rule, the FAA estimated at that time that the present value in 1997 of the costs to comply with those revision was about $48 million (which is equivalent to $58.8 million in year 2000 present value terms) for B–737 airplane operators and Boeing.[7]

Consequently, if those revisions and this proposed rule are viewed as two parts of one rulemaking extended over time, the FAA has estimated that the present value of the overall compliance costs with these two parts would be about $264.1 million for the B–737 operators and for Boeing.

The per-airplane retrofitting costs for only this proposed rule are have been summarized in Table 2 by B–737 series and by type of FDR system. As can be seen, the individual airplane costs can vary widely; the reasons underlying these differences are discussed in the following paragraphs.

TABLE 2.—PER-AIRPLANE COMPLIANCE COST BY 737 SERIES AND FDR SYSTEM

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	165,100–185,000
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	43,775–115,250
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	57,050–78,975

If the 1997 flight data recorder revisions and this proposed rule are viewed as two parts of one rulemaking extended over time, then the per B–737 compliance costs associated with the previous revisions need to be included. However, that Regulatory Evaluation did not disaggregate the compliance costs for individual B–737 series. As a result, the FAA has calculated in the Initial Regulatory Evaluation for this proposed rule that the per B–737 compliance costs associated with the 1997 revisions would be about $45,000.

One-time Compliance Costs to Retrofit B–737s

Types of One-time Compliance Costs

The one-time first-year costs to retrofit B–737s would be: (1) The time to engineer new designs for the retrofitted FDR systems; (2) the equipment and labor costs to retrofit the FDR systems; and (3) the lost net revenue while the airplanes are out of service for a retrofit.

Time to Engineer New Designs for the Retrofitted FDR Systems

There are two general types of engineering design costs associated with the proposed rule. The first type is the manufacturer's or airline's engineering time required to design the FDR system including the parts (that is, the FDR and the FDAU) to be used in a retrofitted B–737 FDR system. The second type is the engineering time required for the airline or repair station to obtain an FAA Supplemental Type Certificate (STC)/ Parts Manufacturing Approval (PMA) for the revised FDR system.

With respect to the FDR manufacturers' engineering costs, industry has reported that the increased number of recorded flight data parameters would require that a solid state FDR (installed to comply with the 1997 DFDR regulations) with a memory capacity of 64 words per second (wps) would need to be increased to 128 wps. This increase would involve a software change that would require FAA approval. The FAA has estimated that these one-time FDR engineering costs would be about $5,000 per airline per B–737 series. The FAA has further estimated that about 40 of these FDR approvals would be required, for a total one-time engineering cost of about $200,000 for the upgraded FDRs.

Although the proposed rule would not specifically mandate a FDAU in every B–737, airline and repair station avionics engineers were unanimous in stating that retrofitting an airplane with a FDAU would be less expensive than retrofitting it with a second FDR system (and coordinating it with the first FDR system) to record the additional flight data parameters. Consequently, the FAA has assumed that an owner of a B–737 that does not have a FDAU would have the FDAU retrofitted in order to keep the airplane in service. Unlike upgrading FDR memory, installing a FDAU would be a substantial modification to the airplane and a FDAU manufacturer has estimated that obtaining FAA approval to integrate its FDAU in an FDR system would take between 16 and 26 weeks and would cost about $200,000 for each airline B–737 series/FDAU combination. However, the FAA has determined that after about five such approvals, a manufacturer could use commonality demonstrations to reduce this estimated time to between 8 and 12 weeks and reduce the estimated cost to about $25,000. It should be noted that several of these applications can be submitted at one time and the applicant would not wait for one airline's FDAU approval

[7] The present value of the total compliance costs for all airplanes affected by the 1997 revisions was estimated to be about $316.3 million (about $387.5 million in year 2000 present value terms).

before submitting the next airline's FDAU for approval. The FAA has estimated that about 40 of these FDAU approvals would be required, for a total one-time engineering cost of about $2.75 million for the FDAU approvals.

With respect to airline or repair station engineering time to obtain an FDR system STC, its engineering staff would need to redesign the entire FDR system, ground test it, flight test it, and submit the drawings and data to the FAA. Airlines have reported that it would take anywhere from 3 months to 1 year to complete the entire engineering/FAA approval process. However, the FAA is concerned that the higher estimates may reflect the worst case. Based on airline reports, the FAA has determined that 4 months would be the average amount of time needed for the entire process. The FAA also has estimated that three industry engineers would work full time on each STC approval. The FAA has used an engineer hourly compensation rate of $100, which includes salary and fringe benefits plus a markup for the hours spent by supervisors, management, legal, etc. Thus, the FAA has estimated that each STC application would cost about $200,000. The FAA has further estimated that about 32 of these STC applications would be made. Thus, the FAA has estimated that the one-time engineering cost for the FDR system STC applications would be about $6.4 million.

Thus, the FAA has estimated that the total one-time engineering costs for obtaining FAA-approved equipment and STCs would be about $9.15 million and would take about 5 months.

Equipment and Labor Costs to Retrofit FDR Systems

The cost of an individual FDR system retrofit will depend on existing equipment and the number of flight data parameters currently recorded on any one airplane. In general, the FDR system components that would be affected by the proposed rule would be the FDR, FDAU, sensors, and wiring.

As noted earlier, the FAA has relied upon industry estimates for the FDR system equipment costs and for the amount of labor time to complete these retrofits. However, the FAA has not used the actual industry labor rates. Instead, the FAA has developed an airplane mechanic hourly compensation rate of $75, which includes salary and fringe benefits plus an adjustment for the otherwise unaccounted hours spent by engineers, supervisors, management, etc., during an FDR system retrofit.

With respect to the FDRs, the FAA has estimated that 156 B–737s would have their FDRs replaced whereas the remaining 1,150 B–737s would have their FDRs upgraded with additional memory. The FAA has determined that a new FDR would cost about $25,000; upgrading the memory of an older FDR that records 18 flight data parameters would cost about $10,000; upgrading the memory of an older FDR that records 22 flight data parameters would cost about $5,000; and upgrading the memory of a newer FDR that records more than 22 parameters would cost about $1,900. Although all FDR systems have an FDR, it would take more labor time to install a new recorder than to upgrade an FDR's memory because the former action would involve more FDR system testing and verifications than would the latter.

Consequently, the FAA has estimated that upgrading to a new recorder would require 32 labor hours to remove the old recorder and to install and to test the new recorder. However, upgrading an FDR would require 16 labor hours because less testing of the FDR system would be needed. Thus, the FAA has estimated that the present value of the equipment cost for replaced or upgraded FDRs would be about $17.2 million.

With respect to the FDAUs, the FAA has estimated that a FDAU would need to be retrofitted into 496 B–737s, whereas the existing FDAUs in 810 B–737s would need to be reprogrammed. In this case, ''FDAU reprogramming'' would involve both hardware modifications and software revisions.

Retrofitting a B–737 with a FDAU would necessitate a complete rerouting of the FDR system wiring because the recorder itself (where the wires formerly terminated) is located in the back of the airplane, while the FDAU would be located in the front of the airplane. Thus, the wiring would now run from the sensors to the FDAU and then back to the recorder. The FAA has determined that a new FDAU would cost about $50,000 while reprogramming an existing FDAU would cost about $10,000. Relying primarily on estimates provided by airlines that have retrofitted FDAUs into their B–737s, the FAA has estimated that this retrofitting would take about 200 labor hours, which includes the associated labor hours to rewire the existing FDR system. The FAA also has estimated that the labor hours to remove, ship to the manufacturer, reinstall, and test a reprogrammed FDAU would take 48 hours for an older FDAU and about 40 hours for a newer FDAU. On that basis, the FAA has estimated that the present value of the FDAU equipment and associated labor costs would be about $37.6 million.

With respect to the additional sensors and wiring, the FAA has divided the equipment and labor costs into two components: (1) The equipment and labor costs to add flight data parameters (a)(19) through (a)(22); and (2) the equipment and labor costs to add the proposed new flight data parameters (a)(89) through (a)(91) and to add flight data parameters found in (a)(88) with the proposed increased sampling rates.

The FAA estimates of the costs of sensors and wiring to add parameters (a)(19) through (a)(22) is based on industry sources that have reported that the sensors to supply the additional flight data parameters to be recorded by the FDR generally cost between $200 and $2,000 each. These additional sensors would also require the addition of wiring to transmit their inputs to the FDAU. The FAA has estimated that the total cost of the sensors and wiring for a B–737 FDR system to add parameters (a)(19) through (a)(22) would be about $20,000.

The FAA has primarily used the estimated labor hours supplied by airlines that have retrofitted flight data parameters (a)(19) through (a)(22) in their B–737s to estimate these costs. On that basis, the FAA has estimated that, in addition to the 200 labor hours associated with the FDAU rewiring, rewiring the sensors and wiring for flight data parameters (a)(19) through (a)(22) would take 200 labor hours for a B–737–200, an Advanced B–737–200, or a B–737–400 and 400 labor hours for a B–737–300 or a B–737–500. Thus, the labor costs of adding flight data parameters (a)(19) through (a)(22) would be about $15,000 for a B–737–200, an Advanced B–737–200, or a B–737–400, while it would be about $30,000 for a B–737–300 or a B–737–500.

Thus, the FAA has estimated that the equipment and labor costs of adding flight data parameters (a)(19) through (a)(22) would be about $35,000 for a B–737–200, an Advanced B–737–200, or a B–737–400 while it would cost about $50,000 for a B–737–300 or a B–737–500.

The primary difficulty in estimating the potential labor hours to retrofit proposed flight data parameters (a)(89) through (a)(91) is that these flight data parameters have not previously been recorded in any B–737. As a result, no engineering analysis has been completed that can serve as an experienced basis for an estimate. Consequently, the FAA has adopted some *preliminary* industry estimates that it would cost about $22,000 for the additional sensors and wiring to retrofit flight data parameters (a)(88) at a higher sampling rate and flight data parameters (a)(89) through (a)(91) in a B–737 FDR system that now records at least 22 flight data parameters. In addition, the FAA has estimated that this retrofit would involve about 360 labor hours. On that basis, the FAA has estimated that these labor costs would be about $27,000 per airplane.

Thus, the FAA has estimated that the per-airplane equipment and labor costs of adding flight data parameter (a)(88) at a higher sampling rate and parameters (a)(89) through (a)(91) to a B–737 currently recording 22 flight data parameters would be about $49,000.

Finally, the FAA has adopted some *preliminary* industry estimates that it would cost about $12,000 for the additional sensors and wiring to retrofit flight data parameter (a)(88) at a higher sampling rate and flight data parameters (a)(89) through (a)(91) in a B–737 FDR system that now records 88 flight data parameters. In addition, the FAA has estimated that this retrofit would involve about 160 labor hours. On that basis, the FAA has estimated that these labor costs would be about $12,000 per airplane.

Thus, the FAA has estimated that the per-airplane equipment and labor costs of adding flight data parameter (a)(88) at a higher sampling rate and parameters (a)(89) through (a)(91) to a B–737 currently recording 88 flight data parameters would be about $24,000.

Therefore, the FAA has estimated that retrofitting each B–737's sensors and wiring would cost about $84,000 and take about 560 labor hours for a B–737–200 or a B–737–400 without a FDAU; about $100,000 and take about 760 labor hours for a B–737–300 and B–737–500 without a FDAU; about $49,000 and take about 360 labor hours for an older B–737 airplane with a FDAU; and about $24,000 and take about 160 labor hours for a newer B–737 airplane.

As a result, the FAA has estimated that the present value over the next 18 months of the total sensor and wiring costs to retrofit all B–737 FDR systems would be about $69 million.

Net Revenue Loss From Out-of-Service Time

The proposed rule would, effectively, require a B–737 to be taken out of service due to the high number of labor hours for an FDR system retrofit and the fact that only a few mechanics can work on the airplane's FDR system simultaneously because of the limited physical work space. An out-of-service airplane does not generate net revenue and the longer the airplane is out of service, the greater the airline's net revenue loss. However, if a retrofit were completed while the B–737 is undergoing a regularly scheduled maintenance check, only the net revenue lost from any *additional* out-of-service time could be considered a cost of the proposed rule. For example, if an FDR system retrofit would take 6 days and the B–737 is scheduled for a 3-day maintenance check, only the lost net revenue from the additional 3 out-of-service days would be a cost of the proposed rule. Thus, the lost net revenue due to an FDR system retrofit of a given duration depends upon whether the retrofit is performed during a regularly scheduled maintenance check or whether the airplane must be taken out of service solely to perform the retrofit.

The FAA has estimated that retrofitting a B–737 with a FDAU and adding flight data parameters (a)(19) through (a)(22) would require 3 days out-of-service time for a B–737–200, an Advanced B–737–200, or a B–737–400 while it would require 5 days out-of-service time for a B–737–300 or a B–737–500. Based on a *preliminary* industry estimate, the FAA has also estimated that, for B–737s that currently record at least 22 flight data parameters, adding proposed parameters (a)(89) through (a)(91) and flight data parameter (a)(88) with the proposed increased sampling rates, would require 4 days out-of-service time. The FAA has further estimated that a B–737 adding flight data parameters ((a)(19) through (a)(22) and (a)(88) through (a)(91)) would require 7 days out-of-service time if retrofitting a B–737–200, a B–737–200 Advanced, or a B–737–400. It would require 9 days out-of-service time if retrofitting a B–737–300 or a B–737–500. If the retrofit were to be completed during a 3-day maintenance check, the FAA has estimated that the incremental out-of-service times due to the retrofit would be 2 days for a B–737 that has a FDAU, 4 days for a B–737–200 that does not have a FDAU, and 6 days for a B–737–300 or –500 that does not have a FDAU. If the retrofit were to be completed during a 14-day or a 21-day major maintenance check, the FAA has determined that the retrofit would create no incremental out-of-service time.

The FAA has assumed that one 3-day maintenance check will occur every 18 months for each B–737 and that a major 14-day or 21-day maintenance check will occur every 5 years. As detailed in the Initial Regulatory Evaluation, the FAA has developed a probability distribution of the number of these B–737s by series and airplane age that would have had a scheduled 3-day or 14-day maintenance check between the estimated final rule effective date and the various compliance dates. On that basis, the FAA estimated the various numbers of out-of-service days for these airplanes.

In calculating the lost *net* revenue due to out-of-service time, the FAA has taken the approach that an airplane is a piece of capital equipment for which the average net revenue would equal the average price of the airplane multiplied by the average annual risk-free productive rate of return of capital. Using OMB's mandated 7 percent average annual risk-free productive rate of return on capital, the FAA has calculated that the average out-of-service lost net revenue per day ranges from about $400 to about $10,500 per B–737, depending upon the series and its average age. Thus, the FAA has estimated that the present value of the total out-of-service lost net revenue due to retrofitting the B–737 FDR systems would be about $25.2 million.

Total One-Time FDR System Retrofitting Costs

In summary, the FAA has estimated that the present value of the total one-time compliance costs to retrofit all B–737 FDR systems by the proposed compliance dates would be about $155 million.

Annual Costs Resulting From Retrofitting B–737 FDR Systems

The proposed rule also would generate annual compliance costs from (1) The additional airplane weight from the retrofitted FDR system equipment and wiring; and (2) additional maintenance costs annually to validate the FDAU.

The FAA has estimated that the proposed rule would add about 40 pounds to a B–737 without a FDAU currently recording 18 flight data parameters and about 10 pounds to a B–737 currently recording at least 22 flight data parameters. In calculating the estimated additional fuel cost, the FAA has assumed a per-airplane average of 2,800 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, resulting in per-airplane annual costs of about $400 for a B–737 that would add 40 pounds and about $100 for a B–737 that would add 10 pounds. On that basis, the FAA has estimated that the present value of the increased fuel consumption over the next 20 years would be about $3.6 million.

The FAA has further estimated that annual validation of a FDAU would cost about $750. This incremental compliance cost would be incurred only for B–737s retrofitted with FDAUs because the operators of the other B–737s have elected to install this equipment and, therefore, the validation cost would not be attributed to this proposed rule. Based on the number of B–737s that would have had FDAUs retrofitted and their expected retirement rates over the 20-year time period, the FAA has calculated that the present value of this annual FDAU validation over the next 20 years would be about $2.7 million.

Thus, the FAA has estimated that the present value of the annual compliance costs over the next 20 years would be about $6.3 million.

Compliance Costs for Future Manufactured B–737

Installing additional proposed flight data parameters (a)(89) through (a)(91) would also impose compliance costs upon all future manufactured B–737s because, absent the proposed rule, those airplanes would not have been manufactured to record those parameters. However, newly manufactured B–737s are capable of recording all of the additional flight data parameters with the exception of the standby rudder on/off discrete (parameter (a)(91)) and the increase in recording rates of all force information from once per second to twice per second (parameter (a)(88)). As a result, the proposed rule would impose production costs for additional wiring, sensors, and testing as well as a cost to install an upgraded FDR system. There would be no additional costs to upgrade the FDAU because the units currently installed in production are capable of processing these additional flight data parameters. The FAA has estimated that the additional wiring and testing for production would cost about $25,000, a midstream rudder force transducer would cost about $12,000, and the FDR upgrade would cost about $1,900, for a total of $38,900 per future manufactured B–737 beginning in the year 2001. On that basis, the FAA has calculated that the present value of the additional costs for the approximately 2,144 U.S.-registered B–737s to be manufactured during the next 20 years would be about $40.4 million.

Potential Net Revenue Losses Currently Unquantifiable

The FAA's analysis of the net revenue losses for an out-of-service airplane, although appropriate for the individual airplanes within an airline's system, may not capture all of the potential lost revenue when the entire system must comply within a short period of time. In recognition of this potential analytical shortcoming, the FAA had queried airlines concerning the potential system impacts. However, the FAA has also realized that much of the information needed to perform a more complete airline system analysis is proprietary and airlines are extremely reluctant to provide it for fear of the data being inappropriately or inadvertently disseminated to competitors. Nevertheless, following discussions with the aviation industry, the FAA believes that there are two areas of potential economic impact that may need additional investigation, but for which the FAA does not have adequate information.

The first area is that the FAA analysis has assumed that the time to obtain the FAA approvals and the STC would not significantly affect the airlines' abilities to meet the compliance dates. However, there is a possibility that several of the airlines or repair stations would not be able to obtain the requisite FAA approvals to be able to complete these retrofits (particularly those for the proposed new flight data parameters (a)(89) through (a)(91)) in the time between the promulgation of the final rule and the August 18, 2000, or even the August 20, 2001, compliance date. If, in fact, airline maintenance and repair facilities would be overwhelmed with idle B–737s that cannot return to service until they have been retrofitted, then the FAA may have significantly underestimated the actual out-of-service times.

The second area is that the FAA does not have an appropriate model to determine the impact on the number of available flights when, for 18 months, large numbers of airplanes would be taken out of service for several days. For example, there is the possibility that air travel service in certain markets would be disrupted, fares would increase, load factors would increase and flights would become more crowded, some passengers would choose not to fly, some passengers would be unable to obtain flights at the times and dates they are accustomed to flying, flight delays due to weather or mechanical problems would be longer because there would be fewer airplanes available to fill in, etc.

In order to attempt to develop some estimates of the economic impacts of these economic effects that have not been quantified, the FAA specifically requests comments and supporting data on the magnitude of these potential effects, including any presumptions applicable to an individual operator or the industry as a whole.

Benefit-Cost Comparison of the Proposed Rule

In comparing the estimated benefits and costs, the FAA has determined that if the proposed rule would prevent one accident during the first 6 years after it would be promulgated, the benefits would be greater than the costs. However, there is uncertainty about this estimate because it depends on whether the future is adequately modeled by past events and the amount of the currently unquantifiable net revenue losses. As a result, the FAA has determined that it is in general agreement with the NTSB recommendations that this information is needed.

Alternatives to the Proposed Rule

The FAA has determined that its responsibilities under the Regulatory Flexibility Act and the Unfunded Mandates Act require an analysis of alternatives to the proposed rule for each purpose. Rather than repeating the alternatives in each of those two sections, they are listed in this separate section for reference.

The FAA has evaluated three alternatives to the proposed rule. In formulating the alternatives, the FAA focused on its responsibility for aviation safety and its particular obligation under 49 U.S.C. 44717 to ensure the continuing airworthiness of airplanes. As a result, the three evaluated alternatives to the proposed rule differ only with respect to the dates of compliance—not on the content of the proposed rule.

Alternative 1

Require all B–737s that currently have FDAUs (not just those B–737s that had a FDAU installed prior to July 16, 1996) to record all of the proposed flight data parameters by August 18, 2000, rather than by August 20, 2001. This would shorten the compliance date for an estimated 197 B–737s by one year. Alternative 1 would increase compliance costs not because the actual retrofitting costs would change but because the lost net revenue from out-of-service time would be greater for some airplanes. A shorter compliance time increases the likelihood that the retrofit would be done as a special project and not as part of a regularly scheduled maintenance check. On that basis, the FAA has estimated that Alternative 1 would increase first-year compliance costs by $2.4 million above those costs associated with the proposed rule. However, this alternative could be considerably more expensive than the proposed rule, particularly if the idle airplane and scheduling costs that the

FAA could not quantify are substantial. In that case, the shorter the compliance period, the greater the idle airplane costs and scheduling costs. As a result, in comparison to Alternative 1, the proposed rule would offer considerably more relief to the airlines than is evidenced by the quantified difference between them.

Alternative 1 would not significantly increase the estimated quantitative benefits because the probability of one of these 197 airplanes having an accident whose probable cause would not have been determined within a one-year timeframe is remote. As a result, the FAA has determined that a commensurate increased level of benefits would not match the increased cost of this Alternative 1.

Alternative 2

Delay the compliance date for all B–737s to August 20, 2001. This would extend the compliance date by one year for about 292 airplanes. The FAA has determined that Alternative 2 could reduce compliance costs by about $7.3 million. This alternative would provide all B–737 operators with greater scheduling flexibility in determining when to have the airplane retrofitted. A greater number of these operators would be able to delay compliance until a regularly scheduled maintenance check and, thereby, reduce the lost revenue from out-of-service time. However, the FAA must also note that the converse to the effect described under Alternative 1 would be a factor. Again, the greater the unquantified costs, the greater the reduction in costs associated with delaying compliance dates. As Alternative 2 would allow greater flexibility than the proposed rule, the estimated compliance cost reduction from Alternative 2 could be substantially underestimated.

However, Alternative 2 could reduce the expected quantitative benefits. There is a probability that one of these 292 airplanes could have an accident or an incident whose cause would have been discovered only if the additional flight data parameters had been recorded. In light of the fact that the NTSB has recommended the August 18, 2000, compliance date, the FAA has decided to meet the majority of the NTSB recommendations and not propose a later compliance date for all B–737s.

Alternative 3

Delay the proposed compliance date for every B–737 until either its next scheduled major (4 days or more) maintenance check or by August 18, 2004. Alternative 3 would give an operator its maximum retrofitting scheduling flexibility. As the FAA has determined that nearly every B–737 will have at least one scheduled major maintenance check within any 5-year time period, Alternative 3 would allow the operator to perform the retrofit during a scheduled major maintenance check, which would eliminate the additional out-of-service time and, hence, the potential lost net revenue from compliance with the proposed rule. In addition, Alternative 3 would spread the cost of the retrofits over a 5-year time period. By doing so, the present value of the compliance cost from Alternative 3 would be about $172.8 million, which would be about $32.6 million less than the compliance cost of the proposed rule. Further, the FAA reiterates that the greater the unquantified costs, the greater the reduction in costs associated with delaying compliance dates. As Alternative 3 would allow greater flexibility than the proposed rule, the estimated compliance cost reduction associated with Alternative 3 could be substantially underestimated.

Alternative 3 would reduce the expected quantitative benefits because it would reduce the number of flight hours that the B–737 fleet would have recorded the additional flight data parameters by about 6.6 million flight hours during those 4.5 years. Further, it would reduce the cumulative probability that the additional recorded flight data parameters from an accident or incident involving a B–737 could provide information that would result in preventive regulatory or industry action. Consequently, since the FAA agrees with the NTSB recommendation that this information is important, the FAA has not proposed the delayed compliance date presented in Alternative 3.

Thus, in comparison to the one higher cost alternative and the two lower cost alternatives evaluated by the FAA, the FAA has determined that the proposed rule would be the best method to address this safety issue.

Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 establishes ‘‘as a principle of regulatory issuance that agencies shall endeavor, consistent with the objective of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the business, organizations, and governmental jurisdictions subject to regulation.’’ To achieve that principle, the Act requires agencies to solicit and consider flexible regulatory proposals and to explain the rationale for their actions. The Act covers a wide range of small entities, including small businesses, not-for-profit organizations, and small governmental jurisdictions.

Agencies must perform a review to determine whether a proposed or final rule will have a significant economic impact on a substantial number of small entities. If the agency determines that it will, the agency must prepare a Regulatory Flexibility Analysis (RFA) as described in the Act.

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 an RFA is not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear.

Recently, the Office of Advocacy of the Small Business Administration (SBA) published new guidance for Federal agencies in responding to the requirements of the Regulatory Flexibility Act. Application of that guidance to the proposed rule indicates that it could have a significant economic impact on a substantial number of small airlines. Accordingly, a complete initial regulatory flexibility analysis was conducted for the proposed rule and is summarized as follows:

Reasons Why the FAA is Considering the Proposed Rule

The flight data being recorded have not been sufficiently comprehensive to determine the causes of several B–737 accidents and incidents. As a result, the FAA and the aviation industry have been unable to develop specific actions that may prevent similar future B–737 accidents and incidents.

The Objectives and Legal Basis for the Proposed Rule

The objective of the proposed rule is to require the B–737 fleet to record additional flight data parameters that may help determine the cause(s) of a B–737 accident, and, thereby allow the development of regulatory and industry actions that could prevent similar future accidents. The legal basis for the proposed rule is 49 U.S.C. 44901 *et seq.* As a matter of policy, the FAA must, as its highest priority (49 U.S.C. 40101 (d)), maintain and enhance safety and security in air commerce.

All Relevant Federal Rules That May Duplicate, Overlap, or Conflict With the Proposed Rule

The FAA is unaware of any federal rules that would duplicate, overlap, or conflict with the proposed rule.

A Description and an Estimate of the Number of Small Entities to Which the Proposal Would Apply

The proposed rule would apply to the operators of all U.S.-registered B–737 airplanes operated under part 91, part 121, part 125, or under part 129.

Nearly all of the 16 operators flying B–737s under part 91 (under deviation authority from part 125) use the airplane as an ancillary part of their primary business (for example, oil, automobile manufacturing, etc.). As a result, these operators are distributed across a spectrum of Standard Industrial Classification (SIC) codes, and, as listed in the Initial Regulatory Evaluation, few are small businesses.

The FAA has determined that the 3 non-U.S. operators of U.S.-registered B–737s operating under part 129 are not small entities.

However, as seen shown in Table 2, based on a SBA definition that a small airline has fewer than 1,500 employees, the FAA has determined that 14 small airlines (assuming Accessair is a small airline and noting that Metrojet is owned by USAirways) operating under part 121 would be affected by the proposed rule. The number of affected B–737s reported in Table 3 is an FAA estimate of the number of those airplanes by airline on August 2000.

TABLE 3.—AFFECTED AIRLINES BY NUMBER OF B–737S

Operator	Number of B–737	Number of employees	Operating revenues (in $ millions)	Net profit (in $ millions)
Southwest	322	19,933	3,438.762	413.602
USAirways	205	43,100	8,556.000	965.182
United	190	76,000	17,472.106	774.128
Continental	185	40,700	7,155.384	389.816
Delta	90	58,097	14,584.906	1,073.535
America West	70	10,013	1,962.480	104.350
Alaska	50	10,137	1,553.158	106.162
Aloha	20	2,365	231.141	6.278
Frontier	19	440	174.713	(3.308)
Metrojet	15			
Winair	12	52	4.939	(1.150)
Vanguard	10	480	97.755	(7.460)
Airtran	9	600		(6.985)
Eastwind	6	800	22.641	(8.684)
Pro Air	6	110	11.247	(18.849)
Accessair	3			
Pace	3	20	4.914	0.256
Casino Express	2	102	15.692	(2.676)
Ryan Int	2	575	138.769	
American	1	111,300	16,394.548	1,097.339
Lorair	1	23		
Nations Air	1	154	6.724	0.299
North American	1	127	61.473	1.434
Sierra Pacific	1	35	6.650	0.631
Total				

The Projected Reporting, Recordkeeping, and Other Compliance Requirements of the Proposed Rule

Existing 14 CFR part 43, in part, already prescribes the content, form, and disposition of maintenance, preventive maintenance, rebuilding, and alteration records for any aircraft having a U.S. airworthiness certificate or any foreign-registered aircraft used in common carriage under part 121. There would be one-time paperwork costs of about $9.15 million to obtain FAA parts approvals and STCs for the modified FDR systems, but nearly all of these costs would be incurred by large airlines and large repair stations and large parts manufacturers. Finally, the proposed rule would necessitate minimal additional annual maintenance, which would require minutes of annual recordkeeping per airplane and negligible recordkeeping costs.

Regulatory Flexibility Cost Analysis

The compliance costs associated with the proposed rule are almost completely specific to an individual airplane. There would be minimal economies of scale in completing the FDR system retrofits. Thus, the compliance cost for an individual B–737 is largely independent of the size of the airline. The estimated present value of the compliance costs per B–737 by series and FDR system capability is summarized in Table 1. However, if the 1997 flight data recorder revisions and this proposed rule are viewed as two parts of one rulemaking extended over time, then the estimated per airplane cost would be increased by about $45,000.

Affordability Analysis

As seen in Table 2, the FAA has obtained 1997 net profit data for 11 of the 14 affected small airlines, although the FAA lacks detailed financial data for most of them. Of those 11 small airlines, 7 reported losses. Of the remaining 4 small airlines, the compliance costs would have turned one airline's positive profit into a loss, cut another's profit in half, and reduced the others' profits by 16 percent and by 7 percent. When coupled with the costs to comply with the 1997 flight data recorder revisions, these profits would have been further reduced and the losses would have been further increased. Consequently, the FAA has concluded that some of these small airlines may face financial difficulties in offsetting these compliance costs. The FAA solicits comments on the affordability of the proposed rule for small airlines and requests that all comments be accompanied with clear supporting data.

Disproportionality Analysis

As noted earlier in this regulatory flexibility cost analysis, the incremental compliance costs for a B–737 operated by a large airline and those costs for an identical B–737 operated by a small airline would be nearly identical. However, to the extent that financing charges tend to be larger for a small airline than for a large airline with a better-established credit line, the financing costs for the retrofit would be disproportionally larger for a small airline than for a large airline. The FAA does not have information concerning this potential impact. Nevertheless, the significant disproportionality that may occur would depend upon the percentage of an airline's fleet that is composed of B–737s. The higher the percentage of B–737s, the greater the impact of this proposed rule on that airline. In reviewing the composition of these various fleets, the FAA has determined that there is not a significant difference, on average, between the group of large airlines and the group of small airlines—although there are certainly differences among individual airlines. As a result, small airlines operating B–737s would not be disadvantaged, as a group, relative to the group of large airlines operating B–737s.

Competitiveness Analysis

The proposed rule would impose significant first-year costs on all operators of B–737s and, as a consequence, may affect the relative position of these airlines in their markets. As the proposed rule would impose no costs on other small operators using McDonnell Douglas or Airbus airplanes, the FAA has determined that there could be a significantly adverse competitiveness effect on certain small (and large) airlines that operate B–737s. The principle beneficiaries would be other small and large airlines that do not operate B–737s.

Business Closure Analysis

The FAA is unable to determine with certainty whether any of these small airlines would close their operations. Many very small operations (1 to 4 airplanes) operate very close to the margin, as evidenced by their constant exit from and entry into various markets. As noted, most of the small airlines reported losses, but, in the absence of sufficiently detailed financial data, the FAA cannot determine which, if any, of these small airlines would close due to the proposed rule.

Description of Alternatives

The three alternatives evaluated by the FAA are discussed in an earlier preamble section. As described, delaying the compliance dates would provide some relief to the affected small and large airlines. However, the proposed rule would still provide a competitive advantage to airlines operating airplanes other than B–737s over small and large airlines that operate B–737s.

Special Considerations

Although the proposed rule would have a significant economic impact on small airlines, the FAA has not exempted them from the proposed rule. The principal reason for not exempting them is that B–737 accidents and incidents whose causes have not been determined are not related to the size of the operator; both large and small airlines have been affected. For example, incidents have occurred to B–737s operated by small airlines. In particular, the 1996 Eastwind B–737 incident is very similar to the United and USAir B–737 accidents. The Eastwind airplane recorded only 11 flight data parameters and, consequently, that incident's cause has not been fully determined. Thus, the FAA has determined that special considerations for small airlines would not be appropriate.

Conclusion

The FAA has determined that there are no viable alternatives to the proposed rule for small airlines. Consequently, the FAA has concluded that exempting B–737s or delaying compliance dates for B–737s operated by small airlines would be an inappropriate action and inconsistent with the FAA mandate to ensure aviation safety. The FAA requests comments on this initial regulatory flexibility analysis and requests commenters to supply supporting data for the comments.

International Trade Impact Assessment

Consistent with the Administration's belief in the general superiority, desirability, and efficacy of free trade, it is the policy of the Administrator to remove or diminish, to the extent feasible, barriers to international trade, including both barriers affecting the export of American goods and services to foreign countries and those affecting the import of foreign goods and services into the United States.

In accordance with that policy, the FAA is committed to develop as much as possible its aviation standards and practices in harmony with its trading partners. Significant cost savings can result from this harmonization, both to American companies doing business in foreign markets, and foreign companies doing business in the United States.

This proposed rule would have a minimal impact on international trade. Although it would increase the cost of manufacturing a future B–737 by about $39,000, the FAA does not believe that this increase would have a significantly negative effect on Boeing's future domestic or international markets for the B–737.

Unfunded Mandates Assessment

Title II of the Unfunded Mandates Reform Act of 1995 (the Act), enacted as Public Law 104–4 on March 22, 1995, requires each Federal agency, to the extent permitted by law, to prepare a written assessment of 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. Section 204(a) of the Act, 2 U.S.C. 1534(a), requires the Federal agency to develop an effective process to permit timely input by elected officers (or their designees) of State, local, and tribal governments on a proposed ''significant intergovernmental mandate.'' A ''significant intergovernmental mandate'' under the Act is any provision in a Federal agency regulation that will impose an enforceable duty upon state, local, and tribal governments, in the aggregate, of $100 million (adjusted annually for inflation) in any one year. Section 203 of the Act, 2 U.S.C. 1533, which supplements section 204(a), provides that before establishing any regulatory requirements that might significantly or uniquely affect small governments, the agency shall have developed a plan that, among other things, provides for notice to potentially affected small governments, if any, and for a meaningful and timely opportunity to provide input in the development of regulatory proposals.

Under 49 U.S.C. 40101(d)(1), the FAA Administrator is required to consider the following matter, among others, as being in the public interest: maintaining and enhancing safety and security as the highest priorities in air commerce. Additionally it is the Administrator's statutory duty to perform the responsibilities ''in a way that best tends to reduce or eliminate the possibility or recurrence of accidents in air transportation.'' (See 49 U.S.C. 44701(c).)

The FAA has determined that this proposed rule would not contain a significant intergovernmental mandate as defined by the Act because the FAA has no knowledge of any State, local, or tribal government operating a B–737.

However, the FAA has determined that this proposed rule would contain a significant private sector mandate as defined by the Act because the compliance costs over the first 18 months would be about $243 million for the private sector. Thus, the FAA has evaluated the three previously described alternatives in order to determine if the burden could be reduced in a manner consistent with the FAA's mandate to provide aviation safety. Of the three alternatives, only Alternative 3 (delaying compliance until a scheduled major maintenance check) would lower the compliance costs below $100 million for every year. Nevertheless, for the reasons discussed in that earlier section, the FAA has determined that Alternative 3 would not attain the same level of B–737 risk reduction at a lower cost than the proposed rule.

Federalism Implications

The regulations proposed herein would not have a substantial direct effect on the States, on the relationship between the national Government and the States, or on the distribution of power and responsibilities among the various levels of government. Therefore, in accordance with Executive Order 12612, it is determined that this proposal would not have sufficient federalism implications to warrant the preparation of a federalism assessment.

Environmental Analysis

FAA Order 1050.1D defines FAA actions that may be categorically excluded from preparation of a National Environmental Policy Act (NEPA) environmental assessment or environmental impact statement. In accordance with FAA Order 1050.1D, appendix 4, paragraph 4(j), this rulemaking action qualifies for a categorical exclusion.

Energy Impact

The energy impact of the proposed rule has been assessed in accordance with the Energy Policy and Conservation Act (EPCA) and Public Law 94–163, as amended (42 U.S.C. 6362). It has been determined that it is not a major regulatory action under the provisions of EPCA.

Comment Period

Comments on this proposed rule must be received by the agency within 30 days of the date of publication of this document. The FAA understands that this does not allow affected operators and other interested parties much time to gather and submit the information requested by the FAA. However, the agency has determined that it is more important to give affected operators the maximum available time to comply with the new requirements once a final rule is adopted. The FAA generally agrees with the NTSB that B–737 airplanes be retrofitted to record the additional flight data by August 18, 2000. The FAA has determined that the short time available requires that the comment period on this rule be kept to a minimum. The FAA also notes that there has been considerable publicity concerning the NTSB recommendations, and that questions addressed to the FAA indicate that the recommended actions and the issues surrounding them are well known.

For these reasons, the FAA strongly encourages commenters to submit their comments as soon as possible. Late-filed comments will be considered to the extent that they do not unnecessarily delay the promulgation of a final rule.

List of Subjects

14 CFR Part 91

Aviation safety, Reporting and recordkeeping requirements.

14 CFR Part 121

Air carriers, Aviation safety, Air transportation, Reporting and recordkeeping requirements.

14 CFR Part 125

Aviation safety, Reporting and recordkeeping requirements.

The Proposed Amendment

In consideration of the foregoing, the Federal Aviation Administration proposes to amend parts 91, 121, and 125 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, 44701, 44705, 44709, 44711, 44712, 44715, 44716, 44717, 44722, 44901, 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. Section 91.609 is amended by adding a new paragraph (h) to read 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, 44101, 44701–44702, 44705, 44709–44711, 44713, 44716–44717, 44722, 44901, 44903–44904, 44912, 46105.

4. Section 121.344 is amended in paragraph (a) by removing the word ''and'' after paragraph (a)(87); by removing the period after paragraph (a)(88) and adding a semicolon in its place; and by adding new paragraphs (a) (89), (90), and (91), (d)(3), (e)(3) and (m); and by revising paragraphs (b) introductory text, (c) introductory text, and (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 status.

(b) Except for Boeing 737 model airplanes, for all turbine-engine powered transport category airplanes manufactured on or before October 11, 1991, by August 20, 2001—

* * * * *

(c) Except for all Boeing 737 model airplanes, for all turbine-engine powered transport category airplanes manufactured on or before October 11, 1991—

* * * * *

(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)(1) or (m)(2) 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)(1) of this section.

(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 paragraph (f)(1) of this section, all Boeing 737 model airplanes, also must also comply with the requirements of paragraph (m)(1) 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 paragraphs (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, in accordance with the following schedule:

(1) All Boeing 737 model airplanes equipped with a flight data acquisition unit of any type as of July 16, 1996, or manufactured after July 16, 1996, must comply by August 18, 2000.

(2) All Boeing 737 model airplanes not equipped with a flight data acquisition unit of any type as of July 16, 1996, must comply by August 20, 2001.

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

Appendix M to Part 121—Airplane Flight Recorder Specification—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).[14]	Full range Control wheel ±70 lbs. Control column ±85 lbs. Rudder pedal ±70 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 status.	Discrete (on/off)		0.5		

[14] For all Boeing 737 model airplanes, the seconds per sampling interval is 0.5 per control input; remarks do not apply.

PART 125—CERTIFICATION AND OPERATIONS: AIRPLANES HAVING A SEATING CAPACITY OF 20 OR MORE PASSENGER 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. Section 125.3 is amended 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. Section 125.226 is amended in paragraph (a) 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), (d)(3), (e)(3), and (m); and by revising paragraphs (b) introductory text, (c) introductory text, and (f) to read as follows:

§ 125.226 Digital flight data recorders.

(a) * * *

(89) Yaw damper status;

(90) Yaw damper command; and

(91) Standby rudder status.

(b) Except for Boeing 737 model airplanes, for all turbine-engine powered transport category airplanes manufactured on or before October 11, 1991, by August 20, 2001—

(c) Except for all Boeing 737 model airplanes, for all turbine-engine powered transport category airplanes manufactured on or before October 11, 1991—

(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)(1) or (m)(2) 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)(1) of this section.

(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)(1) 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 paragraphs (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, in accordance with the following schedule:

(1) All Boeing 737 model airplanes equipped with a flight data acquisition unit of any type as of July 16, 1996, or manufactured after July 16, 1996, must comply by August 18, 2000.

(2) All Boeing 737 model airplanes not equipped with a flight data acquisition unit of any type as of July 16, 1996, must comply by August 20, 2001.

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

Appendix E to Part 125—Airplane Flight Recorder Specification—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).[14]	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 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 status.	Discrete (on/off)		0.5		

[14] For all Boeing 737 model airplanes, the seconds per sampling interval is 0.5 per control input; remarks do not apply.

Issued in Washington, DC, on November 9, 1999.

Ronald T. Wojnar,

Acting Director, Aircraft Certification Service.

[FR Doc. 99–29758 Filed 11–17–99; 8:45 am]

BILLING CODE 4910–13–P