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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 39

[Docket No. FAA-2008-0403; Directorate Identifier 2007-NM-166-AD; Amendment 39-16379; AD 2010-16-03]

RIN 2120-AA64

Airworthiness Directives; McDonnell Douglas Corporation Model MD-11 and MD-11F Airplanes Equipped With General Electric CF6-80C2 Series Engines

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: We are adopting a new airworthiness directive (AD) for certain Model MD-11 and MD-11F airplanes. This AD requires revising the airplane flight manual to advise the flightcrew to use certain procedures during descent in certain icing conditions. This AD results from reports of several in-flight engine flameouts, including multiple dual engine flameout events, in ice-crystal icing conditions. We are issuing this AD to ensure that the flightcrew has the proper procedures to follow in certain icing conditions. These certain icing conditions could cause a multiple engine flameout during flight with the potential inability to restart the engines, and consequent forced landing of the airplane.

DATES: This AD is effective September 9, 2010.

Examining the AD Docket

You may examine the AD docket on the Internet at <http://www.regulations.gov>; or in person at the Docket Management Facility between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays. The AD docket contains this AD, the regulatory evaluation, any comments received, and other information. The address for the Docket Office (telephone 800-647-5527) is the Document Management Facility, U.S. Department of Transportation, Docket Operations, M-30, West Building Ground Floor, Room W12-140, 1200 New Jersey Avenue, SE., Washington, DC 20590.

FOR FURTHER INFORMATION CONTACT: Samuel Lee, Aerospace Engineer, Propulsion Branch, ANM-140L, FAA, Los Angeles Aircraft Certification Office, 3960 Paramount Boulevard, Lakewood, California 90712-4137; telephone (562) 627-5262; fax (562) 627-5210.

SUPPLEMENTARY INFORMATION:

Discussion

We issued a notice of proposed rulemaking (NPRM) to amend 14 CFR part 39 to include an airworthiness directive (AD) that would apply to certain Model MD-11 and MD-11F airplanes. That NPRM was published in the Federal Register on April 7, 2008 (73 FR 18719). That NPRM proposed to require revising the airplane flight manual (AFM) to advise the flightcrew to use certain procedures during descent in certain icing conditions.

Other Relevant Proposed Rulemaking

NPRM, Docket No. FAA-2008-0402, Directorate Identifier 2007-NM-165-AD (73 FR 18721, April 7, 2008), proposes to require similar actions for Model 747 airplanes and Model 767 airplanes, certified in any category, equipped with General Electric Model CF6-80C2 or CF6-80A series engines. These airplanes have been determined to be subject to the identified unsafe condition addressed in this AD.

Comments

We gave the public the opportunity to participate in developing this AD. We considered the comments received.

Support for the NPRM

The Air Line Pilots Association, International supports the intent and language of the NPRM. The National Transportation Safety Board (NTSB), based on the success of similar AFM requirements to address this unsafe condition on Hawker Beechcraft Corporation Model 400, 400A, and 400T series airplanes and Model MU-300 airplanes, supports the adoption of the proposed requirements.

Request for FAA To Actively Pursue Research To Develop a Permanent Solution

The NTSB notes that the NPRM is intended as interim action, and points out that it has issued Safety Recommendation A-06-59, dated August 25, 2006. In this safety recommendation the NTSB asked the FAA to " * * * work with engine and airplane manufacturers and other industry personnel as well as the appropriate international airworthiness authorities to actively pursue research to develop an ice detector that would alert pilots to internal engine icing and require that it be installed on new production turbojet engines, as well as retrofitted to existing turbojet engines." Therefore, the NTSB hopes the FAA pursues research in concert with the multinational Aircraft Icing Research Alliance that might develop an ice detector to alert flightcrews to the accretion of ice crystals on internal engine surfaces, so that flightcrews can take the appropriate actions.

We partially agree with the commenter's request. We agree that the General Electric (GE) CF6-80C2 series engine needs to be modified to mitigate the risk of flameouts caused by ice crystal accretion. However, at this time, we do not agree to pursue research to develop an ice detector that would alert flightcrews to the internal engine icing, or with requiring manufacturers to install ice detectors internal to the engines. In addition, no such designs have been proposed to the FAA. Instead, for future designs, we are developing rulemaking to show acceptable engine operation in an ice crystal environment. For engines that currently demonstrate a susceptibility to ice crystals, we are working with manufacturers to develop engine design changes to make engines more robust during ice crystal accumulation and shedding encounters. We will continue to provide feedback to the NTSB through the established process for addressing safety recommendations. For this AD, if different

methods to address the unsafe condition are developed, under the provisions of paragraph (h) of this AD, we will consider requests for approval of an AMOC if sufficient data are submitted to substantiate that the method would provide an acceptable level of safety. No change to the AD is necessary in this regard.

Request To Require Demonstration of Non-Susceptibility in Future Designs

The NTSB states that it hopes the FAA will require future engine designs to demonstrate that they will not be susceptible to the accretion of ice crystals on internal surfaces. The NTSB points out that this request is in keeping with information provided to the NTSB by an FAA icing expert during a briefing with the Safety Board.

From these statements, we infer that the NTSB is requesting that we revise the NPRM to include a statement of our intent to require manufacturers to demonstrate that future engine designs are not susceptible to the accretion of ice crystals. We partially agree. We agree that current FAA regulations addressing engine and airplane icing do not apply to the ice crystal environment; therefore, we are working with the aviation industry to develop appropriate regulations that address operation in an ice crystal environment. As we determine the necessary requirements to address this issue, we will consider additional rulemaking. We do not agree to revise this AD to include a statement regarding future regulations that have not yet been determined. No change to the AD is necessary in this regard.

Request To Withdraw the NPRM

GE acknowledges that a small number of inclement weather or significant weather system encounters have resulted in short-duration multiple engine power loss. GE points out that these few events occurred out of 14 million flights over 20 years of total service experience on the Model CF6-80C2 series engine. GE states that a forced landing resulting from one of these in-flight ice-crystal icing events is extremely improbable (including demonstrated relight performance). Therefore, GE asserts that the proposed condition does not meet the definition of "unsafe condition," as defined by FAA Advisory Circular 39-8, "Continued Airworthiness Assessments of Powerplant and Auxiliary Power Unit Installations of Transport Category Airplanes," dated September 8, 2003.

From these statements, we infer that GE requests that we withdraw the NPRM. We do not agree. We have evaluated the unsafe condition and find that sufficient data exist to demonstrate that the environment that causes the engine flameout would likely cause engine damage that potentially would prevent an engine from relighting. The condition could exist on all of an airplane's engines, resulting in a forced landing. The advisory circular referenced by the commenter merely provides guidance. We have determined that an unsafe condition exists, and the appropriate vehicle for correcting an unsafe condition is an AD. We have not changed the AD regarding this issue.

Request To Revise Wording of the Unsafe Condition

Boeing proposes that we revise the wording of the unsafe condition from, "These certain icing conditions could cause a multiple engine flameout during flight without the ability of the engines to be relit * * *" to "These certain icing conditions may cause a multiple engine flameout during flight, with the potential inability to restart the engines * * *." Boeing asserts that the wording in the NPRM overly conveys the likelihood of not being able to restart the engine(s) after flameout. While the possibility exists, Boeing confirms that all engines involved in all of the flameout events to date have been restarted in flight with subsequent normal landings.

We agree. We acknowledge that none of the flameout events on this engine model to date have resulted in a forced landing due to the inability to restart the engines. We agree that the inability to restart the engines following flameout is possible, not probable. Therefore, we have revised the

unsafe condition statement in the Summary section and paragraph (e) of this AD (specified as paragraph (d) of the NPRM) as proposed by Boeing.

Requests To Revise Wording in the Discussion Section of the NPRM

Boeing proposes that we revise the Discussion section of the NPRM to state that there have been seven engine flameout events, not six. Boeing states that it has received seven reports of flameout events on Model MD-11 airplanes due to ice-crystal icing conditions.

We acknowledge that Boeing has received seven reports, instead of the six specified in the NPRM. However, the Discussion section of the NPRM is not restated in the final rule; therefore, no change to the AD is necessary in this regard.

GE suggests that we revise the wording of the Discussion section of the NPRM to remove the word "core," or, if that is not acceptable, to change "core flow path" to "booster and core flow path." GE points out that the term "core" can be interpreted to mean just the high-pressure spool portion of a turbofan.

We partially agree. We do not agree with GE's suggestion to remove the word "core" from the Discussion section. We do agree that the phrase "booster and core flow path" is more accurate; however, because the Discussion section of the NPRM is not restated in this AD, there is no need to revise the AD in this regard.

GE suggests that we revise the Discussion section of the NPRM to change the word "usually" to "often" in the following sentence: "Therefore, it [ice-crystal icing] is usually undetected by the flightcrew." GE states that this change would make the NPRM consistent with a similar NPRM (Directorate Identifier 2007-NM-165-AD, Docket FAA-2008-0402 (73 FR 18721, April 7, 2008)), which addresses the same unsafe condition on certain Model 747 and 767 airplanes.

From this statement, we infer that GE is requesting that we revise the Discussion section of the NPRM to clarify that ice-crystal icing is often undetected by the flightcrew, not usually undetected. We partially agree. We agree that the wording change suggested by GE would make this AD consistent with a similar NPRM that addresses the same unsafe condition on certain Model 747 and 767 airplanes. However, as previously noted, the Discussion section in the NPRM is not restated in this AD, therefore, there is no need to revise the AD in this regard.

Requests To Revise the Costs of Compliance Section of the NPRM

GE suggests that there should be an operational cost of compliance included in the proposed Costs of Compliance provided in the NPRM. GE states that, while increasing engine off-take or bleed does provide additional margin against flameout, doing so requires somewhat increased fuel burn. GE believes the proposed procedure would be required on a significant percentage of flights.

Federal Express (FedEx) believes that the total cost of the NPRM has either not been fully considered, or has not been properly communicated. FedEx asserts that the cost of using wing and tail anti-ice increases fuel burn and exposes the airplane to additional reliability risks associated with increased use of the anti-ice system, while only providing a small incremental amount of effectiveness. FedEx also states that it estimates the increased fuel consumption to be 40 pounds for a descent from flight level (FL) 400 to landing.

From these statements, we infer that GE and FedEx are requesting that we revise the Costs of Compliance section of the NPRM to provide an operational cost for increased fuel burn necessitated by use of the proposed AFM procedure. We do not agree. The cost information in AD actions describes only the direct costs of the specific action required by the AD: an AFM revision in this case. The estimated cost of this action represents the time necessary to perform only the actions actually required by this AD. We recognize that, in doing the actions required by an AD, operators might incur operational costs in addition to the direct costs. The cost analysis in AD rulemaking actions, however, typically does not include incidental or operational costs such as the time required for planning or other administrative actions, and, in this case, possible additional fuel costs. Those

costs, which might vary significantly among operators, are almost impossible to calculate. Additionally, we have determined that the additional fuel burn necessitated by the AFM procedure would be insignificant. However, as we explain under "Request to Revise the Proposed AFM Text," we have revised the procedure to allow the ANTI-ICE switches to be placed in the OFF position when icing conditions are no longer present or anticipated. This allowance will further reduce any additional fuel burn caused by the use of the anti-ice system. We have not changed the Costs of Compliance section of this AD in this regard.

Request To Include Alternative AFM Requirements

FedEx recommends that we revise the NPRM to allow alternative AFM requirements based on the full authority digital engine control (FADEC) electronic control unit (ECU) installed software version. FedEx states that GE has documented six flameout events suspected to be a result of ice-crystal accretion. FedEx points out that GE Service Bulletin 73-21-07, Engine fuel and control–Electronic Control Unit Introduction of Software Version 8.3.K (8322), was introduced to improve the flameout margin in ice-crystal conditions. FedEx explains that this software change will create new engine control configurations with enhanced variable bypass valve (VBV) scheduling logic for inclement weather, and will change the scheduling of the VBVs at high altitude to increase ice extraction from the booster-core flowpath transition to the fan exit stream. FedEx believes there have been no suspected flameout events on airplanes using the combination of engine anti-ice and ECU software version 8.3.K on Model MD-11s, and indicates that it is upgrading its fleet to ECU software version 8.3.K in accordance with AD 2007-22-07, Amendment 39-15243 (72 FR 60227, October 24, 2007), applicable to GE CF6-80C2D1F turbofan engines. Therefore, FedEx proposes that airplanes with ECU software version 8.3.J or previous should follow the AFM requirement proposed in the NPRM, and airplanes with software version 8.3.K or subsequent should be allowed to follow alternative AFM requirements. FedEx provides suggested wording for an alternative AFM requirement.

We do not agree to revise this AD to allow alternative AFM requirements based on the installed software version. Based on a recent multiple engine flameout incident on a Model 747-400 airplane equipped with CF6-80C2B1F engines and ECU software equivalent to the version 8.3.K, we have determined that ECU software version 8.3.K alone will not necessarily provide an adequate margin of safety against engine flameout in all environments. We note that the nacelle anti-ice had been switched on prior to engine flameout. Increasing the bleed flow and engine idle speed by placing the ENG, WING, and TAIL ANTI-ICE switches in the ON position will provide additional margin for engine flameout. We have not revised the AD in this regard.

Request To Remove Part of the AFM Requirement

FedEx requests that additional justification be made available to support the proposed AFM requirement to use wing and tail anti-ice systems. FedEx states that both its flight operations and engineering staffs agree that increasing the flameout margin to buffer against possible core shedding of ice-crystal accretion is an important requirement, and fully support activation of the ENG IGN OVRD switch and engine anti-ice as effective means of reducing flameouts. However, FedEx feels strongly that part of the proposed AFM requirement is of limited value and might not be justifiable. FedEx asserts that selection of wing anti-ice would result in a small or incremental increase in core temperature, while increasing fuel flow and unnecessarily exposing the airplane to additional reliability risks. FedEx further notes that the NTSB, in its comments to the NPRM, made no mention of wing and tail anti-ice systems being part of the successful recommendations on Model 400A airplanes.

We do not agree to remove the requirement to use wing and tail anti-ice. As discussed previously, despite having the nacelle anti-ice switched on, a Model 747-400 airplane experienced a multiple engine flameout. Therefore, the use of nacelle anti-ice alone is not sufficient to prevent a

multiple engine flameout. Increasing the bleed flow and engine idle speed by placing the ENG, WING, and TAIL ANTI-ICE switches in the ON position will provide additional margin against engine flameout. We have not revised the AD in this regard.

Request To Revise the Proposed AFM Text

Boeing proposes that we revise the proposed AFM text provided in the NPRM as follows:

Prior to reducing thrust for descent, when icing conditions (defined by visible moisture in the air and TAT is 6 Deg C or below) are present, the ENG IGN OVRD switch and the ENG, WING, and TAIL ANTI-ICE switches must be placed in the ON position. When icing conditions are no longer present or anticipated, place the ENG IGN OVRD switch and the ENG, WING, and TAIL ANTI-ICE switches in the OFF position.

Boeing states that this AFM text provides additional procedural information, as noted in the current Interim Operating Procedures for icing conditions that exist or are anticipated prior to descent.

We agree that the AFM text changes suggested by Boeing do provide helpful procedural information. We have also determined that there is no additional benefit to having the engine, wing, and tail anti-ice switched on once icing conditions are no longer present or anticipated. Therefore, we have revised the AFM text provided in paragraph (g) of this AD (specified in paragraph (f) of the NPRM) to include the supplemental procedural information provided by Boeing, and to allow engine, wing, and tail anti-ice to be switched off once icing conditions are no longer present or anticipated.

Explanation of Additional Paragraph in This AD

We have added a new paragraph (d) to this AD to provide the Air Transport Association (ATA) of America subject code 30: Ice and rain protection. This code is added to make this AD parallel with other new AD actions. We have reidentified subsequent paragraphs accordingly.

Explanation of Additional Change Made to the AD

We have revised this AD to identify the legal name of the manufacturer as published in the most recent type certificate data sheet for the affected airplane models.

Conclusion

We reviewed the relevant data, considered the comments received, and determined that air safety and the public interest require adopting the AD with the changes described previously. We also determined that these changes will not increase the economic burden on any operator or increase the scope of the AD.

Interim Action

We consider this AD interim action. If final action is later identified, we might consider further rulemaking then.

Explanation of Change to Costs of Compliance

Since issuance of the original NPRM, we have increased the labor rate used in the Costs of Compliance from \$80 per work-hour to \$85 per work-hour. The Costs of Compliance information, below, reflects this increase in the specified hourly labor rate.

Costs of Compliance

There are about 118 airplanes of the affected design in the worldwide fleet. The following table provides the estimated costs for U.S. operators to comply with this AD.

Estimated Costs						
Action	Work hours	Average labor rate per hour	Parts	Cost per airplane	Number of U.S.-registered airplanes	Fleet cost
AFM revision	1	\$85	\$0	\$85	70	\$5,950

Authority for This Rulemaking

Title 49 of the United States Code specifies the FAA's authority to issue rules on aviation safety. Subtitle I, section 106, describes the authority of the FAA Administrator. "Subtitle VII: Aviation Programs," describes in more detail the scope of the Agency's authority.

We are issuing this rulemaking under the authority described in "Subtitle VII, Part A, Subpart III, Section 44701: General requirements." Under that section, Congress charges the FAA with promoting safe flight of civil aircraft in air commerce by prescribing regulations for practices, methods, and procedures the Administrator finds necessary for safety in air commerce. This regulation is within the scope of that authority because it addresses an unsafe condition that is likely to exist or develop on products identified in this rulemaking action.

Regulatory Findings

This AD will not have federalism implications under Executive Order 13132. This AD will 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.

For the reasons discussed above, I certify that this AD:

- (1) Is not a "significant regulatory action" under Executive Order 12866,
- (2) Is not a "significant rule" under DOT Regulatory Policies and Procedures (44 FR 11034, February 26, 1979), and
- (3) Will not have a significant economic impact, positive or negative, on a substantial number of small entities under the criteria of the Regulatory Flexibility Act.

You can find our regulatory evaluation and the estimated costs of compliance in the AD Docket.

List of Subjects in 14 CFR Part 39

Air transportation, Aircraft, Aviation safety, Safety.

Adoption of the Amendment

Accordingly, under the authority delegated to me by the Administrator, the FAA amends 14 CFR part 39 as follows:

PART 39—AIRWORTHINESS DIRECTIVES

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

Authority: 49 U.S.C. 106(g), 40113, 44701.

§ 39.13 [Amended]

2. The FAA amends § 39.13 by adding the following new AD:



2010-16-03 McDonnell Douglas Corporation: Amendment 39-16379. Docket No. FAA-2008-0403; Directorate Identifier 2007-NM-166-AD.

Effective Date

(a) This airworthiness directive (AD) is effective September 9, 2010.

Affected ADs

(b) None.

Applicability

(c) This AD applies to McDonnell Douglas Corporation Model MD-11 and MD-11F airplanes, certified in any category, equipped with General Electric CF6-80C2 series engines.

Subject

(d) Air Transport Association (ATA) of America Code 30: Ice and rain protection.

Unsafe Condition

(e) This AD results from reports of several in-flight engine flameouts, including multiple dual engine flameout events, in ice-crystal icing conditions. We are issuing this AD to ensure that the flightcrew has the proper procedures to follow in certain icing conditions. These certain icing conditions could cause a multiple engine flameout during flight with the potential inability to restart the engines, and consequent forced landing of the airplane.

Compliance

(f) You are responsible for having the actions required by this AD performed within the compliance times specified, unless the actions have already been done.

Airplane Flight Manual (AFM) Revision

(g) Within 14 days after the effective date of this AD, revise the Limitations Section of the McDonnell Douglas MD-11/MD-11F AFM to include the following statement. This may be done by inserting a copy of this AD into the AFM.

"Prior to reducing thrust for descent when icing conditions (defined by visible moisture in the air and TAT is 6 °C or below) are present, the ENG IGN OVRD switch and the ENG, WING, and TAIL ANTI-ICE switches must be placed in the ON position. When icing conditions are no longer present or anticipated, place the ENG

IGN OVRD switch and the ENG, WING, and TAIL ANTI-ICE switches in the OFF position."

Note 1: When a statement identical to that in paragraph (g) of this AD has been included in the general revisions of the AFM, the general revisions may be inserted into the AFM, and the copy of this AD may be removed from the AFM.

Alternative Methods of Compliance (AMOCs)

(h)(1) The Manager, Los Angeles Aircraft Certification Office (ACO), FAA, has the authority to approve AMOCs for this AD, if requested using the procedures found in 14 CFR 39.19. Send information to ATTN: Samuel Lee, Aerospace Engineer, Propulsion Branch, ANM-140L, FAA, Los Angeles Aircraft Certification Office, 3960 Paramount Boulevard, Lakewood, California 90712-4137; telephone (562) 627-5262; fax (562) 627-5210.

(2) To request a different method of compliance or a different compliance time for this AD, follow the procedures in 14 CFR 39.19. Before using any approved AMOC on any airplane to which the AMOC applies, notify your principal maintenance inspector (PMI) or principal avionics inspector (PAI), as appropriate, or lacking a principal inspector, your local Flight Standards District Office. The AMOC approval letter must specifically reference this AD.

Material Incorporated by Reference

(i) None.

Issued in Renton, Washington on July 16, 2010.
Ali Bahrami,
Manager, Transport Airplane Directorate,
Aircraft Certification Service.