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**General Aviation
Manufacturers Association**

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WHS 99-44

JULY 23, 1999

U.S. DEPARTMENT OF TRANSPORTATION DOCKETS
DOCKET NO. FAA-1999-5401 - 26
400 SEVENTH ST. SW
ROOM PLAZA 401
WASHINGTON, DC 20590

Subject: **Docket No. FAA-1999-5401: Notice No. 99-02, Aging Airplane Safety**

Dear Ladies and Gentlemen:

The General Aviation Manufacturers Association, together with De Havilland-Bombardier Aircraft and Fairchild-Donnier Aircraft have carefully reviewed the subject FAA Notice of Proposed Rule Making and related draft Advisory Circulars 91-MA and 120-XX on Aging Airplane Safety as published in 64FR16298. GAMA represents 50 American manufacturers of general aviation aircraft, engines avionics and other components. GAMA member companies also operate fleets of aircraft, fixed base operations at many airports, and pilot training facilities across the United States: We wish to collectively provide the following comments in response to this NPRM and associated draft AC's as requested by the FAA.

NPRM 99-02 Requirements Overview

The NPRM proposes changes to certain parts of 14CFR rules to require all airplanes used by an air carrier to provide air transportation (all U.S. registered multiengine airplanes operated under 14CFR part 129 and all multiengine airplanes used in scheduled operations under 14CFR parts 121 and 135) to undergo inspection, maintenance and repair records reviews by the Administrator, or certain representatives of the Administrator. This proposed rule would also prohibit operation of these airplanes after specified deadlines unless damage-tolerance based inspections and procedures are included in their maintenance or inspection programs.



Respondent Qualifications

Aircraft design and manufacturing organizations that have produced many of the airplane models subject to this proposed rule making; namely Raytheon (Beech), Cessna, The New Piper (Piper), DeHavilland-Bombardier, and Fairchild-Donnier, have a long history of designing quality airplane structures and obtaining FAA approval for these designs. Over at least the past 30 years each of these manufacturers has utilized the several variations of fatigue and structural durability regulations contained in 14CFR parts 23 and 25. In addition, each of these manufacturers has assisted the FAA in the development of the latest certification regulations for structural fatigue and durability, has worked with the Technical Oversight Group for Aging Aircraft (TOGAA) on one or more of its airplane models, and now applies the latest form of these regulations in new product designs. Each of these companies is, therefore, fully qualified to respond in substantial detail to this proposed rulemaking as it pertains to the basis for inspections and procedures that are to be included in airplane maintenance and inspection programs.

Public Law 102-1 43

Directions given by Congress to the FAA regarding this rulemaking are contained in Title IV of PL 102-1 43, the “Aging Airplane Safety Act of 1991.” This Act directs the FAA to:

- Initiate / issue rulemaking to assure the continuing airworthiness of aging aircraft
- Make inspections and review maintenance & other records of aircraft used by an air carrier in air transportation to determine that each such aircraft is in safe condition and is properly maintained
- Verify that air carriers are maintaining their aircraft in accordance with FAA approved maintenance programs and have the commitment & technical competence to do so.
- Commence inspections and reviews on the first day after the start of the 15th year of the aircraft’s service life and conduct these as part of the heavy maintenance check
- Require the air carrier to demonstrate that maintenance of the aircraft’s structure, skin, and other age sensitive parts and components has been adequate and timely enough to ensure the highest degree of safety.

Ten Year History of Industry-FAA Aging Airplane Effort

Following the 1989 GAMA-RAA Conference on Aging Commuters, the FAA visited all manufacturers of commuter aircraft in 1990-91 to review service bulletins associated with repetitive structural fatigue related inspections, and to request that terminating action be implemented, wherever possible, in place of these repetitive inspections. FAA justification in support of this request was that the data clearly showed that repetitive structural inspections could not be sufficiently trusted to assure an adequate verification of structural integrity. However, by its

action in issuing this most recent proposed rulemaking, it appears that FAA now wants to rely heavily on structural inspections.

During the 1992-94 period, TOGAA visited our companies to review technical information relating to structural integrity, aging-related inspections, and structural life limits. Manufacturers had defined structural life limits and related inspection programs, where necessary, based upon structural fatigue analyses and fatigue tests. And, if field data were available, these data were correlated with the analyses and test results. It is significant to note that TOGAA generally accepted the manufacturers' structural integrity programs when it accomplished its 1992-94 reviews. In some cases, manufacturers have asked FAA to make their structural integrity programs mandatory through the issuance of airworthiness directives. FAA's response, however, has been essentially limited to correcting known field service problems and has not implemented the full scope of manufacturers' structural integrity and inspection programs. On the other hand, De Havilland-Bombardier requested MOT Canada to issue an AD for their Model DHC-6, and Canada followed through and issued the AD.

Field Inspection and Maintenance Programs

Manufacturers have no control over whether their field inspections and maintenance requirements are accomplished unless an AD is issued to require compliance with such requirements. For the majority of our airplanes covered by this proposed rulemaking, AD's have not been issued. For example: FAA received a request **from** Beech Aircraft Corporation, reference Beech letter 940-90-05-200 dated May 2, 1990 (copy enclosed for reference), which solicited an AD for the structural integrity inspection program contained in Beech document P/N 98-3013 1 for the Model 99 series. The structural life limit cited in Appendix N to part 121 and in other locations of the NPRM 99-02 was requested to be made mandatory many years ago. This has not yet occurred. A unique example where FAA waited too long before taking action to issue an AD for a manufacturer's structural integrity inspection program is found in reference 64FR2978 1. DOT/FAA/AR-98-66 dated March 1999 also applies to this matter. Therefore, in view of NPRM 99-02, the manufacturers will make an effort to obtain FAA AD's for those structural integrity programs already in place and based on fatigue lives derived from fatigue analyses, fatigue tests, and service data correlation.

Manufacturers also strongly recommend the adoption of corrosion control programs as an integral part of fatigue related structural integrity programs. FAA's intent to issue requirements for such programs in 1998, reference pg. 16304, last paragraph in the middle column, has apparently not occurred. What is FAA's intent on this important matter? The significant influence of corrosion on fatigue related structural integrity was recognized at the 1989 GAMA-RAA Aging Commuter Conference and has been an important part of the Aging Aircraft Task Force recommendations and actions.

Proposed Mandating of Damage-Tolerance Based Inspections and Procedures

This NPRM proposes to mandate damage-tolerance based inspections and procedures at defined times for various airplanes. FAA advances this proposal on the proposition that flaw and fatigue induced structural cracking will be more readily detectable and, thus, the structural integrity will

be more positively assured. It is accepted by most of those in the business of evaluating the integrity of airplane structures that the latest procedures of damage-tolerance provide the most conservative approach to defining structural integrity. There are a few documented cases for military aircraft where a crack growth analysis, assuming a zero-time flaw damage of 0.05 inches, predicted the life, after the fact, of failed airframe principle structural elements. In the commercial fleet there are a limited number of cases where inspections based on crack growth analysis could have enabled an earlier detection of cracked principle structural elements. For many of the existing aging commuter and small transport airframes, the material composition, structural element geometry and design operating stresses would result in a crack analysis which predicts very short design lives and inspection intervals. Alternatively, the use of a fatigue analysis together with supporting fatigue testing will, most likely, predict somewhat longer design lives. For the most part, neither methodology fully accounts for all the potential effects of environment, operational damage, aging and operating usage variation. Yet, several fleet airplanes have achieved the design lives developed from fatigue analysis and fatigue tests and are back in operation following replacement of those parts having expired lives. A regimen of replacing components and parts upon reaching their design service lives (which are conservatively factored values derived from fatigue analyses supported by fatigue test results), is one means of achieving the goal of structural integrity assurance. These regimens should be appropriate for particular structural configurations and should employ a schedule of supplemental inspections, as necessary. However, if such airframe structures were to rely on damage-tolerance based inspections, with frequent repetitive inspections caused by the assumption that all critical locations have an initial flaw of approximately 0.05 inches, we have a serious concern about the human factors situation as it pertains to the reliability of such inspections. This is a very real concern for many of the airplanes listed in this NPRM.

It is important to note that the Aging Aircraft Safety Act of 1991 does not direct the FAA to specify damage-tolerance analysis and inspection techniques as the only acceptable method for assuring the continuing airworthiness of older airplane structural designs that were certified before such techniques were available. Indeed, certain other methods exist for assuring the continuing airworthiness of these structures. For example, the type certificate holders for airplanes that are the subject of NPRM 99-02 have worked with FAA experts and developed structural inspection programs and structural life limits to assure an airplane's continuing airworthiness. Such programs and limits are based on structural fatigue analyses, fatigue tests, and field experience correlation, where applicable.

Recommended Changes to Proposed Rule Language

We respondents, therefore, recommend that the requirements proposed in FAR paragraphs **121.370a(a), 121.370a(b)(1) and (2), 121.370a(c), 129.16(a), 129.16(b), 129.16(c)(1) and (2), 129.16(d), 135.168(a), 135.168(b), 135.168(c)(1) and (2), and 135.168(d)** stating, in 14 locations, “. . . unless the inspection program for that airplane includes damage-tolerance-based inspections and procedures” be revised to the following:

“. . . unless the inspection program for that airplane includes damage-tolerance based inspections and procedures or an FAA approved structural integrity program based on fatigue analysis and fatigue tests.”

GAMA would appreciate an opportunity to discuss the details of this proposal further with FAA, if the FAA desires any additional information.

Justification in Support of this Recommendation

- 1). FAA policy in the early 1990's required the termination of repetitive inspections for structural components susceptible to fatigue damage and it required, to the maximum extent possible, the replacement of such components with improved components not requiring repetitive inspections. This policy was based on FAA's determination and conclusion that inspections were not sufficiently reliable for determining the necessary level of structural integrity. This policy continues to have merit today for certain structural integrity assurance programs.
- 2). The fleet service history and safety record support the use of structural integrity assurance programs based on fatigue analysis and fatigue tests which define component design lives and replacement schedules together with supplemental inspections, as necessary. These are the programs reviewed and generally accepted by TOGAA. If not already accomplished, these programs should be FAA approved.
- 3). The FAA has not ascertained the actual structural integrity of airplanes presently in service, and whether these airplanes have been complying with structural integrity inspection and maintenance programs developed by the manufacturers.
- 4). The FAA will, in the future, require inspection of airplanes in accordance with structural integrity inspection and maintenance programs not previously required.
- 5). Manufacturers will likely continue the construction of some airplane designs presently subject to the proposed NPRM, and will, therefore, need to place these new airplanes into service based on their highly effective non-damage tolerance structural integrity programs.
- 6). Future new designs must comply with the latest requirements of FAR 25 in accordance with FAR 121.157 (h).

Specific Comments on the NPRM Preamble

On Pg. 16302, column one, paragraph one, the statement "These data should be developed by the original manufacturer, . . ." refers to the manufacturer being responsible for developing, or assisting operators in the development of damage-tolerant-based inspections and procedures. **This thought process should be eliminated from the final rule** because several manufacturers have already developed, and made available, appropriate structural integrity inspection programs. These programs are based on comprehensive fatigue analyses, fatigue tests, and field data correlation, not damage tolerant procedures, and have in some cases received the approval of FAA and acceptance of the TOGAA. Enforcement of these present programs is an action the manufacturers request of FAA, not to be required to support arbitrarily mandated damage-tolerant based inspections and procedures. Additionally, in the first column on pg. 16302, last paragraph (and elsewhere in the preamble), contrary to FAA's statement, some AC 91-60 inspection and procedures programs have been designed to anticipate the possibility of future cracking in the structure and have

specified appropriate inspections and procedures to find such occurrences. FAA should revise their incorrect broad generalization. This comment also pertains to the writeup on pg. 163 14, middle column, the second to last paragraph.

Pg. 16302, column two, second paragraph from the bottom of the page, reference is made to requiring the damage-tolerant based inspections and procedures sooner than December 20,2010 for airplanes with nine or less passenger seats operated under FAR 129 and 135. In this instance, the **preamble does not properly reflect the language in rule proposals 129.16 (b) and 135.168 (b).**

We are dismayed by the statement made at the bottom of the second column on pg. 163 14. The statement “Obviously, the non-damage-tolerant based program would induce lower costs but with a concomitant reduction in safety assurance.” It is **also** contradictory with the statement on page 163 11, top of the first column, where it is stated that the rule does not increase the intended level of safety but maintains the level of safety established at type design. **The statement on page 16314 is incorrect** for structural integrity inspection and procedures programs developed using comprehensive fatigue analyses, fatigue tests, and the correlation of field service data, as applicable.

On Pg. 163 11, middle column, Comparison of Costs and Benefits, the FAA states that it is unable to quantify the expected benefits of the proposal on the basis of historical accident rates that would be reduced. The respondents **are** certain that **reliable resources for such information exist** in the form of the results compiled from the AATF program and other manufacturer conducted programs where results were shared with the FAA. Because of these programs, which applied and followed the manufacturer’s structural integrity inspections and procedures, several airplanes were removed from service due to their advanced state of structural fatigue, and/or corrosion. It is conservative to assume that several potential safety events were eliminated.

Pg. 163 14, third column, third to last paragraph, FAA refers to an AC on Continued Airworthiness of Older Small Transport and Commuter Airplanes; Establishment of Supplemental Inspection Programs. The preamble states that this document would be published concurrently with the proposed rule. To the best of our knowledge, the publication has not been released. Does FAA have a more accurate date for its release?

Pg. 163 14, third column, second to last and last paragraph, FAA cites a research project to develop a simplified damage-tolerant based methodology, directly applicable to commuter sized airplanes with an expected release date of fiscal 2000. Can FAA be more precise and inform industry as to the earliest possible release date?

Editing Remarks on the Rule Proposal

Pg. 163 16, Appendix M in 121.370a (b) should be N

Pg. 16317, 121.370 should be 129.16 in 129.33 (d) (8) (iii)

Pg. 163 18, Appendix F should be G in 135.168 (c), (c)(1) and (c) (2)

Comments on Draft AC 91-MA

Paragraph 1, for the reasons stated above, this AC should place primary emphasis on providing the necessary guidance for establishing a comprehensive structural integrity inspection and procedures programs to assure the continued airworthiness of aging airplanes operating in air transportation. References in this paragraph and in paragraphs 2,6a, 6b (numerous instances), and 7, **should be revised to make clear that damage tolerant based inspection programs are not the only bases for developing acceptable structural integrity programs.** Similar revisions should also be made to appendix 1, as necessary.

Paragraph 3a, **additional regulatory paragraphs should be referenced** to recognize fatigue analyses and fatigue testing requirements. Also, please correct 121.212 to **121.370a**.

Paragraph 3b, **additional AC's should be cited, as necessary,** to correspond with the additional regulatory paragraphs listed in 3a.

Paragraph 4, the FAA says that service experience has revealed a need to assess the continuing airworthiness of small transport and commuter sized airplanes as they age. Manufacturers have been tracking the service experience of their airplanes for many years and have taken appropriate action to provide the necessary inspection and procedures information to operators. However, manufacturers do not have an ability to require operators to follow such information.

Paragraph 6a, delete the second sentence and revise the last sentence to read "Each program should consider all of the following:" This and the following changes are necessary to align paragraph 6a subparagraphs with the changes recommended under paragraph 1 above. Also revise paragraph 6a(3) by deleting the word "optional" and inserting "based on design life goal" after the word "components". Finally, add a paragraph 6a(6) to read as follows: "Damage tolerance based inspections."

Paragraph 6b, Delete the first sentence for reasons stated above for the first comment listed under the heading Specific Comments on the preamble.

Paragraph 6b(2), Correct the reference to 121.370a.

Appendix 1, paragraph 1.a.(3), Strike ". . . if applicable (Fail safe certified structure only)." WFD may be applicable to all structures, regardless of design philosophy.

Appendix 1, paragraph 2.c.(1)(i), Change to Part 25.

Appendix 1, paragraph 2.d.(4), Delete 2.d.(4) because all continued airworthiness information must be FAA approved. The same applies to paragraph 2.e.(3), delete this sentence.

Appendix 1, paragraph 2.f.(2)(iv), Delete this paragraph because the very limited examples produce a risk of misuse or misinterpretation.

Appendix 1, paragraphs 2.g.(5) and 2.h.(1) should be revised as follows to be consistent with common industry practice. Some proposed factors are unconservative:

- (i) Revise as follows, “A factor of 2.0 should be used when there is fail safe structure.”
- (ii) Revise as follows,” A factor of 3.0 should be used for single load path structure.”
- (iii) Delete
- (iv) Delete

Appendix 1, paragraph 2.i.(2) should be revised to delete the phrase “For fail safe structure.. .” because WFD should be applicable to all structural arrangements.

Appendix 1, paragraph 4.a.(1) should correct typo and/or.

Comments on Draft AC 120-XX

Paragraph 5 .d., change AC 9 1 -XX to 9 1 -MA

Paragraph 6.c., Rewrite the paragraph as follows to maintain compatibility with comments recommended above for the proposed rule and draft AC **91-MA** relative to placing the reference to damage tolerance based inspections and procedures programs into appropriate perspective, to maintain compatibility with the public law **102- 143**, and to eliminate possible confusion:

c. As a result of these statutory requirements, the FAA published on [date of publication of final rule](xxFRxxxxx), a final rule entitled “Aging Airplane Safety” that specifies aging aircraft inspections for certain airplanes according to their time-in-service, and procedures to be included in the maintenance or inspection programs of these airplanes. The rule permits certain representatives of the Administrator to conduct the aging airplane inspections.

Paragraph 7.a., Delete the word “of” after 12 1 in the second line.

Paragraph 8d (2), Delete “damage-tolerance-based” in four (4) locations within this paragraph and insert “supplemental” in place thereof. Also delete the phrase “damage-tolerance” in one location. Also, correct the reference to 12 1.370a. Again the intent is to allow non damage-tolerant based structural integrity programs.

The Respondents appreciate the opportunity to provide comments on this important matter. Please contact me if your offices have any questions or need additional clarifications.

Very truly yours,



-William H. Schultz
Vice President, Engineering and Maintenance

Enclosure

Beechcraft

A Raytheon Company

Model 99
May 2, 1990

In Reply Please Refer
To 940-90-05-200

DOT Federal Aviation Administration
Mr. Lawrence A. **Herron**, Mgr.
Wichita Aircraft Certification Office
Room 100 1801 Airport Road
Mid-Continent Airport
Wichita KS 67209

Subject: Request for Mandatory Enforcement - Model 99 Continued
Airworthiness Program Inspection Document P/N 98-30131
dated **May** 1990 and Beech Mandatory Service Bulletin 2297
dated April 1990

Reference: (1) Model 99 Maintenance and Inspection Findings,
Conclusions and Recommendations Presentation to FAA
dated 13 October 1987
(2) Beech Letter 940-90-01-279 dated 29 January **1990**
(3) FAA Letter to Beech dated 9 April **1990**

Dear Mr. **Herron**:

Enclosed are two copies each of the subject documents which are now being mailed to all Model 99 operators. The CAP is a direct outgrowth of the fleet inspection accomplished by Beech in 1987. Results of the fleet inspection were reported to the FAA Small Airplane Directorate on 13 October 1987, Reference 1. FAA subsequently issued Action Notice 8300.31 dated 2 December 1987.

During a meeting on 17 January 1990, Administrator Busey was informed of the Beech intention to issue a Model **99** CAP. Reference 2 summarizes the Model 99 Aging Aircraft Program and agreements reached during the 17 January 1990 meeting. Small Airplane Directorate letter to Beech dated 9 April 1990, Reference 3, summarizes the disposition status of the items in the Beech Model 99 Aging Aircraft Program. Beech development of the Model 99 CAP and request for FAA mandatory enforcement of the CAP are listed as items 9 and 10, respectively, in Reference 3.

The enclosed CAP is the Beech response to recommendation number **22** of the Summary Report for the **RAA-GAMA** International Conference On Aging Commuter Aircraft, 25-27 April 1989. The CAP also responds to the **FAA** Small Airplane Directorate Aging Fleet Program for Aging Commuter Airplanes (Fall 1989) and the FAA AC 91-60.

First production run airplanes are reaching flight hours well in excess of the original envisioned design goal. The ~~lead-the-~~ fleet airplane now exceeds 40,000 flight hours and many airplanes exceed 30,000 flight hours. Utilization rates can approach 2000 hours per year on these airplanes. The CAP, P/N 98-30131, has been developed to address deterioration trends of older airplanes by establishing a series of in-depth inspections and required maintenance actions which go beyond the current scope of routine and detailed continuous inspection program elements. These inspections and maintenance specifications are considered to be essential to older Model 99 flight safety.

Beech, therefore, requests the FAA issue an airworthiness directive to mandate compliance with the requirements of the Model 99 CAP, P/N 98-30131 (and associated Mandatory Service Bulletin 2297).

Very truly yours,

BEECH AIRCRAFT CORPORATION



W. H. Schultz, **Division** Manager
Technical **Services** and
FAA Liaison

WHS:cjl
Enclosure

cc: James B. Busey, Administrator, Office of 'the Administrator,
National Headquarters
Barry D. **Clements**, Manager, Aircraft Certification Division,
Central Region Headquarters
FAA Designee Office