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U.S. Department of Transportation  
Docket Operations, M-30  
West Building Ground Floor  
Room W12-140  
1200 New Jersey Avenue, SE  
Washington, DC 20590-0001

**Re: FAA-2012-0002: Proposed Airworthiness Directive; Airworthiness Directives; Continental Motors, Inc. Reciprocating Engines; Initial Regulatory Flexibility Analysis**

The Aircraft Owners and Pilots Association (AOPA), the world's largest aviation membership association, submits the following comments in continued opposition to the Federal Aviation Administration's (FAA) Proposed Airworthiness Directive (AD), FAA-2012-0002 affecting; Certain Airmotive Engineering Corp. replacements parts manufacturer approval (PMA) cylinder assemblies marketed by Engine Components International Division (ECi) originally published on August 12, 2013 and to the Initial Regulatory Flexibility Analysis published on March 12, 2014.

Repeatedly, AOPA has asked the FAA to rescind the notice of proposed rulemaking. The FAA lacks justification for the proposed drastic measure and has underestimated its impact. Failure of the affected cylinders has led to no known cases of an accident or injury.

In our original comments, AOPA highlighted the concern that the FAA had understated the significant and unwarranted operational and economic impact on owners and operators including small businesses. In doing so, we cautioned that the FAA had incorrectly determined that this is "not a significant regulatory action" or that it "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".

After conducting the required Regulatory Flexibility Analysis, the FAA is now indicating that the agency significantly underestimated the impact of its proposal. The Initial Regulatory Flexibility Analysis, published March 21, shows that, contrary to the FAA's initial assertions, the AD would have a substantial impact on more than 600 small Part 135 operators and another 5,000 small air services businesses. AOPA maintains that as proposed this is indeed a significant regulatory action with impacts likely exceeding in access of over \$100 million dollars.

In this response, AOPA is resubmitting our discussion of the inadequate justification and potential safety concerns highlighted in our earlier comments.

### **Inadequate Justification, Potential Safety Concerns**

AOPA shares the FAA's goals of ensuring aviation safety and maintaining a safe and efficient National Airspace System (NAS). While pursuing safety, we must also work to minimize negative operational and economic impacts by ensuring that actions taken are based upon sound data and logic.

AOPA continues our opposition to this AD and submits that the FAA has not provided sufficient justification for this level of action. It is our position that this AD should be withdrawn and that any action taken by the FAA should be reflective of and supported by data provided in the docket. Any future action proposed by the FAA should only move forward after issuing a new proposed AD, if warranted, which is more limited in scope and proposes only actions to ensure safety which are supported by the data at hand.

The proposed AD covers an inappropriately broad swath of affected cylinders while also requiring an extremely draconian and economically harsh call for the early retirement of affected cylinders. The proposed actions are based upon inadequate and flawed data and improper assumptions in applying the FAA's Risk Analysis guidelines. There are no known cases of failures of these cylinders leading to accident or injury further bringing into question the FAA's proposal for early retirement.

Also, we share the concerns of many in the industry that this action could lead to further potential safety concerns if implemented.

### **Flaws and Inadequacy of FAA's Supporting Documents and Data Analysis**

#### *Lack of Data Applicable to Supporting Proposed Airworthiness Directive*

The FAA's supporting analysis used in developing its proposal is flawed in a number of aspects. The FAA has failed in developing a case to support the level of airworthiness concerns that would require the drastic action of early retirement of this large population of cylinders.

According to the FAA, the proposed AD was prompted by "failure reports of multiple cylinder head-to-barrel separations and cracked and leaking aluminum cylinder heads". However, nowhere in the proposal does the FAA give any information about the exact number of failures. Only after being requested by industry was the FAA forthcoming with any additional information.

In the supporting documentation that was subsequently added to the docket, the FAA provided information about the failures. In the document entitled "ECi Separations List for Docket", the FAA provides 33 specific incidents of ECi cylinder failures. Upon further review, a number of issues can be found with several of the reports which call into question the justification of the proposal.

- Four of the reported separations occurred on cylinders that were addressed in a previous AD (2004-08-10) and are not a part of the cylinders affected by this AD.

- 14 of the remaining 29 reported separations lack a determination of how the cylinder failed.

This leaves 15 confirmed cases out of a population of 30,000 cylinders upon which the FAA has enough detail to determine how the cylinder failed. It's concerning that the FAA would include reports (18) lacking this level of detail as basis for a proposed AD that would affect 30,000 cylinders and 6,000 aircraft costing a total of \$82.6 million.

The FAA lacks the data needed for reasonable justification for this proposed AD.

#### *Questions Unanswered Regarding the FAA's Risk Analysis*

In response to the industry request for additional information, the FAA provided a copy of its 1999 memo entitled "Risk Assessment for Reciprocating Engine Airworthiness Directives." While the memo is a good explanation of how the FAA conducts a risk assessment and what data is considered when preparing a proposed AD, the memo only gives theoretical examples to demonstrate how it should be applied. This memo does not contain examples directly related to this AD.

To date, the FAA has failed to respond to Industry's specific request for "...the Agency [to] post to the docket, the risk analysis and all supporting data and documentation that led to the decision to require this level of action." Without the actual risk assessment, we can only make assumptions with regards to the data the FAA used to reach the conclusion that this proposed AD is warranted.

In lieu of the actual FAA risk assessment, industry is left to utilize the data presented to work towards a risk assessment using the 1999 memo provided by the FAA. According to the memo, regulations governing the design and operation of reciprocating engine airplanes incorporate "mitigating features" to lessen the criticality of the engine. These mitigating features include low stall speeds, handling and stability criteria, emergency landing procedures, crashworthiness, and pilot training.

The memo, states that these mitigating factors don't guarantee safety when an engine service problem occurs, but instead provide a level of assurance that a pilot can reasonably fly the airplane to a safe landing

The data supplied by the FAA to the docket and data reviewed to develop the AD, shows the majority of the listed cylinder head separations occurred in twin-engine aircraft. A separation of a cylinder in a twin-engine aircraft, and any power loss associated with the service problem, would provide a level of assurance that a pilot can reasonably fly the airplane to a safe landing. That combined with other features the FAA considers such as emergency landing procedures and pilot training is keeping with the FAA's certification philosophy described above regarding mitigating features.

A review of the data and other safety information submitted by the FAA to the docket indicates the FAA did not conduct a Risk Assessment using the 1999 memo. The FAA White Paper written by the FAA's Chief Scientist and Technical Advisor (CSTA) for Engine System Dynamics states "the FAA needs to apply the CAAM Principles (FAA

1999 Memo) to the investigation and look at the risk factor given the engine power loss event.” The FAA’s Doc 4 2013-06-26\_ECI\_Cylinder\_Failure\_Talking \_Points submitted to the docket states, “that the use of typical risk tools limited by incomplete field data and that the primary issue was under reported events. The talking points go on to say that FAA did not have the data to actually perform an analysis rather they relied on the event scatter plot and failure rate in each population to reach a decision consistent with the recip risk policy 1999 memo”

The white paper also goes on to say that “the question isn’t whether the events to date have resulted in fatalities or serious accidents, the question is whether given a power loss or in-flight shut down (IFSD), what percentage of events have historically resulted in significant or fatal outcomes.” The CSTA was asking the FAA to compare the event rate to the number of significant or fatal outcomes.

The FAA did not have the data to complete a risk assessment using the CAAM 1999 memo; therefore they were not able to accurately apply the conditions referenced in the memo. However, AOPA has used the data in the Docket supplied by the FAA to provide additional emphasis to the fact that while an AD maybe warranted, the compliance requirements for replacement times are not.

In utilizing the Risk Assessment Methodology (paragraph 2) to determine the Consequences of the Engine Service Problem (subparagraph 2a). The first step involves evaluation of the engine service problem to determine the potential effect on flight safety. Engine service problems that are being considered for AD action can typically be grouped in one of the three following hazard levels:

- 1) *Hazardous*: Engine service problems that cause fire, uncontainment or other problems that could result in immediate collateral damage to the aircraft.

These require minimal evaluation as they represent a direct safety hazard to the aircraft and they should be considered an unsafe condition that warrants an AD. However, a risk analysis should still be performed to help determine compliance times for the AD.

- 2) *Major*: Engine Service Problems that cause a significant power loss. These events pose an indirect hazard to the aircraft and do not necessarily require an AD.

As discussed above, the design of GA airplanes incorporate mitigating features that contribute to lessening the severity of an engine service problem. Other factors, such as probability and fleet exposure need to be considered before initiating an AD.

- 3) *Minor*: Other types of service problems that do not result in a significant power loss, such as a partial power loss, rough running, pre-ignition, backfire, single magneto failures. These are potential AD candidates only if the probability of the event is very high.

There is no service data or reporting that indicates the cylinder separations caused a hazardous situation as described in the first classification.

The FAA's description of "significant" is not defined in the second classification and as discussed in the guidance on what constitutes a Major, the result of a cylinder head-to-barrel failure does pose an indirect hazard if the event occurs on a single engine aircraft. The mitigating feature of a twin-engine aircraft also reduces the effect of the hazard.

It is difficult to understand how this particular issue could be evaluated to be anything other than a "minor" consequence.

A head-to-barrel separation in a six-cylinder engine results in a partial power loss and a rough running engine. This is an event that is consistent with FAR Part 33 design standards which requires all certificated piston aircraft engines to demonstrate that they can operate with one inoperative cylinder at all RPMs from idle to red line without damaging vibration.

There are no known cases of failures of these cylinders leading to accident or injury and no documented history of such separations causing a significant power loss or a fire hazard. Under the ANE-1999-00006 guidelines, the separation of a cylinder can only be classified as having "Minor" consequences, and cannot be considered a potential AD candidate unless the probability of the event is very high.

The FAA's own data only provides 29 failures of which, as discussed earlier, in only 15 cases does the FAA have enough information to determine how the cylinder failed, indicating that the probability of separations is extremely low.

The FAA's ability to identify a suspect population was also hampered by the lack of data and the dilution of the data they did have because the FAA was unaware of the improvements that were introduced by ECi. They also only considered the domestic fleet and not the worldwide fleet as suggested by the CSTA in the white paper.

The Exposure to Failure Condition in the 1999 memo is defined as a function of the suspect population, and the number of hours those engines can be expected to operate over a specified time period. The FAA has only been able to confirm 29 separations in a population of more than 30,000 ECi cylinders.

The limited identification of the suspect population and the fact that the percentage of events has not resulted in significant or fatal outcomes are additional reasons for the FAA to rescind the proposed AD.

Finally, the 1999 memo requires the FAA to calculate the expected number of events and then compare that number to the historical data or FAA safety objectives. The memo provides a table that illustrates possible alternative courses of action based on the results of the risk assessment.

Had the FAA followed the FAA Risk Assessment 1999 Memo with the safety data that was available to them under the limited population, the result would have been either “None” or an “ANPRM”.

Given the information provided in the docket, including the FAA’s own risk analysis memo, the information that was used in this model does not justify the AD.

*Issues with the independent review*

The white paper describes a high risk and low probability scenario when the CSTA states that a 20% of reduction in power during the most critical phase of take off with a fully loaded aircraft in adverse terrain or weather, may not allow safer return to base. This type of operating environment is not limited to these cylinders or to head separation events but would also be true for other engine malfunctions as well. Going back to the fact that most of these occurred in multi-engine aircraft, returning to the airport, even under the worst of conditions, would not be unattainable.

The Conclusions and Recommendation portion of the white paper, focuses on the PMA approval process regarding ECi and how the FAA should investigate and review the reverse engineering practices of ECi. It also recommends that ECi demonstrate to the FAA that they have the capability to identify and reconcile differences intentionally or inadvertently introduced in their PMA design. This capability along with an effective continued operational safety (COS) is a requirement to receive a PMA approval from the FAA.

AOPA believes that the proposed AD be withdrawn and that the FAA implement the recommendations of the CSTA and review it’s findings before deciding a AD is warranted.

**FAA Proposal Goes Well Beyond NTSB Recommendation With No Justification**

The actions in this proposed AD go well beyond the corrective actions recommended by the National Transportation Safety Board (NTSB), which after conducting its own investigation, called for a more limited scope of affected cylinders and a repetitive inspection.

On February 24, 2012, the NTSB issued Safety Recommendation A-12-7 to the FAA. The NTSB recommended repetitive cylinder inspections and the removal of cylinders with limited serial numbers manufactured between May 2003 and October 2009 once the affected engine reached its recommended time between overhauls (TBO).

Then recently, on November 14, 2013 the NTSB took an unusual step of submitting its own formal comments to the docket, telling the FAA it supports a more conservative approach to handling problems affecting aftermarket ECi cylinders. In its comments, the Board asks the agency to take action “more consistent” with its recommendations released in February 2012, saying there was no available evidence to support the FAA’s more drastic proposal.

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The letter provides significant detail regarding the NTSB's findings utilized in developing Safety Recommendation A-12-7 and the specific reasons for the limited affected serial numbers and action called for to address the concerns. The Board's submittal goes on to question the actions in the FAA's proposed AD noting a lack of supporting documentation to warrant the expansion of the proposed action beyond that of Safety Recommendation A-12-7.

In concluding its letter, the Board states that they "are not aware of information to support the expanded scope and decrease in compliance time contained in the FAA's proposed AD, we support FAA action more consistent with NTSB Safety Recommendation A-12-7."

AOPA agrees with the NTSB's conclusion that not enough information has been provided to justify the FAA's proposed AD.

### **Conclusion**

In conclusion, while AOPA shares the FAA's goals of ensuring aviation safety, we must ensure that actions taken are based upon sound data and logic in order to maximize safety and minimize negative operational and economic impacts.

AOPA is opposed to this AD and recommends the FAA withdraw the proposal completely and analyze the information and data submitted by the NTSB and others to the docket. The FAA should only move forward after issuing a new proposed AD, if warranted, which is more limited in scope and proposes only actions to ensure safety which are supported by the data at hand.

As proposed, the AD covers an inappropriately broad swath of affected cylinders while also requiring an extremely draconian and economically harsh call for the early retirement of affected cylinders. The AD also goes well beyond the recommendations of the NTSB which conducted its own investigation. The proposal understates the significant operational and economic impact on owners and operators including small businesses. Many in the industry are also concerned that this action could lead to further potential safety concerns if implemented.

If, after reviewing the additional data and conducting a proper risk analysis, the FAA determines that an airworthiness concern still exists, the agency should propose actions that align with the NTSB recommendation for recurring inspections in lieu of replacement.

Regards,



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