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

RE: Docket No. FAA-2012-0002; Airworthiness Directives; Continental Motors, Inc. Reciprocating Engines; Notice of Proposed Rulemaking ("NPRM"); Directorate Identifier 2011-NE-42-AD

RAM Aircraft, L.P. ("RAM") Comments Concerning the NPRM

RAM is a 37-year-old small business located and operating in Waco, Texas. RAM is in the business of providing aircraft engine overhaul and upgrade packages, components and parts to its customers. RAM has sold 12,594 of the ECi cylinders affected by the NPRM and, as a result of those sales, is directly affected by the NPRM. RAM requests that the FAA withdraw the NPRM, as presently composed, for the reasons set forth in these comments.

1. **The NPRM provides**, in pertinent part, as follows:

> We received **multiple failure reports** of Airmotive Engineering Corp. PMA cylinder assemblies, part number (P/N) AEC631397, ECi Class 71 and Class 76, installed on certain CMI models IO-520, TSIO-520, IO-550, and IOF-550 reciprocating engines and other engines approved for the use of CMI models 520 and 550 cylinder assemblies such as the CMI model 470 when modified by STC. ECi part numbering includes four Classes of P/N AEC631397 cylinder assemblies based upon their intended use. Only Classes 71 and 76 are affected; Classes 68 and 70 are not affected. The Class number appears in the ECi P/N cylinder marking immediately following AEC631397. … We identified two independent failure modes resulting in the cylinder head separations; however, **the exact root cause of each failure mode could not be definitively identified. One failure mode is cracking that initiates in the internal dome radius of the cylinder head and the**

second is cracking at the cylinder head-to-barrel threads. ... Those two groups are defined by serial number (S/N) ranges. One group consists of cylinder assemblies with **S/N 1 through S/N 33696** [Group A]. The second group consists of cylinder assemblies with S/N 33697 through S/N 61176 [Group B]. [Emphasis added.]

A. Serial numbers 1 through 7708 should not be included in this NPRM. In its comment number 549 posted to the NPRM Docket, the NTSB stated that "The NTSB has not investigated any cases involving engines with serial numbers ranging from S/N 1 through S/N 1043, nor did concerns about this group of cylinders arise during meetings between the NTSB, the FAA, and ECi to discuss findings related to cylinders within the Group A population." In addition, on May 5, 2004 the FAA issued AD 2004-08-10, which recognized 34 failures of cylinder heads, and mandated the removal from service of cylinders bearing serial numbers 1044 through 7708. Therefore, serial numbers 1 through 7708 should not be included in this NPRM.

B. Page 63 of the FAA's Airworthiness Directives Manual, May 17, 2010 (FAA-IR-M-8040.1C) requires the AD Docket must include FAA reports, summaries or lists of facts, or data that support the AD action. The Docket does not include the information required to support the proposed AD. There is no information in the docket to support the expected number of flight/operational hours between cylinders failing in the manner made the subject of this NPRM. Also, there is no relevant information in the docket indicating there has been any damage to persons or property resulting from a cylinder failing in the manner contemplated in this NPRM. Many comments filed have requested the required information. In response, the FAA filed additional information in its comment/docket number 430. Unfortunately, much of the information filed is either irrelevant or misleading:

- Failure modes other than the two failure modes made the subject of the NPRM (i.e. cracking at the internal dome radius; and cracking at the cylinder head-to-barrel threads), are mentioned, to wit: cracking between cooling fins 16 and 17; cracking over the spark plug hole to the intake seat; cracking from the intake seat to the exhaust seat; cracking under the exhaust seat; and a hole through the head of the exhaust seat; etc. They are irrelevant to this NPRM.

- There is no accurate number of cylinder failures of the type made the subject of the NPRM. The NPRM Discussion begins with: "we received multiple failure reports…". No accurate number is stated. In its comment/docket number 430 the FAA published a list of 33 cylinders, but that list includes 4 cylinders below serial number 7708 which, as discussed above, should be eliminated from this NPRM, leaving 29 cylinders on the FAA's list. Thirty-five cylinders is also a number mentioned in the docket. The FAA also states: "Our data indicates that ECi has experienced 104 known head-to-barrel separations since their introduction into the market (after PMA issuance and 1999),… ." The 104 number is misleading. It apparently includes head-to-barrel separations since the PMA was issued to ECi. The FAA knows that the cylinders made the subject of the NPRM do not include earlier versions of the PMA cylinder manufactured by ECi, the failures of which are irrelevant to this NPRM. In addition the FAA recognized 34 failures of cylinder heads when it issued AD 2004-08-10, which are also irrelevant to this NPRM, for the reason stated above.

- The FAA states that: “The information provided indicates that there has been at least one fatal foreign event involving failure of this PMA cylinder design, so the FAA should consider this event when assessing risk associated with failure of an ECi cylinder head.” The FAA is aware and other comments have made clear that the cylinder involved in the fatal event was a cylinder that had been overhauled. Without more information this event is irrelevant to this NPRM and, as stated, is misleading.

2. The regulatory documents. The May 24, 1999 FAA Policy Statement on Risk Assessment for Reciprocating Engine Airworthiness Directives (PS-ANE100-1999-00006) (the “Policy Statement”) states, in pertinent part, as follows:

> **1. INTRODUCTION**
> This memo provides guidance for Aircraft Certification Offices (ACO’s) to use when evaluating reciprocating engine service problems for determination of appropriate FAA action. Airworthiness Directives (AD’s) are required for unsafe conditions, but the determination of which types of engine service problems should be considered unsafe conditions is dependent upon the type of airplane in which the engine is installed. Reciprocating engines are typically installed in small airplanes intended for personal use, and **the regulations governing the design and operation of these 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. **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.** Using loss of engine power as a measure of an airplane’s ability to accommodate engine failures, actual service data indicates that total aircraft power losses on turbine powered transport aircraft are ten times more likely to result in fatalities than on small piston powered GA (sic) aircraft. Therefore, it can be substantiated that General Aviation (GA) aircraft equipped with reciprocating engines differ from turbine powered transports relative to the criticality of the engine. [Emphasis added.]
>
> **2. RISK ASSESSMENT METHODOLOGY**
> A risk analysis utilizes data and information on a service problem to quantify the expected number of future events over a specified time period. **The risk analysis should consider the consequences of the service problem relative to safety of flight** [i.e., the severity of a cylinder separation]**, the probability of that service problem occurring** [i.e., the likelihood of a cylinder separation], and the exposure of the current GA fleet to the problem. … [Emphasis added.]

In addition to the Policy Statement, the FAA's Safety Risk Management Policy (FAA Order 8040.4A, April 30, 2012) (the "Order 8040.4A") establishes the Safety Risk Management policy for the FAA, and "… also establishes common terms and processes used to analyze, assess and accept safety risk" (i.e., decide whether to issue an AD). Appendix C of Order 8040.4A provides the Safety Risk Definition Tables and Risk Matrix that are used "... to determine the acceptability of the safety risk. … [E]ach hazard's associated safety risk is plotted on the risk matrix based on the severity and likelihood of the outcome. The objective of this step is to determine the acceptability of the safety risk." The Risk Matrix requires having enough information to determine both: (a) the likelihood of a cylinder separation; and (b) the severity of a cylinder separation event. The FAA has not published sufficient facts to determine either the likelihood or the severity of a cylinder separation. So, RAM has researched its own information and engaged in engine tests to determine: (a) the likelihood of a cylinder separation; and (b) the severity of a cylinder separation.

3. **The likelihood of a cylinder separation.** After eliminating serial numbers 1 through 7708 from consideration, RAM has sold a total of 12,594 cylinders affected by the NPRM. For the period March 1, 2002 through September 1, 2013, RAM determined from its records: (a) the date each cylinder was purchased; (b) the date each cylinder was sold; (c) the aircraft serial number to which each cylinder was sold; (d) the date each cylinder that was sold was put into service, (e) whether each cylinder is still in service, or not; and (f) if a cylinder has been removed from service, the date on which it was removed from service. RAM then calculated how many years, or partial years, each cylinder has been, or was, in service. See the Data Summary spreadsheet, a copy of which is attached hereto as Exhibit 1.

RAM then determined the average number of hours per year each in-service cylinder was used depending upon whether it was installed on a single engine aircraft or on a multi-engine aircraft. The FAA's Policy Statement provides that:

> The number of hours per engine must be estimated. Manufacturer's data can be used, or the General Aviation and Air Taxi Activity Survey, published by the FAA Office of Aviation Policy and Plans, provides GA fleet utilization hours to estimate the number of hours the suspect population of engines are operated.

RAM used the FAA's General Aviation and Air Taxi Activity Survey, which can be found at: http://www.faa.gov/data_research/aviation_data_statistics/general_aviation/, to calculate the average number of flight hours for single and multi-engine aircraft between 2002 and 2013. See Table 28 and Table 29, copies of which are attached hereto as Exhibits 2 and 3. RAM incorporated the foregoing data on the Data Summary, Exhibit 1. RAM's cylinder sales records show that 85.32% of the cylinders were used on multi-engine, and 14.68% were used on single engine aircraft. The 12,594 cylinders, if installed in groups of six, would complete 2099 engines. Those engines have flown a total of 1,563,938 hours: 1,395,710 hours in multi–engine aircraft; and 168,228 hours in single engine aircraft.

Sometime in 2012, Steve Laufman, Aviation Safety Inspector, San Antonio, Texas requested that RAM provide the FAA with any information it had concerning ECi cylinders cracking near the head to barrel shrink band interface since January 1, 2006. On February 13, 2013 RAM sent Mr. Laufman (the FAA) a letter, spreadsheet and photographs concerning cylinders cracking near the head to barrel shrink band interface. See a copy of the letter and spreadsheet attached hereto as Exhibit 4. The photographs that were provided to the FAA on February 13, 2013, via separate thumb drive, will also be provided in the envelope with this Comment, via separate thumb drive. It is important to note that only 25 of the cylinders reflected on the February 13, 2013 spreadsheet are the subject of this NPRM (i.e., those cylinders bearing part number TISN71.2xxx). Of those, 22 had been installed on multi-engine aircraft, and 3 had been installed on single engine aircraft. On October 16, 2013 RAM received a written request from S. Frances Cox, Manager, Special Certification Office, ASW-190, Fort Worth, Texas, for a copy of the February 13, 2013 information. RAM complied with Ms. Cox's request on October 31, 2013.

Given the serial number scope of the NPRM and Mr. Laufman's request for information limited to the period from and after January 1, 2006, RAM determined to expand the search of its records for cylinders cracking near the head to barrel shrink band interface to include the period from January 1, 2001 through December 31, 2005. RAM found an additional 11 cylinders that had cracking near the head to barrel shrink band interface: 10 of which were installed on multi-engine aircraft; and one of which was installed on a single engine aircraft. See the January 1, 2001 through December 31, 2005 spreadsheet, which is attached hereto as Exhibit 5. Note: in the spreadsheet under the "Control" column are two control numbers highlighted in yellow for which we have no photographs. We have included "notes" in the rows immediately below those two cylinders explaining what was observed by RAM personnel. Otherwise, photographs of the nine remaining cylinders will be provided in the envelope with this Comment, via separate thumb drive.

As stated above, the 12,594 cylinders RAM sold have been in service for a total of 1,563,938 engine hours, and have experienced 36 cylinders with cracking near the shrink band interface. See the Data Summary, Exhibit 1. That's one cylinder separation for every:

A. 21,808 multi-engine aircraft flight hours, or 172 average years of active service; and

B. 42,057 single engine aircraft flight hours, or 455 average years of active service.

Remember most of the engines that use the affected cylinders are certified for 1600 hours time in service between overhauls. Clearly the "likelihood of a separation" must be plotted no higher than row D in the Risk Matrix, "Extremely Remote," which is defined as "expected to occur rarely." See Risk Matrix, Exhibit 6.

4. The severity of a cylinder separation. RAM requested that ECi provide it with two of the cylinders that had suffered head-barrel separations near the shrink band interface, so that RAM could run them on a six cylinder engine in RAM's test cell in order to determine engine performance with; (a) first, one cylinder having suffered a head-barrel separation, and (b) then, with two cylinders having suffered a head-barrel separation. ECi provided RAM with serial numbers 48916-18 and 51847-12, both of which appear on ECi's List of Head Barrel Separations filed in the Docket. Each of the cylinders was photographed prior to being installed on the test engine. See Exhibits 7 through 12 (serial number 48916-18), and 24 through 29 (serial number 51847-12).

RAM used one of its freshly overhauled 335 hp Continental Motors TSIO 520 NB engines, serial number 509811, as the test engine. See Exhibit 13. Three test runs were performed in one of RAM's instrumented production test cells on September 11-12, 2013: (a) a baseline test run to gather the engine's performance data prior to installing either of the separated cylinders; (b) a test run to gather the engine's performance data after having one separated cylinder installed; and (c) a test run to gather the engine's performance data after having had a second separated cylinder installed.

The baseline test run lasted 29 minutes 25 seconds. The engine was run for various time intervals at 100%, 75%, 65%, 55%, and 40% of its rated 335 hp. The test engine performed as expected. See the data collected during the baseline test run on the spreadsheet entitled "Test Run #1:…", a copy of which is attached hereto as Exhibit 14.

After the test engine cooled the first separated cylinder, serial number 48916-18, was installed in the #6 position on the test engine. See Exhibits 15 through 18. The test engine was started and warmed up. Except for the test cell instrumentation indicating one "dead" cylinder, nothing unusual was experienced during the start and warm-up phase. After the warm-up phase, the test engine was run at full throttle, achieving 82% of its rated 335 hp. Thereafter, the test engine was run for various time intervals to simulate throttle controllability at approximately 62%, 52%, and for the last 15 minutes (approximately), 75% of its rated 335 hp. Test Run #2 lasted just over 43 minutes. During the entirety of the test run the engine ran with less vibration than expected - less than might be expected with an ignition problem. See the data collected during the second test run on the spreadsheet entitled "Test Run #2:…", a copy of which is attached hereto as Exhibit 19. See the post-second test run photographs attached hereto as Exhibits 20 through 23. The test engine with the one separated cylinder installed remained in the test cell overnight.

Though RAM has never received any report of, and is not aware of, any engine experiencing two separated cylinders during the same flight, RAM installed the second separated cylinder, serial number 51847-12, in the #5 position on the test engine. See Exhibits 30 through 33. The test engine was started and warmed up with the two separated cylinders installed in the #5 and #6 positions. Again, except for the test cell instrumentation indicating two "dead" cylinders, nothing unusual was experienced during the start and warm-up phase. After the warm-up phase, the test engine was run at full throttle, easily achieving 63-64% of its rated 335 hp. Thereafter, the test engine was run for less than five minutes at approximately 48%, and for the last 30+ minutes at 60% of its rated 335 hp. The throttle changes were made in order to simulate throttle controllability. Test Run #3 lasted just over 53 minutes and was stopped because the engine had already successfully run longer than necessary to meet IMC reserve requirements. Again, during the entirety of the third test run the engine ran with less vibration than had been expected - again, it was not unlike what might be experienced with an ignition system problem. See the data collected during the third test run on the spreadsheet entitled "Test Run #3:…", a copy of which is attached hereto as Exhibit 34. See the post-third test run photographs attached hereto as Exhibits 35 through 37.

RAM videoed its test cell instrumentation monitor during each of the three test runs. During Test Runs #1 and #2 the video camera was focused on a TV screen monitoring the condition of the test engine in the test cell. During the Test Run #1 video, from approximately 30 minutes 20 seconds through 31 minutes 37 seconds, the test engine and some instrumentation wires are visible, while the engine was running at 75% of its rated 335 hp. There is no significant vibration evident in that portion of the video. During the Test Run #2 video, from approximately 38 minutes 15 seconds through 40 minutes 30 seconds, the test engine and some instrumentation wires are visible, while the engine was running at 60% of its rated 335 hp. Again, there is no significant vibration evident in that portion of the video. Note also that there were no fires and there was no significant loss of oil during the over 96 minutes that the test engine ran with either one separated cylinder or two separated cylinders. See the post-test runs photographs attached hereto as Exhibits 38 through 44.

Copies of the videos of each of the test cell runs are provided in the envelope with this Comment, via separate thumb drive. Nonetheless, all three videos of the three test cell runs are available for viewing by clicking on the following link, or by pasting the link below in your browser:

Test Run #1 video: http://youtu.be/xld10XaJ_pw
Test Run #2 video: http://youtu.be/yO5tgFgnjYM
Test Run #3 video: http://youtu.be/B3cU8ha1AtE

Note: RAM chose the #5 and #6 positions for installation of the separated cylinders on the test engine because those positions are most often reported to RAM as the positions from which separated cylinders are removed. RAM is willing to consider running another test engine with separated cylinders installed in other positions. RAM has never had reported to it that any of the cylinders, separated in the manner contemplated by the NPRM, have ever separated in an "explosive" manner, left the cowling of the aircraft, or even moved very far from their original position, as originally installed on the engine. During the separation sequence, and once separated, a separated cylinder head is mechanically held in place by the exhaust manifold, intake manifold, and other plumbing on the engine. See Exhibits 45 through 48, which are photographs of an engine received by RAM as a core exchange engine in November, 2012. The engine is a CMI TSIO520 P, removed from a Cessna P210 aircraft at 1138.5 hours time since CMI overhaul, with a #2 CMI cylinder head-barrel separation. It is RAM's understanding that the pilot did not know his engine had suffered a cylinder head-barrel separation until after landing and taxiing in for what he thought would be maintenance on his ignition system. The condition of the P210's head-barrel separation is typical of what RAM has been told about by its customers, or has observed, in other similar events.

The FAA's Policy Statement must not be ignored, and should be followed in determining to proceed with the NPRM. Paragraph 2.a. of the FAA Policy Statement provides:

> … For the purpose of this Guidance Memo, engine service problems that are being considered for AD action can typically be grouped in one of three following hazard levels:
>
> …
>
> 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.**
>
> [Emphasis added.]

Historical data and information thus far evident leads to the conclusion that there has been no physical discomfort to pilots or passengers and no damage to any aircraft as a result of the subject cylinders. Given that Test Run #2 proved that a separated cylinder results only in a partial power loss (i.e., approximately 18% power loss), and that there has never been two separated cylinders reported on any engine, then the severity definition on the Risk Matrix must be placed at “minimal”, which is defined as having a “negligible safety effect.” See Risk Matrix, Exhibit 6.

Remember, Cessna publishes for its aircraft cruise power charts at 50% power and even less. Test Run #3 proved that even if the, never having previously occurred, condition of two separated cylinders occurred on an engine, then the engine would still produce in excess of 60% power, and will do so for periods of time exceeding IMC reserve requirements. Again, the result was a partial power loss. But that having been said, an 18% loss of power in a single engine aircraft during a critical phase of flight might result in physical discomfort to the pilot or passengers, and some damage to the aircraft as a result of an off airport landing. Under such conditions, for a single engine aircraft, the severity definition on the Risk Matrix might need to be placed in the “minor” category, which is defined as “physical discomfort to persons” and/or “slight damage to aircraft/vehicle.” See Risk Matrix, Exhibit 6.

In accordance with the guidance in the Policy Statement and the Risk Matrix, “minimal” or “minor” severity determinations are potential AD candidates only if the probability of the event is very high, which in this case it is not. In fact, as shown above, the probability of a cylinder separation is "Extremely Remote." Therefore, the NPRM, as presently composed, should be withdrawn in its entirety.

5. FAA’s March 21, 2007 Special Airworthiness Information Bulletin NB-07-09R1. This SAIB was issued by the FAA, citing 179 Malfunction or Defect Reports received from engine repair stations and aircraft operators, in order to alert owners and operators of ECi cylinders about fatigue cracking that propagates all the way through the cylinder head wall near the exhaust valve seat. The SAIB states that:

> Loss of cylinder compression in one cylinder of a six-cylinder engine **will result in a partial loss of engine power** and will cause the engine to run rough. [Emphasis added.]

The FAA recommended that after the cylinder assemblies accumulate 500 hours they should be inspected by a standard cylinder compression test and also a separate soap solution bubble test within the next 10 operating hours and, thereafter, at 50 hour intervals. The FAA noted that the compression tests can coincide with normally scheduled oil and filter changes at 50 hours intervals.

This SAIB correctly understood and stated, back in March 2007, what RAM’s engine test runs, discussed above, have proved: that the loss of cylinder compression in one cylinder of a six-cylinder engine results in a partial loss of engine power. This confirms the approach to the Risk Matrix discussed in paragraph 4 above.

6. The Small Airplane Directorate Airworthiness Directives Manual Supplement (Airworthiness Concern Process Guide) (the "AD Manual Supplement"). Appendix VI of the AD Manual Supplement is entitled "Risk Assessment for Airworthiness Concerns on Small Airplane Directorate Products." Paragraph 5.0 of Appendix VI is a Safety Effect Listing of safety of flight examples broken down by potential airworthiness impact (i.e., severity). Paragraphs 5.1 through 5.4 list examples of conditions that have potentially "catastrophic," "hazardous," "major" or "minor" effects, with the "minor" category being the lowest severity category in the AD Manual Supplement.

Paragraph 5.4 of Appendix VI contains examples of conditions that potentially have a "minor" affect. The **"loss of one engine (multi-engined aircraft)"** is listed as a condition with a **"minor"** effect.

Once again the AD Manual Supplement confirms the approach to the Risk Matrix discussed above. As previously recognized, just a 18% loss of power in a single engine aircraft might lead to the determination of a slightly higher severity determination. However, even the loss of one entire engine in a multi-engined aircraft does not result in making a higher severity determination. To the contrary, in such event the AD Manual Supplement makes it clear that making the lowest severity determination available, in this case "minor," is appropriate. Thus, with the "severity" of a cylinder separation in a multi-engined aircraft being determined in the lowest category available, and the "likelihood" of a cylinder separation being extremely remote, then the proposed AD should never be issued against multi-engined aircraft.

To find the AD Manual Supplement search for "CPI challenge session" at www.FAA.gov. Interestingly Appendix V of the AD Manual Supplement is the above-referenced Policy Statement.

7. The NTSB's February 24, 2012 Safety Recommendation A-12-7, and it's November 5, 2013 Comment FAA-2012-0002-0549 posted in the Docket. In its Safety Recommendation A-12-7, the NTSB recommended requiring repetitive inspection of cylinder serial numbers 7709 through 52884, and removal of those cylinder assemblies once they reach the engine manufacturer's recommended normal time (hours) in service between overhauls.

Based on the facts and reasoning stated in the NTSB's November 5, 2013 Comment, the NTSB recommends modifying certain of the serial number ranges, and requirements for cylinder inspections within those ranges, from what the NTSB previously proposed in its Safety Recommendation A-12-7. But the NTSB does not recommend removing any of the cylinders from service, prior to reaching their recommended TBO, unless a cylinder fails one of the repetitive inspections.

RAM currently uses both ECi and CMI cylinders in its overhauled engines. Although it has in the past, RAM does not currently use Superior cylinders and is, therefore, not able to comment about Superior cylinders. RAM is aware that both ECi and CMI have made great improvements in their cylinder products over the past 15-20 years. Today we enjoy the best cylinder reliability we have ever experienced, whether from ECi or CMI. By their very nature and design compromises (i.e., steel barrels to contain the forces of combustion combined with lighter cylinder head alloys to reduce weight so that aircraft engines have commercial viability and value), and the harsh conditions, altitudes and temperatures they operate in, reciprocating aircraft engine cylinders will inevitably crack. Additionally, given the factors raised by ECi in this NPRM that contribute to and cause cylinder failure (i.e., operator misuse, abuse, and failure to perform proper maintenance, including preventative maintenance and monitoring), there is no question but that some cylinders are going to crack. It is clear that all cylinders must be properly operated, maintained and inspected.

Both the FAA in their SAIB, and the NTSB in its Safety Recommendation and Comment, have communicated to owners and operators the value of inspecting their cylinders. While it is clear there is no basis for issuance of the AD as currently proposed, RAM recommends that the FAA consider requiring an MSB and/or issuing an SAIB to educate all owners and operators about the proper care and operation of their cylinders, and to require the inspection of cylinders on the terms and conditions it determines to be appropriate for all manufacturers.

8. The Cost of Compliance. The FAA's estimate of the Cost of Compliance is understated for the following reasons:

- All six cylinders cannot be replaced in 18 hours. CMI's labor allowance to replace all six cylinders is 36 man-hours, and that does not include the time required to break in the cylinders.

- The FAA estimated parts cost to be $10,200 per engine, or $1700 per cylinder, which is understated. CMI currently lists $1889.43 for each cylinder assembly.

- The labor cost of $85 per hour is understated. RAM believes, based on warranty claims it receives, that a more appropriate average labor cost in the US is $95 per hour.

- The estimate does not include any labor or fuel for breaking in the cylinders. Running an engine for a total of 2.0 hours, together with the time necessary for cowling, un-cowling, adjustments and paperwork, will total 3.0 hours per engine. At present a good average fuel cost is $5.50 per gallon, and each engine will burn a total of 40 gallons to be properly broken in.

- If the AD is issued as currently proposed, then there will be a world-wide shortage of cylinders to replace those prematurely removed from service. There is no estimate of the cost to small and medium-sized businesses and other consumers and individuals for the loss of use of approximately 3000 aircraft while they sit for months waiting for replacement parts to be manufactured.

- There are no published procedures for engine mechanics to follow in order to properly, correctly and safely perform the top overhauls that will be required on the estimated 6000 affected engines. A substantial and material number of the top overhauls performed will inject problems into the engines that will result in further future costs and expenses, and the possible loss of life and property. (Reference the several Comments in the Docket published by Michael D. Busch.) There is no estimate shown for any of these costs.

The FAA is required to properly estimate the Costs of Compliance with the proposed airworthiness directive. The currently filed estimate of the costs is incomplete and inaccurate for the reasons stated above. After the costs have been properly calculated they will amount to more than $100 million.

Conclusion

For the reasons set forth, the NPRM as presently composed must be withdrawn in its entirety. RAM recommends that the FAA consider educating the public and requiring inspections of all reciprocating aircraft engine cylinders on the terms and conditions it determines to be appropriate.

Respectfully submitted,
RAM Aircraft, L.P.

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General Counsel

enc.: Thumb drive, as referenced above