October 8, 2013

TO:

Cessna Caravan (i.e. 208) And Cessna Grand Caravan (i.e. 208B) Operators,

Utilizing MORE Company’s Instructions For Continued Airworthiness For

PT6A-114 And PT6A-114A Engines ONLY

(i.e. FAA STC SE00002EN).

Subject:

PT6A-114 And PT6A-114A Engines, CT Blades, P&WC Service Bulletin 1669, And Transport Canada Airworthiness Directive No. CF-2013-21, “Compressor Turbine (CT) Blade Failures”.

BACK GROUND

There have been a large number of PT6A-114 and PT6A-114A engines that have experienced CT blade failures (e.g. several dozen engine failures). Since the Cessna Caravan (i.e. 208) and Cessna Grand Caravan (i.e. 208B) are SINGLE engine aircraft this has precipitated an equally large number of FORCED LANDINGS.

Since these engine failures began, Pratt & Whitney Canada (P&WC) has contended that abnormal (i.e. abusive) engine operation has been a major cause of this problem. July 22, 2008 P&WC issued Service Bulletin (S/B) Number 1669 “Compressor Turbine Blades – Replacement Of”. S/B 1669 provides “redesigned turbine blades made from a different material” (i.e. single crystal CT blades).

SUMMARY

Transport Canada Airworthiness Directive No. CF-2013-21 (copy attached) addresses this service difficulty problem. CF-2013-21 can be summarized as follows:

1. CF-2013-21 applies to P&WC PT6A-114 and PT6A-114A engines only.
2. Engines with PRE-S/B 1669 CT blades must be subjected to borescope inspections at 500 flight hour intervals.
3. At hot section inspection, two PRE-S/B 1669 CT blades must be subjected to metallurgical evaluation (i.e. look for changes in the metallurgical grain structure / early signs of metallurgical compromise).
4. Prior to August 15, 2016 ALL PRE-S/B 1669 CT blades must be replaced with POST- S/B 1669 CT blades.

P&WC S/B 1669 and Transport Canada CF-2013-21 indicate that a “better CT blade” as well as more careful engine operation are necessary to minimize the CT blade distress problem.

COMMENTS

The first version of the MORE Company Instructions For Continued Airworthiness (IFCA) for PT6A-114 and PT6A-114A Engines (et al) (i. e. FAA STC SE00002EN) was approved by the FAA on February 10, 1994. Since February 10, 1994 all engines utilizing this MORE STC have had to perform borescope inspections at nominal 400 or 450 hour intervals, so MORE IFCA operators should already be complying with the 500 hour (or earlier) borescope inspection requirement.

October 25, 2006 P&WC issued Service Information Letter S.I.L. NO. PT6A-146 (copy attached). SIL PT6A-146 recommended that at hot section inspection two PRE-S/B 1669 CT blades be subjected to metallurgical evaluation etc.

September 19, 2007 Transport Canada issued Service Difficulty Advisory AV-2007-06 “PT6A-114/114A Compressor Turbine Blades” (copy attached) strongly advising that borescope inspections be performed and that CT blades must be subjected to metallurgical evaluation at hot section inspection.

November 12, 2007 European Aviation Safety Authority (EASA) issued EASA Safety Information Notice 2007-42 (copy attached) informing operators of Transport Canada issued Service Difficulty Advisory AV-2007-06.

August 30, 2010 Federal Aviation Administration issued Special Airworthiness Information Bulletin NE-10-47 (copy attached) calling attention to the CT blade creep and failure problem etc.

Since P&WC, Transport Canada, European Aviation Safety Authority, and Federal Aviation Administration have provided the above listed documents, ALL PT6A-114 and PT6A-114A engine operators should already be complying with the metallurgical evaluation requirement(s).

As a result the only new Transport Canada requirement is the mandatory incorporation of S/B 1669 prior to August 15, 2016, on CANADIAN REGISTERED AIRCRAFT.

Since European Aviation Safety Authority, and Federal Aviation Administration have previously followed Transport Canada by issuing their own documents relating to this service difficulty problem, all PT6A-114 and PT6A-114A engine operators should anticipate the issuance of European Aviation Safety Authority, and Federal Aviation Administration Airworthiness Directives (or equivalent). Since these EASA and FAA ADs have not been issued, it is difficult to speculate on their specific requirements.

Further MORE Company is in the process of preparing and requesting FAA approval of a MORE Company Service Bulletin on this topic.

HELPFUL INFORMATION

BORESCOPE INSPECTION

(400/450 hours)

Attached to this letter are five photographs that will assist the mechanic who is performing the borescope inspection(s):

Photograph DSC\_0402 shows a large crack on the trailing edge of a PRE-S/B 1669 CT blade from a PT6A-114A engine.

Photograph DSC\_0407 shows a large crack on the trailing edge of another PRE-S/B 1669 CT blade.

It is highly desirable that cracked CT Blades be removed from service LONG BEFORE they reach the condition shown in photographs DSC\_0402 and DSC\_0407.

Photograph DSC\_0421 shows a smaller crack on the trailing edge of still another PRE-S/B 1669 CT blade. Photographs DSC\_0422 and DSC\_0423 show smaller cracks on the trailing edges of a fourth and fifth PRE-S/B 1669 CT blades.

The goal would be to identify cracked CT blades when the cracks have not progressed any further than the cracks shown in DSC\_0421, DSC\_0422 and DSC\_0423 and to immediately remove the entire set of PRE-S/B 1669 CT blades. Obviously, any CT disk and blade assembly with any CT blade(s) exhibiting cracks or possible cracks should be removed from the engine for further inspection.

While most cracks appear on the trailing edge of the CT blades, and while special attentions should be paid to the trailing edge of the CT blades, a complete borescope inspection of the combustion chamber liner, the CT vane ring, the CT Blades, the (CT) shroud segments etc. is expected and required.

HELPFUL INFORMATION

DURING HOT SECTION INSPECTION

(nominal 1800 hours)

Destructive metallurgical examination of two CT blades during hot section inspection is extremely desirable, since this examination will identify changes in the CT blade metallurgical structure BEFORE cracks begin. These changes are proportional to the combination of BOTH the degree of abnormally high temperature and the amount of time at abnormally high temperature(s) experienced by the CT blade airfoil(s). During the application of aluminide coating(s) to the CT blade airfoils, the CT blades are subjected to a temperature well in excess of the normal engine maximum operating temperature. The destructive metallurgical examination compares the condition of the CT blade fir tree area with the CT blade airfoil area. For this reason any changes that are observed are a clear and positive indication that the CT blades have been “abused”. Any CT blades with metallurgical changes MUST be replaced.

HELPFUL INFORMATION

ENGINE OPERATION

There are a number of methods that the pilot can adopt that will help minimize CT blade distress in PT6A-114 and PT6A-114A engines.

The pilots operating handbook for Cessna 208 and 208B Caravans specifies:

Takeoff maximum ITT degrees C 805

Maximum climb maximum ITT degrees C 765

Maximum cruise maximum ITT degrees C 740

These limits MUST be complied with in order to minimize CT blade distress.

The PT6A-34 engines have a takeoff maximum ITT of 790 degrees C, and the PT6A-34 engines don’t seem to have this problem. Hence, engine operation above 790 C should be minimized as much as possible without endangering aircraft operation.

Utilization of an EXTERNAL start cart during engine starting can reduce peak starting temperatures by as much as 100 degrees C. For this reason, the regular use of an external start cart during engine starting will increase hot section longevity and reduce CT blade distress.

Typically the lowest PT6A operating temperature occurs at approximately 59 percent compressor speed (i.e. about half way between ground idle and flight idle). As the compressor speed is reduced below 59 percent, the inter turbine temperature increases. For this reason, any time that it is possible to increase ground idle speed with the throttle, without endangering aircraft operation, will increase hot section longevity and reduce CT blade distress.

The PT6A-114 and PT6A-114A engines have an emergency fuel control. This emergency fuel control is intended to be used ONLY when the automatic fuel control has ceased to operate in flight and EXTREME MEASURES must be taken in order to divert to the nearest airport. DO NOT **PRACTICE** WITH THE EMERGENCY FUEL CONTROL UNDER ANY CIRCUMSTANCES!!!

Occasionally during ground operation, the throttle could be pulled back beyond the low idle stop and a flame out may occur. DO NOT attempt to relight the engine during spool down!!! Allow the engine to come to a complete stop and THEN re-start the engine using the normal procedures.

POST S/B 1669 CT BLADES

(Should they be installed?)

An operator’s experience concerning CT blade distress will dictate whether post S/N 1669 CT blades are appropriate / necessary. The following guidelines are intended to assist this decision.

The post S/N 1669 CT blades are very, very expensive. On the other hand, installation of post S/N 1669 CT blades will make it much less likely that an in flight CT blade failure will occur (much less likely that a forced landing will be necessary).

IF your engine has experienced any CT blade cracks, then post S/N 1669 CT blades are very desirable.

IF your engine has experienced premature abnormal metallurgical distress to the CT blades (observed during hot section inspection), then post S/N 1669 CT blades are very desirable. When a PT6A-114 and PT6A-114A engine has NOT been “abused” it is common to observe less severe metallurgical changes after approximately 3600 flight hours (i.e. two normal hot section inspection intervals).

IF your Caravan operations include carrying passengers, then post S/N 1669 CT blades are very desirable.

IF your Caravan operations include flights over water or rugged terrain, then post S/N 1669 CT blades are very desirable.

When in doubt, post S/N 1669 CT blades should be installed.

LAST WORD

The MORE Instructions For Continued Airworthiness for PT6A-114 & 114A et al engines, page 196 states, “Federal Aviation Administration (FAA) Airworthiness Directives (AD) shall be complied with. No aspect of the MORE Instructions For Continued Airworthiness is intended to interfere with the proper implementation of FAA ADs. IF ADs require maintenance (i.e. check, repair, inspection etc.) to be performed on an engine; the ADs compliance schedule shall take precedence over the schedules in the MORE Instructions For Continued Airworthiness.” “If an engine is operated and registered outside the United States Of America, and if an AD or equivalent issued by that country’s airworthiness regulatory authority is applicable to the engine, that AD shall apply as well.”

Sincerely,

Ralph Hawkins

Chief Engineer

MORE Company