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NEW FAA RULES
FOR MAJOR STRUCTURAL STATIC PARTS

BY DONNA DOLEMAN
Aerospace companies that manufacture or repair certain static engine parts face new rules as a result of Federal Aviation Administration (FAA) Regulation 14 CFR Part 33, Section 33.70, which took effect in November 2007. Section 33.70 states that engine and part manufacturers who hold Parts Manufacturing Authority (PMA) must use an FAA-approved procedure that specifies the maximum allowable number of flight cycles for "rotor and major static structural parts whose primary failure is likely to result in a hazardous engine effect."

Hazardous effects include such results as significant thrust in the direction opposite to the pilot's command, an operator being unable to shut down the engine, failure of the engine mount system that leads to engine separation, noncontainment of high-energy debris, and uncontrolled fire. These and other hazardous effects can be found in Section 33.75.

Defining parts as life-limited is not new to the aerospace industry, which has long been subject to similar FAA regulations for various rotating parts. What is new is that static or nonrotating structural parts, such as casings and nonredundant mount components, now must be analyzed for their potential involvement in any of the outcomes spelled out in Section 33.75.

Section 33.19 previously required manufacturers to establish life limits for some static parts, because their failure potentially could result in an unsafe condition between overhauls. Despite this requirement, manufacturers did not establish such limits on a consistent basis and compliance varied, says FAA spokesperson Les Dorr.

The European Aviation Safety Agency (EASA) regulations already contain identical static part requirements. Therefore, Dorr explains that Section 33.70 both formalizes and supports previous FAA actions and achieves a common certification basis for the FAA and the EASA.

The FAA does not believe that this provision in the new regulation will affect the vast majority of static parts, however. According to Dorr, "We expect relatively few static parts that will require a life limit." In fact, the FAA suspects that the maintenance and repair procedures of most static parts will continue to follow previously established practices.

**WHY THE CHANGE?**

The change was made to ensure an adequate safety margin - in terms of maintenance, repair, and replacement - for all parts whose failure could potentially result in a hazardous condition. The parts are chosen based on data gathered from past service experience regarding the potential damage that such failures could incur.

"There are other considerations as well," Dorr reports, "as the newer engines strive for greater fuel efficiency and higher thrust through higher compression ratios. Higher compression ratios require the engine static parts to contain internal air, which is hotter and contains a greater amount of potential energy that can be released in a hazardous manner in the event of casing failure. This threat requires that the high-pressure engine casings be designed, manufactured, and maintained to a higher standard."
In the new rule, the FAA cited manufacturing-induced anomalies in some rotating engine parts that were the root cause of the commercial aircraft accidents in Sioux City, Iowa, in 1989 and in Pensacola, Florida, in 1996. In the 1989 crash, a disk on the engine fan rotor assembly failed and disintegrated, resulting in debris that was not contained by the nacelle; the debris then penetrated and destroyed the aircraft’s hydraulic systems. Hydraulic fluid from each system rapidly leaked from the aircraft and resulted in the inability of the crew to move the flight control surfaces. The thrust levers for the two remaining engines remained workable, giving the crew limited control by using thrust modulation. The aircraft eventually broke up during an emergency landing on the runway, killing 111 of its 285 passengers and one of the 11 crew members.

Other hazards mentioned in the FAA rule include failure of an engine high-pressure turbine disk during a ground test in June 2006, which was “attributed to a manufacturing-induced anomaly in a rim slot,” and an in-flight failure of an engine fan disk on an airplane that departed Denver International Airport in January 2007. The root cause of the latter failure still is under investigation, but the NTSB has called it an “uncontained engine failure.”

“Most of the uncontained engine failures have been traced to material, manufacturing, or operations/maintenance-induced anomalies,” states the new FAA rule. Dorr explains, “The approach in Section 33.70 recognizes that the prior design processes incorrectly assumed engine rotor parts did not contain anomalies or imperfections and remained that way in service. It also recognizes that many of these anomalies cannot be found in every case by the best available inspection techniques. Service experience has shown...
that neither of these assumptions is valid in every case.”

Furthermore, Dorr says that the FAA realizes such anomalies can exist in any part, despite extensive preventive measures. “Although they occur infrequently, they are often very difficult to detect and eliminate through in-service actions, like manufacturer service bulletins, which are only manufacturer recommendations and not mandatory unless the FAA incorporates them through an Airworthiness Directive.” Thus, in their view, reliance on service bulletins is an ineffective approach with cost consequences of its own. For those reasons, the FAA decided to implement the new rule and also to sponsor “improvements in material cleanliness, manufacturing procedures, and inspection techniques, as well as, raising the overall awareness of the issue.”

The FAA believes that including major structural static parts in Section 33.70 is necessary to ensure that all parts that potentially represent a hazard to the aircraft are formally analyzed and addressed. While 33.70 appears to be a significant expansion of the prior regulation, the FAA maintains that, in reality, it is not. The relevant static parts, they say, have been addressed for at least the last decade by a different regulatory process, which included Section 33.19 and Issue Papers.

The FAA also points to static parts that were designated as life-limited prior to the publication of Section 33.70. Examples of current engines with...
INDUSTRY CONCERNS ABOUT THE NEW RULE
During the regulation’s review and comment period, the inclusion of engine casings, in particular, raised objections from American Airlines, United Airlines, and Chromalloy, one of the world’s largest non-OEM (original equipment manufacturer) providers of advanced coatings, repairs, and replacement parts for gas turbine engines. In publishing the new rule, the FAA quoted from the comments they received:

• "American [Airlines] noted that based on Continued Airworthiness Assessment Methodologies (CAAM) data from 1992 to 2000 ‘the probability of occurrence of case ruptures is very small’ and ‘there does not seem to be a good reason to consider static cases or other static parts as life-limited, and they should not be.’” And further, “American Airlines expressed concern that the rule would result in ‘unjustifiable additional costs.’”

• “Similarly, United Airlines ‘does not see imposing life limits on this static hardware as enhancing safety.’” And “United Airlines stated that the rule will ‘significantly drive up operator's costs. . . . To compensate, operators will be forced to increase inventory levels of this expensive hardware.’”

• Chromalloy found “that the FAA has not identified sufficient, nor appropriate substantiating cause to make such a bold change as to include static structures (high-pressure turbine casings) under the term life-limited parts.”

Bruce Johnson is Vice President, Engineering Technical Services, at Chromalloy, which is headquartered in Orangeburg, New York. He expands upon the company’s objections: “The new rule requires engine manufacturers to designate certain static parts to be ‘life-limited,’ according to the definitions in the language. Previously, there were very few such static parts - two or three pressure casings total in the industry - that were designated as life-limited. Under the new rule, it is likely that the engine original equipment manufacturers will attempt to designate many static parts as life-limited.”

In Johnson’s opinion, the previously existing designation of a very few problematic structural casings as life-limited parts effectively addressed the most serious of the known problem part designs. He goes on to say, “Other casings, which have exhibited unusual service-related problems, have been handled effectively by service bulletins, technical notices, special repair precautions, and the like.”

Johnson also points out that there have been few instances in the industry history of casings being the subject of FAA Airworthiness Directives as a result of maintenance performed. “Again, precautions for maintenance of problematic parts designed by the OEMs have historically been handled effectively through service bulletins, field notes, and customer technical conferences.”

The main concern he expresses is regarding whether this rule will add bureaucracy and increase costs, “which will all be passed on to the end user - the airlines,” with no real benefit in terms of safety. Johnson predicts, “There will be no competitive pressure to curtail increased costs or implementation of abusive pricing practices, because the airlines will not have the ability to choose independent component repair facilities as an alternative maintenance provider.”

HEICO, headquartered in Hollywood, Florida, is one of the world’s
largest providers of solutions for FAA-approved PMA parts, repairs, and distribution. Patrick Markham, Vice President of Technical Services, agrees that Section 33.70 will result in an impact on the industry. "The new rule will have an effect on the people who are doing repairs on static parts that were not life-limited before. Any of those repairs will end up being major repairs and will require FAA approval, not just FAA acceptance. Owner-operators will be affected.”

Fortunately for HEICO, Markham says that the new regulation will have a minimal effect on the company’s business. "We typically don’t work on life-limited parts," he explains, "so the only way it would affect us is if we wanted to work on a particular life-limited part. A whole new set of rules would apply in that case. But the vast majority of what HEICO does is not in that arena.

"The FAA narrative points out that these types of parts were covered before by 33.19 and that this new rule is just making it more definitive," he observes. "The requirements were in the regulations before, just not as explicitly.”

Markham understands the problems in store for those who supply major structural parts that are designated as life-limited. He suggests, "Ultimately, they won’t lose much, because they will find ways to conform. But it will make it more difficult for them.”

COMPLIANCE
The FAA contends that the rule does not prevent any qualified supplier from performing maintenance on life-limited static or rotating parts. Dorr advises, "Any entity, however, that repairs critical aircraft engine parts must possess the necessary inspection, design, analysis, and engineering skills to
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ensure the work is done properly, because the safety of the flying public depends on it." He also says that the FAA does realize, "If an entity does not possess these skills and wants to enter this business, of course, there will be a cost to acquire them."

Dorr points out that Section 33.70 applies to all new engine certification programs that began after November 7, 2007. However, "Manufacturers don't have to go back and re-evaluate existing major static parts."

That being said, if there are significant changes to the original type design under the change product rule (14 CFR Section 21.101), then suppliers will have to meet the new rule and be certified to Section 33.70.

The engine manufacturer must list in the airworthiness limitations section (ALS) of the engine manual all parts designated as life-limited.

Compliance will necessitate the development of engineering, manufacturing, and service management plans by the engine/part manufacturer, in order to ensure that life-limited parts are withdrawn from service before any hazardous effect might occur. A list of the approved life for each life-limited part then must be published in the manufacturer's manuals in the "Airworthiness Limitations Section of the Instructions for Continued Airworthiness."

VIEWPOINTS VARY ON THE MAGNITUDE OF THE EFFECT

The FAA estimates the number of affected parts per engine to be in the range of two to three, and the rule included financial estimates of the anticipated impact.

"The new regulation, Section 33.70, won't affect the vast majority of static parts and the maintenance and repair procedures will remain consistent with prior practices," Dorr contends. "It is in the interest of the OEMs to ensure the number of static parts designated as life-limited is limited to the smallest number possible to remain competitive. We are already seeing OEMs making competitive comparisons. It is certainly a consideration when attempting to sell their product to the airlines. Also, the number of static and rotating parts covered by this regulation is determined by the 33.75 hazard analysis, not by financial interests."

Some in the industry, such as Johnson, question these estimates. "The concept of 'cost reduction' in the rule as written and addressed by the FAA and in the FAA response to comments by industry is a myth. The FAA recognizes only an increased cost of implementation for the engineering work required to designate a static structure as life-limited - this being a tiny cost to the original equipment manufacturers - and certainly not all-inclusive of the additional cost to the airline operators. What the FAA stipulates as a 'cost savings' to counter the perceived cost of engineering is that even one less uncontained failure will bring huge savings, and they proceed to calculate the cost of an uncontained engine failure. However, there is no basis to presume that this rule change will prevent an uncontained engine failure to a greater degree than currently exists."

"This rule change could be substantial for Chromalloy and other
independent repair station companies," he continues. "The number of parts that must comply should be expected to be as many as the manufacturers can possibly include, because it is in their financial interest to do so. We anticipate all structural casings of every engine type to be included. There are at least ten potential casings per engine. Most casings have dozens of part number variants. Industry-wide, we estimate the maintenance cost for all of these cases by all repair stations to be in the range of $50 million dollars annually."

Markham, whose background prior to HEICO included experience at a leading engine OEM, agrees that such a market-blocking scenario is possible, "If there’s a repair the OEMs wanted to keep out of the market, for example. "But, the OEMs have other levers to pull," he advises. "If they make a piece of hardware life-limited, they would increase the burden on themselves." He does not think their doing so would result in a big competitive advantage. "There is a great deal of complexity in managing numerous life-limited parts on an engine. There are whole businesses that have sprung up to get the full life out of a used engine by matching up life-limited parts that still have some life left, so that the engine can be used to its limit."

Johnson remains skeptical and believes that the real increased cost of the rule "will be felt by the airlines when there is no competition, choice, or alternative for engine component maintenance on these parts, since the manufacturers will control the entire market for this work. The end result of implementation is that, without competition and alternatives, costs to the operators will increase substantially. For the airlines, which already examine every cost to identify savings on services that offer reliable, safe alternatives, this will put additional financial pressure on them."

**NEXT STEPS**

Dorr states that the FAA currently has identified one engine program that will comply with 14 CFR Section 33.70. He also advises manufacturers to learn more about the new rule by reading Advisory Circular, AC 33.70-1, and by working with their local FAA office.

If your company performs maintenance on engine parts, be aware that certain components on aircraft certificated after November 5, 2007, may be classified as life-limited, even if similar parts on aircraft certificated before the new regulation took effect are not. Similarly, if significant changes to the existing original type-certificated design have been made, a part that formerly was not classified as life-limited may bear the life-limited designation in the future.

Suppliers always should check the airworthiness limitations section of the OEM’s engine manuals to ascertain whether any component is a life-limited part or not. The true magnitude of the effect on the industry will be determined as the OEMs proceed with compliant new designs, design changes, certifications, and related analyses over the next few years.

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