FINMECCANICA MULLS LONGER RUN-DRY DURATION FOR HELOS

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Finmeccanica Helicopters (formerly AgustaWestland) is studying ways to enhance main gearbox performance in case of loss of lubrication. At the EASA rotorcraft symposium in December, Marco Tamborini, one of the company's experts in transmission system design and development, gave details on Finmeccanica's strategy in gearbox durability.

Unless the possibility of such a failure is extremely remote, EASA rules call for continued safe operation for at least 30 minutes. In November, Finmeccanica announced it had demonstrated to the Italian airworthiness authority a “60-plus minute 'run dry' capability” for the AW139's improved main gearbox.

Finmeccanica's target is to achieve the longest durability after loss of oil, Tamborini said. It has adopted five ways to prevent or mitigate such an event: minimizing the probability of oil loss, minimizing power losses, maximizing heat rejection, increasing high-temperature capability and managing residual oil.

First, to minimize the probability of a major oil loss, the company has replaced external pipes with

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integrated oil passages, a process that makes casting more complex. Redundancy is provided by dual pumps working in parallel. For those pressurized items with fittings, fail-safe design is ensured in the event the gearbox loses a fastener.

Then, assuming oil is lost, design engineers want to minimize power losses. To do so, they have reduced the number of reduction stages. They prefer roller bearings to ball bearings. Moreover, they have adopted fine-pitch gears to reduce sliding velocity.

They have also used ceramic rolling elements to further minimize power losses. Surface finishing of gear teeth and integral bearing raceways has been improved by fine grinding or super-finishing, Tamborini explained. TheAW189, which demonstrated 50-minute run-dry capability and was certified in 2014, was a key step in gearbox design, according to Tamborini. Some features were transferred to the improved AW139.

Better ventilation in the transmission bay improves heat rejection. Some 10 percent of the heat is normally rejected by convective exchange, Tamborini said.

Maintaining clearances throughout the highest expected temperatures is another design measure to increase the operating endurance after loss of oil, he went on. For instance, loss of clearance on gear tooth and bearings is likely to generate an uncontrolled increase of contact forces. Adopting special materials for bearings and gears enables them to withstand operating temperatures up to 350 degrees C, “without dramatically losing their hardness.”

As a result of these changes , the gearbox has maintained a steady thermal balance during run-dry conditions for more than 50 minutes (AW189) or 60 minutes (AW139) in certification testing. Finmeccanica, however, has not released an entry-into-service schedule for the upgraded AW139.

A next step might be using “ultra hybrid” bearings, involving a combination of ceramic rolling elements and low-friction coating of the raceways, Tamborini suggested.

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