NEW COMBUSTOR DESIGN SIMPLIFIES SAFRAN'S ARRANO

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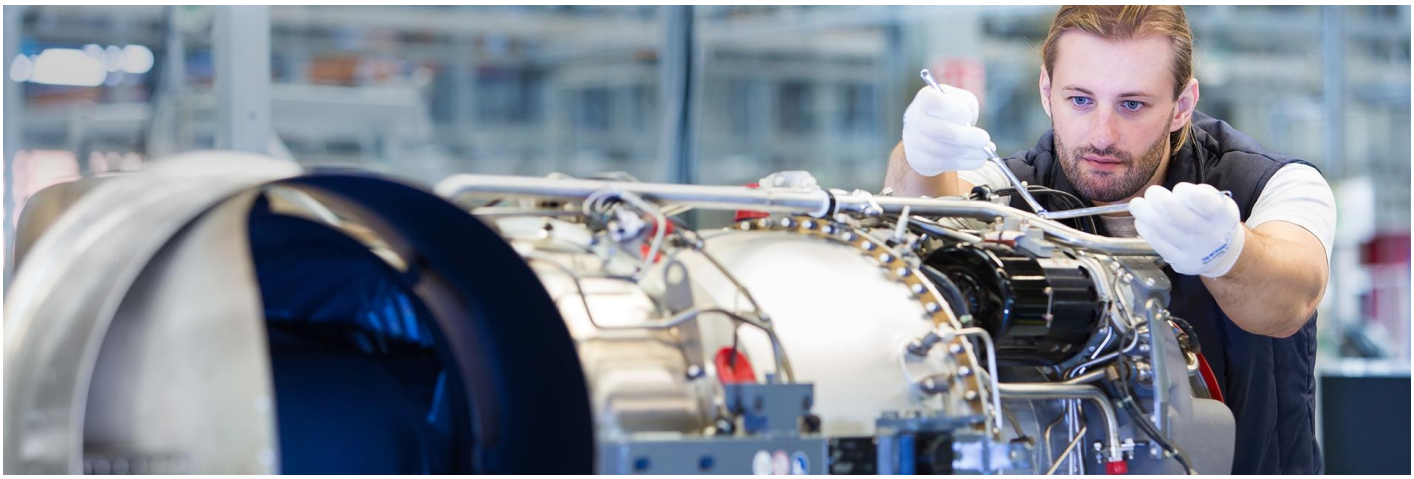

Safran Helicopter Engines (née Turbomeca) has designed a new kind of combustor for the Arrano turboshaft, thus allowing for better operability and a simpler arrangement, the engine manufacturer announced in May. Keeping the flow swirling is key, head of combustion department Claude Bérat told AIN. The 1,100- to 1,300-shp Arrano powers the in-development Airbus Helicopters H160 medium twin.

Safran’s engineers in Bordes, southwest France, have managed to stabilize a flame in a swirling flow of mixed air and fuel in the combustor. Without such a swirling flow, the engine requires numerous fuel nozzles (20 on the Ardiden, a previous-generation engine) to reach a homogeneous temperature to protect the components from damage, Bérat explained.

The swirling mix flow, if the originating flame is steady, ensures swift and consistent flame propagation. Therefore, the engineers could reduce the number of fuel nozzles to nine. Only the main fuel nozzles remain and those normally used for start have been eliminated, simplifying the design.

The engine maker cites several additional advantages of the new combustor design. First, the design offers improved operability, according to the company. In May, “we validated engine start at a simulated altitude of 14,700 feet and a temperature of minus 40 degrees C,” Bérat said. In addition, relighting after an engine shutdown is expected to be easier, too. Combustor weight and cost, for a given power, have been halved if compared to a late-1980s engine such as the Arrius, according to Bérat.

A favorable feature of the turbomachinery’s design is that the last compressor stator, just upstream from the combustor, has to “de-swirl” the airflow only partially so that when it enters the turbine it is already rotating. The result, said Bérat, is reduced power loss.

The latest generation of computing hardware and software helped a lot, he noted. Additive manufacturing (3-D printing) made it possible to create the fuel nozzles. “They would have been

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impossible to machine," Bérat explained. Finally, at the demonstration stage, the proximity between the design office and the assembly workshop contributed to the success.

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