Europe is focused on research

By Martina Vollmuth

Silencer, Clean, Vital – in Europe, industry and science have for years been developing innovative, clean engine technologies. A new initiative focuses on optimizing the core engine: Within the framework of Newac (New Aero Engine Core concepts), 40 partners from industry, science and research are developing new concepts and technologies centering on active systems, heat management and advanced combustors. The effort is headed by MTU.

The research program aims at reducing the fuel consumption of engines by six percent—and with it carbon dioxide emissions—and at slashing nitrogen oxide emissions by 16 percent. Specifically, Newac investigates new technologies for four different core engine architectures with active systems, heat management (intercooler, cooling-air cooling and heat exchanger), improved components and an exhaust gas recuperator.

The innovative engine elements will be developed and produced under the Newac program and validated by model, rig and core engine testing. Assessment of the new core engines will be based on various missions and aircraft sizes. “That automatically produces different roadmaps leading to cleaner and thriftier engines,” explains Dr. Günter Wilfert. The MTU technology expert leads the research program, which proceeding under the European Commission’s Sixth Framework Program is designed to initially extend over four years.

MTU is pursuing the “active core engine” concept that provides engineers with new technological options: various systems are intended to permit the core engine to be optimally adapted to any prevailing flight regime. That improves efficiency and reduces fuel consumption and harmful emissions. It can be achieved, for instance, by actively controlling the high-pressure compressor in the event of critical or deviating responses by means of active clearance control for the aft stages and an active surge control system for the forward stages of that compressor. Other options include active cooling-air cooling, which reduces the amount of cooling air needed and thus reduces the engine’s fuel consumption.

The concept developed by Rolls-Royce is intended to benefit from the advantages afforded by a very high overall pressure ratio. This concept uses an intercooler to avoid an increase in the turbine inlet temperature. If the air between the low-pressure compressor and the high-pressure compressor is cooled less power is needed to drive the compressors. Furthermore, the combustion process is optimized and nitrogen oxide emissions are reduced.

The Clean demonstrator undergoing testing.

New technologies for optimum flow control inside the high-pressure compressor, such as boundary layer suction, open up new possibilities for improving efficiency and surge margin. New abradable linings will be introduced to decelerate the loss in compressor performance that inevitably occurs over time. This concept, which is pursued by Snecma, is particularly suitable for highly stressed core engines.

The fourth concept focuses on an exhaust gas recuperator the basic principles of which had been developed by MTU under the Clean (**c**omponent va**l**idator for **e**nvironmentally friendly **a**ero e**n**gine) concept. Tests had revealed that integration of the exhaust gas recuperator could still be improved. Under the Newac program, therefore, universities and research institutions are now investigating its optimization.

Since the various core engine concepts are based on different overall pressure ratios, special combustors will be needed. The Newac engineers will look into three different versions, all of which involve lean premixing. It is hoped that this concept will drastically reduce nitrogen oxide generation. Wilfert announced that tests slated to begin by the middle of next year “will show whether we’re on the right track with our approaches.”

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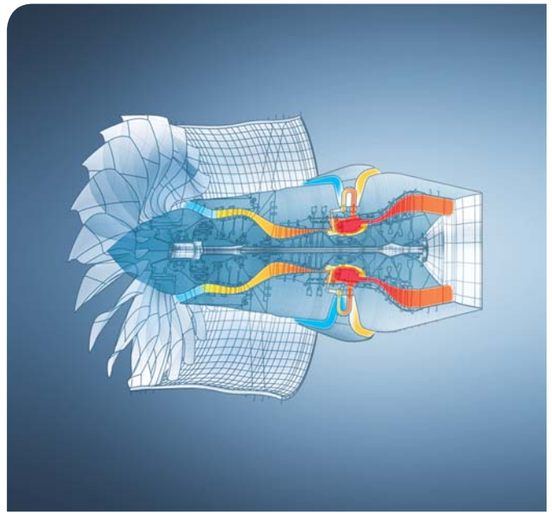
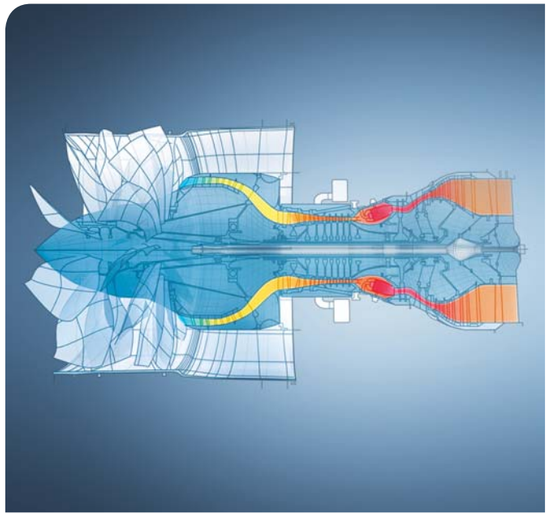
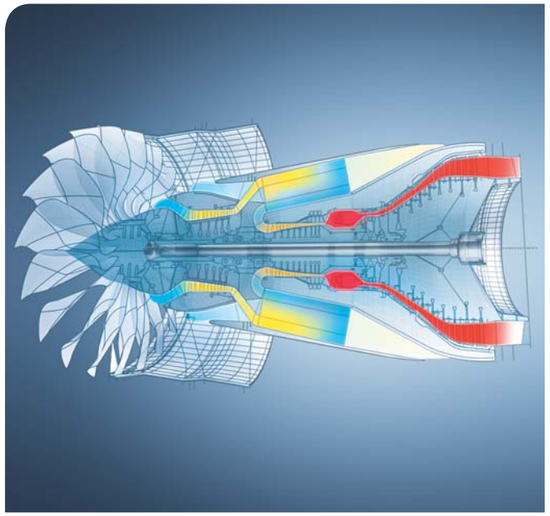


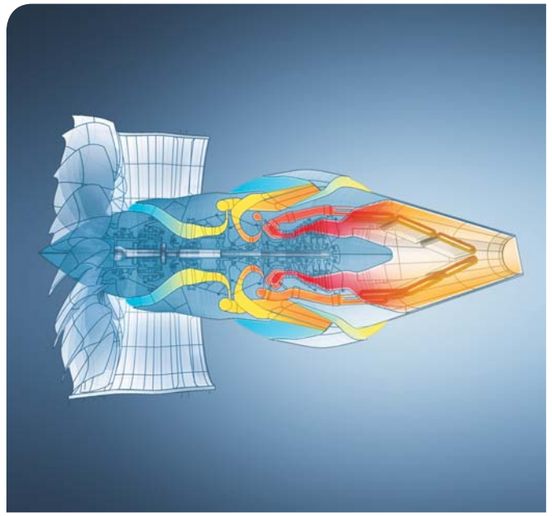
Concept of an “active core engine”.



Core engine with optimized flow control.



Concept featuring an intercooler.



Concept featuring an exhaust gas recuperator.