Clean Sky 2: MTU Aero Engines is further developing turbine and compressor technologies

* Aviation engines becoming more efficient, with fuel savings and lower emissions
* Cooperation partnerships with DLR and GKN Aerospace Sweden

Berlin, Germany, June 5, 2024 – EMVAL and the two-shaft compressor rig – those are the two Clean Sky 2 demonstrators of MTU Aero Engines. Together with its strategic cooperation partners GKN Aerospace Sweden and the German Aerospace Center (DLR = Deutsches Zentrum für Luft- und Raumfahrt), Germany’s leading engine manufacturer has further developed the low-pressure turbine (LPT) and high-pressure compressor (HPC) components as part of the Clean Sky 2 research program, and validated the new technologies. Now they will feed into the next generation of geared turbofan engines.

“We focused on how our components work with their neighboring modules, and we especially want to optimize their interactions,” explains Dr. Claus Riegler, Senior Vice President Technology & Engineering Advanced Programs at MTU Aero Engines in Munich. In the area of low-pressure turbines, the inlet and exit case were considered; for the high-pressure compressor, the low-pressure compressor and inter-compressor duct (ICD) also played an important role. Among other things, the goal was to further improve the aerodynamics and to develop new, more lightweight and more temperature-resistant materials along with new manufacturing processes.

The overarching goal of the Clean Sky 2 technology program, which has been underway since 2014 under the EU Framework Program Horizon 2020 and which will be completed this year, is clearly defined: making aviation even cleaner and more efficient. MTU’s results are quite respectable. “What we have achieved shows that we can significantly support the initiative and the EU’s efforts toward clean aviation, as well as the lasting success of the European aviation industry,” concludes Dr. Stefan Weber, Senior Vice President Engineering and Technology at the Munich engine manufacturer. MTU, he said, is acting as one of 16 lead companies. “We were the lead party,” explains Weber. Riegler adds, “In our collaboration with GKN and the DLR, we perfectly integrated the strengths of each partner: GKN’s competence with large structural components and DLR’s experience in the area of testing, as well as MTU’s expertise with compressors, turbines, and systems.”

**EMVAL engine demonstrator**

To validate the LPT technologies, the EMVAL (**E**ngine **M**aterial **Val**idation) engine demonstrator was developed, built, and tested at MTU in Munich. The test vehicle was an MTR390. This engine was being used in a Tiger helicopter and was provided to MTU by the German Army. In order to integrate the newly developed technologies, a complete power turbine had to be redesigned, built, and attached to the core engine.

MTU is more than satisfied with the evaluation of the comprehensive testing program. Riegler: “We met all of our goals.” For instance, the analysis of material behavior under engine conditions proved that the technologies are ready for use. Specifically, the goal was to optimize and further develop the design of innovative, highly heat-resistant materials, such as fiber-composite ceramics, with manufacturing processes for highly heat-resistant disc materials as well as additively manufactured components. GKN Aerospace contributed the turbine exhaust case for this project.

**Two-shaft compressor rig**

At the same time, the two-shaft compressor rig for validating new compressor technologies was developed, and it was constructed at DLR in Cologne. GKN Aerospace is a collaborator here too: the Swedish engine experts are responsible for designing and manufacturing the low-pressure compressor and the inter-compressor duct.

The two-shaft compressor rig is an expanded compressor rig consisting of a low-pressure compressor, inter-compressor duct and HPC. Riegler: “Our goal is to align the low-pressure compressor, inter-compressor duct, and high-pressure compressor even better with one another to leverage new potential for engines that are even more fuel-efficient.” One important step was systematically measuring the flow conditions in short, steep inter-compressor ducts. For this purpose, a wind canal rig known as the ICD rig had already been builz at DLR in Cologne – the MTU Center of Competence (CoC) for engine systems. Various ICD configurations were tested.

Now it is time for the final test series of the two-shaft compressor rig. The results should be available and evaluated by the end of the year. The focus is on validating the designs of individual components, along with the performance of the entire compressor system.

**About MTU Aero Engines**

MTU Aero Engines AG is Germany's leading engine manufacturer. The company is a technological leader in low-pressure turbines, high-pressure compressors, turbine center frames as well as manufacturing processes and repair techniques. In the commercial OEM business, the company plays a key role in the development, manufacturing and marketing of high-tech components together with international partners. Some 30 percent of today’s active aircraft in service worldwide have MTU components on board. In the commercial maintenance sector the company ranks among the top 3 service providers for commercial aircraft engines and industrial gas turbines. The activities are combined under the roof of MTU Maintenance. In the military arena, MTU Aero Engines is Germany's industrial lead company for practically all engines operated by the country’s military. MTU operates a network of locations around the globe; Munich is home to its corporate headquarters. In fiscal 2023, the company had a workforce of more than 12,000 employees and posted consolidated sales of 6.3 billion euros.

Your contact:

Martina Vollmuth

Press Officer Technology

Mobile: +49 (0) 176-1001 7133

Email: martina.vollmuth@mtu.de

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